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# Contributions of Social Support to Mitigate the Impact of the COVID-19 Pandemic on Pediatric Depressive and Irritability Symptoms

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# Contributions of Social Support to Mitigate the Impact of the COVID-19 Pandemic on Pediatric Depressive and Irritability Symptoms

**By**

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ABSTRACT

Prior research, including my initial research on the mental health of children in Southwestern Ontario, highlighted the broad, widespread impact of the COVID-19 pandemic on the mental health of adults, children, and youth, globally, including the potential for social support to attenuate the harmful impact of the pandemic. Social support, one's belief that others will help in times of need, may protect against the impact of myriad life stressors on the development of psychopathology. The present study examines the potential for social support to mitigate the longitudinal impact of the COVID-19 pandemic on children's irritability and depressive symptoms. Families ($N = 317$) encompassing one child aged 8 to 13 and a parent or guardian reported on children's perception of social support, irritability, and depressive symptoms at baseline assessment and seven follow-up assessments over nine months between June 2020 and December 2021. Although depressive and irritability symptoms fluctuated over time, children's initial perception of social support availability from family and friends did not predict interindividual variability in irritability or depressive symptom change over time. Social support fluctuated over time but showed no systematic increase or decrease. At each monthly assessment, social support was associated with child- and parent- or guardian-report of children's symptomatology; children self-reported, and parents or guardians observed, lower symptomatology on months when children reported higher social support. Findings highlight the importance of social support for pediatric depression and irritability and suggest that social support may be bolstered during public health crises to assist children.

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## *Mental Health During the COVID-19 Pandemic*

### *Adults' Mental Health Internationally*

In addition to the physical health effects of the SARS-CoV-2 virus, the COVID-19 pandemic has both acute and chronic implications for the psychological well-being of children, adolescents, and adults in every country affected. Since being declared a public health crisis by the World Health Organization, myriad research has documented mental health outcomes of the COVID-19 pandemic. For example, initial research in China, which documented the first viral onset of the SARS-CoV-2 virus, indicated worsening mental health and symptomology related to anxiety and depressive disorders as compared to symptoms prior to the pandemic in adults (Xie et al., 2020). Similarly, in a large community sample, over half of adults in China reported moderate to severe psychological impacts of the pandemic: 16.5% reported depressive symptoms, 28.8% anxiety symptoms, and 8.1% reported stress levels of at least moderate severity (Wang et al., 2020).

A growing global literature highlights the effects of the COVID-19 pandemic on the psychological distress and well-being of adults but also of children and adolescents. Internationally, mental health issues and distress including, but not limited to, stress, anxiety, depressive symptoms, insomnia, anger, and fear may have increased as an acute result of the pandemic (Rajkumar, 2020; Torales et al., 2020). Experiences of psychological stress are elevated in the general population; 24.84% of adults reported significant stress (Cooke et al., 2020). Increased psychological distress has also been documented among young adults; in one Chinese study, 0.9% reported severe anxiety, 2.7% moderate anxiety, and 21.3% mild anxiety symptoms (Cao et al., 2020). Experiences of stress, anxiety, and depression are particularly high

among young adults and severity decreases in older cohorts; in the United States and Canada, older adults reported a larger perceived risk of dying from COVID-19, but lower perceived risk of contracting the virus and fewer mental health symptoms than younger adults (Bruine de Bruin, 2021; Nwachukwu et al., 2020).

Global reviews have further documented the wide-spread impact of the pandemic on adults' mental health. A review of research from China, Turkey, Spain, Italy, Iran, the United States of America, Nepal, and Denmark found high rates of anxiety, depression, posttraumatic stress, and psychological distress from the onset of the pandemic until May of 2020 in a total sample of 93,569 individuals, mostly consisting of adults (Xiong et al., 2020). Moreover, Xiong et al. concluded that female sex; age under 40; chronic or psychiatric illness; unemployment; student status; and exposure to COVID-19-related news were associated with elevated risk for psychological distress. A review of 65 studies on the COVID-19 pandemic similarly documented broad increases in adverse mental health symptoms, particularly in March and April 2020 (Robinson et al., 2021). Across many countries, adults reported increased adverse mental health symptoms, particularly depressive and mood disorder symptoms, which did not appear to differ as a function of whether participants had a psychiatric disorder prior to the COVID-19 pandemic (Robinson et al., 2021). Another review similarly identified broad increases in mental health symptomology across depressive, anxiety, stress, panic, anger, impulsivity, somatization, sleep, posttraumatic stress, and suicidal symptoms (Hossain et al., 2020). Women, healthcare workers, young adults, elderly adults, and adults who live near outbreak areas were at increased risk of worsened mental health, as were adults with less education; low social support; adults who recently lost a job or property; adults with a mental or physical health conditions that predates

the pandemic; and adults at risk for exposure to COVID-19-related news (Hossain et al., 2020; Vindegaard & Benros, 2020).

The psychological impact of the COVID-19 pandemic has been documented in countries world-wide. For example, in Bangladesh, 40% of an adult sample reported moderate to severe anxiety, 53% moderate to poor mental health status, and 72% depressive symptoms (Faisal et al., 2021). In another study, 44.59% of adults reported severe, 48.41% moderate, and 3.82% mild anxiety (Dhar et al., 2020). Greater worry and knowledge about the virus predicted anxiety and poorer mental health status, whereas belief in COVID-19's severity in Bangladesh predicted greater depressive symptoms (Faisal et al., 2021). In the Philippines, 16.3% of adults reported moderate to severe psychological impact of the pandemic, 16.9% moderate to severe depressive symptoms, 28.8% moderate to severe anxiety levels, and 13% moderate to severe stress levels (Tee et al., 2020). Of a sample of adults in Turkey, 64.1% reported significant psychological fatigue (Morgul et al., 2021). In Soweto, South Africa, 14.5% of adults were screened as at-risk for depression between August of 2019 and March of 2020, with greater depressive symptoms related to higher perceived COVID-19 risk and history of childhood trauma (Kim et al., 2020).

Myriad studies have highlighted the mental health impact of the pandemic on adults in the United States. For example, 41% of adults reported distress related to mental or behavioural health symptoms in June of 2020 (Czeisler et al., 2020). In a follow-up study in September, 33% reported distress related to anxiety or depressive symptoms; 29.6% reported COVID-19-related stress or trauma symptoms; 15.1% increased substance use relative to pre-pandemic levels; and in August 2020, 11.9% reported recent thoughts of killing themselves, which highlights the persistence of mental health sequelae of the pandemic (Czeisler et al., 2021). Between August and December of 2020, rates of clinically significant anxiety symptoms among adults increased

from 31.4% to 36.9% and significant depressive symptoms increased from 24.5% to 30.2% (Vahratian et al., 2021). An additional line of research in the United States identified prevalence rates of clinically symptoms that were significantly higher than population estimates prior to the pandemic: point prevalence of moderate to severe depression ranged from 27.2% to 32.2%, clinically significant anxiety disorders (i.e., generalized anxiety disorder) ranged from 29.8% to 45.8%, clinically significant insomnia 25.1%, suicidal ideation 17.6%, 15.2% screened positive for probable acute stress disorder, and 17.9% screened positive for possible posttraumatic stress disorder (Killgore et al., 2021). In an additional study, 29% of adults reported moderate to severe depression and 34% moderate to severe anxiety, with higher rates among young adults (Jewell et al., 2020). In another study following lockdown in July 2020 in the United States, 39% of participants had clinically significant depressive symptoms, 42% anxiety, and 29% psychological distress; there were also gender differences in COVID-19 related adverse mental health symptoms, with men reporting more depressive symptoms and women reporting more anxiety symptoms (Khubchandani et al., 2021).

Research has highlighted risk factors and predictors for elevated adverse mental health symptoms among adults during the COVID-19 pandemic. Higher prevalence rates of clinically significant adverse mental health symptoms were predicted by financial worry, insomnia, social isolation, and alcohol consumption, whereas time spent outdoors, perceived social support, and older age were protective against distress (Killgore et al., 2021). Fear of being infected, dying, or loss of employment were also related to adverse mental health symptoms (Bhattacharjee & Acharya, 2020). High levels of co-rumination, grater social strain, and low social support were related to worse COVID-19 related mental health outcomes (Zhou et al., 2020), which suggests

the importance of positive social interactions to protect against worsened mental health during the pandemic.

Additionally, research has demonstrated the mental health implications of the pandemic on adults in Italy. University students reported worse depressive symptoms during mandated lockdown in April 2020 compared to October-December 2019, which reflects a 2-point median increase on the Beck Depression Inventory-2. In this study, adults without a diagnosis of psychopathology prior to the pandemic experienced greater deteriorations in mental health than adults with a prior diagnosis (Meda et al., 2021), which may reflect a potential floor effect in those with pre-existing psychopathology. An additional sample of Italian adults also reported greater severity of depressive symptoms, anxiety syndromes, altered sleep, altered appetite, reduced libido, and health anxiety, as well as cognitive complaints related to attention, temporal retention, and executive functioning (Fiorenzato et al., 2021). The greatest risk for worsened mental health appeared among women, adults under 45 years of age, individuals working from home, and adults who were unemployed (Fiorenzato et al., 2021). In the general population of Italy, 28.12% of adults reported significant depressive symptoms, 21.25% significant anxiety symptoms, and 7.82% insomnia; rates of anxiety in the general population exceeded that of front- (20.55%) and second-line workers (18.05%; Rossi, Socci, Pacitti, et al., 2020), which indicates widespread COVID-19-related fear. An additional study found elevated rates of clinically significant symptoms: 37% of adults reported significant posttraumatic stress symptoms, 17.3% depression, 20.8% anxiety, 7.3% insomnia, and 22.9% adjustment disorder symptoms. COVID-19 related stressful life events were associated with increases in all symptoms (Rossi, Socci, Talevi, et al., 2020). In a study conducted during the last two weeks of lockdown, 24.7% of participants reported significant depressive symptoms, 23.3% reported

significant anxiety symptoms, and 17.4% reported moderate to severe insomnia (Gualano et al., 2020). Female gender, increased time on the internet, chronic illnesses, and avoidance of activities increased likelihood of psychological distress; increased age, absence of work-related stress, and being married or cohabitating were protective against worsened symptoms (Gualano et al., 2020).

Research has also highlighted the mental health implications of the COVID-19 pandemic on adults in the United Kingdom. One study identified worsened mental health symptoms across demographic subgroups and clarified that, among adults, the highest levels of psychological distress appeared among adult women of any ethnicity, as well as Black, Asian, and ethnic-minority men, even after controlling for socioeconomic characteristics (Proto & Quintana-Domeque, 2021). A longitudinal study in the United Kingdom further documented elevated rates of adverse mental health symptoms early in the COVID-19 pandemic; 26.1% of individuals reported at least moderately severe depressive symptoms, 21% reported at least moderately severe generalized anxiety, and 8.2% reported suicidal ideation (O'Connor et al., 2021). The prevalence of at least moderately severe anxiety decreased over time to 16.8% at the third follow-up, however rates of at least moderately severe depressive symptoms remained consistent across follow-up assessments while rates of suicidal ideation increased to 9.8%. Women, young adults, adults with psychopathology prior to the pandemic, or adults from socially disadvantaged backgrounds broadly reported worse distress (O'Connor et al., 2021).

To conclude, research has highlighted negative mental health effects of the COVID-19 pandemic globally. Psychiatric outcomes include, but are not limited to, depressive, anxiety, and posttraumatic stress symptoms. Several risk factors have been identified which predict severity of adverse mental health symptoms during the pandemic, such as demographic variables.

### *Adults' Mental Health in Canada*

In Canada, adult mental health declined significantly during the early months of the pandemic; in May 2020, 52% of adults reported "bad" mental health and high levels of anxiety (Zajacova et al., 2020). In one study, the proportion of individuals who reported high to extremely high anxiety severity quadrupled (i.e., from 5% to 20%) and the proportion of individuals who reported high to extremely high depressive severity more than doubled (i.e., from 4% to 10%; Dozois, 2020). Similarly, in another study, 38.2% of adults reported deteriorations in their mental health since the onset of the pandemic; 14.3% reported that they were not coping well, while 6.4% reported suicidal ideation, 1.9% reported self-harm, and 19.5% reported increased alcohol use as compared to alcohol use prior to the pandemic (Jenkins et al., 2021). Of individuals in a community sample from Quebec, 21.6% of female and 16.7% of male adult participants reported at least moderately severe depressive symptoms during the COVID-19 pandemic; young adults (i.e., adults aged 18 to 24) evidenced the highest prevalence of at least moderate depressive symptoms of any age group at 37.8% (Schmitz et al., 2020).

Worsened mental health may be related to multiple factors that confer vulnerability to the impact of the pandemic, such as economic concerns, younger age, female gender, non-heterosexual sexuality, ethnicity, illness that predates the pandemic, and Canada-born status (Jenkins et al., 2021; Zajacova et al., 2020). For example, transgender and gender diverse youth reported greater mental health challenges during the pandemic than cisgender peers (Hawke et al., 2021). Additionally, adults with lower incomes and adults of Arab decent reported the highest psychological distress in a sample of adults in Quebec (Miconi et al., 2020). Furthermore, Black adults who reported facing discrimination or exposure to the SARS-CoV-2 virus were at risk to report higher psychological distress; according to Miconi et al. (2020), the

greatest mental health burden associated with the COVID-19 pandemic may present among the Black community. Thus, there may be sociocultural inequalities in the experiences of COVID-19-related mental health outcomes in Canada.

### *Children's Mental Health Internationally*

Children and youth are particularly at risk for psychopathology and psychological distress during the COVID-19 pandemic, which may have a greater impact on the emotional and social functioning of developing children as compared to adults (Singh et al., 2020). For example, the literature reviewed above consistently documents that younger adults reported worse psychological distress and greater risk for psychopathology than did older adults, excluding elderly adults who may have a particular grave medical risk for complications related to the SARS-CoV-2 virus. Recent research documents a particularly severe impact of the COVID-19 pandemic on the mental health of children and youth ages three through 18, including increased depressive, anxiety, and irritability symptoms, as well as difficulty concentrating (Tambunan et al., 2021). For example, of children in grades two through six in China, 22.6% reported depressive symptoms and 18.9% reported anxiety symptoms above putative thresholds (Xie et al., 2020). Another study of children and adolescents ages seven to 18 in China similarly found that 22.28% experienced clinically significant depressive symptoms (Duan et al., 2020). In an additional Chinese study, 24.9% of children and adolescents in grades one through 12 reported anxiety symptoms, 19.7% depressive symptoms, and 15.2% stress symptoms (S. Tang et al., 2021). Moreover, in a sample of Chinese children and adolescents ages six to 15, 11.78% reported clinically significant depressive symptoms, 18.92% anxiety symptoms, and 6.56% both depressive and anxiety symptoms, with higher prevalence rates

among girls and adolescents distanced from peers and lacking physical activity (Chen et al., 2020).

The impact of the COVID-19 pandemic on children's mental health is evident, globally. A global review of children's mental health during the COVID-19 pandemic found pooled prevalence estimates of clinically elevated depression and anxiety symptoms of 25.2% and 20.5%, respectively, which are double that of pre-pandemic estimates (Racine et al., 2021). A study of Dutch adolescents ages 11 to 17 found increased psychosomatic symptoms, such as irritability, sleeping problems, headaches, stomach aches, and feeling low (Ravens-Sieberer et al., 2020). A study in Germany similarly found increased psychosomatic complaints among children and adolescents ages seven to 17; 54% of children surveyed reported symptoms related to irritability, 34% low mood, 31% stomach aches, 40% headaches, and 44% sleeping problems (Ravens-Sieberer et al., 2021). Additionally, children in this study reported increases in anxiety symptoms and lower quality of life; their parents reported that their children exhibited increases in hyperactivity, emotional problems, and conduct issues during the pandemic (Ravens-Sieberer et al., 2021). In a study in England during lockdown, over a quarter of children ages five to 16 reported sleep disruptions, 10% reported often or always feeling lonely, and 18% feared leaving the house (Newlove-Delgado et al., 2021). Finally, children in a qualitative study in Ireland reported negative mental health effects of the pandemic, including feeling socially isolated, as well as symptoms of depression, anxiety, and increases in maladaptive behaviours (e.g., bedwetting, violence, "clinginess", etc.). Families of children with Autism Spectrum Disorder noted the greatest increases in children's mental health difficulties, mostly related to changes in daily routines (O'Sullivan et al., 2021).

Similarly, adolescents in the United States demonstrated increased depression, anxiety, sluggish cognition, inattention, hyperactivity, and oppositional defiant symptoms from pre-COVID-19 to Spring 2020; symptoms abated following the lift of stay-at-home orders (Breaux et al., 2021). Individuals diagnosed with attention-deficit/ hyperactivity disorder prior to the pandemic were more likely to experience increased inattentive, hyperactivity, impulsive, and oppositional defiant disorder symptoms across all follow-up assessments; adolescents ages 15 to17 who reported poorer emotion regulation abilities in an assessment prior to the pandemic were at increased risk for elevations across all measured adverse mental health symptoms across two timepoints: May-June and July-August 2020 (Breaux et al., 2021). Magson and colleagues similarly documented increased depressive and anxiety symptoms among adolescents ages 13 to 16 during the pandemic, as compared to 12 months before the pandemic; change in depressive and anxiety symptoms was moderated by worry, online learning difficulties, and increased conflict with parents (Magson et al., 2021). Additionally, youth ages 10 to 14 reported increased nicotine use and misuse of prescription drugs, compared to pre-pandemic use; increased use was related to pandemic-related uncertainty; family hardship; parental alcohol and drug use; and greater anxiety and depressive symptoms (Pelham et al., 2021). Higher exposure to pandemic-related stressors was related to increases in both internalizing and externalizing symptoms over the first six months of the pandemic (Rosen et al., 2021). However, adherence to stay-at-home orders and feelings of social connection may be protective against increased psychological distress (Magson et al., 2021).

Globally, the adverse mental health implications of the COVID-19 pandemic for children and adolescents have been investigated. Broadly, youth are experiencing elevations in psychiatric symptoms, such as depression, anxiety, and psychosomatic complaints. Potential risk

factors- such as pre-existing psychopathology- and protective factors- such as social connectiveness- have been highlighted.

### *Children's Mental Health in Canada*

Similar to the global impact of the COVID-19 pandemic on children's mental health, mental health sequalae of the COVID-19 pandemic are observed among Canadian children. For example, 24.8% of Canadian parents of children under the age of 18 reported that their child's mental health worsened since the pandemic began in Canada (Gadermann et al., 2021). During the first wave of COVID-19, as compared to pre-pandemic severity, 37-56% of children ages six to 18 experienced worsening symptoms of depression, 31-50% anxiety, 40-66% irritability, 40-56% inattention, 23-56% hyperactivity, 13-30% obsessions and compulsions, depending on their age; and rates of mental health deterioration were higher among children who were diagnosed with a psychiatric condition prior to the pandemic (Cost et al., 2021). A sample of youth, ages 14 to 28, similarly documented worsened mental health during the pandemic; 68.4% of a clinical sample and 39.9% of a community sample met criteria for an internalizing disorder following the onset of the pandemic (L. Hawke et al., 2020). These rates are significantly elevated above the typically-observed prevalence of mental health disorders in children; prior to the pandemic, international rates of childhood psychopathology were approximately 13.4% (Polanczyk et al., 2015). In the sample collected by Hawke et al., increases in anxiety symptoms, depressive symptoms, suicidality, and self-harm were apparent across both the community and clinical samples; youth reported that increased distress was related to disruptions in mental health services and unmet support needs (L. Hawke et al., 2020).

School-age children may have been more affected by the first wave of the COVID-19 pandemic than preschool-age children, which may be related to a loss of daily school routines

(Cost et al., 2021). Anxiety and irritability were most common for children ages 6 to 9; depression was most commonly reported for children ages 10 to 12; and for children ages 13 to 18, deterioration in attention, hyperactivity, obsessions, and compulsions symptoms were most common, likely reflecting developmental trajectories in the onset of psychopathology (Cost et al., 2021).

The acute impact of the COVID-19 pandemic on children in Southwestern Ontario in Canada has also been identified, with children ages eight through 13 and their parents reporting increases in anxiety, depressive, and irritability symptoms, as compared to pre-pandemic experiences (Mactavish et al., 2021). Up to 34% of children reported anxiety symptoms, 26% depressive symptoms, and 51% irritability symptoms above established thresholds for probable diagnoses (Mactavish et al., 2021). Longitudinal research with the same sample of children highlight long-term elevations in symptoms of anxiety, depression, irritability, and posttraumatic stress in children; monthly elevations were associated with worry about contracting COVID-19 and local prevalence, hospitalization, and death rates of the virus (L. Rappaport et al., 2022).

### *Chronic Stress*

Given its extended duration and broad impact on children's mental health, the COVID-19 pandemic appears to act as a chronic stressor. Chronic stressors, partially as a result of sustained activation of the central nervous system, can have broad and lasting impacts on psychological well-being (Checkley, 1996; Cicchetti & Walker, 2001; Gold & Chrousos, 1999; Putnam, 2006). Chronic stress from myriad of sources (e.g., health, relationships, financial, housing, occupational, or educational difficulties) has been implicated in the development of a number of psychiatric illness (Slavich, In Press). For example, chronic stress has been associated with the development of various medical conditions (e.g. cancer, cardiovascular disease, asthma;

Barnthouse & Jones, 2019; Dai et al., 2020; Landeo-Gutierrez & Celedón, 2020; Reiche et al., 2004; Steptoe & Kivimaki, 2012). Additionally, it is associated with the development of myriad psychological conditions, such as anxiety disorders, posttraumatic stress disorder, substance use disorders, attention-deficit/hyperactivity disorder, schizophrenia, bipolar disorders, personality disorders, and depressive disorders (Brietzke et al., 2012; Davidson & Baum, 1986; Marin et al., 2011; McGonagle & Kessler, 1990; Slavich, In Press; Staufenbiel et al., 2013; Wingenfeld et al., 2011). Moreover, experience of chronic stress accumulates to increase one's risk for psychopathology, such as increased depressive symptomology and severity over time (Dougherty et al., 2004). For example, exposure to multiple risk factors for psychopathology have an additive impact that exceeds the impact of exposure to any single risk factor in child development, including children's academic achievement, language acquisition, externalizing and internalizing symptoms, suicidality, overall psychological well-being, self-regulation, social competency, peer relationships, and antisocial behaviour (Evans et al., 2013).

Chronic stress appears to be linked to *common psychopathology* risk, operationalized and assessed as the *p factor*, across multiple psychopathological conditions (Brietzke et al., 2012; Caspi et al., 2014). The p factor is a latent variable that explains variance common to a broad range of psychopathologies, such as life impairment, distress, and dysregulation, and is related to broad risk for development of mental health disorders (Murray et al., 2016; Ronald, 2019; Selzam et al., 2018). Thus, it accounts for high levels of co-morbidity across mental health diagnoses, as it captures the common elements of various mental health disorders (Caspi et al., 2014; Murray et al., 2016). Due to its association with the p factor, chronic stress is related to increased risk for myriad psychiatric illnesses, such as depression, anxiety, obsessive compulsive disorder, conduct disorder, oppositional defiant disorder, aggression, and attention-

deficit/hyperactivity disorder (Brietzke et al., 2012). In a three-year longitudinal study, exposure to chronic stress predicted a single latent p-factor common to all forms of psychopathology assessed, which suggests that the association of chronic stress with internalizing psychopathology was completely accounted for by a general association of chronic stress with common psychopathology (Snyder et al., 2019). This suggests that chronic stress may be associated with multiple psychopathological conditions in a transdiagnostic manner but with little specific association with each condition, such as anxiety and depression.

Chronic stress also has been found to mediate the relationship between life events and depressed mood, and works to maintain depression over time (Dougherty et al., 2004; Kessler et al., 1985). In a five-year follow-up study, chronic stress was associated with lower rates of recovery from depressive disorders; additionally, major stressors such as family history of psychopathology, poor childhood parental relationships, childhood sexual abuse, and chronic stress predicted higher levels of depression (Hayden & Klein, 2001). Thus, chronic stress can affect prognosis and disorder maintenance through additive and cumulative risk and have implications for later stress response and functioning.

### *Childhood Chronic Stress*

Childhood presents a particularly vulnerable period for exposure to chronic stress; with increased exposure to adverse experiences in childhood, the risk of physical and psychiatric conditions increases (Putnam, 2006). For example, the number of adverse childhood experiences encountered shows a graded association with risk for a depressive disorder diagnosis; individuals who reported more adverse experiences in childhood were at higher likelihood for a lifetime or recent depressive disorder diagnosis (Chapman et al., 2004).

Chronic adverse childhood experiences, such as racial minority status and financial difficulties, are related to increased levels of mental and physical diseases; early childhood stressors cause damage to physiological stress response systems that can result in health disparities (Wadsworth, 2015). Chronic adverse childhood events may present a risk factor for adult depressive and anxiety disorders (Coyne & Downey, 1991; Young et al., 1997). One retrospective adult study of risk for developing psychopathology found that emotional, physical, and sexual abuse was present in 35% of individuals with major depressive or panic disorder; these individuals also reported a history of parental marital discord, parental divorce, and parental psychopathology, indicating early childhood adversity and increased cumulative risk for psychopathology (Young et al., 1997). High levels of chronic childhood stress load have also been found to be related to adult posttraumatic stress, depressive disorders, personality disorders, schizophrenia, and substance abuse diagnoses. In one study, personality disorders were associated with the highest childhood stress, with major contributions from emotional and sexual abuse (Weber et al., 2008). Most importantly, stress load in childhood, but not in adulthood, was implicated in adult psychiatric disorders (Weber et al., 2008), which highlights the long-lasting influences of childhood experiences on development. Additionally, childhood chronic stress is related to negative physical health outcomes (e.g. cancer, asthma; Jacobs & Bovasso, 2000; Landeo-Gutierrez & Celedón, 2020).

Along with research on factors that modify the impact of chronic stress on psychopathology risk and severity (e.g., the number of chronic stressors encountered), considerable research examines potential mediators that identify how chronic stress might be associated with the later development of psychopathology. Exposure to early and chronic stress is related to exhaustion of stress response systems which, in turn, are related to adverse physical

and psychological outcomes (e.g., Juster et al., 2011). One such example of childhood chronic stress is socioeconomic disadvantage, which may present a range of stressors that are particularly impactful in childhood. Socioeconomically disadvantaged children are more likely to face physical (e.g., chaotic household environment) and psychosocial stressors (e.g., parental conflict), which can accumulate to overwhelm the body's physiological response systems and disrupt self-regulatory processes and development (Evans & Kim, 2013). Early adversity affects functioning of neural networks that underlie executive functioning and self-regulation (Blair, 2010) and is also related to working memory impairments in adulthood (Evans et al., 2009). Additionally, chronic stress across development appears to mediate the effects of chronic stress related to low childhood socioeconomic status on the development of emotion regulation into adulthood (P. Kim et al., 2013), which is consistently implicated in myriad psychiatric conditions (e.g., Aldao et al., 2010; Berking et al., 2014; Mennin et al., 2007).

Prolonged family disruption in childhood, such as parental psychopathology, is an additional chronic stressor that can affect risk for psychopathology both concurrently and in adulthood (Coyne & Downey, 1991). Children of mothers with affective disorders are at increased of also developing affective disorders; however, risk is not just related to familial psychopathology, as children of mothers with chronic medical illnesses demonstrated moderate rates of affective disorders as compared to those with healthy mothers (Hammen et al., 1987). After controlling for chronic stress, there were few differences between groups, thus this relationship may be moderated by the chronic stress associated with having a parent with a mental or physical illness (Hammen et al., 1987).

### *Chronic Stress and The Hypothalamic-Pituitary-Adrenal Axis*

Vulnerability to developing psychiatric disorders may be partially a result of adapting to early-life stressful environments, such as heightened vigilance or altered threat processing, which become maladaptive over time (McCrory & Viding, 2015). Chronic stress may interact with the developing brain to change neural circuits in a manner that increases susceptibility to develop psychiatric disorders (Sheth et al., 2017). One mechanism through which chronic stress may affect child, youth, and adult psychiatric vulnerability is the hypothalamus-pituitary-adrenal (HPA) axis, which mobilizes in times of stress to produce glucocorticoids, suppress immune functioning, and prepare the body to respond to a given stressor (Thompson, 2014). However, prolonged exposure to glucocorticoids, such as cortisol, can cause dysregulation of the HPA axis. Over time, chronic stress may increase the sensitivity and reactivity of the HPA axis (Checkley, 1996; Marin et al., 2011; Tafet & Bernardini, 2003; Thompson, 2014). Eventually, HPA axis dysregulation may contribute to problems related to cognition, attention, emotion regulation, and social difficulties, as the biological effects of stress interfere with one's ability to learn and effectively interact with peers (Thompson, 2014). Similarly, alterations in the HPA axis can, in turn, lead to neurotransmitter dysregulation with attendant implications for the development of multiple psychiatric conditions, such as depressive disorders (Tafet & Bernardini, 2003).

Stress-related changes in neurobiology are associated with multiple psychiatric conditions and may underlie shared vulnerability across multiple childhood psychiatric disorders, especially depressive, substance abuse, and anxiety disorders (Sheth et al., 2017). If so, stress-related changes in neurobiology, such as changes in HPA regulation or dysregulation may be transdiagnostic and partially explain high rates of comorbidity between multiple conditions (e.g., Angold & Costello, 1993; Hasin & Kilcoyne, 2012; Kessler et al., 2005), as described by

research on higher-order clusters of psychiatric disorders that are frequently comorbid (e.g., Kotov et al., 2021) including research on the p-factor (Caspi et al., 2014).

### *Children's Unique Vulnerability to Stress*

Children are particularly vulnerable to the adverse impacts of stressors, especially chronic stress such as that posed by the COVID-19 pandemic, as childhood presents a sensitive period for exposure to stress (Andresen, 2014; Courtney et al., 2020; Racine et al., 2020). Stress during childhood and adolescence is related to increased risk for psychological distress and psychopathology, such as depressive disorders (Brietzke et al., 2012; Compas et al., 1993; Sheth et al., 2017; Wingenfeld et al., 2011). Stressful events in childhood predict increases in psychopathology symptom severity and the likelihood of a psychiatric diagnosis over time (Compas et al., 1993). The most common chronic stressors in childhood include poverty, familial or neighbourhood violence, racism, sexism, parental loss, and parental psychopathology; all of which are related to risk for psychological distress and psychiatric disorders (Compas et al., 1993; Lewinsohn et al., 2000). Additionally, disasters and mass violence present cumulative risk for childhood psychopathology, in which a child's capacity for resilience may depend on their age and social support connections; younger children and those with weaker community connections are at an increased risk ( Masten & Narayan, 2012).

Myriad chronic childhood stressors are significant predictors of psychopathology across the lifespan. These include, but are not limited to, parental mental illness, parental substance use, parental crime, family violence, physical abuse, sexual abuse, emotional abuse, neglect, parental divorce, and physical illness (Bagner et al., 2010; Benjet et al., 2010; Hammen et al., 1987; Lewinsohn et al., 2000; Wingenfeld et al., 2011). Moreover, severity of, and risk for, psychopathology increases with greater number of stressors experienced; there is a dose-

response relationship between number of adverse childhood experiences and psychopathology (Anda et al., 2006; Benjet et al., 2010; Edwards et al., 2003) The strongest and most consistent predictors of developing any psychopathology, including mood, anxiety, substance use, and externalizing disorders, may be family dysfunction (Benjet et al., 2010; Edwards et al., 2003; Kessler et al., 2010; McCrory et al., 2012; Wolfe & Jaffe, 1991). The greatest population-level risk factors for children may be male sex, young age, low birth wight, mother's lower educational attainment, and English as a second language status (Curtin et al., 2013).

### *Childhood Stress and Neurodevelopmental Plasticity*

Children may be particularly vulnerable to stress, especially chronic stress, because of the plasticity of their brain architecture (Courtney et al., 2020; Fox et al., 2010). Neural plasticity is critical for children's development as it allows them to learn and develop. However, neural plasticity can also ingrain the adverse effects of stress to have particularly long-term effects (Thompson, 2014). Childhood presents many critical and sensitive developmental periods, during which stress may alter development in a manner that may cascade throughout an individual's lifetime (Marin et al., 2011; McEwen, 2016; Pine & Fox, 2015; Romeo, 2017). For example, during periods of key brain development, cortisol may act as a neurotoxin to cause permanent alterations to brain architecture (Codon, 2018; Swick et al., 2013) and DNA methylation (McEwen, 2016). Early cortisol exposure can also cause structural alterations that increase future vulnerability and sensitivity to stress hormones, which can increase risk for psychopathology, both concurrently and in adulthood (Lupien et al., 2018; Romeo, 2017). Additionally, structural alterations that occur during sensitive periods of development can be resistant to change in the future; thus, exposure to stress hormones in childhood can have fundamental and long-term implications for children (Fox et al., 2010).

The hippocampus is particularly sensitive to the effects of chronic stress in childhood, which can have implications for children's learning and memory (Marin et al., 2011). The hippocampus is also responsible for the negative feedback regulation of the body's stress response system; dysregulation of the hippocampus can impair an individual's ability to control the stress response and can result in its exhaustion (Vyas et al., 2002). Specifically, extended cortisol secretion can cause dendritic atrophy and debranching in hippocampal structures, which decreases hippocampal volume (Vyas et al., 2002). Smaller hippocampal volumes are, in turn, observed in individuals with depressive disorders (Campbell et al., 2004). A five-year longitudinal study of adolescents ages 12 to 20 found that early life adversity was associated with decreased hippocampal volumes and later development of a depressive disorder (Rao et al., 2010). Thus, early life stress may increase children's risk for developing a depressive disorder partially through altered hippocampal development.

Additionally, development of the amygdala- which is responsible for processing emotional stimuli- is consistent throughout childhood and adolescence; increased exposure to cortisol in childhood and adolescence can effect children's emotional regulation and emotion processing (Marin et al., 2011). In contrast to hippocampal development, chronic stress can cause increased arborization in the amygdala, which results in increased emotionality and increased risk to develop a mood disorder (Vyas et al., 2002).

Dysregulation in brain regions responsible for emotional processing, self-regulation, and memory, such as the amygdala and hippocampus, can place children at risk of developing psychopathologies, such as anxiety and mood disorders (Marin et al., 2011; Thoresen & Eagleston, 1983). In particular, chronic stress has been found to put children at an increased risk of developing depressive disorders (Marin et al., 2011; McGonagle & Kessler, 1990). Thus, the

neurocognitive alterations described above can have implications for children's development of social skills, their capacity to learn, and their psychological well-being (Thompson, 2014).

Early life and chronic stressors are also associated with many negative physical health outcomes (e.g., Thoresen & Eagleston, 1983). Chronic stress can also affect allostasis (i.e., the body's ability to adapt to environmental demands; Johnston-Brooks et al., 1998). Prolonged production of cortisol in response to chronic stress can cause long-term and heightened activation of a child's physiological response systems, which can exhaust the child's body over time and cause damage; this is referred to as allostatic overload (Checkley, 1996; Johnston-Brooks et al., 1998; Katz et al., 2012). Children's immune, cardiovascular, neurological, metabolic, respiratory, and anthropometric systems are all susceptible to the effects of chronic stress, particularly through exposure to stress hormones (Codon, 2018; Swick et al., 2013). This puts children who experience chronic stress at elevated risk of developing myriad health issues, such as cardiovascular disease, immunosuppression, and diabetes, as well as adverse psychological outcomes (e.g., anxiety and depressive disorders; Johnston-Brooks et al., 1998; Katz et al., 2012).

### *Childhood Stress in the Context of the COVID-19 Pandemic*

Given children's particular vulnerability to stress, especially chronic stress, the Early Childhood Development Action Network, a non-governmental agency comprised of groups including the World Health Organization, UNESCO, UNICEF, and Save the Children issued an early recommendation that all governments prioritize children's development and mental health in their responses to the COVID-19 pandemic (Early Childhood Development Action Network, 2020). Shortly thereafter, the United Nations, UNICEF, World Health Organization, and World Bank Group issued an interagency note to highlight that "we know from other pandemics and

humanitarian crises that young children face a substantial risk of immediate and longer-term negative impacts including poorer health, growth, learning and development outcomes" (United Nations Educational, Scientific and Cultural Organization et al., 2020).

Children may be at particular risk for a variety of reasons, including sensitive and critical developmental periods and their reliance on care from adults, such as parents who, under stress, may be less able to provide psychological resources and support for their children (Courtney et al., 2020). For example, a study out of Pakistan suggests that children may sense their parents' pandemic-related stress and subsequently experience increases in mental health symptomology related, in part, to children's limited coping strategies, including difficulty communicating complex feelings (Imran et al., 2020). Loneliness and isolation may also contribute to the deleterious impact of the pandemic on children's mental health. For example, a review prior to the pandemic highlighted the mental health implications of loneliness, which was associated with mental health problems, particularly depressive disorders, up to nine years after initial assessment in children and adolescents (Loades et al., 2020).

Children's disaster preparedness highly relies on that of their parents (Masten & Motti-Stefanidi, 2020; Masten & Osofsky, 2010). The COVID-19 pandemic presents a moment of markedly increased vulnerability for children. The Family Stress Model (FSM) highlights children's reliance on the family unit for support during times of stress (Masarik & Conger, 2017). Family processes play a crucial role in mediating the association between stressful experiences and child outcomes. For example, in one study, parental distress mediated the association of economic hardship with children's externalizing behaviours (Neppl et al., 2016). In another study, family economic pressure was related to parental depressive symptoms, which were related to hostile parenting that was, in turn, related to depressive symptoms and suicidality

in adolescent participants (Yoder & Hoyt, 2005). Thus, the family unit can influence one another's experiences of distress; parents have the capacity to buffer against mental health symptomology in children.

Parents play a key role in protecting their children during times of stress and crises including natural disasters (e.g., hurricanes and pandemics) and manmade disasters (e.g., terrorist attacks). Parents model adaptive behaviours and communicate important information about safety and danger ( Masten & Osofsky, 2010). Parents' personal distress can strain family relationships and disrupt typical parenting behaviours, which can threaten the well-being of children in the home. Parental psychological stress is also related to inconsistent parenting, which, in turn, is related to externalizing and problematic behaviours in children (Masarik & Conger, 2017).

Given evidence that indicates children rely on their parents and families for support during life stress, parents' pandemic-related mental health concerns may have repercussions for children's mental health. Weaker parent-child relationships are associated with an increased risk that children will develop a depressive disorder in response to life stress, which is then more likely to persist over time (Dougherty et al., 2004). During the COVID-19 pandemic, of a sample of Canadian parents, 44.3% reported worsening mental health and increased incidences of both conflict and positive interactions with their children (Gadermann et al., 2021). Parents also self-reported increased psychological distress if their children were struggling with online learning (Davis et al., 2021). School closures were related to worsening mental health of mothers, especially those with less education and primary school age children (Yamamura & Tsustsui, 2021). Additionally, a study on the effects of COVID-19 on children's mental health experiences in England found that children of parents who faced personal psychological distress were more

likely to report mental health symptomology, which highlights the importance of parental support for children during the pandemic (Newlove-Delgado et al., 2021). Social disruptions, financial insecurity, caregiver burden, and confinement-related stress present risk for family systems (Prime et al., 2020). Thus, children's well-being is at risk during the pandemic, as their adjustment is affected by family functioning and caregiver well-being. (Prime et al., 2020).

### *Social Support*

Social support, the belief that one can rely on others to help in times of need, may protect one from adverse psychological and physiological effects of life stress (Cohen & Wills, 1985; Thompson et al., 2006). Social support works to buffer against stress through offering opportunities for connection and positive emotion, a sense of self-worth through connections with others, and predictability in otherwise unpredictable times (Cohen & Wills, 1985; Orehek & Lakey, 2011; Ozbay et al., 2007; Thompson et al., 2006). As such, social support is often associated with improved self-concept, psychological adjustment, social adjustment, psychological well-being, and physical health (Chu et al., 2010; Cohen & Wills, 1985; House et al., 1988). Moreover, it appears that *perceived* social support (i.e., the perception that support would be available from others if required), is more important than the actual availability or provision of support in protecting against mental health sequelae (Aba et al., 2019; Rueger et al., 2016). For example, research by Niall Bolger and colleagues suggests that occasions in which objective social support is provided may actually be associated with acute distress in the recipient of support (Bolger et al., 2000; Bolger & Amarel, 2007; Shrout et al., 2006).

In seminal work, Cohen and Wills (1985) propose a *buffering hypothesis* of social support, which suggests that social support may act as a buffer to protect one against psychological distress when faced with negative events or life stressors (Cohen & Wills, 1985;

Dalgard et al., 1995; Rueger et al., 2016). In a ten-year longitudinal study, social support was protective against the development of psychopathology following exposure to negative life events; this was especially true for depression (Dalgard et al., 1995). Moreover, social support buffers against the effects of a wide range of life stressors, from ongoing stressful conditions to episodic events, on experiences of psychological distress (Wilcox, 1981). For example, social support may moderate the long-term consequences of childhood maltreatment; social support has been found to be protective against the development of anxiety and depression in adulthood in individuals who experienced child abuse (Sperry & Widom, 2013).

One mechanism through which social support may buffer against the development of psychopathology is through offering the opportunity to regulate thoughts, feelings, and actions. Through conversations and shared activities, one can improve mood and break negative thought patterns (Orehek & Lakey, 2011). Social support also presents opportunities to experience positive emotions (Cohen & Wills, 1985), which can interrupt rumination and negative schemas.

Conversely, low social support has been shown to be related to increased psychological distress and worsened psychopathology following life stress (e.g., Hefner & Eisenberg, 2009; Lepore et al., 1991). This is especially true for depression (Ibarra-Rovillard & Kuiper, 2011). For example, in one study, poor social support was related to a six-fold increase in risk for depressive symptoms in a large sample of college students (Hefner & Eisenberg, 2009).

The buffering role of social support appears to be true across myriad life stressors (Aba et al., 2019; Gariépy et al., 2016). For example, social support significantly buffered against the effects of Hurricane Katrina-related distress on depressive symptoms (McGuire et al., 2018), whereas low social support predicted the development of major depressive disorder among individuals exposed to Hurricane Katrina (Nillni et al., 2013). Further, the risk polymorphism

(i.e., short allele) in the serotonin transporter gene (5-HTTLPR), high stress exposure, and low social support may interact to increase risk for developing posttraumatic stress disorder and major depressive disorder following exposure to hurricanes; higher social support may mitigate both environmental risk related to exposure and genetic risk for psychiatric disorders (Kilpatrick et al., 2007). A longitudinal study of the effects of multiple prominent stressors and traumatic events (e.g., assault, natural disasters, illness) reports that low baseline social support predicted depressive symptoms one year later (Tracy et al., 2014). Similarly, a study of the impact of the Great East Japan earthquake and tsunami found that baseline social support predicted mental health outcomes; individuals with higher social support prior to the disaster were less likely to develop depressive symptoms following disaster exposure (Sasaki et al., 2019). Social support also buffered against the negative psychological impact of the Indian Ocean tsunami on distress and mental health symptomology, such as posttraumatic stress (Ozbay et al., 2007). Thus, social support works to mitigate both genetic and environmental risk for psychopathology and bolsters resilience across myriad stressful events (Ozbay et al., 2007).

Social support is an especially important protective factor for children in times of stress, as children may rely on adults and others for assistance coping with major stressors (Norris et al., 2002; Tang et al., 2014). Similar to research with adults, social support protected against posttraumatic stress symptoms in children exposed to Hurricane Katrina (Lai et al., 2018). Children in grades 3 through 5 who sought social support to help cope with psychological distress also reported less severe depressive symptoms following exposure to Hurricane Hugo (Jeney-Gammon et al., 1993). Following exposure to Hurricane Ike, social support behaved as a resilience factor to protect against the development of posttraumatic stress and depressive symptoms in children at increased risk for psychological distress due to either genetic risk or

greater exposure to the hurricane (e.g., exposure to hurricane destruction; La Greca et al., 2013). Specifically, the brain-derived neurotrophic factor (BDNF) met allele may confer greater risk to develop posttraumatic stress symptoms or depressive symptoms following major life stress; however, this risk was mitigated among children who reported high levels of social support (La Greca et al., 2013). For children and youth, social support from parents and family appears to be the most important, but support from teachers and friends are also important (Aba et al., 2019; Chu et al., 2010; Gariépy et al., 2016; Rueger et al., 2016).

### *Bidirectional Association of Social Support and Psychological Distress*

The association of social support with psychological distress appears to be bidirectional (Ibarra-Rovillard & Kuiper, 2011). In addition to evidence that low social support may be associated with worsened well-being, psychological distress can result in decreased social support (Aba et al., 2019; Coyne, 1976). For example, psychological distress and posttraumatic stress disorder symptoms were related to future erosion of social support for military veterans (Shallcross et al., 2016). In another study, adolescents' initial depressive symptom severity predicted future decreases in peer social support (Stice et al., 2004). Moreover, chronic depressive disorders can undermine interpersonal relationships and the availability of social support due to their pervasive nature and characteristic interpersonal hostility (Coyne, 1976).

Life stressors can also disturb one's perception that support is available (Aba et al., 2019; Norris & Kaniasty, 1996). For example, flood exposure has been associated with declines in the perception of social support availability up to six months following the disaster (Kaniasty & Norris, 1993). Following exposure to Hurricane Katrina, children's posttraumatic stress symptoms significantly decreased the effects of social support, especially within the first two years following the disaster; this was true for social support from parents, teachers, and peers

(Lai et al., 2018). Additionally, childhood maltreatment has been shown to predict lower social support in adulthood (Vranceanu et al., 2007). Moreover, chronic stressors may be more resistant to the buffering effects of social support than acute stressors, as chronic stressors cause distress over longer periods of time and are thus less easily mitigated (Rueger et al., 2016). Instead, long-term stressors may erode the buffering effects of social support over time by breaking down the availability of social ties (Aba et al., 2019). For example, the effects of social support were dampened among children who experienced long-term stressors, such as a medically ill family member, family death, abuse, or sexual minority status, as compared to children who had not faced these major stressors (Rueger et al., 2016).

The *stress generation hypothesis* highlights the role of the individual in actively contributing to the initiation and maintenance of interpersonal conflict and stress in their environment. Specifically, the stress generation hypothesis suggests that psychopathology may increase an individual's risk to experience life stress and interpersonal conflict, which can erode social support networks (D. Cole et al., 2006; Flynn et al., 2014; Hammen, 1991). This model may be especially relevant for individuals with major depressive disorder, which inherently limits one's exposure to positive environments and is characterized by depressotypic beliefs about oneself, the world, and the future (Beck et al., 1979; Eberhart & Hammen, 2009; Sahl et al., 2007).

Self-generated and dependent stressors, which are stressors an individual plays a role in generating or maintaining, are related to an individual's personal characteristics and behaviours that affect their interpersonal interactions, such as their cognitions, values, and traits (Hammen, 2006; Liu & Alloy, 2010). These forms of stressors are more common in individuals with a depressive disorder, as a result of depressotypic negative thought patterns and interpersonal

behaviours (Beck et al., 1979; Eberhart & Hammen, 2009; Hammen, 2006). As a result, individuals with psychopathology (e.g., depressive disorders) may report decreased frequency of peer interactions and social contact (Leaf et al., 1984), as well as increased hostility or quarrelsome behaviour (Blumberg & Hokanson, 1983; Kahn et al., 1985; L. M. Rappaport et al., 2014; Zuroff et al., 2007). In turn, increased quarrelsome behaviour may interfere in forming or maintaining relationships (Coyne, 1976; Hokanson et al., 1989; Ibarra-Rovillard & Kuiper, 2011; Joiner et al., 1992), which leads to conflict (e.g., relationship dissolution), life stress, and greater social isolation in the face of life stress (e.g., Sahl et al., 2007). This strain on social relationships can negatively affect social support availability by weakening social ties (Flynn et al., 2014; Gladstone et al., 2007). Thus, high rates of stress generation experienced by individuals with psychopathology (e.g., depressive disorders) may interfere with an individual's ability to form and maintain supportive social connections (D. Cole et al., 2006).

The stress generation process also plays out in childhood and adolescence. Elevations in depressive symptoms in children predict increased peer victimization and interpersonal conflict over a six-month follow-up (Gibb & Hanley, 2010), which indicates a dose-response relationship between depressive symptoms and the generation of peer conflict. This provides further evidence of the key role that hostility plays in the stress generation hypothesis (Sahl et al., 2007). Additionally, youth with a prior depressive episode experience more dependent stressors (i.e., stressors to which they contribute) than youth without a prior depressive episode (Connolly et al., 2010; Kercher & Rapee, 2009). The association of depressive disorders with stress may be mediated by one's cognitive vulnerability for a tendency to make depressogenic attributions and ruminate, which are characteristic negative attributes of depressive disorders (Kercher & Rapee, 2009). In a study of children ages 8 to 12, children's baseline level of depressive symptoms

predicted generation of dependent family stress a year later (Chan et al., 2014). Factors that increase one's vulnerability to a depressive disorder, such as parental psychopathology, can also contribute to stress generation in children. For example, both child and parent depressive symptoms at baseline predicted the occurrence of stressful events over a year (Shih et al., 2009). Additionally, a study of girls highlighted the cycle of psychopathology and stress generation: depressive symptoms predicted interpersonal stress, which predicted subsequent depressive symptoms and suggests that self-generated interpersonal stress may partially account for the maintenance of depression over time (Rudolph et al., 2009). Thus, there may be a transactional nature between stress and depression in children and adolescents (Shapero et al., 2013).

Beyond psychopathology (e.g., depressive disorders), stress also acts as a predictor of stress generation, which suggests that stress generation may feed into itself in a kindling pattern (Liu & Alloy, 2010). Increased stress may precipitate increased quarrelsome behaviour, which may increase the likelihood of interpersonal conflict and reduce the availability of social relationships to help manage stress from a variety of sources. Ultimately, in this manner, stress may beget worsened stress in a cyclical fashion (Liu & Alloy, 2010). Children are also at risk for the stress generation process (Flynn & Rudolph, 2011). However, if one depends on assistance from others, as children do ( Masten & Motti-Stefanidi, 2020), the possibility that elevated stress might interfere with the support available from others may pose a particularly grave threat to one's well-being. External stress that affects caregivers (e.g., parents), such as from the COVID-19 pandemic, may leave caregivers more sensitive to children's quarrelsome behaviour when stressed, which may leave children especially vulnerable to increased stress generation and decreased social support when upset.

### *Social Support in the COVID-19 Pandemic*

Research suggests that perceived social support from friends and family may buffer the acute psychological effects of stress related to the COVID-19 pandemic (Mactavish et al., 2021). Children who reported greater baseline social support reported less increase in psychological distress and lower anxiety symptoms, depressive symptoms, and irritability (Mactavish et al., 2021). In another study, across multiple age groups of adults, greater social support buffered against the negative impact of the COVID-19 pandemic on mental health (Li et al., 2021). Family support may be particularly important (Marques de Miranda et al., 2020). However, in recent research, children report deteriorating peer relationships in the face of the pandemic (Ravens-Sieberer et al., 2020), which may have negative effects on perceived availability of social support.

Efforts are presently underway to increase children's and youth's ability to connect with peers, teachers, and extended family to access support networks and buffer their mental health during the ongoing COVID-19 pandemic. For example, a randomized controlled study of an online peer support training program found that adolescents' self-care, empowerment, compassion, well-being, and agency improved after learning peer support skills, as well as frequency of providing support to peers, with gains maintained four-weeks post randomization (Pavarini et al., 2021).

### *The Present Study*

While my prior research highlighted the acute impact of the COVID-19 pandemic on the mental health of children in Southwestern Ontario, the long-term impact of the COVID-19 pandemic is largely unknown. Given that children are undergoing significant development throughout the pandemic, research on the effects of this chronic stressor on psychosocial

development is critical. Thus, the present study used data from an ongoing longitudinal study in Southwestern Ontario to investigate the impact of the COVID-19 pandemic on children's experiences of depressive and irritability symptoms, particularly to examine the possible protective role of social support.

Specifically, the present study investigated the impact of the COVID-19 pandemic on longitudinal experiences of depressive symptoms in children. Given evidence that, at baseline, 25.64% of children reported depressive symptoms above a putative threshold, the long-term duration of the pandemic, and the tendency for childhood stressors to contribute to the development of psychopathology such as depression, it appears that the pandemic is presenting as a chronic stressor in children's lives (e.g., Courtney et al., 2020; Mactavish et al., 2021). Depressive symptoms are a common mental health sequela of both early life stress and chronic stress (Marin et al., 2011; McGonagle & Kessler, 1990). Children, who are undergoing neurobiological and psychosocial development, are especially vulnerable to the negative effects of stress (e.g., Andresen, 2014). Across myriad early life or chronic stressors, children are at increased risk of developing depressive disorders (e.g., Benjet et al., 2010; Wingenfeld et al., 2011). Thus, I anticipated that the chronic nature of the COVID-19 pandemic would be associated with elevated depressive symptoms, which would fluctuate as the severity of the pandemic (e.g., local prevalence of the SARS-CoV-2 virus) fluctuated.

Additionally, the present study investigated the impact of the COVID-19 pandemic on irritability in children. Irritability, which is characterized by increased anger proneness and temper outbursts, is uniquely and highly related to depression in children (Leibenluft, 2017; Stringaris, 2011). For example, irritability is a criterion for a depressive episode in childhood (American Psychiatric Association, 2013). Irritability is extremely comorbid with childhood

depression; it may be present in more than a third of children with a depressive disorder (Stringaris et al., 2013). Recent work suggests that shared genetic loci underpin the association of depression with irritability (L. M. Rappaport et al., 2020; Savage et al., 2015), which may be associated with mechanisms related to affective processing (Brotman et al., 2017; Stringaris, Zavos, et al., 2012). Irritability predicts future depressive symptoms and long-term psychopathology, and irritability may present as a broad transdiagnostic risk factor for the development of internalizing disorders (Krieger et al., 2013; Stringaris, 2011; Stringaris, Zavos, et al., 2012). Given that irritability presents as a risk factor for the development of comorbid mental health symptomology in children, and given the already elevated rates of irritability in our sample (see Mactavish et al., 2021), it is important to investigate children's experiences of irritability through the COVID-19 pandemic, as this chronic stressor may act as a catalyst in the development of future depressive and irritability symptomology. At baseline, 50.96% of children reported irritability symptoms above a putative threshold, which indicates that the effect of stress from the pandemic may exacerbate irritability in this sample (Mactavish et al., 2021). Thus, I hypothesized that the chronic nature of the COVID-19 pandemic would be associated with elevated irritability symptoms, which would fluctuate as the severity of the pandemic (e.g., local prevalence of the SARS-CoV-2 virus) fluctuated.

The present study had three aims: 1) to evaluate whether baseline social support predicts changes in depressive and irritability symptoms over time during the COVID-19 pandemic; 2) to identify whether social support changed over time; and 3) to evaluate how experiences of social support may be related to experiences of depressive and irritability symptoms over time. As such, I had three hypotheses related to the above research questions. Based on previous research on the buffering effects of social support to protect against the negative effects of life stress (e.g.,

Cohen & Wills, 1985; Dalgard et al., 1995), I hypothesized that higher baseline social support would act as a moderator, and be protective against worsening depressive and irritability symptoms over time. I also hypothesized that social support would decrease as the COVID-19 pandemic persisted, based on previous research that chronic stress can erode social support over time (e.g., Aba et al., 2019; Rueger et al., 2016). Lastly, I hypothesized that decreased social support would be related to increased depressive and irritability symptoms throughout the pandemic. Low social support is related to poorer mental health outcomes, especially depressive symptoms, in the face of life stress (e.g., Hefner & Eisenberg, 2009; Ibarra-Rovillard & Kuiper, 2011). Additionally, psychological stress and distress (e.g., depressive symptoms) may be associated with reduced social support related to hostility and interpersonal stress (e.g., Gibb & Hanley, 2010; Hammen, 2006). Thus, I hypothesized an association of social support with both depressive and irritability symptoms over time. However, it would be inappropriate to have hypothesized the exact directionality of this association, given extensive previous literature that provides evidence for both directions, as noted above.

The present study presents several innovations. In applying the buffering hypothesis to a pandemic, this study extends the current body of literature on the protective power of social support against a broad range of life stressors to include global disease outbreaks. It also clarified how elevations or decreases in depressive and irritability symptoms are related to changes in perceived social support. Additionally, the present study investigated how social support responds to the chronic stress created by the COVID-19 pandemic including whether children may be at risk for degraded social support over time.

# CHAPTER TWO: METHOD

## *Participants*

The present study used data from the Southwestern Ontario Children's Mental Health Study, in which 337 pairs of children aged 8 to 13 years and one parent or guardian were recruited from Southwestern Ontario (i.e., London, Sarnia, Windsor, and the surrounding counties) for a longitudinal study to document the mental health impact of the COVID-19 pandemic. This sample size provides 80% statistical power to identify even small associations ($\beta$= 0.15) between changes in social support and depressive and irritability symptoms. Recruitment was conducted through information provided to families by local school boards, advertisements in local newspapers, and advertisements on social media. To participate in the study, children and parents or guardians had to reside in Southwestern Ontario and comprehend English sufficiently to complete study questionnaires.

## *Procedure*

The Southwestern Ontario Children's Mental Health Study began in June 2020 and continued longitudinal follow-up assessments through November 2021. During this time, children and a parent or guardian completed a battery of questionnaires at baseline, then once a month for six months, and once at nine months after baseline. Families were compensated $12 for baseline and $9 for each follow-up assessment completed. Links to the online questionnaires were provided via email to the parent or guardian, and questionnaires were administered using Qualtrics, an online survey system. The battery of parent questionnaires was presented first, follow by the battery of child questionnaires. Parent questionnaires contained wording asking parents to report on their child's experiences and symptoms; child questionnaires asked children to report about their own experiences and symptoms.

The use of both child and parent report is consistent with best practices for child assessment (De Los Reyes et al., 2015). Each informant provides important information about children's behaviour across contexts to comprehensively assess children's experiences (Weisz et al., 2017).

### *Measures*

#### *CoRonavIrus Health Impact Survey (CRISIS)*

The CRISIS is a questionnaire developed to assess COVID-19 related outcomes for cohesive and comparable research (Merikangas et al., 2020). It assesses a broad range of COVID-19 related experiences, impacts, and outcomes, such as exposure to the SARS-CoV-2 virus, employment, etc. Data from the CRISIS were used in the present study to collect demographic information (e.g., age, sex, ethnicity, etc.) and to assess children's perceived availability of social support. Children were asked to self-report their perceived availability of social support from friends and family members on four items at baseline and each follow-up assessment (e.g., "When I was sad, worried, or in a bad mood, I could count on my family/friends to help me feel better") on a five-point Likert scale from *strongly disagree* (0) to "*strongly agree* (4). Ratings on these four items were combined to create a sum score of social support with higher scores indicating higher levels of social support. Previous research supports use of the CRISIS with youth and children (Hawke et al., 2020; Nikolaidis et al., 2020) including in the present study, based on baseline data collected in June and July 2020 (Mactavish et al., 2021). The CRISIS was selected for the present study for ease of direct comparison with other COVID-19-related research being conducted globally, as well as its inclusion of items assessing social support. In the present study, social support items on the CRISIS had high internal reliability ($\alpha$= 0.74- 0.90; see Supplemental Table 1).

### *Short version of the Mood and Feelings Questionnaire (SMFQ)*

The SMFQ is a 13-item assessment of depressive symptomology (Angold et al., 2005). Children and parents completed the SMFQ at each assessment period to report on children's depressive symptoms over the past two weeks. Each item (e.g., "I felt miserable or unhappy") is rated on a 3-point Likert-type scale, ranging from *not true* (0) to *true* (2). Ratings for each item are combined to create a total score of depressive symptoms, with higher scores indicating more depressive symptoms. The SFMQ was selected for the present study due to its consistent reliability and validity with children, aged 8 to 16 (Klein et al., 2005). The short version was selected in place of the original MFQ to reduce participant burden. Reliability of the SMFQ for the present sample is reported in Rappaport et al (2022).

### *Affective Reactivity Index (ARI)*

The ARI is a 7-item assessment of irritability symptoms and provides a threshold indicative of disruptive mood dysregulation disorder (Stringaris, Goodman, et al., 2012). Children and their parents completed the ARI at each assessment period to report on the child's irritability symptoms over the past two weeks. Each item (e.g., "I often lose my temper") is rated on a 3-point Likert-type scale ranging from *not true* (0) to *certainly true* (2). Ratings for each item are combined to create a total score of irritability, with higher scores indicating more irritability symptoms. The ARI was selected for the present study due to its high reliability and validity in community samples of children aged 6 to 17 (e.g., L. M. Rappaport et al., 2020; Stringaris, Goodman, et al., 2012). Reliability of the ARI for the present sample is reported in Rappaport et al (2022).

### *Data Analyses*

Primary data analyses used multilevel, mixed effects models in the open-source R statistical environment to address the three research questions (R Core Team, 2020; Raudenbush & Bryk, 2002). Regarding aim one, to evaluate whether baseline social support predicts changes in depressive and irritability symptoms over time during the pandemic, depressive and irritability symptoms were, separately, regressed onto month since the onset of the COVID-19 pandemic in Canada (i.e., March 2020). The regression of symptom severity (e.g., depressive symptom severity) on time analytically indexed change in symptom severity over time. Time was included as both a fixed and random effect to account for between-person variation in change in symptom severity (e.g., depressive symptom severity) over time as might be evident if some children experienced substantial changes in symptom severity over time while others changed very little.

I then added children's baseline reports of their perceived social support to the model as a main effect and interaction with time, to empirically test whether baseline social support moderates the association of symptom severity with time, while accounting for any baseline association of social support with symptom severity (i.e., the main effect).

Analyses included data from all participants to identify change in depressive and irritability symptoms. However, I note that baseline social support data are only available from the 190 parent-child pairs who completed their baseline assessment in Summer 2020; baseline data from participants who started the study in November 2020 and later do not accurately reflect their baseline social support over the Summer of 2020.

Analyses were conducted for depressive and irritability symptoms separately, to determine whether slopes of symptoms were differentially predicted (i.e., moderated) by social

support. Analyses were repeated separately for child- and parent-report of depressive and irritability symptoms to examine consistency of findings between child- and parent-report.

Regarding aim two, to identify whether social support changes over time, I fit a multilevel, mixed effect model in which social support was regressed on time since the onset of the COVID-19 pandemic in Canada (i.e., March 2020). Time was included as both a fixed and random effect to allow for between-person variation in change in social support over time, such as might be evident if some children demonstrated substantial change while others changed very little. Analyses drew from the full sample of 317 parent-child pairs, with each pair contributing eight months (baseline, six monthly follow-ups assessments, and a final nine-month follow-up assessment) to the total 20 months of assessments.

Regarding aim three, to evaluate how time-varying experiences of social support may be related to time-varying experiences of depressive and irritability symptoms, I added concurrent, time-varying social support to the models of depressive and irritability symptoms across all 20 months of data collection (i.e., from June 2020 through November 2021). Analysis drew from the full sample of 317 parent-child pairs. Each parent/guardian and child pair contributed eight months (baseline, six monthly follow-ups assessments, and a final nine-month follow-up assessment) to the total 20 months of assessments in the study. Symptom severity was regressed onto social support, which was treated as a time-varying covariate given that it changed month-to-month. Levels of depressive and irritability symptoms were regressed onto social support at each time point independently to capture differences in the relationships between these variables. Similar to aim one, analyses were repeated for child- and parent- or guardian-report to examine consistency of findings between raters of children's mental health.

# CHAPTER THREE: RESULTS

## *Participants*

Three hundred and thirty-seven families completed baseline assessment. Software obstacles, such as captcha, were used to block non-human respondents (i.e., bots). Additionally, 60 responses were manually removed from analyses during data cleaning due to suspicious response patterns (e.g., responses completed infeasibly quickly). Data from 317 families were retained for analyses. Children ranged in age from eight to 13 years old (*M*=10.83; *SD*=1.48) and were balanced between females *(N*=164 [51.74%]) and males (*N*=153 [48.26%]). Most parents or guardians identified as female (*N*=287 [90.45%]) and ranged from 21 to 58 years old (*M*=41.26; *SD*=5.85). Almost all respondents were from the Windsor-Essex region of Ontario (*N*=297 [93.69%]); others lived in Middlesex-London (*N*=12 [3.79%]), Sarnia-Lambton (*N*=4 [1.26%]), or Chatham-Kent (*N*=3 [0.95%]). Parents or guardians reported ancestral or ethnic descent of the child; 49.53% of children enrolled in the study (*N*=157) were of descent from England, Ireland, Scotland, or Wales; 25.24% (*N*=80) from Western Europe; 16.09% (*N*=51) from Eastern Europe; 21.77% (*N*=69) from North America – not of First Nations, Native American, Inuit, or Métis descent; 17.03% (*N*=54) from Southern Europe; 10.09% (*N*=32) from the Middle East; 7.26% (*N*=23) from North America – of First Nations, Native American, Inuit, or Métis descent; 4.42% (*N*=14) from Eastern Asia; 2.21% (*N*=7) of Hispanic or Latinx descent; 2.21% (*N*=7) from Northern Europe; 2.21% (*N*=7) from South Asia; 1.89% (*N*=6) from South-East Asia; 1.89% (*N*=6) from Africa; 1.58% (*N*=5) from Central or South America; 1.90% (*N*=6) from other another ethnicity; and 2.52% (*N*=8) didn't know their ancestral or ethnic descent. Family ancestry approximated the demography of Southwestern Ontario, with slightly elevated

representation of children with family originating from England, Ireland, Scotland, or Wales (Statistics Canada, 2020).

T-tests between missing and non-missing data points were conducted to determine if there were significant effects of attrition. Child age, parent age, child sex, parent sex, highest education a parent had attained, region, neighbourhood type, size of house, a parent being an essential worker, a parent being a health care worker, government assistance, parent- or guardian-report of a child's physical health, parent- or guardian-report of a child's mental health, children's report of physical health, children's report of mental health, children's report of social support, children's report of fear of contracting COVID-19, and children's report of stress related to stay-at-home orders were considered ($p \leq 0.03$). To account for multiple testing, as 23 t-tests were conducted in calculating attrition, significance was set to $p < 0.01$; no variables were significantly related to attrition. The total rate of attrition was 42.90% (N= 136). For a breakdown of monthly drop-out, see Rappaport et al (2022).

### *Association of Baseline Social Support with Change in Depressive Symptoms and Irritability Over Time*

#### *Depressive Symptoms*

Baseline child-reported perceived availability of social support was inversely correlated with baseline child- (see Table 1) and parent-/guardian-reported depressive symptoms (see Table 2). Children who reported higher baseline social support also reported lower depressive symptom severity at baseline assessment. For either child- or parent-/guardian-reported depressive symptoms, there was no evidence of significant interaction effects of baseline social support with time, which would indicate distinct trajectories of depressive symptoms over time as a function of baseline social support. In other words, children's initial level of social support at baseline did

not predict change in their depressive symptoms over time according to self-report or observation by parents or guardians. As reported in Rappaport et al. (2022), there was statistically significant evidence of linear, quadratic, and possible cubic effects of time on child- and parent-/guardian-reported depressive symptoms, which indicate change in children's depressive symptoms over time. Random effects for intercept indicate interindividual heterogeneity in initial depressive severity according to both child self-report and parent or guardian observation. Random effects for linear change over time similarly indicate interindividual heterogeneity in change in depressive symptoms over time according to both child self-report and parent or guardian observation. Finally, for both models of child self-report and parent- or guardian-report, the random correlations of intercept with time indicate that children who reported or demonstrated relatively higher baseline depressive symptoms experienced less variability in symptoms over time.

**Table 1.**

Association of social support with change in child-reported depressive symptoms.

| Variable | Fixed Effects | | Random Effects |
|---|---|---|---|
| | *b* (95% CI) | *p* | *SD/Correlation* (95% CI) |
| Intercept | 12.22 (7.66, 16.78) | $2.18 \times 10^{-7}$*** | 4.22 (3.43, 5.18) |
| Baseline Support | -0.59 (-0.91, -0.26) | 0.001** | - |
| Survey | -0.41 (-1.25, 0.43) | 0.34 | - |
| Linear Slope over Time | -3.26 (-5.20, -1.31) | 0.001** | 0.33 (0.23, 0.47) |
| Quadratic Slope over Time | 0.42 (0.11, 0.72) | 0.01* | - |
| Cubic Slope over Time | -0.01 (-0.03, -0.002) | 0.02* | - |
| Baseline Support X Linear Slope over Time (interaction) | 0.01 (-0.02, 0.04) | 0.58 | - |
| Intercept with Linear Slope over Time (correlation) | - | - | -0.51 (-0.73, -0.19) |

*p< 0.05. **p< 0.01. ***p< 0.001.

**Table 2.**

Association of social support with change in parent- or guardian-reported depressive symptoms.

| Variable | Fixed Effects | | Random Effects |
|---|---|---|---|
| | *b* (95% CI) | *p* | *SD/Correlation* (95% CI) |
| Intercept | 13.60 (0.88, 17.32) | $2.41 \times 10^{-12}$*** | 4.93 (4.21, 5.79) |
| Baseline Support | -0.38 (-0.71, -0.04) | 0.03* | - |
| Survey | 0.29 (-0.40, 0.97) | 0.41 | - |
| Linear Slope over Time | -3.02 (-4.59, -1.45) | 0.0002*** | 0.29 (0.21, 0.40) |
| Quadratic Slope over Time | 0.26 (0.02, 0.51) | 0.04* | - |
| Cubic Slope over Time | -0.01 (-0.02, 0.003) | 0.16 | - |
| Baseline Support X Linear Slope over Time | 0.01 (-0.02, 0.04) | 0.37 | - |
| Intercept with Linear Slope over Time | - | - | -0.66 (-0.81, -0.44) |

*p< 0.05. **p< 0.01. ***p< 0.001.

### *Irritability Symptoms*

Baseline child-reported perceived availability of social support was inversely correlated with baseline child-reported irritability symptoms (see Table 3). Children who reported higher baseline social support also reported lower irritability at baseline assessment. The association of child-reported social support with parent-/guardian-reported irritability symptoms did not reach statistical significance (see Table 4). There was no evidence of significant interaction effects of baseline social support with time for either child- or parent-/guardian-reported irritability symptoms. This suggests that children's reported level of social support at baseline did not predict distinct trajectories in their irritability symptoms over time, according to both child self-report or parent- or guardian-report of the child's symptoms. Like results reported in Rappaport et al. (2022), there was statistically significant evidence of linear and quadratic effects of time on child- and parent- or guardian-reported irritability symptoms, which indicated change in children's irritability symptoms over time. Random effects for intercept suggest interindividual heterogeneity in initial irritability severity according to both child-report and parent or guardian observation. Random effects for time also indicate interindividual heterogeneity in change in irritability symptoms over time according to both child-report and parent- or guardian-report. Random correlations of intercept with time indicate differing trends in irritability symptoms over time based on one's initial irritability severity. For example, children who reported or demonstrated higher baseline irritability also experienced less variability in symptoms over time.

**Table 3.**

Association of social support with change in child-reported irritability symptoms.

| Variable | Fixed Effects | | Random Effects |
|---|---|---|---|
| | *b* (95% CI) | *p* | *SD/Correlation* (95% CI) |
| Intercept | 5.02 (2.85, 7.20) | $7.09 \times 10^{-6}$*** | 3.86 (2.73, 5.46) |
| Baseline Support | -0.24 (-0.42, -0.05) | 0.01* | - |
| Survey | 0.08 (-0.29, 0.46) | 0.67 | - |
| Linear Slope over Time | -0.65 (-1.24, -0.06) | 0.03* | 0.76 (0.48, 1.20) |
| Quadratic Slope over Time | 0.03 (0.01, 0.05) | 0.003** | 0.04 (0.02, 0.06) |
| Baseline Support X Linear Slope over Time | 0.01 (-0.01, 0.03) | 0.47 | - |
| Intercept with Linear Slope over Time | - | - | -0.84 (-0.94, -0.61) |
| Intercept with Quadratic Slope over Time | - | - | 0.82 (0.43, 0.95) |
| Linear Slope over Time with Quadratic Slope over Time | - | - | -0.99 (-1.00, -0.93) |

*p< 0.05. **p< 0.01. ***p< 0.001.

**Table 4.**

Association of social support with change in parent- or guardian-reported irritability symptoms.

| Variable | Fixed Effects | | Random Effects |
|---|---|---|---|
| | *b* (95% CI) | *p* | *SD/Correlation* (95% CI) |
| Intercept | 6.80 (4.83, 8.78) | $3.65x10^{-11}$*** | 4.89 (3.89, 6.17) |
| Baseline Support | -0.23 (-0.64, 0.17) | 0.26 | - |
| Survey | 0.34 (0.01, 0.66) | 0.05 | - |
| Linear Slope over Time | -1.08 (-1.60, -0.56) | 0.0001*** | 0.89 (0.64, 1.26) |
| Quadratic Slope over Time | 0.04 (0.03, 0.06) | $4.13X10^{-6}$*** | 0.04 (0.03, 0.07) |
| Baseline Support X Linear Slope over Time | 0.04 (-0.05, 0.13) | 0.42 | - |
| Baseline Support X Quadratic Slope over Time | -0.002 (-0.01, 0.002) | 0.30 | - |
| Intercept with Linear Slope over Time | - | - | -0.91 (-0.96, -0.83) |
| Intercept with Quadratic Slope over Time | - | - | 0.90 (0.75, 0.96) |
| Linear Slope over Time with Quadratic Slope over Time | - | - | -0.99 (-1.00, -0.95) |

*p< 0.05. **p< 0.01. ***p< 0.001.

### *Change in Perceived Social Support Over Time*

Children's report of the perceived availability of social support from family and friends fluctuated over time with evidence of linear, quadratic, and cubic trends (see Table 5 and Figure 1). Over the period studied, there was no statistically significant evidence of overall linear change in children's perceived availability of support from family and friends around said fluctuations. Additionally, neither the cohort in which each family was recruited, nor the survey to which they responded, were related to children's perceived availability of social support (see Table 5). Random effects indicate heterogeneity in baseline perceived social support availability and in one's initial, linear change in perceived social support availability over time. The correlation between the random effect for intercept and linear slope over time indicate that children who reported higher initial perceived social support availability experienced less variability in social support over time.

Based on previously documented associations of internalizing psychopathology with fear of contracting COVID-19 and stress related to stay-at-home orders or the cancellation of significant events (e.g., graduation; Rappaport et al., 2022), social support was also regressed onto both children's reported fear of contracting COVID-19 and stress related to stay-at-home orders. Following procedures recommended for multilevel modeling (Curran & Bauer, 2011), both variables were person centered to disaggregate within-person variation (i.e., monthly variation within each child over time) from between-person variation (e.g., variation among children's average fear of contracting COVID-19). Within-person, monthly variation in stress related to stay-at-home orders was significantly related to fluctuations in social support such that children reported less available social support from family and friends on months when they also reported greater stress related to stay-at-home orders (see Table 6). There was no evidence that

between-person variation in stress related to stay-at-home orders or the cancellation in significant events or between- or within-person variation in fear of contracting COVID-19 were related to social support.

Potential indices of local COVID-19 severity were added as covariates in three subsequent models. Specifically, social support was regressed onto indicators of local COVID-19 severity (i.e., case prevalence per 100,000 persons, hospitalization rate, and death rate) in separate models. There was no statistically significant evidence that the monthly prevalence of COVID-19 per 100,000 persons ($b = -0.004$, 95% CI [-0.01, 0.01], $p = 0.43$), hospitalization rate ($b = 0.16$, 95% CI [-0.37, 0.17], $p = 0.46$,), or death rate ($b = -0.13$, 95% CI [-0.42, 0.15], $p = 0.45$) due to COVID-19 were related to monthly fluctuations in children's perceived availability of social support from family and friends.

**Table 5.**

Interactions of time and survey-related factors with change in social support over time.

| Variable | Fixed Effects | | Random Effects |
|---|---|---|---|
| | *b* (95% CI) | *p* | *SD/Correlation* (95% CI) |
| Intercept | 10.00 (8.22, 11.79) | $7.78 \times 10^{-27}$*** | 2.25 (1.85, 2.72) |
| Survey | 0.02 (-0.19, 0.22) | 0.86 | - |
| Cohort | -0.03 (-1.35, 0.69) | 0.53 | - |
| Linear Slope over Time | 0.72 (0.25, 1.19) | 0.003** | 0.15 (0.11, 0.22) |
| Quadratic Slope over Time | -0.07 (-0.12, 1.19) | 0.01* | - |
| Cubic Slope over Time | 0.002 (0.001, 0.003) | 0.01* | - |
| Intercept with Linear Slope over Time | - | - | -0.53 (-0.72, -0.27) |

*p< 0.05. **p< 0.01. ***p< 0.001.

**Figure 1.**

Change in child-reported social support over time.

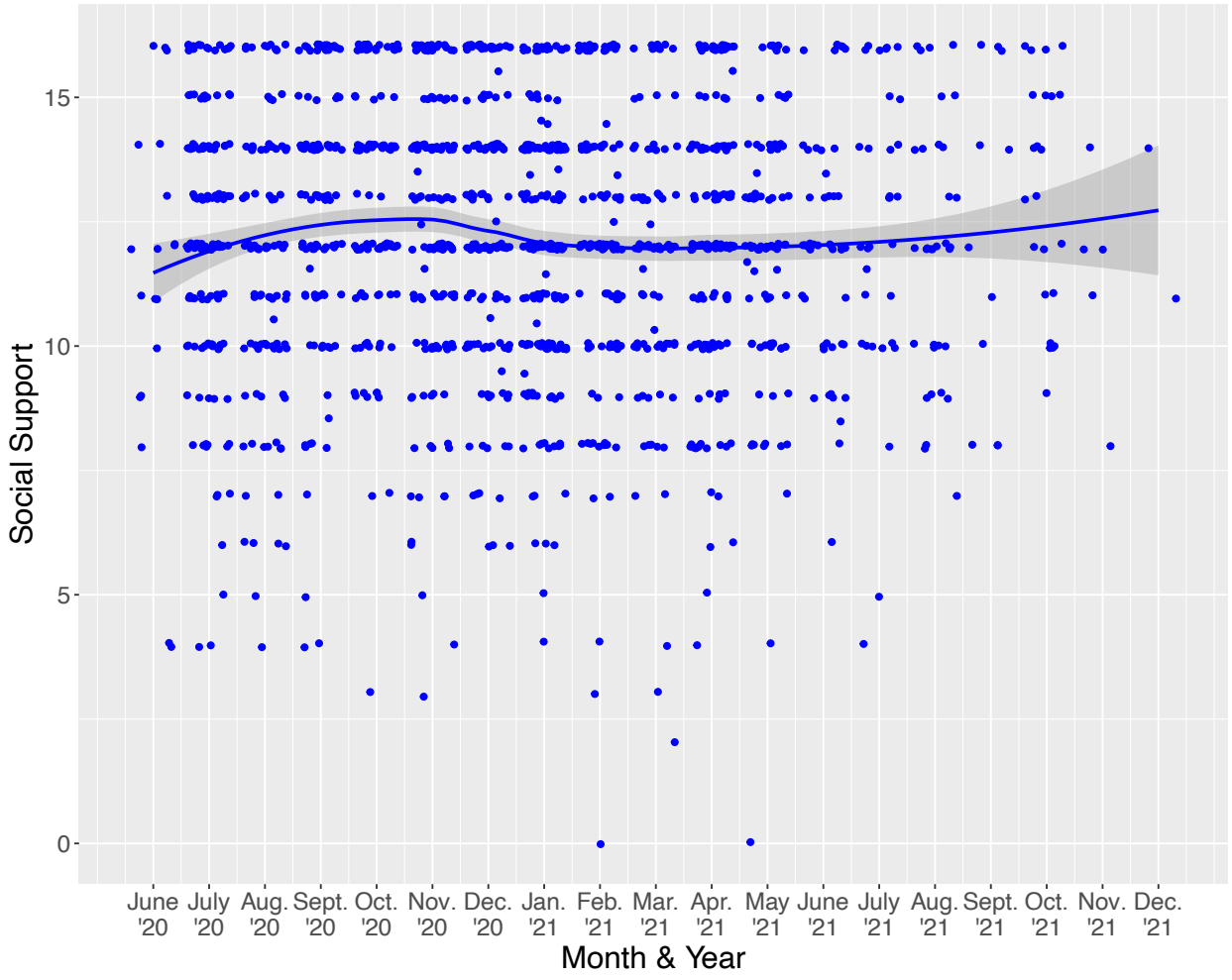

**Table 6.**

Interactions of time, survey-related factors, and COVID-19-related factors with change in social support over time.

| Variable | Fixed Effects | | Random Effects |
|---|---|---|---|
| | *b* (95% CI) | *p* | *SD/Correlation* (95% CI) |
| Intercept | 10.73 (8.91, 12.554) | $2.08 \times 10^{-29}$*** | 2.20 (1.82, 2.66) |
| Survey | -0.07 (-0.27, 0.13) | 0.50 | - |
| Cohort | -0.64 (-1.64, 0.36) | 0.21 | - |
| Stress related to stay-at-home orders and cancellation of significant events (within-person) | -0.49 (-0.72, -0.27) | $1.82 \times 10^{-5}$*** | - |
| Stress related to stay-at-home orders and cancellation of significant events (between-person) | -0.21 (-0.58, 0.16) | 0.26 | - |
| Fear of contracting COVID-19 (within-person) | -0.03 (-0.22, 0.15) | 0.72 | - |
| Fear of contracting COVID-19 (between-person) | -0.37 (-0.79, 0.04) | 0.08* | |
| Linear Slope over Time | 0.61 (0.15, 1.08) | 0.01* | 0.14 (0.10, 0.21) |
| Quadratic Slope over Time | -0.05 (-0.10, -0.01) | 0.01* | - |
| Cubic Slope over Time | 0.002 (0.0003, 0.003) | 0.02* | - |
| Intercept with Linear Slope over Time | - | - | -0.52 (-0.72, -0.23) |
| Intercept with Stress related to stay-at-home orders and cancellation of significant events (within-person) | - | - | 0.41 (-0.01, 0.71) |
| Linear Slope over Time with Stress related to stay-at-home orders and cancellation of significant events (within-person) | - | - | -0.20 (-0.60, 0.28) |

*p< 0.05. **p< 0.01. ***p< 0.001.

### *Time-Varying Association of Social Support with Depressive and Irritability Symptoms*

#### *Depressive Symptoms*

Statistically significant within-person associations of social support with depressive symptoms indicate that children reported lower depressive symptoms (see Table 7) and parents or guardians noted lower child depressive symptoms (see Table 8) on months when children reported high social support relative to each child's average. Rappaport et al. (2022) demonstrated that child and parent or guardian report of child depressive symptoms fluctuated over time during the study period. Within-child increases in children's monthly perceived social support availability were associated with lower reported monthly depressive symptom severity. Moreover, children who reported higher average social support over the study period also reported lower average depressive symptoms over the study period (see Table 7) and demonstrated lower average depressive symptoms as reported by parents or guardians (see Table 8).

Random effects for intercept indicate that children varied from one another in their initial depressive symptom severity according to both child-report and parent-/guardian-report. Random effects for the linear slope of depressive symptoms over time reported by child and their parents or guardians suggest that children differed from one another in their variability in depressive symptom severity over time. Random effects for within-person variability in social support suggest that the association of fluctuations in depressive symptoms with social support varied across people according to child self-report and parent or guardian observations; some children may show a stronger association of monthly social support with monthly depressive symptoms than other children. The correlation of random effects for intercept with linear slope over time for child-reported and parent-/guardian-reported depressive symptoms suggest that children

differ in their linear trajectory of depressive symptoms over time depending on their initial level of depressive symptoms. For example, children with higher initial depressive symptoms demonstrate less variability in symptoms over time. Additionally, the correlation of random effects for intercept with within-person social support suggest that children differ in the strength of the association between social support and depressive symptoms over time depending on their initial levels of depressive symptoms, according to parent-/guardian-report. For example, children with higher initial parent-/guardian-reported depressive symptoms had less of an association between time-varying social support and time-varying observed depressive symptoms. This correlation of random effects was not significant for child-reported depressive symptoms.

Rappaport et al. (2022) identified time-varying psychological variables, namely fear of contracting COVID-19 and stress related to stay-at-home orders or the cancellation of important events, strongly related to child well-being and mental health during the COVID-19 pandemic. To ensure that social support was related to child well-being and mental health independent of other psychological correlates of child well-being and mental health, these variables were added to a second model (see Supplemental Tables 2 and 3). Both additional covariates were person centered to disaggregate within- from between-person variability. In separate analyses, child- and parent- or guardian-reported depressive symptoms were regressed onto fear of contracting COVID-19 and stress related to stay-at-home orders or the cancellation of important events. There were significant main effects of fear of contracting COVID-19 and stress related to stay-at-home orders, both between-person and within-person, on change in depressive symptoms according to both child-report and parent-/guardian-report. However, both within-person and between-person social support remained significantly related to change in depressive symptoms

after the addition of these COVID-19-related variables to the model, highlighting the independent relationship that exist between time-varying social support and time-varying depressive symptoms.

**Table 7.**

Time-varying associations of child-reported social support and child-reported depressive symptoms.

| Variable | Fixed Effects | | Random Effects |
|---|---|---|---|
| | *b* (95% CI) | *p* | *SD/Correlation* (95% CI) |
| Intercept | 16.55 (12.60, 20.50) | $6.31X10^{-16}$*** | 4.71 (4.01, 4.54) |
| Cohort | -1.14 (-2.89, 0.61) | 0.20 | - |
| Survey | -0.55 (-0.88, -0.22) | 0.001** | - |
| Case Rate Reported | 0.01 (-0.004, 0.03) | 0.14 | - |
| Linear Slope over Time | -0.82 (-1.57, -0.06) | 0.03* | 0.32 (0.25, 0.41) |
| Quadratic Slope over Time | 0.11 (0.05, 0.18) | 0.001** | - |
| Cubic Slope over Time | -0.003 (-0.006, -0.001) | 0.001** | - |
| Social Support (Within-person) | -0.29 (-0.40, -0.19) | $1.11X10^{-7}$*** | 0.42 (0.32, 0.57) |
| Social Support (Between-person) | -0.86 (1.09, -0.65) | $2.43X10^{-13}$*** | - |
| Intercept with Linear Slope over Time (correlation) | - | - | -0.53 (-0.69, -0.33) |
| Intercept with Social Support (Within-person) | - | - | -0.07 (-0.48, 0.36) |
| Social Support (Within-person) with Linear Slope over Time | - | - | -0.55 (-0.84, 0.01) |

*p< 0.05. **p< 0.01. ***p< 0.001.

**Table 8.**

Time-varying associations of child-reported social support and parent- or guardian-reported depressive symptoms.

| Variable | Fixed Effects | | Random Effects |
|---|---|---|---|
| | *b* (95% CI) | *p* | *SD/Correlation* (95% CI) |
| Intercept | 16.37 (12.63, 20.11) | $3.29X10^{-17}$*** | 5.78 (5.10, 6.54) |
| Cohort | 0.05 (-1.51, 1.61) | 0.95 | - |
| Survey | -0.30 (-0.59, -0.01) | 0.04* | - |
| Case Rate Reported | 0.01 (-0.002, 0.02) | 0.11 | - |
| Linear Slope over Time | -1.41 (-2.07, -0.76) | $2.75X10^{-5}$*** | 0.35 (0.29, 0.42) |
| Quadratic Slope over Time | 0.15 (0.09, 0.20) | $1.52X10^{-6}$*** | - |
| Cubic Slope over Time | -0.004 (-0.01, -0.002) | $3.78X10^{-6}$*** | - |
| Social Support (Within-person) | -0.20 (-0.29, -0.11) | $1.29X10^{-5}$*** | 0.31 (0.21, 0.45) |
| Social Support (Between-person) | -0.61 (-0.83, -0.39) | $1.13X10^{-7}$*** | - |
| Intercept with Social Support (Within-person) | - | - | -0.39 (-0.64, -0.06) |
| Intercept with Linear Slope over Time | - | - | -0.75 (-0.82, -0.64) |
| Social Support (Within-person) with Linear Slope over Time | | - | 0.19 (-0.16, 0.50) |

*p< 0.05. **p< 0.01. ***p< 0.001.

### *Irritability Symptoms*

Rappaport et al (2022) demonstrated that child- and parent- or guardian-report of children's irritability symptoms fluctuated over time during the study period. The present study demonstrated that within-child fluctuations in children's monthly perceived social support were markedly inversely associated with fluctuations in irritability symptoms according to both child-report and report of parents or guardians. Children self-reported (see Table 9) and parents or guardian observed (see Table 10) lower irritability symptoms on months when children reported social support higher than the child's average perceived social support over time. Additionally, children who reported higher average social support over the study period also reported lower average irritability symptoms over the study period according to both child-report and parent- or guardian-report.

Random effects for intercept suggest that children varied in their initial levels of irritability symptoms according to child-report and parent- or guardian-report. Random effects for linear change over time suggest that children's change in irritability symptoms varied over time in both models of child self-reported irritability and parent or guardian observations of children's irritability. Random effects for within-person social support suggest interindividual heterogeneity in the association of fluctuations in irritability symptoms with social support; some children may be more sensitive to the effects of higher social support on their monthly irritability symptoms, according to both child-report and parent- or guardian-report. The correlation of random effects for intercept with random effects for linear slope over time suggests that, in both models of child- and parent- or guardian-report, children differ on their linear trajectory of irritability symptoms over time depending on their initial irritability symptom severity. For example, children who report higher initial irritability symptoms may demonstrate less

variability in irritability over time. The correlation of random effects for intercept with the random effects for within-person social support suggests that, for child-reported irritability, lower baseline irritability may be associated with greater sensitivity of a child's monthly irritability to monthly fluctuations in social support.

Additionally, Rappaport et al (2022) identified time-varying psychological variables (i.e., fear of contracting COVID-19 and stress related to stay-at-home orders or the cancellation of important events) related to child well-being and mental health during the COVID-19 pandemic. To ensure that social support was related to mental health independent of other psychological correlates, these variables were added to a second set of models (see Supplemental Tables 4 and 5). Similar to social support, both additional covariates were person centered to disaggregate within- from between-person variability. Child- and parent- or guardian-reported irritability symptoms were examined in separate analyses. Both between-person and monthly within-person variation in social support remained significantly related to monthly variation in irritability symptoms after the addition of these COVID-19-related covariates, which highlights the independent association of time-varying social support with time-varying irritability symptoms.

**Table 9.**

Time-varying associations of child-reported social support and child-reported irritability symptoms.

| Variable | Fixed Effects | | Random Effects |
|---|---|---|---|
| | *b* (95% CI) | *p* | *SD/Correlation* (95% CI) |
| Intercept | 9.57 (7.37, 11.76) | $4.41X10^{-17}$*** | 2.42 (2.03, 2.87) |
| Cohort | 0.17 (-0.79, 1.14) | 0.72 | - |
| Survey | -0.04 (-0.23, 0.15) | 0.67 | - |
| Case Rate Reported | -0.0003 (-0.01, 0.01) | 0.96 | - |
| Linear Slope over Time | -0.87 (-1.31, -0.44) | 0.0001*** | 0.12 (0.08, 0.19) |
| Quadratic Slope over Time | 0.08 (0.04, 0.12) | 0.0001*** | - |
| Cubic Slope over Time | -0.002 (-0.004, 0.001) | 0.0001*** | - |
| Social Support (Within-person) | -0.16 (-0.22, -0.10) | $1.29X10^{-5}$*** | 0.26 (0.19, 0.34) |
| Social Support (Between-person) | -0.34 (-0.46, -0.22) | $1.13X10^{-7}$*** | - |
| Intercept with Social Support (Within-person) | - | - | -0.15 (-0.45, -0.18) |
| Intercept with Linear Slope over Time | - | - | -0.47 (-0.69, -0.17) |
| Social Support (Within-person) with Linear Slope over Time | - | - | -0.36 (-0.72, 0.15) |

*p< 0.05. **p< 0.01. ***p< 0.001.

**Table 10.**

Time-varying associations of child-reported social support and parent- or guardian-reported irritability symptoms.

| Variable | Fixed Effects | | Random Effects |
|---|---|---|---|
| | *b* (95% CI) | *p* | *SD/Correlation* (95% CI) |
| Intercept | 8.70 (6.46, 10.95) | $6.98X10^{-14}$*** | 3.10 (2.71, 3.54) |
| Cohort | -0.02 (-0.97, 0.92) | 0.96 | - |
| Survey | -0.10 (-0.28, 0.08) | 0.27 | - |
| Case Rate Reported | 0.003 (-0.01, -0.25) | 0.47 | - |
| Linear Slope over Time | -0.65 (-1.05, -0.25) | 0.002** | 0.16 (0.13, 0.21) |
| Quadratic Slope over Time | 0.06 (0.02, 0.10) | 0.001** | - |
| Cubic Slope over Time | -0.002 (-0.002, -0.001) | 0.002** | - |
| Social Support (Within-person) | -0.11 (-0.16, -0.04) | 0.0002** | 0.19 (0.12, 0.28) |
| Social Support (Between-person) | -0.30 (-0.43, -0.17) | $1.34X10^{-5}$*** | - |
| Intercept with Social Support (Within-person) | - | - | -0.36 (-0.70, 0.12) |
| Intercept with Linear Slope over Time | - | - | -0.96 (-0.77, -0.50) |
| Social Support (Within-person) with Linear Slope over Time | - | - | 0.16 (-0.42, 0.64) |

*p< 0.05. **p< 0.01. ***p< 0.001.

# CHAPTER FOUR: DISCUSSION

The present study investigated possible longitudinal associations of social support with children's experiences of depressive and irritability symptoms during the COVID-19 pandemic. Specifically, the present study examined three aims: 1) to evaluate whether baseline social support predicts change in irritability or depressive symptoms over time during the COVID-19 pandemic; 2) to identify whether social support changes over time; and 3) to evaluate how experiences of social support may be related to experiences of irritability or depressive symptoms over time. To that end, children reported monthly on social support, irritability, and depressive symptoms while a parent or guardian of each child reported on their child's irritability and depressive symptoms. Prior research highlights the importance of perceived social support to protect individuals from worsened mental health in the face of life stressors (Cohen & Wills, 1985; Orehek & Lakey, 2011; Ozbay et al., 2007; Thompson et al., 2006). Perceived social support may be especially important for children, who rely on parents and trusted adults for assistance in coping with stressors (F. Norris et al., 2002; B. Tang et al., 2014). Therefore, the present study examined the concurrent and longitudinal implications of children's perceived availability of social support from family and friends during the COVID-19 pandemic to clarify the potential role of social support to help mitigate the psychosocial impact of life stressors. Ultimately, the present study adds to existing research to inform the development of resources to help children through chronic health challenges.

## *Associations of Baseline Social Support with Change in Depressive Symptoms and Irritability Over Time*

The first aim examined whether baseline social support predicted change in irritability or depressive symptoms over time during the COVID-19 pandemic. Baseline social support was

positively correlated with baseline child- and parent- or guardian-report of child depressive symptoms and child-report of irritability. Children who reported higher perceived social support at baseline also reported lower severity of irritability symptoms; their parents also observed less severe depressive symptoms. This is consistent with research on the acute impact of the pandemic during June and July of 2020, in which baseline perceived social support attenuated increases in psychological distress (Mactavish et al., 2021). There was little evidence that baseline social support was correlated with parent- or guardian-report of child irritability, which may reflect the limited information on internal experiences available to any informant, including a parent or guardian. For example, I note that items used to assess irritability ask about the speed and frequency with which one becomes angry or annoyed (e.g., "I am easily annoyed by others"). Parents and guardians may only witness behavioural markers of a child's annoyance, whereas children are able to report on all circumstances where they felt annoyed.

Baseline child reports of perceived social support early in the pandemic did not predict trends in irritability or depressive symptoms over time according to either child-report or parent- or guardian-report. These four null results suggest that a child's level of support early in the pandemic may not influence the course of their psychiatric symptoms over time. This is inconsistent with previous research that suggests baseline social support may partially predict the trajectory of one's mental health concerns over time. For example, in a one-year longitudinal study of the psychosocial effects of multiple stressors and potentially trauma events (e.g., natural disasters, illness, assault), low baseline social support predicted increases in depressive symptoms one year later (Tracy et al., 2014). Similarly, individuals who reported greater social support prior to the Great East Japan earthquake and tsunami were less likely to develop depressive symptoms following exposure to the disaster (Sasaki et al., 2019). However, unlike

previous research, I did not assess social support before the onset of the pandemic; the first assessments were collected in June of 2020, three months after the local onset of the COVID-19 pandemic. Therefore, I do not know if social support prior to the pandemic's onset, or initially thereafter, is related to children's trajectory of mental health symptoms. Regardless, the present study highlighted that social support was significantly related to depressive and irritability symptoms every single month. Thus, social support is important throughout the pandemic, not just early in its onset, and thus interventions should focus on bolstering continuous and consistent social support to best assist children in the face of this life stressor. Additionally, I found that pediatric depressive and irritability symptoms do not follow a linear trajectory; instead, there are observed fluctuations in symptoms over time. As such, while I do not know how longitudinal symptoms are related to early social support, I know that, overall, children aren't experiencing a decline in mental health over time. Instead, they experience monthly increases or decreases, due in part to COVID-19 factors (i.e., fear of contracting COVID-19; Rappaport et al., 2022), which are related to monthly reports of social support.

Consistent with Rappaport et al. (2022), depressive and irritability symptoms fluctuated over time. Additionally, children differed from one another in the degree of variability experienced over time, which suggests that interindividual difference factors may contribute to change in symptomology over time. For example, pre-existing psychopathology, previous life stressors or traumatic experiences, or COVID-19-related variables (e.g., fear of contracting COVID-19; illnesses in a family member; having a parent who is a front-line or healthcare worker) may contribute to a child's psychiatric symptoms over time during the pandemic. Children also differed in their initial severity of symptoms at baseline assessment. These differences may result from various factors including previous experiences of stress, potential pre-existing psychiatric

symptoms, or differing impacts of the pandemic during the initial months prior to the June 2020 start date of the present study.

### *Change in Social Support Over Time*

Aim two evaluated potential changes in children's perceived social support over time during the COVID-19 pandemic. There was no evidence of a linear trend that would indicate an overall increase or decrease in social support over time. Instead, social support fluctuated over time (see Figure 1). This is inconsistent with previous research on social support that suggests that perceived support decreases over time during stressful events (Aba et al., 2019; F. Norris et al., 2002). In prior research, social ties appear to breakdown over time during long-term stressors, which may reduce one's perception of the availability of social support (Aba et al., 2019; Rueger et al., 2016). For example, children's perception of the availability of social support decreased in the six months following exposure to a flood (Kaniasty & Norris, 1993). However, assessments in the present study covered a longer period of the stressor (i.e., 20 months of the COVID-19 pandemic) than prior research. Therefore, the present study may have captured an extended and more complete picture of the trends that social support follows over time during chronic stress. For example, the present data are consistent with prior research in identifying a period of decreased social support. However, following the previously documented decrease in social support, there may be some recovery in social support. The elongated period assessed in the present study suggests that future research on life stressors or traumatic events may benefit from longer follow-up periods than have been traditionally used. Finally, assessments for the present study could not begin until June 2020, three months after the local onset of the pandemic. Thus, there may be acute changes in children's perceived availability of social support not captured by this design. Future research investigating the longitudinal impact

of chronic stress on social support may benefit from quick mobilization to identify any early changes in social support.

The present study also illustrates the potential contribution of external factors to children's experiences of social support. Due to prior evidence that psychiatric symptoms may be correlated with fear of contracting COVID-19 and stress related to stay-at-home orders or the cancellation of events (Rappaport et al., 2022), I examined the association between fear of contracting COVID-19 and stress related to stay-at-home orders with social support. Children's monthly reports of perceived social support were related to their monthly reports of stress related to stay-at-home orders or the cancellation of important events. In other words, months in which children experienced acutely elevated stress due to the cancellation of social events (i.e., graduation) or in response to enacted stay-at-home orders, children reported lower perceived availability of social support. Unlike documented associations with psychiatric symptoms (L. Rappaport et al., 2022), monthly reports of children's fear of contracting COVID-19 were not related to monthly reports of social support. This suggests that fear of contracting COVID-19 may reflect a unique experience of COVID-19-related stress rather than stress broadly. As such, the development and dissemination of mental health resources to assist in the recovery from psychiatric sequalae of the pandemic should specifically address fear of getting sick. Said interventions may have downstream effects on improving symptomology, given previously documented associations between fear of contracting COVID-19 and pediatric psychiatric symptoms (Rappaport et al., 2022). Additionally, the significant relationship between monthly elevated stress related to stay-at-home orders and cancellation of important events and monthly decreased reports of perceived social support suggest that we need to find ways to support children in conjunction with the enactment of necessary public health protective measures. For

example, it may be necessary to mobilize online and social media resources to keep children connected as they follow distancing rules. Bolstering alternative means of receiving social support through stay-at-home orders may assist in buffering against mental health sequelae of the pandemic, while continuing to keep children safe.

Lastly, local monthly indices of COVID-19 epidemiology (e.g., case prevalence, hospitalization rates, and death rates) were not associated with children's monthly reports of social support. As such, there is something specific about stress related to stay-at-home orders and the cancellation of important events that is uniquely related to decreased perceived social support. It isn't that case prevalence rates increase, and thus there are concurrent enactment of stay-at-home orders and cancellation of events, which are both related to decrease in social support. Instead, there is something specific about the stress children experience in response to the cancellation of events or stay-at-home orders that is related to decreases in perceived social support. This provides further evidence to suggest that we need to develop alternative means of connecting children through stay-at-home orders, so they do not experience a decrease in their perception that they are supported.

Children who reported higher initial social support experienced less variability (i.e., month-to-month increases or decreases) over time. This potentially reflects a ceiling effect in assessments of social support, where individuals at the high end of the scale have less space to increase, and thus are capped in their reports. However, the majority of the sample was not at the upper limits of the social support sum score. Additionally, the present study did detect significant changes in social support across months. However, future research may consider using additional items to assess social support to capture a wider range of experiences.

### *Time-Varying Associations of Social Support with Depressive and Irritability Symptoms*

Aim three evaluated how children's experiences of social support may be related to experiences of irritability and depressive symptoms over time. Months in which children reported higher perceived availability of social support, children also reported, and parents or guardians observed, lower severity of irritability and depressive symptoms. Similarly, at the between-person level, children who, on average, reported higher perceived availability of social support also reported lower severity of irritability and depressive symptoms.

Data from the present study are consistent with the *buffering hypothesis* of social support (see Cohen & Wills, 1985 for review), which suggests that social support protects against worsened mental health when one is confronted with life stressors. Further research highlighted the importance of social support to buffer against psychological distress in the face of various life stressors including chronic and episodic experiences (La Greca et al., 2013; Wilcox, 1981). Consistent with the present study, low social support has previously been associated with increased psychological distress and worsened psychopathology following life stressors, especially depressive symptoms and depressive disorders (Hefner & Eisenberg, 2009; Ibarra-Rovillard & Kuiper, 2011; Lepore et al., 1991). As such, the present findings extend the current body of literature on the buffering hypothesis of social support to understand how social support can help children through global health crises.

The associations of higher monthly reports of social support with lower monthly reports of irritability and depressive symptoms are also consistent with research on the *stress generation model.* This model suggests that individuals with greater depressive symptoms generate additional interpersonal conflict, which can erode interpersonal relationships and support networks, as a result of increased hostile, submissive, or variable behaviour (D. A. Cole et al.,

2006; Eberhart & Hammen, 2009; Flynn et al., 2014; Hammen, 2006). Within research on adolescence, initial depressive symptom severity predicts future decreases in social support from peers (Stice et al., 2004). Ongoing depressive symptoms can also undermine interpersonal relationships and erode the availability of social support (Coyne, 1976). Additionally, elevations in depressive symptoms in children predict increased interpersonal conflict over six months, which can interfere with one's access to social support (Gibb & Hanley, 2010). Thus, previous research suggests that psychological distress can decrease one's perceived availability of social support (Aba et al., 2019; Coyne, 1976; Gladstone et al., 2007). As such, the present evidence of concurrent associations of monthly low social support with elevated symptom severity are consistent with previous stress generation research, in which greater experiences of symptomology, especially depressive symptoms, can result in decreased availability of social support.

Across the sample, children differed from one another in the strength of the evident association of monthly reports of social support with irritability or depressive symptom severity. According to parent and guardian observations, children with higher initial levels of depressive symptoms had a weaker association between their monthly reports of depressive symptoms and their perceived availability of social support. Similarly, according to both parent and guardian observations and children's self-report, children with greater initial irritability had a weaker association of monthly irritability with social support. This finding is consistent with the stress generation hypothesis, in which individuals with severe psychiatric symptoms have the greatest risk of interpersonal conflict and erosion of support networks (D. A. Cole et al., 2006; Flynn et al., 2014; Hammen, 2006). This suggests that children who report or display elevated symptom severity at baseline may be less likely to benefit from social support. Thus, these children may

require more intensive and directed intervention to prevent worsening mental health symptoms. For example, they may require intervention that provides higher degrees of support or addition forms of support. Alternatively, they may require the implementation of different forms of intervention beyond those that focus on support, such as cognitive behaviour interventions.

Rappaport et al (2022) identified psychosocial factors (i.e., fear of contracting COVID-19 and stress related to stay-at-home orders) that predicted both between- and within-person variability in various psychiatric symptoms. Therefore, analyses in the present study adjusted for both psychosocial factors to ensure that evident associations of irritability and depressive symptoms with social support were unique from other psychosocial contributions to children's mental health. Even after the addition of both previously identified factors, monthly reports of social support remained independently related to monthly reports of irritability and depressive symptoms, both between- and within-children. Thus, evident associations of social support with irritability and depressive symptoms cannot solely be explained by children experiencing stress during the pandemic; there appears to be a specific and unique association of social support with irritability and depressive symptoms, which may guide the development of novel interventions. We cannot assume that with the resolution of the pandemic, and the removal of fear of contracting COVID-19, that symptoms will spontaneously return to pre-COVID-19 levels. We need directive intervention to assist children through their stress associated with living in the pandemic and in their recovery from its mental health sequalae. Interventions should focus on increasing perceived social support for children every month for the best mental health outcomes.

### *Implications*

The present study presents several implications for, and innovations in, the field of social support research that may be considered to advance the development of mental health resources and future long-term health stress research with children. First, variations in monthly reports of a child's perceived level of social support were related to their monthly stress related to stay-at-home orders and the cancellation of social events (i.e., graduation ceremonies). Thus, we need to research and develop ways of supporting children in conjunction with necessary safety measures and the cancellation of events and in-person schooling. For example, social media may be mobilized to extend social support in times where children need to limit their physical social contact with friends and family.

Second, across months, social support was related to depressive and irritability symptoms independent from the relationship between symptoms and fear of contracting COVID-19 and stress related to stay-at-home orders. This extends findings of these associations reported in Rappaport et al (2022). Thus, mental health resources and the bolstering of social support are crucial, regardless of the severity of COVID-19 and associated safety measures within a month.

Third, the present study highlighted the association between monthly social support and children's irritability symptoms. Previous research has extensively documented the importance of social support in buffering against pediatric depressive symptoms in the face of life stress (e.g., Aba et al., 2019; Rueger et al., 2016; Tang et al., 2014). My findings suggest that future research should consider the implications of social support for well-being more broadly and investigate its implications for a wider range of psychiatric symptoms (i.e., anxiety, posttraumatic stress, etc.), given evident associations with irritability in the present study. Said

research may extend the application of interpersonal therapy and support-based programs typically applied to childhood depression to other symptomology and disorders.

Lastly, my findings suggest that a child's degree of early-stressor perceived availability of social support does not have implications for their long-term experience of depressive and irritability symptoms. Instead, relationships exist between their monthly support and symptoms. Thus, mental health interventions are important and necessary at each month and can help regardless of a child's initial levels of support. Monthly bolstering of social support can boost positive interpersonal interactions and potentially assist in lessening mental health sequelae (Cohen & Wills, 1985).

### *Limitations and Future Directions*

The present study should be considered in light of several limitations. First, correlated random effects, specifically the correlation between random effects for intercept and change over time, indicate less variability in symptoms over time among children at the highest severity for both irritability and depressive symptoms at baseline. In other words, children with the most severe reports of irritability and depressive symptoms at baseline experienced less change over time. This may reflect a potential ceiling for the measures used. However, the measures selected for the present study were validated in clinical and community samples (e.g., Angold et al., 2005; Klein et al., 2005; Stringaris et al., 2012), which frequently include individuals with severe psychiatric conditions. Given that they are validated with clinical samples, these measures are valid to assess experiences of, and changes in, symptoms in individuals who experience the most severe forms of symptomology. Additionally, the present study identified significant changes in symptomology over time, both across the entire sample and within children themselves, with

variation in symptom severity that spanned the range of measure scores. Therefore, taken together, the measures used were appropriate for use in the present community sample.

Second, I did not conduct diagnostic assessments of psychopathology for children in the sample. As a result, I was not able to capture changes in a child meeting diagnostic criteria throughout the study. I chose to use dimension assessments of pediatric depressive and irritability symptoms instead of diagnostic assessments to capture continuous and specific change in symptoms across monthly reports. Diagnostics are limited in providing a binary answer to measurement of symptomology. Thus, my continuous measures provided me with more detail than I would have received with a strictly categorical diagnostic assessment. The present study found that, across the entire sample of children, higher monthly reports of social support were related to lower monthly reported and observed symptoms, regardless of whether a child met a putative diagnostic threshold within that month. As a result, I know that social support is an important factor for all children in a community sample, regardless of their diagnostic status.

Third, I did not assess pre-existing psychiatric diagnoses at a children's baseline assessment. Thus, I do not know how psychological experiences at the onset of the COVID-19 pandemic may influence or alter one's experience of stress and symptomology throughout the pandemic. However, in our sample of 317 children, assuming a 15% community prevalence rate of depression, approximately 47 children would meet clinical criteria for a diagnosis. This would not yield sufficient power to detect group differences between those with diagnosis or not. Instead, the use of dimension assessments of symptoms, regardless of whether a child meets diagnostic criteria at their baseline assessment, provided me with the opportunity to investigate how changes in symptoms are related to social support across a community sample. Dimensional

measurement of symptoms at a child's baseline assessment provided an initial symptom level to which future dimensional assessments were compared, to capture changes in psychiatric symptoms. Future research should investigate the associations between social support and mental health sequelae in a large sample consisting of children that meet diagnostic criteria. There may be implications of a child being at a diagnostic level of symptomology, not just for depressive or disruptive mood dysregulation disorders, but across other DSM-5 diagnostic categories, for trajectories in symptoms and associations with social support across a public health crisis. Said research would be directly beneficial to clinicians assisting children as they continue to face stress related to COVID-19, and in interventions designed to help children recover, beyond the findings of the present study that can be applied to a wide range of children in the community.

Fourth, the present study examined concurrent correlations between monthly reports of social support and monthly reports of irritability and depressive symptoms. However, I do not know the directionality of these associations. Regardless, the present study was an important step in this field of research. It extended previous research highlighting the relationship between greater social support and less severe reports of psychiatric symptoms following stressful life events in childhood, in following children for 20 months of a chronic stressor. It also extended previous research in investigating associations between social support and symptoms every single month for those 20 months, narrowing the window of time between assessments that has been previously reported. As such, the present study found that each and every month, social support is significantly related to reported and observed pediatric depressive and irritability symptoms. From these findings, future research should clarify the direction of the relationship (i.e., does a change in social support result in a change in symptoms, or vice versa?), in order to

assist in the development of clinical interventions to break a negative cycle and assist children in their recovery from mental health sequelae following the COVID-19 pandemic.

Beyond implications for the COVID-19 pandemic, the present study informs development of interventions and resources for children facing a broader range of health crises. For example, in the current rise in monkeypox and poliomyelitis cases globally, findings of the importance of monthly social support should be considered and interventions should be implemented to address mental health sequelae of upcoming and future public health crises. For example, we should mobilize interventions and community-level resources to inform parents on the important of continuous and consistent social support in supporting their children's mental health through chronic stressors. Additionally, my findings that highlight the relationship between increased stress related to stay-at-home orders and decreased reports of perceived social support suggest that we should be implementing additional means of providing support in conjunction with necessary public health protection measures.

Beyond public health crises, however, social support research should be extended to the mental health sequelae of broad childhood health experiences (e.g., cancer, asthma, diabetes, etc.). A long-term study frequently (i.e., monthly) assessing psychiatric symptomology and perceived social support for children facing chronic conditions should be developed. This research would work to clarify the extent of the health disparity that exists among children who face the life stress associated with receiving a chronic diagnosis early in life. Additionally, it would work to investigate how social support may be protective, both in the face of diagnoses and over time, for children who experience chronic health disparity. This research is crucial as, while pandemics are expected to eventually end, early life chronic diagnosis will often persist for the lifetime. Thus, we need research investigating how we can support these children.

### *Conclusion*

The present study highlighted the importance of monthly perceptions of the availability of social support for children's monthly experiences of irritability and depressive symptoms over 20 months during the COVID-19 pandemic. Broadly, perceived social support was associated with child-report and parent or guardian observation of children's irritability and depressive symptoms monthly, and on average, over the course of a nine-month follow-up period. Given evidence to implicate social support in children's well-being over time, interventions may benefit from bolstering social support over the course of chronic stressful experiences, such as pandemics and epidemics. Additionally, social support was associated with child irritability and depressive symptoms independently of children's fear of contracting COVID-19 and stress related to stay-at-home orders and the cancellation of social events, which suggests that interventions that work to bolster child social support may benefit children's mental health during and after the biomedical risk associated with pandemics or epidemics.

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APPENDIX A: SUPPLEMENTAL TABLES

**Supplemental Table 1.**

Monthly reliability of the social support items on the CRISIS.

| Month | Cronbach's alpha | McDonald's omega |
|---|---|---|
| July 2020 | 0.74 | 0.95 |
| August 2020 | 0.78 | 1.20 |
| September 2020 | 0.81 | 1.04 |
| October 2020 | 0.87 | 1.05 |
| November 2020 | 0.82 | 1.11 |
| December 2020 | 0.81 | 1.04 |
| January 2021 | 0.77 | 1.15 |
| February 2021 | 0.82 | 1.21 |
| March 2021 | 0.85 | 1.15 |
| April 2021 | 0.8*4* | 1.13 |
| May 2021 | 0.77 | 1.13 |
| June 2021 | 0.78 | 1.11 |
| July 2021 | 0.86 | 0.96 |
| August 2021 | 0.78 | 1.15 |
| September 2021 | 0.90 | 0.85 |
| October 2021 | 0.78 | 0.92 |

**Supplemental Table 2.**
Time-varying associations of child-reported depression and social support with additional COVID-19-related covariates.

| Variable | Fixed Effects | | Random Effects |
|---|---|---|---|
| | *b* (95% CI) | *p* | *SD* (95% CI) |
| Intercept | 11.10 (7.26, 14.95) | $2.10X10^{-8}$*** | 3.36 (2.98 3.79) |
| Cohort | -0.47 (-2.12, 1.18) | 0.58 | - |
| Survey | -0.28 (-0.59, 0.04) | 0.09 | - |
| Case Rate Reported | 0.000 (-0.02, 0.02) | 0.97 | - |
| Linear Slope over Time | -0.48 (-1.20, 0.25) | 0.20 | 0.16 (0.11, 0.23) |
| Quadratic Slope over Time | 0.07 (0.001, 0.13) | 0.05* | - |
| Cubic Slope over Time | -0.002 (-0.004, 0.000045) | 0.06 | - |
| Social Support (within-person) | -0.23 (-0.38, -0.17) | $4.19X10^{-7}$*** | 0.39 (0.28, 0.54) |
| Social Support (between-person) | -0.74 (-0.94, -5.35) | $1.42X10^{-11}$*** | - |
| Fear of contracting COVID-19 (within-person) | 0.78 (0.41,1.14) | $3.54X10^{-5}$*** | 1.39 (1.01, 1.92) |
| Fear of contracting COVID-19 (between-person) | 1.98 (1.22, 2.74) | $5.66X10^{-7}$*** | - |
| Stress related to stay-at-home orders and cancellation of significant events (within-person) | 0.79 (0.04, 1.18) | $3.72X10^{-5}$*** | 1.66 (1.29, 2.13) |
| Stress related to stay-at-home orders and cancellation of significant events (between-person) | 1.00 (0.33, 1.66) | 0.004** | - |

*p< 0.05. **p< 0.01. ***p< 0.001.

**Supplemental Table 3.**

Time-varying associations of parent- or guardian-reported depression and social support with additional COVID-19-related covariates.

| Variable | Fixed Effects | | Random Effects |
|---|---|---|---|
| | *b* (95% CI) | *p* | *SD* (95% CI) |
| Intercept | 10.93 (7.23, 14.63) | $1.00X10^{-8}$*** | 3.58 (3.24, 3.95) |
| Cohort | 0.43 (-1.11, 1.97) | 0.58 | - |
| Survey | -0.17 (-0.46, 0.11) | 0.24 | - |
| Case Rate Reported | 0.003 (-0.01, 0.02) | 0.68 | - |
| Linear Slope over Time | -1.02 (-1.67, -0.37) | 0.002** | 0.12 (0.07, 0.20) |
| Quadratic Slope over Time | 0.10 (0.04, 0.16) | 0.001** | - |
| Cubic Slope over Time | -0.003 (-0.01, -0.001) | 0.001** | - |
| Social Support (within-person) | -0.16 (-0.24, -0.01) | $2.60X10^{-4}$*** | 0.23 (0.13, 0.42) |
| Social Support (between-person) | -0.51 (-0.72, -0.30) | $2.90X10^{-6}$*** | - |
| Fear of contracting COVID-19 (within-person) | 0.56 (0.26, 0.87) | $2.63X10^{-4}$*** | 0.96 (0.93, 1.69) |
| Fear of contracting COVID-19 (between-person) | 1.26 (0.49, 2.03) | 0.002** | - |
| Stress related to stay-at-home orders and cancellation of significant events (within-person) | 0.52 (-.19, 0.84) | 0.002** | - |
| Stress related to stay-at-home orders and cancellation of significant events (between-person) | 1.31 (0.63, 1.99) | $1.87X10^{-4}$*** | - |

*p< 0.05. **p< 0.01. ***p< 0.001.

**Supplemental Table 4.**

Time-varying associations of child-reported irritability and social support with additional COVID-19-related covariates.

| Variable | Fixed Effects | | Random Effects |
|---|---|---|---|
| | *b* (95% CI) | *p* | *SD/Correlation* (95% CI) |
| Intercept | 6.58 (4.40, 8.75) | $4.37X10^{-9}$*** | 1.84 (1.62, 2.08) |
| Cohort | 0.34 (-0.59, 1.27) | 0.48 | - |
| Survey | 0.04 (-0.15, 0.22) | 0.69 | - |
| Case Rate Reported | -0.01 (-0.01, 0.004) | 0.28 | - |
| Linear Slope over Time | -0.84 (-1.26, -0.41) | $1.33X10^{-4}$*** | 0.07 (0.04, 0.13) |
| Quadratic Slope over Time | 0.08 (0.04, 0.11) | $1.47X10^{-4}$*** | - |
| Cubic Slope over Time | -0.002 (-0.003, -0.001) | $2.52X10^{-4}$*** | - |
| Social Support (within-person) | -0.15 (-0.21, -0.09) | $3.85X10^{-6}$*** | 0.23 (0.17, 0.32) |
| Social Support (between-person) | -0.26 (-0.37, -0.15) | $8.48X10^{-6}$*** | - |
| Fear of contracting COVID-19 (within-person) | 0.34 (0.14, 0.53) | 0.001** | 0.56 (0.34, 0.93) |
| Fear of contracting COVID-19 (between-person) | 0.54 (0.12, 0.95) | 0.01* | - |
| Stress related to stay-at-home orders and cancellation of significant events (within-person) | 0.17 (-0.05, 0.40) | 0.14 | 0.95 (0.76, 1.18) |
| Stress related to stay-at-home orders and cancellation of significant events (between-person) | 0.93 (0.56, 1.29) | $1.04X10^{-6}$*** | - |

*p< 0.05. **p< 0.01. ***p< 0.001.

**Supplemental 5.**

Time-varying associations of parent- or guardian-reported irritability and social support with additional COVID-19-related covariates.

| Variable | Fixed Effects | | Random Effects |
|---|---|---|---|
| | *b* (95% CI) | *p* | *SD/Correlation* (95% CI) |
| Intercept | 6.52 (4.23, 8.82) | $3.49X10^{-8}$*** | 2.26 (2.05, 2.49) |
| Cohort | 0.23 (-0.72, 1.18) | 0.63 | - |
| Survey | -0.04 (-0.22, 0.14) | 0.66 | - |
| Case Rate Reported | -0.001 (-0.01, 0.01) | 0.84 | - |
| Linear Slope over Time | -0.59 (-0.99, -0.19) | 0.004** | 0.06 (0.02, 0.14) |
| Quadratic Slope over Time | 0.05 (0.02, 0.09) | 0.01* | - |
| Cubic Slope over Time | -0.001 (-0.003, -0.0004) | 0.01* | - |
| Social Support (within-person) | -0.08 (-0.14, -0.03) | 0.003** | 0.18 (0.12, 0.28) |
| Social Support (between-person) | -0.24 (-0.37, -0.12) | $3.68X10^{-4}$*** | - |
| Fear of contracting COVID-19 (within-person) | 0.22 (0.05, 0.39) | 0.01* | 0.29 (0.08, 1.01) |
| Fear of contracting COVID-19 (between-person) | 0.39 (-0.09, 0.87) | 0.11 | - |
| Stress related to stay-at-home orders and cancellation of significant events (within-person) | 0.28 (0.09, 0.57) | 0.01* | 0.65 (0.45, 0.93) |
| Stress related to stay-at-home orders and cancellation of significant events (between-person) | 0.64 (0.22, 1.06) | 0.003** | - |

*p< 0.05. **p< 0.01. ***p< 0.001.

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