

RAPID REVIEW

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Negative Impacts of Community-based Public Health Measures on Children, Adolescents and Families During the COVID-19 Pandemic: Update

What is new in this update?

- This update focuses exclusively on studies published during the Coronavirus Disease 2019 (COVID-19) pandemic from May to October 2020.
- We expanded our inclusion criteria to incorporate evidence of negative impacts in adolescent populations, including the priority populations of LGBTQ+, children with disabilities, and pre-existing conditions such as medical comorbidities and mental health conditions.
- We organized the findings by type of outcome rather than by type of public health measure (e.g. school closure, stay-at-home recommendation). The global response to COVID-19 is specific to COVID-19 epidemiology in each country or region; therefore, we have highlighted the study location rather than the exact public health measure enacted.

Key Findings

- Children's mental health and behaviour have been overall negatively impacted by the COVID-19 public health measures. Young children and adolescents were affected differently. Parents of young children reported more behavioural difficulties, hyperactivity, and conduct problems, while adolescents were more likely to have increased anxiety and depressive symptoms, increased suicidal ideation, and increased frequency of alcohol consumption for those reporting any use.
- Parental stress was a mediator in the association between exposure to COVID-19 public health measures and negative child outcomes. The level of parents' perceived stress due to the COVID-19 pandemic may exacerbate or buffer mental health and behaviour problems in children.
- Other child outcomes negatively impacted by the pandemic included movement behaviours (decreased physical activity, increased sedentary behaviour and screen time), increased food insecurity, negative educational outcomes, increased injuries occurring at home, and increased reports of child maltreatment.
- Health service utilization of tertiary care services (emergency department visits and hospitalizations) decreased substantially during the early months of the pandemic. However, it was reported that illness severity increased, and visits for mental health reasons increased in

the later weeks of the pandemic. There may have been some parents delaying care for their children due to fear of acquiring COVID-19 infection in the hospital.

- Although this review identified many relevant studies, most were convenience samples. As such, families from diverse ethnicities or racialized communities, who are more likely to experience greater social and health inequities which may be exacerbated during the pandemic, are systematically underrepresented.

Scope

- Public Health Ontario (PHO) conducted an update to the previous rapid review on the potential negative impacts of community-based public health measures in response to a pandemic on young children and families.¹ Community-based public health measures aim to reduce disease spread during pandemics, in the absence of pharmaceutical interventions such as effective anti-viral treatment and/or a vaccine.
- Measures at the community level include physical distancing, school and childcare closures, workplace closures, and limiting gatherings.² This review identifies and synthesizes literature published during the COVID-19 pandemic from May to October 2020.
- Studies included in this review focused on outcomes relevant to children, adolescents and families. This review is intended to serve as a resource for local and provincial decision-makers; however, mitigation strategies of these potential negative effects are out of scope for this document.
- This review addresses the following research question: *What are the negative impacts on health and well-being of children, adolescents and families from the public health measures implemented in response to the COVID-19 pandemic?*

Background

The impact of the COVID-19 pandemic on the health and well-being of all populations continues to develop. In Canada, community-based public health measures have been widely implemented since March 2020, in order to reduce morbidity and mortality from COVID-19 and sustain health system capacity.² It is important; however, to understand the unintended consequences of public health measures, including for specific populations, to inform ongoing pandemic mitigation, response, as well as recovery. Research on the effects of the public health measures implemented to mitigate COVID-19 infection, has been published at a rapid pace. The effects on children, adolescents, and families are particularly concerning as school closures during the spring of 2020 were the longest in modern history. Additionally, the potential negative outcomes including educational loss, increased risk of child maltreatment, and mental health conditions in the critical years of childhood may lead to irreversible effects for this generation of children.³

At the time of this update, community-based public health measures, including stay-at-home orders/recommendations, lockdowns, home confinement, work from home, and school closures, are being implemented with varying intensity throughout Ontario. Regions with high daily case counts have the strictest restrictions. Schools in Ontario reopened in mid-September with various added mitigation measures implemented by the Province as well as local school boards (e.g., wearing masks, daily

symptom screening, physical distancing in hallways, and staggered entry). Despite these measures, a substantial number of parents opted to keep their children home and do virtual/online learning.⁴

As we move through this pandemic, it is important to understand how communities are coping with not only the effects of COVID-19 infection, but also the effects and burden of the public health measures. This can serve to inform mitigation strategy planning and/or approaches to implementation and/or prioritization of measures, in relation to unintended consequences. This update reviews the most current literature from peer-reviewed journals, pre-prints, and grey literature on the negative impacts of the community-based public health measures due to the COVID-19 pandemic on children, adolescents, and families.

Methods

- A rapid review was conducted to synthesize primary research evidence on the negative impacts of community-based public health measures implemented in response to the COVID-19 pandemic on the health and well-being of young children, adolescents, and families. A rapid review is a form of knowledge synthesis based the steps of a systematic review, making certain compromises in those steps in order to be timely. A rapid review can respond to questions similar to those that a systematic review can answer. In this case, a rapid review was the most practical way to systematically review the most recent evidence.
- To identify the evidence, comprehensive literature searches for peer-reviewed literature were conducted from May 2020 to October 2020. PHO Library Services conducted an electronic database search in MEDLINE, Embase, PSYCINFO, CINAHL, SOCINDEX, and CHILD DEVELOPMENT & ADOLESCENT STUDIES, using a combination of indexing terms and keywords. The results from all databases were integrated and duplicates removed. See example search strategy in Appendix A.
- A web search was also conducted using keywords that mirrored search terms employed in bibliographic databases to identify any relevant grey literature reports. The following search tools were used: Google, The Centre for Addiction and Mental Health (CAMH) Library Google Custom Search, and custom search engines for international public health organizations.
- Peer-reviewed and grey literature papers were eligible for inclusion if they examined the negative impacts of public health measures implemented in response to the COVID-19 pandemic on health and well-being of children, adolescents and families. Papers were excluded if they did not include children or parents of children ages 18 and younger, or if they did not report on any unintended health and well-being outcomes related to COVID-19 public health measures. Reviews with no methods, commentaries, editorial letters, editorials and conference abstracts were also excluded.
- PHO staff screened titles and abstracts, and then full-text versions of all papers for inclusion. Title and abstract screening, and full-text screening was divided between authors. Decisions on included full texts were finalized by consensus.
- For all included papers, relevant data was extracted and summarized. Content was reviewed by PHO medical and scientific staff involved in the COVID-19 response.

Results

The library database search identified 846 articles, of which 36 met inclusion criteria. An additional 20 articles were retrieved from Google Scholar, including preprints. In total, 56 studies were included from the peer-reviewed and preprint databases. The grey literature search identified seven relevant reports and policy documents.⁵⁻¹¹ There were seven main types of outcomes that studies reported on: child mental health and well-being (including child maltreatment and substance use), parenting and parent mental health, nutrition and food insecurity, movement behaviours, education, injury, and health services utilization.

The 56 studies were mainly from the United States (US), Canada, China, Italy, Spain, France, the United Kingdom (UK), Israel, Germany and Norway. Included studies were also conducted in Poland, the Netherlands, Bosnia-Herzegovina, Turkey, Singapore, Japan, Argentina, Brazil, Colombia, Chile, and Bangladesh. All studies were observational: 36 studies were cross-sectional and 2 were repeated cross-sectional; 5 studies were longitudinal cohorts; 6 were descriptive; 3 were reviews; 1 study was a case-series; 2 studies were mixed methods; and 1 study was qualitative. Although these studies were predominantly cross-sectional designs, multiple studies used validated tools to measure symptoms of anxiety, depression and child behaviour including the Center for Epidemiologic Studies Depression Scale (CES-D), Revised Child Anxiety and Depression Scale (RCADS), the State and Trait Anxiety Inventories (STAI-S), and the Strengths and Difficulties Questionnaire (SDQ). Studies examining health services utilization analyzed health administration databases to measure changes in emergency department (ED) and hospitalization rates from previous years to 2020. Despite having larger sample sizes, these studies lacked granularity of data to determine mechanisms for the observed changes in rates of ED visits or hospital admission.

Child mental health and well-being

The literature search identified 23 primary studies¹²⁻³⁴ and 3 reviews³⁵⁻³⁷ that described mental health outcomes of children and adolescents during the COVID-19 pandemic (see Table 1). Most studies were cross-sectional, online surveys conducted in the first wave of the pandemic (between March to May 2020). Eight studies focused on adolescents and 13 studies included parents of preschool and school-aged children in the general population. Four studies included specific populations such as children with severe obesity,¹² physical disabilities,¹³ autism spectrum disorder (ASD),^{14,37} and learning disabilities.³⁷ One study examined mental health in a population of adolescents identifying as LGBTQ+.¹⁷ The mental health and child well-being outcomes identified were anxiety and depressive symptoms, general mental health and well-being status, behaviour (e.g., conduct, emotional, and hyperactivity problems), post-traumatic stress symptoms (PTSS), suicide outcomes, substance use, and child maltreatment.

ANXIETY, DEPRESSIVE SYMPTOMS, PTSS, AND GENERAL MENTAL HEALTH OUTCOMES

Eight studies and three reviews examined the prevalence of or changes to adolescents' anxiety, depressive symptoms and general mental health during the pandemic.^{12,17-20,22,30,31,36,37} Three grey literature reports were also retrieved.^{7,9,10} The prevalence of anxiety estimates ranged from 19.4% of Brazilian children (median age 9 years)¹⁸ to 32% of adolescents with severe obesity reporting increased levels of COVID-19-related anxiety.¹² Similarly, 32% of children and adolescents in a Canadian survey reported worrying more during the pandemic,⁷ and 32% of children and adolescents in the UK reported public health measures implemented during the pandemic made their mental health worse.¹⁰ Risk factors for higher levels of anxiety included exposure to information and news on television;²² parents

who were essential workers; having to isolate or quarantine without parents; having a higher number of persons in the home; and low education levels of parent(s).¹⁸ Previous adverse childhood experiences (ACEs) also predicted higher levels of anxiety symptoms and PTSS,²⁰ and those with a previous psychiatric referral had higher odds of anxiety symptoms.²² Adolescents identifying as LGBTQ+ reported feeling anxious and uncertain about school closure, particularly those who were “stuck at home with unsupportive parents.”¹⁷ For those who only disclose their LGBTQ+ identity at school there were feelings of grief due to losing a “safe space” and a loss of access to friends and gender and sexuality alliances.¹⁷

Three studies estimated depressive symptoms in school-aged children and adolescents during the COVID-19 lockdown period.^{19,30,31} Zhang et al. found depressive symptoms significantly increased (24.9% vs 18.5%; adjusted odds ratio (aOR) = 1.50 [95%CI, 1.18-1.90]; $P = .001$) from pre-COVID to the period of lockdown in China.³¹ The study by Gotlib et al. reported that the rates of stress and depression in their sample of adolescents during the COVID-19 pandemic were high. They also determined that the severity of early life stress significantly predicted severity of both perceived stress ($r(106) = 0.35, p<.001$) and depression scores ($r(107) = 0.26, p=.006$) during COVID-19.¹⁹ Yeasmin et al. measured three constructs of mental health: depression, anxiety and sleep disturbance, and grouped children into 4 clusters (sub-threshold, mild, moderate, and severe). In this study, 30.5% of children had mild disturbances, 19.3% suffered moderate disturbances, and 7.2% suffered severe disturbances.³⁰

Three reviews were included that reported on general mental health and well-being of children during the COVID-19 pandemic.³⁵⁻³⁷ Overall, the authors of all three reviews concluded the pandemic had generally negative effects on the mental health and well-being of children and adolescents; however, the magnitude and degree of these effects were wide-ranging. Singh et al. wrote “The results of these studies show that the nature and extent of this impact depend on several vulnerability factors such as the developmental age, educational status, pre-existing mental health condition, being economically underprivileged, or being quarantined due to infection/fear of infection.”³⁷

CHILD BEHAVIOUR

Four studies estimated child behaviour in young and school-aged children using the SDQ which has three validated subscales: conduct problems, hyperactivity-inattention problems, and emotional problems.^{15,23,24,27} In Spanish children, 30-40% displayed more behavioural disturbances (i.e., conduct problems, emotional problems, hyperactivity) during lockdown periods compared to pre-COVID-19.²⁷ Similarly, data from Ontario showed 40% of parents indicated their children’s behaviour and mood had deteriorated.⁶ In two studies, younger children struggled with worse behavioural and mental health outcomes compared to older children.^{15,25} One study examined the behavioural impact of COVID-19 on children (mean age 13 years) with ASD. Parents reported that the intensity of their child’s social problems increased by 35.5% and frequency increased by 41.5% compared to before COVID-19.¹⁴ The majority of these studies investigated the indirect effects of the COVID-19 mitigation measures on child behaviour outcomes, through mediation by parental stress. These studies are discussed further in the Parenting outcomes section.

SUICIDE, SUICIDAL IDEATION, AND SELF-HARM

Three studies measured mental health outcomes related to suicide.^{21,31,35} Chinese students part of an ongoing longitudinal cohort study (N=1241, mean age=12.6 years) reported significantly increased levels of depressive symptoms (24.9%), non-suicidal self-injury (42.0%), suicidal ideation (29.7%), suicide planning (14.6%), and suicide attempt (6.4%) in mid-May 2020 as compared to November 2019.³¹ In

Japan, there was no significant change in the rate of suicide during the school closure from March to May, compared to the same period in 2018-19 (incidence rate ratio (IRR) = 1.15, 95% confidence interval (CI): 0.81-1.64). Conversely, suicides appeared to decrease in 2020 compared to 2019. Although, there was an increase in the rate of suicide from March to May 2020 (IRR = 1.34, 95% CI: 1.01-1.78).²¹ Loades et al. also reported on 3 previous studies that reported positive associations between social isolation/loneliness and suicidal ideation or self-harm.³⁵

CHILD MALTREATMENT

One study from the US was identified that examined factors associated with the risk of child abuse and neglect during the COVID-19 pandemic.³⁴ A community sample of parents in the US (N=342, 62% mothers) with children ages 4-10 years reported on job loss, depression, conflict in the home, and cognitive reframing from mid-April to mid-May 2020. The study found parents who lost their jobs (OR = 4.86, 95% CI [1.19, 19.91], p=.03), were more depressed (OR = 1.05, 95% CI [1.02, 1.08], p<.01), or previously psychologically maltreated their children (OR = 111.94, 95% CI [28.54, 439.01], p<.001), had significantly higher odds of psychological maltreatment during the pandemic. Of parents who lost their jobs ($n = 43$), 72.1% reported psychologically maltreating their child during the pandemic.³⁴ This study was a crowd-sourced sample of parents and generalizability to general populations is unknown.

A second US study examined the impact of school closures during the COVID-19 pandemic on child maltreatment reporting.³³ There was a 27% decline in reports of child maltreatment allegations in March and April 2020 due to school closures. This is consistent with previous Canadian research that estimated 33% of substantiated child abuse incidents were detected in schools.³⁸ Counties in Florida where a higher number of staff are trained to identify and report child maltreatment reported the highest number of reductions in allegations. This finding supported the authors' conclusion that the lower number of allegations are likely due to school closures.³³

SUBSTANCE USE

One Canadian study evaluated the changes in adolescent substance use before and during COVID-19 (data collection from April 4 to 13, 2020).¹⁶ The proportion of adolescents who used alcohol did not change significantly. Binge drinking decreased from 15.7% to 9.8% (p<0.01), as did vaping (16.6% to 11.5% p<0.01), for all adolescents. Cannabis use significantly decreased by 3% in females only (16.4% to 13.4% p<0.01). However, for those who reported use, the frequency of alcohol and cannabis use increased. Overall, 49.3% of adolescents reported using substances alone, 23.6% used while physically with friends (face-to-face), 31.6% used virtually with friends, and 42.0% used substances, mainly alcohol, with their parents. Although males reported no significant change in the proportion or frequency of substance use from pre- to post-COVID-19 lockdown, they were significantly more likely to use substances alone and in the presence of friends face-to-face, during COVID-19, compared to females. Adolescents reporting greater fears of COVID-19 and more depressive symptoms were significantly more likely to use substances alone.¹⁶

Parenting, parental stress, and parent mental health and wellbeing

Ten peer-reviewed studies^{13,15,23,25,27,32,34,39-41} and two reports^{6,8} were identified that examined the impact of the COVID-19 public health measures on parent-related outcomes including parenting practices (harsh, focused, soothing, structured, avoidant), parent-child relationship, parents' individual stress or parenting stress, parent mental health (anxiety or depression symptoms), resilience, and family functioning. Multiple studies reported on both child and parent mental health and well-being as well as

various correlations between parent and child factors. All studies found that parental factors such as stress, resilience, and anxiety were significantly associated with their child's mental health and behaviour outcomes in both negative and positive directions. Study details are presented in Table 2.

A descriptive report from the Offord Centre for Child Studies and McMaster University described Ontario parents' mental health and well-being during May and June 2020. Overall, 1 in 3 parents or caregivers reported moderate to high levels of anxiety, and almost 60% reported symptoms that met the criteria for depression.⁶ Parents also reported difficulty in managing their children's behaviour (31%), and child's anxiety and depression (48%). Family dysfunction was also measured with 21% of parents reporting getting into long arguments with their children and 49% indicating a high level of conflict with their spouse.⁶ Data from the US, collected by the Kaiser Family Foundation, showed 59% of women and 49% of men with children <18 years reported negative impacts to their mental health due to stress and worry about COVID-19.⁸ In another study from the US, female unmarried parents reported higher rates of their own mental health worsening.²⁵

Four studies reported on parents' perceived stress during the COVID-19 pandemic.^{27,32,39,40} Cumulative stressors related to COVID-19 (e.g., loss of employment or income, inability to provide for family needs) were significantly associated with perceived stress,³⁹ distress,²⁷ or parenting stress.⁴⁰ Parents' anxiety and depression symptoms were also significantly associated with perceived stress or distress.^{27,39} In two studies, the direct impacts of COVID-19 risk or quarantine risk were not significantly associated with a child's mental health outcomes,³² parent-child relationships, or harsh parenting style.⁴⁰ However, parental stress was significantly associated with harsh parenting and poor parent-child relationships,⁴⁰ well as child's behavioural and emotional problems.³² Gunther-Bel et al., reported COVID-19 confinement in Spain was significantly associated with situational anxiety in parents and Spinelli et al. estimated parents' individual perception of COVID-19 risk and level of parental stress was significantly associated with children's well-being.^{32,41} Parents' anxiety was positively associated with avoidant and soothing parenting practices, while parents' depressive symptoms were negatively associated with soothing parenting.²⁷ However, Romero et al. describe that "results showed an indirect effect of anxiety on structured parenting, which was totally mediated by parenting distress. Similarly, parenting distress totally mediated the effect of depressive symptoms on both focused and structured parenting."²⁷ Brown et al. reported parental support and perceived control over the COVID-19 pandemic were significantly associated with less perceived stress.³⁹ Overall, parental stress acted as a mediator in the association between COVID-19 pandemic measures and parent and child outcomes.

Two cross-sectional analyses were conducted from the Confinement Effects on Families and Children (CONFIA-20) Study in Spain that measured parent-related factors that were associated with child outcomes.^{15,27} In the first study, preschool children with parents who had perceived distress and an emotional response to the COVID-19 crisis had increased conduct problems and hyperactivity compared to school-aged children.²⁷ However, this study also showed that specific positive parenting practices (e.g. focused parenting) had a positive association with the child's emotional problems. Similarly, Dominguez et al. reported higher levels of parent-perceived fear of the future predicted significantly higher levels of child behavioral and emotional problems when children displayed disengaged coping.¹⁵ Finally, Cacioppo et al. reported 81% of parents of a child with a disability needed more parental help, 46% needed more social interaction, and 60% reported a need for human, psychological and schooling support.¹³

Nutrition and food insecurity

Overall, five studies were included that examined nutrition and food insecurity (see Table 3). Four studies evaluated the prevalence of household food insecurity.^{25,42-44} Two studies that assessed the change in food insecurity pre- and post-COVID all reported significant increases in households with children.^{25,42} The percent of low and very low food security increased from 14.1% in 2017 to 20.12% in 2020 (marginal food security was not included) in an unrepresentative survey of Americans using the validated US Department of Agriculture (USDA) Food Insecurity questions.⁴² The authors found a higher proportion of low or very low food security in households (with and without children) that had at least one member who had lost their job or expected to make less money in 2020, than those who reported no change in income.⁴² Patrick et al. found that the prevalence of mild, moderate, or severe food insecurity increased from 32.6% to 36.0% according to a US survey where parents with children under 18 years self-reported changes since pre-COVID (March 2020).²⁵ In Canada, 4.5% of fathers and 8.5% of mothers enrolled in the Guelph Family Health study reported being worried about having enough money to buy food in the past month and in the next six months.⁴³

Two studies evaluated changes in eating behaviours⁴³ and food intake.⁴⁵ In the Guelph Family Health study, eating habits reportedly changed in 70% of mothers, 60% of fathers, and 51% of children including eating more food (57% of mothers, 46% of fathers, 42% of children) and more snack food (67% of mothers, 49% of fathers, 55% of children). Only approximately 10% of mothers, fathers, and children reported eating more fast food/take-out.⁴³ A cross-sectional survey of 10 to 19 year olds in Spain, Italy, Brazil, Colombia, and Chile reported that there was a significant increase in the frequency of sweet foods and fried foods (including packaged potatoes) before and during COVID lockdown.⁴⁵ The proportion of survey respondents who consumed sweet foods daily increased from 13.4% to 20.8%. The frequency of processed meat intake increased for boys only.⁴⁵ Changes in dietary intake are self-reported and at risk of recall and social desirability bias. The survey samples are not representative, and Ruiz-Roso et al.'s study of adolescents' food intake may not be generalizable to Canada.

A single study of adolescents in Poland assessed motives for food choices and assessed changes since COVID-19.⁴⁴ Weight control (low in calories, low in fat, helps control my weight) and health (e.g., high in vitamins and minerals, nutritious, high in protein, fiber, good for my skin/teeth/hair/nails, keeps me healthy) were rated significantly more important than before COVID, whereas mood (helps me relax, cheers me up, helps me cope, keeps me awake, makes me feel good) and sensory appeal (smells nice, looks nice, pleasant texture, tastes good) became less important. Sex-based analyses found that health was not more important for boys before or during COVID but the importance of weight control increased. For girls, the importance of weight control and health both increased.⁴⁴ Although there were statistically significant changes in food choice motives, the clinical significance is unknown.

Movement behaviours (physical activity, sedentary behaviour, screen time, sleep)

There were seven studies retrieved from the search that examined movement behaviours including physical activity, sedentary behaviour, screen time and sleep.^{13,46-51} The studies were all cross-sectional designs surveying adolescents and parents of younger children about activity levels during the pandemic public health measures. Study details are presented in Table 4.

Two studies were found that used data from Canadian children aged 5-17 years.^{49,50} One study reported overall for children and adolescents: 56% decreased outdoor activities; 64% less outdoor physical activity and sport; 53% less walking and biking; and 51% less outdoor play during April 2020. Indoor play

increased by 53% and screen time increased by 79% for children and adolescents.⁴⁹ The second study found only 4.8% (2.8% female, 6.5% male) of children and 0.6% adolescents (0.8% female and 0.5% male) were meeting the combined movement behaviour guidelines during COVID-19 restrictions.⁵⁰ Both children and adolescents had lower overall physical activity levels, less outside time, more sleep time and more screen time.⁵⁰ Similarly, a national Canadian survey found 53% of children and adolescents decreased physical activity, 47% going outside less than once a day, 83% increased screen time, 31% reported decreased sleep quality, and 51% reported sleeping more.⁷

One study examined risk factors, including parental influence, on physical activity levels in adolescents from Bosnia-Herzegovina.⁴⁸ The authors found parental education was positively correlated with physical activity. This finding was supported in one of the Canadian studies that showed parental encouragement and support, parental engagement in physical activity, and family dog ownership was positively associated with healthy movement behaviours.⁵⁰ Another study of adolescents from five countries (Brazil, Colombia, Spain, Chile, Italy) found physical inactivity increased from 73% to 79.5% during the lockdown.⁵¹ One study in the US found children 5 to 13 years averaged 91.1 (SD = 109.2) minutes of sitting for school-related activities, 398.5 (SD = 184.6) minutes of sitting for leisure activity, and 489.4 (SD = 211.5) minutes of total sitting on the previous day.⁴⁷ Cacioppo et al. reported 44% of children with disabilities stopped physical activities they used to do and 22% reported sleep difficulties.¹³

Two studies reported on sleep duration and quality during the COVID-19 pandemic.^{46,49} Dellagiula et al. examined preschool children (3 to 6 years) sleep quality and duration from the end of February to the end of March and found an initial decrease in sleep duration followed by a stabilization. Similarly, sleep quality and bedtime routines were decreasing in the first part of the month, with the pattern stabilizing in the second half of the lockdown month.⁴⁶ In one of the Canadian studies, sleep duration increased and sleep quality decreased by a small amount.⁴⁹

Education

Two peer-reviewed studies and three grey literature reports assessed educational attainment outcomes during the COVID-19 pandemic.^{52,53} Study details are presented in Table 5. One survey asked Chinese parents' perceptions of their child's early childhood education and how much time was spent in online learning per day after switching to online learning.⁵³ Overall, 84.6% spent less than 30 minutes each time they logged on, 43.1% participated in online learning once per day, and 18.4% multiple times per day. A small percentage of parents thought online learning had better content (18.4%), improved outcomes (11.0%), and was more efficient (12.6%). However, there were also reported difficulties at home due to children's lack of self-regulation, and parental concern about lack of physical activity and potential vision problems.⁵³ Bao et al. completed a modelling study examining kindergarten students reading ability over the course of the early lockdown months of the pandemic. The rate of gain in reading ability in kindergarten children was predicted to decrease 66% during COVID-19 between January and September 2020 (compared to regular in-person attendance).⁵³ However, the modelling study used inputs from previous studies measuring reading ability during summer months when children are out of school, and did not account for the potential gains made through online learning.

Three reports were retrieved from the grey literature that assessed educational outcomes during school closures.^{7,11,54} A report published by the British Columbia (BC) Centres for Disease Control and BC Children's Hospital reviewed the global literature and BC data⁵⁴ on the impact of school closures on children and youth.⁵ A majority of BC families (76.0%) reported impaired learning during the school closure. Further, these effects may worsen existing disparities in cognitive development and literacy. In BC, up to 30% of families reported having no access to technology at all when schools closed in March.⁵

Secondly, a national Canadian survey, conducted by Maximum City, reported 44% of children and youth described decreased school engagement, 53% spending less time on school work, 47% increased school stress, and 39% finding it harder to concentrate during school closures.⁷ A Ministerial Briefing Paper for the Australian Government Department of Education, Skills and Employment found students who were socially and educationally vulnerable were negatively impacted by remote learning.¹¹ In this report, 32% of Australian students at or below a standard reading literacy benchmark reported that they did not have their own desk or place to study at home as compared to 16% of students whose reading is above the benchmark.¹¹ Most schools did not have the appropriate infrastructure to support remote learning and many teachers did not have the skills to manage remote learning and required added support. Similar to BC, although most developed countries have access to internet and digital technologies, there was still evidence of a “digital divide”, with lower socio-economic status (SES) and rural populations having less access to internet and technologies.¹¹

Injury

Two studies were found that reported on injuries in children as an outcome during the COVID-19 pandemic.^{55,56} Study details are presented in Table 6. Claudet et al. compared the number of injuries presenting to hospital that occurred at home, across injury types during the quarantine period (March 17th to April 19th, 2020) to data from the same time period, in previous years. The authors report an increase in the number of home-based injuries presented to hospital during the pandemic compared to previous years (n=684; 74% compared with 40%), especially among children ages 2 to 5 years old. In most cases, injuries were the result of a fall, in particular from a trampoline or a loft bed, and sharp object injuries. Cases of poisoning, burns, foreign body ingestions or inhalations, or admissions for suspicion of abuse were not proportionally different from previous years.⁵⁵ Kruchevsky et al. compared the number of burn injuries during the COVID-19 lockdown period (March 14th to April 20th, 2020) to the same time period from 2017-2019. In this study, the total number of patients and trauma patients decreased during the lockdown period; however, the number of pediatric cases did not decrease. Children ages 2-5 years were reported to have a higher proportion of burn injuries, compared to previous years (56.3% v. 23.8%), as well as female patients across all pediatric age groups (57.1% v. 25%).⁵⁶

Health services utilization

There were two main outcomes reported in articles published on how the COVID-19 pandemic affected pediatric health services utilization: seven studies examined tertiary care use (numbers of ED visits and hospitalizations),⁵⁷⁻⁶³ and seven studies examined delays in access to health care or child and community services.^{13,59,64-68} Study details are presented in Table 7.

PEDIATRIC EMERGENCY DEPARTMENT VISITS AND HOSPITALIZATIONS

The majority of studies examining the number of pediatric ED visits during the COVID-19 pandemic showed a decrease in the number of visits; one study reported an increase in the proportion of visits, compared to 2019.⁶³ The percent reduction ranged from 24.8% (USA)⁶² to 88% (Argentina).⁶¹ In a study by Chaiyachati et al., the mean number of daily ED visits in 2020 was 95 (\pm 16) compared to 286 visits (\pm 42) in 2019 ($p<0.001$).⁵⁸ Dopfer and Angoulvant et al. reported similar declines in 2020, 63.8% (26.8 ± 1.5 to 9.7 ± 1 , $p=0.005$) in Germany⁶⁰ and a 68% (95% CI: 55.8% - 81.2%) reduction in France.⁵⁷ The study by Leeb et al.; however, reported that while the overall number of mental health-related ED visits decreased by 43% (149,055 v. 262,714), the average proportion of mental health-related ED visits increased 44% (1,673/100,000 v. 1,161/100,000) during March to October 2020, compared to the same

period in 2019.⁶³ This study also reported results by age, where mental health-related ED visits in children ages 5-11 increased by 24% and 31% in children ages 12-17, compared to 2019. COVID-19 lockdown and school closures were also reported to be associated with a significant decrease (over 70%) in reported infectious diseases including the common cold, gastroenteritis, bronchiolitis, and acute otitis media.⁵⁷

There is evidence to suggest that while the number of pediatric ED visits decreased during the lockdown period of the pandemic, the number of pediatric hospitalizations may have increased, compared to previous years. Three studies reported a higher proportion of hospital admissions including studies by Isba et al., Chaiyachati et al. and Dopfer et al., where the number of pediatric hospital admissions were significantly higher in 2020, compared to 2019. Isba et al., reported a 26% (OR = 1.26, 95% CI: 1.08-1.46) and 60% (OR = 1.60, 95% CI: 1.31-1.98) increase in the odds of hospital admissions in the UK and US, respectively. Chaiyachati and Dopfer, using data from the US and Germany, respectively, reported similar increases in pediatric hospitalizations: 22.4% v. 18.5% ($p<0.001$) and 26.6% v. 13.9% ($p<0.001$), compared to 2019.^{58,60,62}

ACCESS TO HEALTH AND COMMUNITY SERVICES

Seven studies reported on accessing health and/or community services during the pandemic.^{13,59,64-68} Ashton et al. surveyed pediatric gastroenterology centres serving patients with inflammatory bowel disease (IBD) and reported that 10-75% of sites had reduced access to various services compared with pre-COVID data. The delays in diagnostic services may delay important early treatment for children.⁶⁴ This result; however, was not consistent across studies. Roland et al. surveyed parents of children in the ED to assess if these cases were a result of a delay in seeking care. They found a low rate of reported delays and a low rate of hospital admission in their sample (i.e., data collected over a 2-week period in early May).⁶⁵ Whaling et al. examined access to community services during the pandemic by measuring the number of new case openings for child preventive services in New York between March and May 2020. The mean number of cases opened was less than half compared to the same period in 2013-2019.⁶⁷ The odds of opening a new child maltreatment prevention case during the COVID-19 pandemic was 179% lower compared to pre-COVID-19 cases (OR = -0.79, $p<.001$). Cacioppo et al. reported 77% of children with a disability had medical appointments cancelled or postponed during the pandemic.¹³ In the study by Rodenberg Danziger et al., authors report on 7 cases of delayed diagnosis of pediatric diseases due to the COVID-19 pandemic. They report that COVID-19 influenced care and resulted in worse outcomes in the 7 patients.⁶⁶ These studies postulate that families that are in need of services are not accessing them at a time when they are most needed. This review did not find any studies related to changes in access to primary healthcare services or immunization rates beyond what was previously reported.¹ There was a notable decline in vaccination rates during the first months of the pandemic, although the decrease was less pronounced for children ≤ 24 months.¹

Discussion

This rapid review identified 56 studies that examined the effects of COVID-19 community-based public health measures on the health and well-being of children, adolescents, and families. Multiple negative outcomes were identified including poor parent and child mental health, child maltreatment, increased food insecurity, decreased physical activity and increased sedentary behaviour and screen time, increased injury risk at home, and decreased access of health services. There is a large quantity of evidence concerning the mental health of children and parents during the COVID-19 pandemic. Furthermore, the findings from these studies are concerning as most surveys were conducted in the early months of the pandemic. At the time of this review, various community-based public health

measures have been implemented for 9 months. Although schools were re-opened in September, the school environment has changed, extra-curricular activities have been canceled, and the effects of stress during crises are cumulative. It might be expected that health and well-being outcomes will become more apparent and potentially worsen with time.⁶⁹

The main outcome reported was related to child mental health. A total of 23 studies investigated various mental health outcomes including anxiety and depressive symptoms, child behaviour, suicidal ideation, and general psychological distress. We also included studies that examined parents' mental health and stress related to COVID-19 public health measures. It was found that overall parent emotional regulation and mental health is highly correlated with their child's mental health and stress,²⁸ and family-related variables would be likely to constitute risk or protective factors for children. The majority of the included studies determined perceived parental stress as a mediator of the association between COVID-19 mitigation strategies and child mental health. Parents' who had high levels of resilience and lower levels of parenting stress had children with better mental health outcomes compared to parents' with lower resilience.²⁷ Building resilience in parents and children, developing strategies for reducing parenting stress, and supporting mental health promotion in schools and communities,⁷⁰ will be important mitigation strategies as the pandemic continues.

The majority of studies found that physical activity decreased during the pandemic public health measures. However, it is important to note that the level of physical activity, particularly in adolescents, was initially quite low pre-pandemic. Data from five countries reported physical inactivity before COVID-19 was already 73% in adolescents⁵¹ and data from Canada indicated only 39% of 5 to 17 year olds met recommended physical activity levels.⁷¹ Therefore, it is even more critical that efforts to promote physical activity during the COVID-19 pandemic are supported by public health and health practitioners. Specifically, there is a well-established association between physical activity levels and mental health; thus, getting outside, engaging in free play and exercise is important. As one author concluded "of public health concern is these short term changes in behavior in reaction to COVID-19 may become permanently entrenched."⁴⁷

In this review, we found that changes to nutrition and eating behaviours were not necessarily negative. Although food insecurity appears to be increasing at a population-level, eating habits improved for some individuals due to decreased exposure to restaurants and fast food options. More families ate at home, together, more often during the pandemic. Nonetheless, aspects of pandemic lockdowns, such as disruptions to routine, media consumption, preoccupation with appearance during videoconferencing, and emotional distress may increase the risk of disordered eating behaviours⁷² and may be further compounded by other aspects of poor mental well-being and food insecurity.⁷³ We did not find any studies that examined the loss of access to food due to school closures during COVID-19. However, this was found in our previous review as a potential negative outcome during other pandemic and disaster situations. Research on the magnitude of this effect may still be in progress.

The public health measures introduced to mitigate coronavirus transmission also decreased pediatric ED visits and overall hospitalizations. While these decreases seem positive from a population health perspective at first glance, there is concern among health professionals that "corona-phobia" (i.e., a fear of being infected by coronavirus) may delay parents seeking care for their sick children or other preventive health care such as vaccinations. The results of this review found low-level evidence that some parents may have delayed seeking care which resulted in more serious illness and hospitalizations.⁶⁶ This is consistent with health services research in other age groups that is showing delayed screening, cancer diagnosis, and treatments may be worsening health outcomes in adult populations.

Injury rates likely decreased due to reduced exposure, particularly for traumatic motor vehicle injury and sport-related injury, although home-based injuries such as falls increased. During the pandemic public health measures, fewer people and children were engaging in activities outside the home and spent more time in the home; therefore, injury types reflected this change. However, data presented for the two injury papers were reported from ED data – therefore not representative of the true burden of injuries during the COVID-19 lockdown (there would be a high likelihood that parents would not take their child(ren) to the ED during COVID (particularly in lockdown which were these two studies), unless the injury was severe. This was seen in a general decrease in ED visits for common pediatric illnesses as parents were less likely to take their children to the ED for minor reasons and the added individual preventive measures (face masks, social distancing) likely reduced more common pediatric infectious diseases.⁷⁴

This review identified many relevant studies, however most studies used online surveys in the general population of parents. These convenience samples provide a quick snapshot of the population but often are missing some of the most marginalized populations due to access to online platforms, language and cultural appropriateness of survey questions. Families residing in low income and racialized communities are disproportionately impacted by both the COVID-19 infection and the public health measures implemented to mitigate transmission. For example, the educational impact of remote learning was more profound for socially and educationally marginalized children, therefore widening the gap between low and high income families.¹¹ Marginalized populations require added layers of prevention and mitigation strategies to address the health inequities that the COVID-19 pandemic has exacerbated.

Although out of scope for this review, there have been some reported positive outcomes of the stay-at-home recommendations. Particularly around eating habits and nutrition, as well as decreases in health services utilization. There were positive changes for some populations in eating habits and dietary behaviours observed by Carroll and Ruiz-Roso, including spending more time cooking, making meals from scratch, eating meals with children, and engaging children in meal preparation more often, more frequent intake of fruits, vegetables, and legumes, and reduced frequency of fast food intake.^{43,45} For some children, being at home compared to being in school has been beneficial.⁷⁴ For example, Isumi et al., provided evidence that suicide rates decreased during the pandemic months compared to the same period in previous years. The authors postulated that increased time spent at home with parents increased dialogue as a potential mechanism for this finding.²¹

Limitations and Strengths

The majority of studies were cross-sectional, using online surveys, which are generally low quality evidence.⁷⁵ Other limitations included small sample sizes and generalizability. Although most of the data was parent-reported, which may lead to social desirability bias, many studies used validated measurement tools such as the CES-D and SDQ. The study samples in European, Australian, US, or Canadian studies were predominantly Caucasian families with high income and education. This may lead to these studies' results biased to the null, if families from diverse ethnicities or racialized communities, who are more likely to experience greater social and health inequities which may be exacerbated during the pandemic, are systematically underrepresented.

Further, the generalizability of findings from the studies on food insecurity may be limited as employment, income supports, and other social services that impact food insecurity differ between nations. Further, the survey samples are not representative of populations in the US nor Canada as more respondents were white and had higher incomes than national population profiles and thus may underrepresent the true prevalence and incidence of food insecurity. In this review, we excluded some

studies where context related to some outcomes (e.g., food security) would be extremely different than Ontario, for example India and Bangladesh.

This rapid review had some limitations. Due to time constraints, no quality appraisal was conducted. Similarly, all abstracts and full-texts were reviewed by three single reviewers, as opposed to at least two independent reviewers. However, the final decision on inclusion of full-text documents was made by consensus by the authors. Despite these limitations, there are strengths to this review. Multiple databases were searched using a search strategy defined and validated by PHO Library Services. A grey literature search was also conducted.

Conclusion

Since our initial review in May 2020, a large number of studies on the multiple negative impacts of public health measures implemented during the COVID-19 pandemic on children and families have been published. The magnitude and number of negative impacts appears to be increasing as well. The stay-at-home orders and school closures enacted in response to COVID-19 are unprecedented in their breadth and duration and this presents a risk to children and families for various physical and mental health problems. It may be that, as Ontario students have returned to in-person learning as of September 2020, some of these negative impacts can be mitigated. Intersectoral collaboration, involving public health, primary and acute care health services, community partners, and education will be needed to develop evidence-informed programs, particularly on mental health promotion, to support families and their communities as the pandemic continues and likely into the years ahead.

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Appendix A: Included Study Characteristics by Outcome

Table 1: Studies on child mental health and well-being outcomes (N=26)

Author (Year)	Location	Study Design	Population (N)	Outcome(s)
Abawi (2020)	Netherlands	Mixed methods	Children with severe obesity Median age=10.5 years N=75	Anxiety related to COVID-19 Reasons for anxiety and behavioural consequences were determined qualitatively Health-related quality of life
Baron (2020)	US	Modelling study	Children using the Florida Child Abuse Hotline, Department of Education (No demographics)	Decline in allegations of child maltreatment
Cacioppo (2020)	France	Cross-sectional	Parents of children with physical disability 1-18 years Mean age=9.5 years N=1000	Well-being (morale, behavioural problems, sleep difficulties) Access to physical activities, rehabilitation, and medical follow-up
Colizzi (2020)	Italy	Cross-sectional	Parents of children with ASD Mean age=13 years N=527	Intensity and frequency of behaviour problems Managing daily activities (meals, free time, structured activities)
Dominguez-Alvarez* (2020)	Spain	Cross-sectional (CONFIA-20 Study)	Parent of children 3-12 years Mean age 7.26 years N=1123	Child coping strategies Child maladjustment (SDQ subscales) – conduct problems, emotional problems, hyperactive behaviours

Author (Year)	Location	Study Design	Population (N)	Outcome(s)
Dumas (2020)	Canada	Cross-sectional	Adolescents Mean age=16.68 years N=1054	Substance use (alcohol, cannabis, vaping) Ever use, frequency of use, and binge drinking
Fish (2020)	US	Qualitative	Adolescents identifying as LGBTQ+ 13-19 years N=159	Concern for mental health due to pandemic restrictions (stress frustration, anxiety, depression) Concern for loss of extracurricular activities, and being stuck at home with “unsupportive parents”
Garcia de Avila (2020)	Brazil	Cross-sectional	Parents of children 6-12 years Median age=9 years N=289	Anxiety (Children’s Anxiety Questionnaire)
Gotlib (2020)	US	Longitudinal cohort	Adolescents 13-20 years (recruited at 9-13 years) N=109	Early Life Stress (ELS) predicted depressive symptoms during the pandemic Adolescents perceived levels of stress (mediator)
Guo (2020)	China	Cross-sectional	Adolescents 11-18 years N=6196	Anxiety (Zung self-rated anxiety scale) Post-traumatic stress symptoms (PTSS)
Isumi (2020)	Japan	Cross-sectional	Children < 20 years Total national population of children	Suicide rate per 100,000 per month No significant change in suicide rate
Kilincel (2020)	Turkey	Cross-sectional	Adolescents 12-18 years Mean age=16.83 years	Anxiety (State-Trait Anxiety Inventory)

Negative impacts of community-based public health measures on children, adolescents, and families during the COVID-19 pandemic: Update

Author (Year)	Location	Study Design	Population (N)	Outcome(s)
			N=745	Previous psychiatric referral increased odds of situational anxiety during COVID-19
Lawson (2020)	US	Cross-sectional	Parents of children 4-10 years N=342	Psychological maltreatment and physical abuse Cognitive reframing Parental depression
Loades (2020)	N/A	Review	Children and adolescents	Depressive symptoms Anxiety symptoms Suicidal ideation Self-harm Eating disorder risk behaviour
Marques de Miranda (2020)	Multiple countries	Review	Children 6-21 years	Anxiety and depressive symptoms Post-traumatic stress symptoms (PTSS) General mental health status Stress and coping
Mazza (2020)	Italy	Cross-sectional	Parents of children 3-13 years Mean age=7.57 years N=833	Child behavior, subscales (SDQ) Hyperactivity-inattention, emotional symptoms
Neubauer (2020)	Germany	Cross-sectional and Longitudinal	Parents of children 6-19 years Mean age=9.81 years N=970 (baseline)	Child behavior, subscales (SDQ) Hyperactivity-inattention, emotional problems, prosocial behaviours Family environment

Author (Year)	Location	Study Design	Population (N)	Outcome(s)
Riiser (2020)	Norway	Cross-sectional	N=562 (follow-up) Adolescents 16-19 years Mean age=17.3 years N=2205	Parents' stress
Romero* (2020)	Spain	Cross-sectional (CONFIA-20 Study)	Parents of children 3-12 years Mean age=7.26 years N=1049	Child negative outcomes (SDQ) – conduct problems, emotional problems, hyperactive behaviours Child positive outcomes – routine maintenance, prosocial activities, social-oriented reflections, social bonding)
Patrick (2020)	US	Cross-sectional	Parents of children <18 years N=1011	Change in overall child physical and mental health
Shorer (2020)	Israel	Cross-sectional	Parents of children 2-7 years Mean age=4.82 years N=351	Child's stress reactions (e.g., separation fears, clinging, nervousness, agitation, aggressiveness) Parents' emotion regulation Parental playfulness
Singh (2020)	Multiple countries	Review	Children and adolescents Children and adolescents with special needs (e.g., ASD, ADHD, learning disabilities)	Psychological distress (clinginess, irritability, agitation, inattention and separation related anxiety) Intolerance with uncertainty and aggravation of symptoms due to routine disruptions
Spinelli (2020)	Italy	Cross-sectional	Parents of children 2-14 years	Children's psychological problems (SDQ subscales)

Author (Year)	Location	Study Design	Population (N)	Outcome(s)
von Soest (2020)	Norway	Repeated cross-sectional	N=854	Emotional symptoms, hyperactivity-inattention, and conduct problems
			Adolescents 13-16 years in lower secondary school	Life satisfaction Subjective well-being
			N=8116	Concerns and changes to everyday life
Yeasmin (2020)	Bangladesh	Cross-sectional	Parents of children 5-15 years N=384	Child anxiety and depression (RCADS) Child behavior (CBCL)
Zhang (2020)	China	Longitudinal cohort study	Children 9-16 years Mean age=12.6 N=1241	Depressive symptoms Non-suicidal self-injury Suicidal ideation, plan, or attempt

*Same study sample CONFIA-20 Study (Confinement Effects on Families and Children)

Table 2: Parenting, parenting stress and parent mental health outcomes (N=10)

Author (Year)	Location	Study Design	Population (N)	Outcome(s)
Brown (2020)	US	Cross-sectional	Parents of children <18 years	Parenting stress
Cacioppo (2020)	France	Cross-sectional	Parents of children with disability 1-18 years Mean age=9.5 years	Parental concerns about social interactions, risk of COVID-19 infection, need for support (human resources, psychological support or school recommendations)

Author (Year)	Location	Study Design	Population (N)	Outcome(s)
N=1000				
Chung (2020)	Singapore	Cross-sectional	Parents (with ≥ 1 child 12 years or younger) N=258	No independent evidence of COVID-19 impact on harsh parenting Significant impact of COVID-19 on parenting stress, and parenting stress on harsh parenting Parenting stress was a mediator
Günther-Bel (2020)	Spain	Cross-sectional	Parents living with children N=407	State Trait Anxiety Inventory (STAI) Beck Depression Inventory (BDI) Conjugal, parental, and co-parental functioning
Lawson (2020)	US	Cross-sectional	Parents of children 4-10 years N=342	Psychological maltreatment and physical abuse Cognitive reframing Parental depression
Mazza (2020)	Italy	Cross-sectional	Parents of children 3-13 years N=833	Parents' distress
Patrick (2020)	USA	Cross-sectional	Parents of children <18 years N=1011	Change in parents' mental health (26.9% reported worsening of mental health)
Romero (2020)	Spain	Cross-sectional	Children 3-12 years Mean age=7.26 years N=1123	Parents' resilience Parents' perceived distress Parenting distress and parenting practices

Author (Year)	Location	Study Design	Population (N)	Outcome(s)
Parents' emotional problems				
Spinelli (2020)	Italy	Cross-sectional	Parents of children 2-14 years N=854	Parents' dyadic parenting stress Parents' stress
Ontario Parent Survey (2020)	Canada (Ontario)	Cross-sectional	Parents of children 0-17 years N=7437	Parent or caregiver's anxiety or depressive symptoms Managing their child's anxiety, stress or behaviour

Table 3: Nutrition and food insecurity (N=5)

Author (Year)	Location	Study Design	Population (N)	Outcome(s)
Ahn (2020)	US	Repeated cross-sectional	Households with children N=421	Food security status (high, marginal, low, very low as per USDA 18-item food security questionnaire)
Carroll (2020)	Canada	Cross-sectional	Families with children 18 months to 5 years Mean child age=6 years N=254	Eating behaviours Food insecurity (current [last month] and future [next 6 months] worries from 2 yes/no questions)
Glabska (2020)	Poland	Cross-sectional	Adolescents 15-20 years Median age=16.8 years	Motives for food choice

Author (Year)	Location	Study Design	Population (N)	Outcome(s)
			N=2,448	
Patrick (2020)	US	Cross-sectional	Parents of children <18 years N=1,011	Use of public food assistance resources (e.g. the Supplemental Nutrition Assistance Program (SNAP), the Special SNAP for Women, Infants, and Children (WIC), food banks) Food insecurity (mild, moderate, severe from 1-item question)
Ruiz-Roso (2020a)	Spain, Italy, Brazil, Colombia, and Chile	Cross-sectional	Adolescents 10 to 19 years Mean age=15 years N=820	Dietary intake (frequency of food type intake)

Table 4: Movement behaviours (N=7)

Author (Year)	Location	Study Design	Population (N)	Outcome(s)
Cacioppo (2020)	France	Cross-sectional	Parents of children with disability 1-18 years Mean age=9.5 years N=1000	Physical activity
Dellagulia (2020)	Italy	Longitudinal cohort	Children 3-6 years Mean age=3.81 years No sample size reported	Sleep quality, duration, bedtime routines

Author (Year)	Location	Study Design	Population (N)	Outcome(s)
Dunton (2020)	US	Cross-sectional	Children 5-13 years Mean age=8.73 years N=211	Physical activity Sedentary behaviour
Gilic (2020)	Bosnia-Herzegovina	Longitudinal cohort	Adolescents 15-18 years N=688	Physical activity level
Maximum City National Survey (2020)	Canada	Cross-sectional	Children 9-15 years N=616	Movement behaviours (physical activity, screen time, sleep duration and quality)
Mitra (2020)*	Canada	Cross-sectional	Children 5-17 years N=1472	Movement behaviours (physical activity, sedentary behaviour, screen time, sleep)
Moore (2020)*	Canada	Cross-sectional	Children 5-17 years N=1472	Movement behaviours (physical activity, sedentary behaviour, screen time, sleep)
Ruiz-Roso (2020b)	Multiple countries	Cross-sectional	Adolescents 10 to 19 years N=726	Physical activity status (active vs inactive)

*Same survey sample

Table 5: Education outcomes (N=2 peer-reviewed, 2 reports)

Author (Year)	Location	Study Design	Population (N)	Outcome(s)
Bao (2020)	US	Modelling study	Children in kindergarten (No demographics)	Reading ability decreased
Dong (2020)	China	Cross-sectional	Parents of children 3-4 years (50.5%) and 4-5 years (34.5%) N=3275	Frequency and content of online learning Parents' perceptions of online learning
Maximum City National Survey (2020)	Canada	Cross-sectional	Children 9-15 years N=616	School engagement School stress Difficulty concentrating
BC COVID Population Health Survey (2020)	Canada (BC)	Cross-sectional	Households with children	Child's impaired learning Child's stress Child's mental health Child's screen time Child's connection with friends

Table 6: Injury outcomes (N=2)

Author (Year)	Location	Study Design	Population (N)	Outcome(s)
Claudet (2020)	France	Cross-sectional	Mean (SD) age = 4.6 (2.7) years	Injuries presenting to hospital that occurred in home (e.g., falls, burns, sharp objects)
Kruchevsky (2020)	Israel	Retrospective cohort	Children 2-18 years	Burn injuries presenting to level 1 trauma centre

Table 7: Health services utilization studies, by outcome (N=13)

Author (Year)	Location	Study Design	Population	Outcome(s)
Emergency Department (ED) Visits and Hospitalizations				
Angoulvant (2020)	France	Cross-sectional	Children ages 0-18 years N=871,543	ED visits
Chaiyachati (2020)	US	Descriptive	Children ages 1-21 years	ED visits and hospitalizations
Ciacchini (2020)	Italy	Descriptive/case-series	Children ages 0-18 years	ED visits
Dopfer (2020)	Germany	Repeat cross-sectional	Children (mean age=7 years) N=5,424	ED visits and hospitalizations

Author (Year)	Location	Study Design	Population	Outcome(s)
Ferrero (2020)	Argentina	Descriptive	Children ages 0-18 years	ED visits
Isba (2020)	US and UK	Cross-sectional	Children aged < 16 years N=13,671 [UK], N=10,005 [USA]	ED visits and hospitalizations
Leeb (2020)	US	Descriptive	Children ages 0-17 years	Mental health-related ED visits
Access to Health Services				
Ashton (2020)	UK	Cross-sectional	Children with inflammatory bowel disease (IBD) N=20 pediatric gastroenterology IBD centres	Health services: diagnosis of new IBD, facilities available, management of IBD
Cacioppo (2020)	France	Cross-sectional	Parents of children with disability ages 0-18 years N=1,000	Access to services
Roland (2020)	United Kingdom	Descriptive	Children ages 0-16 years N=1,349	Delayed health service use
Rosenberg Danziger (2020)	Israel	Case series	Children ages 4 days-16 years N=7	Cases of delayed pediatric illness presenting to the ED
Whaling (2020)	US	Descriptive	Children (no demographic data)	Social services, new case openings Access to community services

Author (Year)	Location	Study Design	Population	Outcome(s)
Wilke (2020)	Multiple countries	Cross-sectional	Non-Governmental Organizations (NGO) service providers for vulnerable children and families	Access to NGO services

Appendix B: Example Search Strategy

MEDLINE

Ovid MEDLINE(R) ALL <1946 to September 17, 2020>

#	Searches	Results
1	("COVID-19" or "severe acute respiratory syndrome coronavirus 2" or "SARS-CoV-2").nm,ps,px,rs,rx.	24439
2	(*Pandemics/ and Coronavirus Infections/) or (Pandemics/ and *Coronavirus Infections/) or (*Pneumonia, Viral/ and Coronavirus Infections/) or (Pneumonia, Viral/ and *Coronavirus Infections/)	23202
3	("2019 corona virus" or "2019 coronavirus" or "2019 ncov" or "corona virus 19" or "corona virus 2019" or "corona virus 2019" or "corona virus disease 19" or "corona virus disease 2019" or "corona virus epidemic*" or "corona virus outbreak*" or "corona virus pandemic*" or "coronavirus 19" or "coronavirus 2019" or "coronavirus 2019" or "coronavirus disease 19" or "coronavirus disease 2019" or "coronavirus epidemic*" or "coronavirus outbreak*" or "coronavirus pandemic*" or "covid 19" or "covid 2019" or "new corona virus" or "new coronavirus" or "novel corona virus" or "novel coronavirus" or "novel human coronavirus" or "sars coronavirus 2" or "sars cov 2" or "sars cov2" or "sars like coronavirus" or "severe acute respiratory syndrome corona virus 2" or "severe specific contagious pneumonia" or "wuhan corona virus" or "wuhan coronavirus" or 2019ncov or covid19 or covid2019 or ncov or sarscov2 or "coronavirus response" or "corona virus response").kf,kw,ti.	51957
4	((pandemic* or novel or wuhan) adj3 (coronavirus* or "corona virus*" or betacoronavirus* or "beta coronavirus*" or "beta corona virus*" or pneumonia* or SARS or "severe acute respiratory syndrome")).kf,kw,ti.	4314
5	(pneumonia adj3 (coronavirus* or "corona virus*" or betacoronavirus* or "beta coronavirus*" or "beta corona virus*" or SARS or "severe acute respiratory syndrome")).kf,kw,ti.	709
6	(*Coronavirus Infections/ or coronavirus.ti.) and ("2019 corona virus" or "2019 coronavirus" or "2019 ncov" or "corona virus 19" or "corona virus 2019" or "corona virus 2019" or "corona virus disease 19" or "corona virus disease 2019" or "corona virus epidemic*" or "corona virus outbreak*" or "corona virus pandemic*" or "coronavirus 19" or "coronavirus 2019" or "coronavirus 2019" or "coronavirus disease 19" or "coronavirus disease 2019" or "coronavirus epidemic*" or "coronavirus outbreak*" or "coronavirus pandemic*" or "covid 19" or "covid 2019" or "new corona virus" or "new coronavirus" or "novel corona virus" or "novel coronavirus" or "novel human coronavirus" or "sars coronavirus 2" or "sars cov 2" or "sars cov2" or "sars like coronavirus" or "severe acute respiratory syndrome corona virus 2" or "severe acute	14632

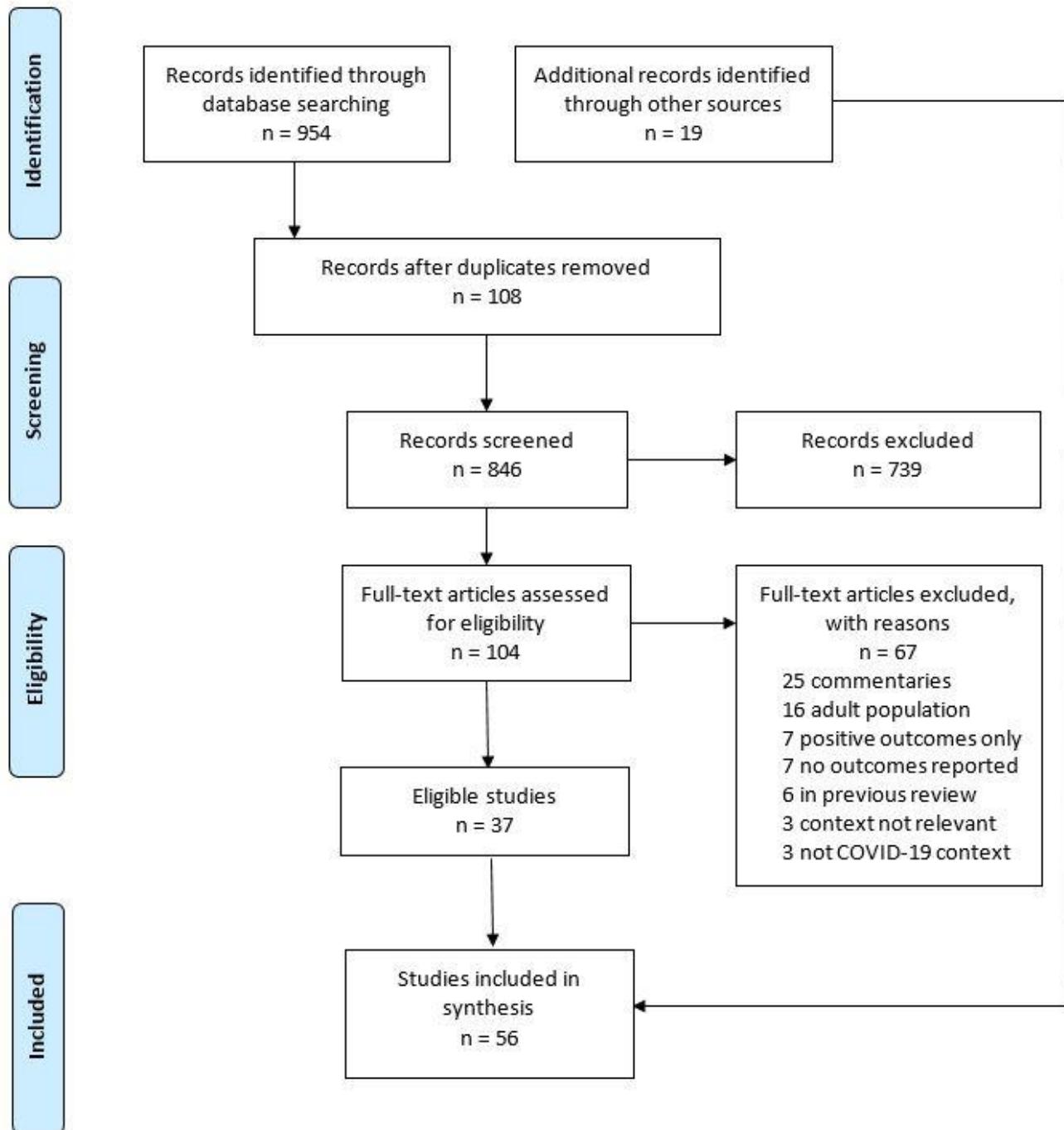
#	Searches	Results
	respiratory syndrome coronavirus 2" or "severe specific contagious pneumonia" or "wuhan corona virus" or "wuhan coronavirus" or 2019ncov or covid19 or covid2019 or ncov or sarscov2 or "coronavirus response" or "corona virus response").ab.	
7	(*Coronavirus Infections/ or coronavirus.ti.) and ((pandemic* or novel or wuhan) adj3 (coronavirus* or "corona virus*" or betacoronavirus* or "beta coronavirus*" or "beta corona virus*" or pneumonia* or SARS or "severe acute respiratory syndrome")).ab.	3687
8	(*Coronavirus Infections/ or coronavirus.ti.) and (pneumonia* adj3 (coronavirus* or "corona virus*" or betacoronavirus* or "beta coronavirus*" or "beta corona virus*" or SARS or "severe acute respiratory syndrome")).ab.	403
9	or/1-8	54313
10	Public Policy/ or Social Control, Formal/ or Government Regulation/ or Law Enforcement/ or Civil Defense/ or Social Control Policies/ or Resource Allocation/ or Social Isolation/ or Social Change/ or Social Marginalization/ or Quarantine/ or *Infection Control/mt, og or *Communicable Disease Control/mt, og or *Public Health/mt or *Health Promotion/mt or ("public health" or emergency or mandat* or government* or state) adj3 (respons* or respond* or measur* or strateg* or interven* or recover* or relief* or restrict* or rule* or law* or legislat* or regulat* or isolat*).ti,ab,kf,kw. or (mitigat* or quarantine* or self-quarantine* or self-isolat* or (confine* adj2 home*) or "social isolation" or "physical distanc*" or "social distanc*" or "workplace distanc*" or "control measur*" or (restrict* adj2 travel*) or (restrict* adj2 movement) or lockdown* or "national emergenc*" or state-of-emergency or "state of emergency" or "state emergenc*" or "state intervention*" or shelter*-in-place or "shelter in place" or "stay at home" or (stay* adj2 home*) or (stay adj2 hous*) or (work* adj2 (home* or hous* or remot*)) or ((on-line or online or virtual* or distance or remot*) adj2 (education or learning or school*)).ti,kf,kw. or (mitigat* or quarantine* or self-quarantine* or self-isolat* or (confine* adj2 home*) or "social isolation" or "physical distanc*" or "social distanc*" or "workplace distanc*" or "control measur*" or (restrict* adj2 travel*) or (restrict* adj2 movement) or (reduc* adj2 interact*) or (limit* adj2 contact*) or lockdown* or "national emergenc*" or state-of-emergency or "state of emergency" or "state emergenc*" or "state intervention*" or shelter*-in-place or "shelter in place" or "stay at home" or (stay* adj2 home*) or (stay adj2 hous*) or (work* adj2 (home* or hous* or remot*)) or ((on-line or online or virtual* or distance or remot*) adj2 (education or learning or school*)).ab. /freq=2	239705
11	((close* or closur* or closing* or "shut down" or shutdown or shut-down or discontinu* or cease or reduc* or decreas* or suspend* or suspension* or "stay* home") adj2 (school or schools or daycare* or childcare* or park* or playground* or librari* or "community centre*" or "recreation centre*" or "health servic*" or "community health*" or immuniz* or immunis* or "routine-immuniz*" or "routine-immunis*" or "nonessential service*" or "non-essential service*").ti,kf,kw. or ((close* or closur* or closing* or "shut down" or shutdown or shut-down or discontinu* or	1043

#	Searches	Results
	cease or reduc* or decreas* or suspend* or suspension* or "stay* home") adj2 (school or schools or daycare* or childcare* or park* or playground* or librар* or "community centre*" or "recreation centre*" or "health servic*" or "community health*" or immuniz* or immunis* or "routine-immuniz*" or "routine-immunis*" or "nonessential service*" or "non-essential service*").ab. /freq=2	
12	10 or 11	240599
13	Parents/ or Fathers/ or Mothers/ or Single Parent/ or Parenting/ or Siblings/ or Spouses/ or Family Health/ or Domestic Violence/ or Spouse Abuse/ or Intimate Partner Violence/ or Parent-Child Relations/ or Maternal Health Services/ or Maternal Health/	210102
14	(family or families or parent* or father* or mother* or caregiver* or spous* or husband* or wife or wives or partner* or marriag* or parent-child*).ti,kf,kw. not medline.st.	52697
15	13 or 14	262799
16	Infant/ or exp Infant, Newborn/ or Infant Health/ or exp Infant, Premature/ or Child Health/ or Child/ or Adolescent Health/ or Adolescent/ or Psychology, Child/ or Psychology, Adolescent/ or Child Development/ or Child Behavior/ or Infant Behavior/ or Child Behavior Disorders/ or Child Welfare/ or Pediatrics/ or Pediatric Obesity/ or Pediatricians/ or Pediatric Emergency Medicine/ or Neonatology/ or Child, Preschool/ or Adolescent Medicine/ or Siblings/ or Child Health Services/ or Maternal-Child Health Services/ or Child, Foster/ or Homeless Youth/ or Immunization Programs/ or Adverse Childhood Experiences/ or Child Abuse/ or Child Abuse, Sexual/ or ((paediatric* or pediatric* or "school age*" or (age? adj3 ("4" or "5" or "6" or "7" or "8" or "9" or "10" or "11" or "12" or four or five or six or seven or eight or nine or ten or eleven or twelve)) or (year* adj3 ("4" or "5" or "6" or "7" or "8" or "9" or "10" or "11" or "12" or four or five or six or seven or eight or nine or ten or eleven or twelve) adj3 old) or boy or boys or child or schoolchild* or children or childhood or girl or girls or kid or kids or preteen* or toddler* or infant* or newborn* or new-born* or baby or babies or neonat* or (age? adj3 ("1" or "2" or "3" or one or two or three)) or (year* adj3 ("1" or "2" or "3" or one or two or three) adj3 old) or (month* adj3 ("1" or "2" or "3" or "4" or "5" or "6" or "7" or "8" or "9" or "10" or "11" or "12" or "18" or "24" or "30" or "36") adj3 old) or adolescent* or (age? adj3 ("13" or "14" or "15" or "16" or "17" or "18" or "19" or thirteen or fourteen or fifteen or sixteen or seventeen or eighteen or nineteen)) or (year* adj3 ("13" or "14" or "15" or "16" or "17" or thirteen or fourteen or fifteen or sixteen or seventeen or eighteen or nineteen) adj3 old) or adolescence or adolescent or juvenile* or teen* or youth*).kf,kw,ti. not medline.st.) or ((paediatric* or pediatric* or "school age*" or (age? adj3 ("4" or "5" or "6" or "7" or "8" or "9" or "10" or "11" or "12" or four or five or six or seven or eight or nine or ten or eleven or twelve)) or (year* adj3 ("4" or "5" or "6" or "7" or "8" or "9" or "10" or "11" or "12" or four or five or six or seven or eight or nine or ten or eleven or twelve) adj3 old) or boy or boys or child or schoolchild* or children or childhood or girl or girls	3847399

#	Searches	Results
	or kid or kids or preteen* or toddler* or infant* or newborn* or new-born* or baby or babies or neonat* or (age? adj3 ("1" or "2" or "3" or one or two or three)) or (year* adj3 ("1" or "2" or "3" or one or two or three) adj3 old) or (month* adj3 ("1" or "2" or "3" or "4" or "5" or "6" or "7" or "8" or "9" or "10" or "11" or "12" or "18" or "24" or "30" or "36") adj3 old) or adolescent* or (age? adj3 ("13" or "14" or "15" or "16" or "17" or "18" or "19" or thirteen or fourteen or fifteen or sixteen or seventeen or eighteen or nineteen)) or (year* adj3 ("13" or "14" or "15" or "16" or "17" or thirteen or fourteen or fifteen or sixteen or seventeen or eighteen or nineteen) adj3 old) or adolescence or adolescent or juvenile* or teen* or youth*).ab. /freq=2 not medline.st.)	
17	Schools/ or Students/ or School Teachers/ or Child Day Care Centers/ or Child Care/ or Infant Care/ or Nurseries, Infant/ or Schools, Nursery/ or ((school* or class or classes or classroom* or preschool* or "primary school*" or daycare or "day care" or childcare or child-care or "early learning" or (education* adj3 (setting* or institution*))) or kindergarten* or teacher* or instructor* or student* or pupil or pupils).kf,kw,ti. not medline.st.)	158202
18	("grade* 1" or "grade* one" or "first grade*" or "1st grade*" or "grade* 2" or "grade* two" or "second grade*" or "2nd grade*" or "grade* 3" or "grade* three" or "third grade*" or "3rd grade*" or "grade* 4" or "grade* four*" or "fourth grade*" or "4th grade*" or "grade* 5" or "grade* five*" or "fifth grade*" or "5th grade*" or "grade* 6" or "grade* six*" or "sixth grade*" or "6th grade*" or "grade* 7" or "grade* seven" or "seventh grade*" or "7th grade*" or "grade* 8" or "grade* eight" or "eighth grade*" or "8th grade*" or "grade* 9" or "grade* nine" or "ninth grade*" or "9th grade*" or "grade* 10" or "grade* ten" or "tenth grade*" or "10th grade*" or "grade* 11" or "grade* eleven" or "eleventh grade*" or "11th grade*" or "grade* 12" or "grade* twelve" or "twelfth grade*" or "12th grade*" or "high school*" or "secondary school*" or "middle school*" or "grade school*" or "primary school*" or pre-school* or preschool* or "nursery school*" or "elementary school*" or "public school*" or "private school*" or montessori or kindergarten* or "school age*").kf,kw,ti. not medline.st.	8182
19	((school or schools) adj2 (open* or reopen* or "re-open*" or restart* or "re-start*" or resume* or resuming or "re-establish*" or reestablish* or "re-instat*" or reinstat* or return* or restor* or "go* back" or "back to?" or recover*)).kf,kw,ti. not medline.st.	96
20	"adverse childhood experience*".ti,ab,kf,kw.	2027
21	or/16-20	3918097
22	(15 or 21) and 12	43062
23	9 and 22	768
24	23 not (comment or editorial or letter or news).pt.	657

#	Searches	Results
25	limit 24 to english	637
26	limit 25 to yr="2020 -Current"	635
27	26 and (202005* or 202006* or 202007* or 202008* or 202009*).ez.	539

Appendix C: PRISMA Diagram



Citation

Ontario Agency for Health Protection and Promotion (Public Health Ontario). Negative impacts of community-based public health measures on children, adolescents and families during the COVID-19 pandemic: update. Toronto, ON: Queen's Printer for Ontario; 2020.

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