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RAPID REVIEW

(ARCHIVED) Negative Impacts of Community-Based Public Health Measures During a Pandemic (e.g., COVID-19) on Children and Families

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Key Findings

- Evidence on the negative effects of community-based public health measures on young children and families is limited. It includes studies from the 2009 H1N1 pandemic, and more recent studies from the COVID-19 pandemic.
- Reported effects of the COVID-19 public health response so far have been decreased vaccination coverage, decreased movement behaviour, impacts on nutrition (e.g., low physical activity, poor diet, increased screen time, and sedentary behaviour) and on children's mental health.
- The reduction in outdoor activities, free play, and social interactions may be associated with an increase in children's depressive symptoms, anxiety, irritability, boredom, and stress. These effects are in addition to potential financial stressors, such as unemployment and loss of income in families due to the COVID-19 pandemic.
- Evidence shows community-based public health measures implemented in response to COVID-19 may be negatively affecting factors related to children's healthy growth and development.
- While we found no studies that examined recent reports of increased calls to helplines and police, this problem is important for future study, given school closures and disruptions in health care provider access may have resulted in reduced detection.

Scope

- Public Health Ontario (PHO) conducted a rapid review on the potential negative impacts of community-based public health measures in response to a pandemic on young children and

families. 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.[1]

- Measures at the community level include physical distancing, school and childcare closures, workplace closures, and limiting gatherings.[1] This review identifies and synthesizes existing literature published during the Coronavirus Disease 2019 (COVID-19) pandemic, as well as recent respiratory virus pandemics and outbreaks.

- Studies included in this review focused on outcomes relevant to children 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. Future work should include a review of mitigation strategies, and local and/or provincial mitigation planning.

- This review addresses the research question: *What are the negative impacts on health and well-being of public health measures imp lemented in response to a pandemic (e.g.,, COVID-19) on young children and families?*

Background

The first reported case of COVID-19 in Ontario was January 25, 2020. On March 11, the World Health Organization (WHO) declared the outbreak of COVID-19 a pandemic. To limit the spread of COVID-19, the Ontario government enacted multiple public health measures, similar to many jurisdictions globally. On March 12, public schools were ordered closed for two weeks following March Break. On March 17, a state of emergency was declared in Ontario and the Premier ordered the closure of some businesses including daycares, bars and restaurants, theatres and private schools. Closure of all non-essential businesses was ordered on March 23. By March 31, all provincial parks and outdoor amenities were closed and it was announced that schools would be closed until the end of May, subsequently extended to the remainder of the school year.[2,3]

In addition to closures of schools, childcare centres, and non-essential workplaces, families were asked to stay at home and not visit friends or extended family members. Essential services such as grocery stores and medical care that could not be delivered virtually (e.g., childhood vaccination) remained open. Physical distancing measures (i.e., remaining two metres away from another individual) were recommended for those required to leave their homes for exercise or essential services.[4] Implementation of provincial and local measures influenced children related to closures of school and child care centres; peer and family social connections; and no access to playgrounds. While these measures have shown success in slowing the spread of the pandemic, the interruption in the daily routines of children and families may have important impacts on physical and mental health and wellbeing.

Children and families may be particularly vulnerable to disease severity and unintended harms of public health measures during pandemics and have been previously defined as a high-risk population for negative impacts during an outbreak.[5] COVID-19 is an unprecedented global crisis compared to the most recent pandemics (e.g., H1N1 influenza in 2009)[6] and the community-based measures are lasting a longer period of time. Although there is evidence that the disease seems to be less severe in children,[7] evidence on pediatric disease severity and the role of children in transmission is still emerging.[8] Beyond

the direct disease impacts, the indirect impacts of COVID-19 from the community-based public health measures on children and families are an important consideration for the public health response.

During the COVID-19 pandemic, parents are often working from home or may be recently unemployed due to business closures. Alternatively, some parents are essential workers with inherent occupational risks and stressors, and may face additional challenges such as limited access to childcare.[9] Therefore, public health measures may result in various household challenges and substantial disruption of routines. Early childhood is a critical period for developing physical, social, emotional, and cognitive abilities that will set the stage for healthy behaviours and outcomes throughout the life course. Quality relationships, optimal nutrition, a safe home environment, and physical health support positive outcomes in learning, behaviour and health.[10] The disruption in the family context due to the closure of childcare centres, schools, recreational facilities, and playgrounds may have consequences particularly for young children, as a protective factor for both physical and mental health is having routines and structured days.[11] In addition, the potential negative effects of the COVID-19 pandemic response is disproportionately affecting high-risk populations including children living in poverty,[12] children with behavioural problems and complex medical needs,[13] and children in the care of Canada's welfare system.[14]

As provincial and local public health agencies move into the next phases of the pandemic response, it will be important to understand the potential negative impacts of the COVID-19-related measures in order to develop and implement mitigation strategies for these unintended consequences post-pandemic and if public health measures are re-instituted during a potential second wave of infection. The purpose of this review is to determine the breadth and magnitude of those effects.

Methods

- A rapid review was conducted to synthesize primary and secondary research evidence about the negative impacts of community-based public health measures implemented in response to a pandemic (e.g., COVID-19) on the health and well-being of young children and families.

- A rapid review is a form of knowledge synthesis based the steps of a systematic review,[15] making certain compromises in those steps in order to be timely.[16] 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, systematic searches for peer-reviewed literature were conducted from inception to May 2020. PHO Library Services conducted an electronic database search in Ovid MEDLINE, Embase, PSYCINFO, EBSCOhost 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 the search strategy in Appendix A.

- A grey literature search was also conducted using a standard search strategy, to identify any grey literature reports. Searches were conducted in Google, Center for Addiction and Mental Health (CAMH) Library Google Custom Search, and custom international public health databases.

- Peer-reviewed and grey literature papers were eligible for inclusion if they examined the negative impacts on health and well-being of public health measures implemented in response to a pandemic (e.g., COVID-19), or another infectious disease emergency on young children and

families. Papers were excluded if they did not include children ages 12 and younger (and/or their families) or if they did not report on any unintended health and well-being outcomes related to infectious disease outbreaks. 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 the three authors (EB, SC, HS). Decisions on included full texts were finalized by consensus (including author YK).

- For all included papers, one PHO staff member extracted relevant data and summarized content. Content was reviewed by PHO medical and scientific staff involved in the COVID-19 response.

Results

The library database search identified 1729 articles, of which 15 met inclusion criteria.[17-31] See the PRISMA diagram in Appendix B. Fourteen were primary studies[17-25,27-31] and one was a review.[26] By intervention, six peer-reviewed articles focused on school closures mainly occuring during the 2009 H1N1 pandemic.[26-31] Eight peer-reviewed articles and one pre-print article focused on stay at home, self-isolation, and quarantine measures that have been widely implemented during the COVID-19 pandemic.[17-25] The one review focused on both school closures and isolation/quarantine in the event of influenza-like illness.[26] Studies were conducted in China, Italy, Spain, U.S., Canada, Australia, Argentina, and England. See Table 1 for general study characteristics of the peer-reviewed articles.

Additionally, the grey literature search identified 11 relevant reports and policy documents.[32-41] These documents focused on stay at home measures as well as school closures. Reports were produced by relevant global health and child health agencies such as the WHO, the United Nations (UN), and the United Nations International Children's Emergency Fund (UNICEF). As well, a literature scan by the Policy Bench at the Fraser Mustard Institute of Human Development at the University of Toronto examined the effects of pandemics on children in the care of Canada's child welfare system.[14]

The results below are organized by public health intervention followed by outcomes. The outcomes identified by this search included household income and unemployment, lack of school meals, loss of education, access to school-based healthcare services, mental health and emotional well-being, vaccination coverage, movement behaviours and nutrition, child abuse or neglect, and in-home services for child welfare.

School Closure

The literature search retrieved six studies that described the negative impacts of school closures on children.[26-31] Of these, one was a systematic review,[26] and five were cross-sectional surveys.[27-31] The negative impacts described in these articles included parental loss of income/employment and additional child care expenses,[27-31] loss of access to adequate nutrition due to missed school provided meals,[26,28,31] loss of access to education[27], loss of access to school-based healthcare services,[28] and effects on mental health and emotional well-being.[29] The duration of school closures in the studies ranged from three days to two weeks.

In contrast, the current school closures in Ontario were extended from mid-March to the end of school year. The COVID-19 school closures have been largely proactive closures in the absence of cases or

outbreaks in schools, implemented as an approach to physical distancing in communities to flatten the epidemic curve. In addition, the measures in the identified studies were limited only to school or childcare centre closures, and were not accompanied by other public health measures such as closure of all non-essential businesses. Thus, there is a potential that the negative impacts identified may be much more pronounced during COVID-19 given the current duration of school closures.[26]

HOUSEHOLD INCOME/PARENTAL EMPLOYMENT

Child care responsibilities resulting from school closures may impose extra financial burden on families. This is due to the loss of parental income from lost work hours as they stay home to take care of their children. Five studies with a cross-sectional survey study design described the economic impact of school closures due to public health measures in a pandemic context on families.[27-31] Of these five cross-sectional surveys, three were conducted in the U.S.,[28,30,31] and one each in Australia,[29] and Argentina.[27] These studies found that household income and parental employment were negatively affected by sudden school closures. Four of these studies were conducted in response to the 2009 H1N1 pandemic,[27-30] while the remaining one was in response to school closure due to a seasonal influenza outbreak.[31] Our search did not find any studies on the effect of COVID-19 related school closures on household income or parental employment. The duration of school closure in these studies ranged from three days to two weeks. Some of the problems faced by families and parents included missing work hours due to child care responsibilities, lost wages, and expenses incurred on making additional child care arrangements. The majority of respondents who reported economic problems due to sudden school closure as a major concern were from lower income families.

NUTRITION

In addition to education, schools provide other services such as access to meals. School-based nutrition programs provide free or low-cost meals during the school day and support adequate nutrition for children, especially those from economically vulnerable families. Three studies described the effect of school closures due to pandemics on access to adequate nutrition for children, one systematic review and two cross-sectional surveys.[26,28,31] Rashid et al. in their review reported that school closure in a pandemic context can lead to lack of free/reduced cost school meals,[26] therefore preventing access to adequate nutrition for children.[42-45] Two U.S. based cross-sectional surveys evaluated the effect of temporary school closures (3-5 days) due to the 2009 H1N1 pandemic on access to subsidized school meals.[28,31] In both studies, by Epson et al., and Steefisher (CDC) et al., 3% and 19% of the respondents respectively, reported challenges because of children missing the school-based subsidized meal.[28,31] Grey literature reports from the Centre for Educational Attainment in Australia,[34] The Alliance for Child Protection in Humanitarian Action,[37] and World Vision[33] have also noted that school closures can prevent access to school nutrition, increase food insecurity and severity of malnutrition among children.

LOSS OF EDUCATION

Providing access to education is the primary goal of schools. Our search found one cross-sectional survey of 229 households from three schools in Argentina, closed due to the 2009 H1N1 pandemic for two weeks, showed that a quarter of the respondents disagreed with the school closure measures and their main concern was the negative impact on education of their children.[27] A majority of these respondents were families with lower socio-economic status and thus did not have means to minimize the impact on education due to these closures. While online learning platforms provide an alternative to support the educational needs of children during the COVID-19 pandemic, access to reliable internet service, or material hardware such as laptops/computers, printers etc. may be a barrier for some families. UNICEF,[35] the Centre for Educational Attainment in Australia,[34] and Human Rights Watch[38]

also reported that school closures negatively affect children's education and learning. Additionally, UNICEF[32] mentions that increased online activity (due to isolation and school closures) can put children at heightened risk of online sexual exploitation, cyberbullying, online risk-taking behavior, and exposure to potentially harmful content (e.g.,, violent content).

ACCESS TO SCHOOL-BASED HEALTHCARE SERVICES

School health services in Ontario may include coordination and health system access including information and referrals, nursing, physiotherapy and occupational therapy (home only), speech-language therapy (home only), diet and nutrition counselling, etc.[46] Health services provided in schools are often important initial health assessments to children in many communities. School closures can prevent access to school health services for children. Our search found a 2010 cross-sectional survey of 523 households affected by school closure (up to three days) due to the 2009 H1N1 pandemic. The survey found that only 1% of the respondents reported lack of access to school-based health services as a risk for their child's health.[28] However, this was likely due to the short duration of the closure.

MENTAL HEALTH AND EMOTIONAL WELL-BEING

Schools provide children with stable daily routines, structures, physical activity, social connections, and extra-curricular activities that are essential for emotional well-being and mental health.[34] Sudden closure of schools in a pandemic can cause disruption in the family routine and may also have an impact on the mental health and emotional well-being of the children. A cross-sectional survey of 233 households with school-aged children from three schools in Perth, Australia during the 2009 H1N1 pandemic found that 90% of parents did not report any anxiety in their child due to the one week school closure, but 55% reported that school closure caused moderate or severe disruption to their family routines.[29] As previously mentioned, short duration of the school closure may have accounted for the lack of effect on mental health outcomes. UNICEF[35] and World Vision[36] have noted that school closure measures can negatively affect mental health and cause psychological distress among children.[37]

Physical Distancing and Stay at Home Recommendations or Orders

There were nine studies identified that examined potentially negative outcomes of stay at home recommendations/orders due to COVID-19, and H1N1. Six of those studies reported data collected, analyzed and reported in the past three months during the COVID-19 pandemic response in multiple countries including the U.S.,[17,24] China,[25] and Italy,[18,23] as well as one study from Canada.[19] The remaining study investigated the effects of isolation and quarantine during the H1N1 pandemic in 2009 in cities that had high rates of pediatric infection in the U.S., Mexico and Toronto, Canada.[21] The main outcomes that were examined in these studies were vaccination coverage, movement behaviours and nutrition (e.g., physical activity and diet), and mental health concerns for children and parents.

VACCINATION COVERAGE

Three studies examined the effects of COVID-19 pandemic measures, initiated in mid-March, on the rates of vaccination in the U.S. and England.[17,20,24] In two Centers for Disease Control and Prevention (CDC) Morbidity and Mortality Weekly Report studies, vaccination coverage for children <18 years[24] and for young children ≤24 months declined in the U.S. after the national emergency was declared. Santoli et al. used national data from two vaccination databases to estimate the change in healthcare provider-ordered and vaccine doses administered in two time periods: January-April 2019 and January-April 2020. There was a notable decline in non-influenza vaccines as well as any measles-containing vaccine, particularly for children 2 to 18 years. The decrease was less pronounced for children ≤24 months.[24] The second study from Michigan, where a stay at home order was announced on March 23, focused on the

routine immunization coverage of children ≤24 months. The authors reported a substantial decrease (15.5%) of doses of vaccine administered in the stay at home period compared to the previous three years (2016-2019).[17] Furthermore, 7 month old children enrolled in Medicaid were less likely to be up-to-date with their vaccinations (34.6%) in May 2020 compared to their non-Medicaid counterparts (55.0%).

In the third study of children in England, electronic health records were used to establish vaccination doses administered in January-April 2020 compared to the same period in 2019.[20] In the first three weeks after physical distancing measures were introduced in March, hexavalent vaccination (diphtheria, tetanus, pertussis, polio, *Haemophilus influenzae* type b and hepatitis B) was 6.7% lower (95% CI: −7.1 to −6.2) and measles-mumps-rubella (MMR) vaccination 19.8% lower (95% CI: −20.7 to −18.9) than in 2019. However, in the last weeks of April, vaccination rates had improved to above 2019 levels, even though physical distancing measures were still in effect.[20]

MOVEMENT BEHAVIOURS AND NUTRITION

Four studies examined the effect of stay at home recommendations/orders, home confinement, and national lockdowns related to COVID-19 on movement behaviours and nutrition in children.[18,19,22,23] Two studies focused on children with a pre-existing condition,[19,23] a third study examined how mothers' sleep time and quality during lockdown could affect their young children,[18] and the fourth study assessed parental report of children's movement behaviours before and during lockdown.[22] The first study from Canada examined physical activity in 109 school-aged children with congenital heart disease, measured by step count using a FitBit, from January to April 2020 and compared the step counts to a corresponding time period in 2019. A statistically significant 21-24% reduction in step counts started in the second week of March 2020, around the time the WHO announced COVID-19 was a pandemic.[19]

The second study examined multiple health behaviours including diet, physical activity, sleep, and screen time in a previously established cohort of children with obesity (age 6 to 18 years) in Italy comparing data from May-June 2019 to March-April 2020 (3 weeks into the national lockdown).[23] There were no significant changes in fruit and vegetable intake; however, the number of meals eaten per day increased significantly by 1.15 ±1.56, ($p<0.001$) and there was an increased intake of potato chips, red meat, and sugary drinks. Children had decreased time spent in sporting activities, sleep time increased (0.65±1.29 hours/day, $p=0.003$), and screen time related to non-school activities increased by 4.85±2.40 hours/day ($p<0.001$). Similarly, Orgilés et al. found children spent more time daily using screens such as iPads, TVs, or mobile devices ($p<0.001$), spent less time doing physical activity ($p<0.001$), and tended to sleep more ($p<0.001$) and 21.9% of parents reported their children ate more compared to before the quarantine/lockdown period.[22]

The Centre for Educational Attainment in Australia[34] has also noted that when children are out of school they are less physically active, therefore school closures can increase the risk of physical inactivity among children which has been linked to obesity.

MENTAL HEALTH AND EMOTIONAL WELL-BEING

Four cross-sectional studies surveyed parents to assess the psychological impacts of pandemic response measures on their children's mental health and behaviour.[18,21,22,25] Three studies were published during the COVID-19 pandemic from Italy, Spain, and Hubei province, China, three of the most impacted jurisdictions in early 2020. In Hubei province, a cross sectional survey of 1,784 school-aged children (Grades 2-6) showed a higher proportion of students (22.6%) reported having depressive symptoms than in other investigations in China's primary schools, and 18.9% had anxiety symptoms.[25] Students

reported being not optimistic (11.8%) and 37.2% were quite worried about the pandemic, although 24.9% were moderately worried, and 37.8% were only slightly or not worried.[25]

In Italy and Spain, a large cross-sectional survey (N=1,143) was conducted examining the parent-reported emotional and mental well-being of children (mean age 9.1 years, standard deviation (SD) 4.2).[22] The most common symptoms reported were difficulty concentrating (77%), boredom (52%), irritability (39%), restlessness (39%), nervousness (38%), and worried (30%). Only 11.4% reported that family coexistence during the quarantine was difficult or very difficult, and 61.8% reported family coexistence was easy or very easy. However, 35.4% of parents reported being stressed or very stressed and primary caregivers' level of stress was related to 25 of the 31 child symptoms.[22] In one study in Italy, surveyed mothers of young children (mean age 4.1 years, SD 0.9) reported their children had increased emotional symptoms but not conduct problems or hyperactivity/inattention measured by the Strengths and Difficulties questionnaire. The mothers reported families' difficulties following routines, and children had self-control difficulties during the lockdown.[18] Finally, a survey of parents from USA, Canada and Mexico about their experiences with pandemic illness (91% H1N1, 8% Severe Acute Respiratory Syndrome (SARS) found that children who experienced isolation or quarantine were four times more likely to meet the clinical cut-off score for post-traumatic stress disorder (PTSD) compared to those who had not been in isolation or quarantine based on parental reporting.[21]

UNICEF,[35] World Vision,[36] the UN and The Alliance for Child Protection in Humanitarian Action[37] have also noted that stay at home or lockdown measures can negatively affect mental health and cause psychological distress among children.

CHILD ABUSE OR NEGLECT

No primary studies were identified that examined the effects of pandemic-related public health measures on increased incidence of child abuse or neglect. However, multiple grey literature reports including a UN Policy Brief[47] and a UNICEF report[35] mentioned possible increasing incidence of child abuse or neglect based on an increase of risk factors including unemployment, reduced income, limited resources, and limited social support. The American Psychological Association (APA),[41] Substance Abuse and Mental Health Services Association (SAMHSA),[40] WHO,[39] and the Human Rights Watch[38] have also highlighted the impacts of stay at home orders/lockdown on increased risks for violence, child abuse and neglect among children. A comprehensive review of the effects of pandemics on children in the care of Canada's child welfare system determined there is increased risk of physical and emotional maltreatment, gender-based violence, separation from caregivers, and social exclusion.[14] There was also a likelihood of decreased access to in-home child welfare services.[14]

Table 1: Included Studies

Author	Year	Location	Study Design	Population	Infectious disease outbreak/ Pandemic	Community-based public health measures	Outcome(s)
Basurto-Davilla[27]	2013	Argentina	Cross-sectional	Children up to grade 9 (6-15 years) N=226	H1N1	School closure (2 weeks)	Child care and non-child care expenses Loss of workdays Household economy Impact on education
Bramer[17]	2020	USA	Descriptive	0-24 months N=9,539	COVID-19	Stay at home order as of March 23, 2020	Vaccination coverage
Di Giorgio[18]	2020	Italy	Cross-sectional	Children 2-5 years Age: mean 4.1 years (SD 0.9) N=245	COVID-19	Home confinement/ national lockdown as of March 10, 2020	Behavioural habits (e.g., sleep timing and quality, subjective time experience) Psychological well-being (e.g., emotional regulation, self-regulation capacity)
Effler[29]	2010	Australia	Cross-sectional	Parents of school-aged children (5-13 years) Age: median 11 years N=233	H1N1	School closure (1 week)	Parental loss of income/Employment Mental Health/Emotional Well-being

Author	Year	Location	Study Design	Population	Infectious disease outbreak/ Pandemic	Community-based public health measures	Outcome(s)
Epson[31]	2015	USA	Cross-sectional	Parents of school-aged children (pre-kindergarten to grade 12) N=35 households	Influenza-like illness (ILI)	School closure (4.5 days)	Parental loss of income/ Employment Nutrition
Gift[30]	2010	USA	Cross-sectional	Parents of school children (< 18 years) N=214	H1N1	School closure (1 week)	Parental loss of income/Employment
Hemphill[19]	2020	Canada	Cross-sectional	Children with congenital heart disease (CHD) (9-16 years) Age: mean 13 years) N=109	COVID-19	Stay at home as of March 17, 2020	Physical activity
McDonald[20]	2020	England	Descriptive	Infants <6 months; children 12-18 months	COVID-19	Stay at home/physical distancing as of March 23, 2020	Vaccination coverage
Orgilés[22]	2020	Italy and Spain	Cross-sectional	Parents of children 3-18 years Age: mean 9.1 years (SD 4.2) N= 1,143	COVID-19	Home confinement/ national lockdown as of March 10, 2020	Parent perception of child's emotional well-being, parent´s perception of family coexistence, parenting stress, children's routines (physical activity, sleep, screen time)

Author	Year	Location	Study Design	Population	Infectious disease outbreak/ Pandemic	Community-based public health measures	Outcome(s)
Pietrobelli[23]	2020	Italy	Longitudinal cohort	Children 6-18 years with obesity Age: mean 13.0 years, SD (3.1) N=41	COVID-19	Home confinement/ national lockdown (3 weeks into lockdown, April 2020)	Movement behaviours: physical activity, sleep behaviours, screen time Nutrition: dietary intake, number of meals per day
Santoli[24]	2020	USA	Descriptive	Children 0-18 years	COVID-19	Stay at home (various duration)	Vaccination coverage
Sprang[21]	2013	USA, Mexico, Canada	Cross-sectional, mixed methods	Parents Age: mean 37 years N=398	H1N1, SARS	Isolation and quarantine (duration not reported)	Post-traumatic stress disorder in parents and in children
Steelfisher[28]	2010	USA	Cross-sectional	Children 0-18 years N=523	H1N1	School closure (up to 3 days)	Reported school closure was a major challenge Missed work Child who missed a free or reduced-cost lunch Child missed health services usually provided by school
Xie[25]	2020	China	Cross-sectional	Students in grades 2 to 6 N=1784	COVID-19	Stay at home order January 23-April 8, 2020 (2.5 months)	Optimism about the epidemic Worrying related to COVID-19 Depressive and anxiety symptoms

Author	Year	Location	Study Design	Population	Infectious disease outbreak/ Pandemic	Community-based public health measures	Outcome(s)
Rashid[26]	2015	N/A	Review with methods	All ages	Influenza	School closure Self-isolation Stay at home (various durations)	General difficulties Lack of school lunch

Discussion

This rapid review identified negative impacts of community-based public health measures, such as stay at home orders and school closures, on the health of children and families. Reviews and policy documents from child health organizations and experts were also identified that caution about the potential negative health impacts of prolonged public health measures. The negative impacts included lack of access to school nutrition and healthcare services, decreased vaccination coverage, unhealthy movement behaviours and nutrition (e.g., low physical activity, ultra-processed, calorie-dense diet, excessive screen time), and children's mental health (e.g., emotional regulation, post-traumatic stress symptoms). All these negative health impacts are in addition to the potential overarching financial stressors, such as unemployment and loss of income in families due to the COVID-19 pandemic.

School closures lasting for a couple of days to weeks without stay at home orders were described in the non-COVID-19 pandemics (e.g., H1N1) and provide a different context than the current COVID-19 pandemic. During COVID-19, stay at home orders as well as school closures suggest a proportion of parents are at home with their children (working remotely or have become unemployed). Therefore, some of the outcomes reported in the H1N1 school closure data, such as cost of alternative child care arrangements, or safety issues due to children being left in the care of under-age siblings or alone, are less relevant in the present situation. However, parents balancing work from home, child care, and online learning simultaneously may be under different stressors. Importantly, the impact on families of one or more essential workers with limited childcare options represents important context for COVID-19, including recognition that many essential workers may be in lower income categories, influencing other stressors for children such as food security or housing. Our search did not identify any evidence on the effect of COVID-19 related school closures on household income or parental employment, although it may be too early to assess those effects and research is likely ongoing. In the COVID-19 context, we did find evidence of school and child care centre closures resulting in substantial disruption to family schedules.[22] These negative impacts may be disproportionately affecting at-risk populations of children including children in low-income households,[12] and children with disabilities.[5,13]

The present review found some compelling evidence to support possible negative impacts, particularly on children's mental health, vaccination coverage, and movement behaviours. Reduction in health services such as attending well-visits to receive routine immunization may be the result of parental concerns about potentially exposing their children to COVID-19, and might contribute to declines observed in vaccination coverage. Fortunately, vaccination in infants and toddlers appears to be less impacted,[20,24] possibly due to efforts from public health agencies in communicating the importance of immunization. For example, the CDC supported a public awareness campaign for young children to keep receiving immunizations as an essential service during lockdown.[24] Nonetheless, local public health units that have had to cease school-based immunization clinics during the pandemic, and primary health care providers who deliver routine immunizations will require immunization recovery planning and may need to develop innovative approaches to delivery, allowing for high volumes while accommodating physical distancing.[20]

Movement behaviours and nutrition were measured by three studies during the COVID-19 pandemic demonstrating increased screen time and sedentary behaviours, low physical activity, poor diet quality and increased number of meals per day. Adequate levels of physical activity, sleep duration, reduced screen time, and access to an optimal diet are all recommended for children's healthy growth and development.[48-50] These concerns have been highlighted in two reviews of the possible effects of community-based public health measures on obesity-related risk factors.[51,52] Unhealthy behaviours

were reported for general populations of children in Italy and Spain, as well as in children with obesity and congenital heart disease. Dunn and colleagues also highlighted the critical importance that "the nutritional needs of vulnerable children are met in order to avoid exacerbating disparities in health and educational attainment for years to come".[51]

The reduction in opportunities for outdoor activities, free play, and social interactions may be associated with an increase in children's depressive symptoms.[25] Multiple studies in this rapid review demonstrated mental health concerns for children and parents including increased anxiety, parent stress, boredom, irritability, and reduced social support. Loss of daily routine is especially relevant for children and families because of the protective effect of operating on structured schedules.[11] Furthermore, a sense of isolation from family, friends and community may be distressing to individuals and parents.[53] Particular support for parents/caregivers who are working from home and providing child care duties may be required.[18] Understanding these unintended consequences of public health measures to manage the COVID-19 pandemic can help optimize interventions for children's mental health. Evidence-informed and innovative mitigation strategies to reduce these potential impacts are required.

Although this review did not identify any primary studies showing an increased incidence of child abuse or neglect, multiple risk factors for child maltreatment (e.g., alcohol use, irritable behaviour, stress) have increased and support services for some familes may have decreased (home care, welfare visitations).[54] There is also some evidence of increased calls to helplines and police reports that indicate family violence has increased.[55] This review did not include evidence on intimate partner violence (IPV); however, it is well-established that children's exposure to IPV may be a potentially traumatic experience and have life-long effects.[56] Paradoxically, reports of child maltreatment are likely to decrease because of school closures, as approximately 33% of substantiated child abuse incidence reports in Ontario come from schools[57] and the remaining proportion of reports come from physicians and emergency departments where visits have also decreased. Therefore, decreased reports of child abuse are likely due to fewer opportunities for detection rather than an actual decrease in incidence. Community organizations and public health will need to find novel ways to communicate the risks of family violence to their communities.

This search identified multiple studies that examined the effectiveness of public health measures on the transmission and clinical characteristics of COVID-19 in children, however that was out of scope for this review and those papers were excluded for this review's research question. Additionally, we excluded studies where context and setting were not similar enough to Ontario, particularly on outcomes related to health systems and services, such as those from the Ebola outbreak in Africa.[58] For example, disruptions to the food supply chain or access to health services would be difficult to quantify due to the differing baseline access to services in low vs. high income countries.

Balancing the potential harm to children and families from community transmission and infection with the harms of prolonged public health measures will ultimately be up to health officials and policy makers.[59] Although multiple studies and reviews indicate low severity of disease in children,[7,60] there are still many unknowns including the risk factors for clinical severity in children, the role of children in community transmission dynamics, and the future effectiveness of public health measures that will be implemented to mitigate transmission once schools re-open. Timely, high quality surveillance[61] and special studies will help fill these data gaps and may identify new questions to better understand how COVID-19 affects children and families, particularly those in high-risk populations.

Limitations and Strengths

The majority of studies were cross-sectional surveys and descriptive studies, which are generally low quality evidence.[62] Other limitations included parent-reported outcomes, small sample sizes, low response rates, lack of appropriate comparison group, and generalizability. The duration of school closure during the H1N1 pandemic was relatively short (three days to two weeks) compared to school closures during COVID-19, therefore the effects on child health described in these studies may be attenuated and short-term. How these prolonged public health measures are affecting children's long-term health and well-being is uncertain. Generalizability to an Ontario population may be difficult, due to the different levels of public health measures enacted in studies from different countries. There were gaps in evidence including children in low income settings, and immigrant children. Only one review commented on the effects of COVID-19 on children in immigrant families;[63] however, this was mainly discussing the situation in the U.S. which has different immigration polices than Canada therefore it was excluded. Finally, the lack of primary data on child maltreatment may be due to the difficulty of researching this highly sensitive topic, and due to the relatively short duration of public health measures in previous pandemics.

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

There are multiple negative impacts that have been examined in children and families as a result of public health measures implemented during recent pandemics, including the current COVID-19 pandemic. The stay at home orders and school closure measures enacted in response to COVID-19 are unprecedented in their breadth and duration and this presents risk to children and families for various physical and mental health problems, and access to services. Intersectoral collaboration involving public health, primary and acute care health services, community partners, and education will be needed to develop evidence-informed programs to support families and their communities in the next phase of the pandemic.

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Appendix A: Example Search Strategy

MEDLINE

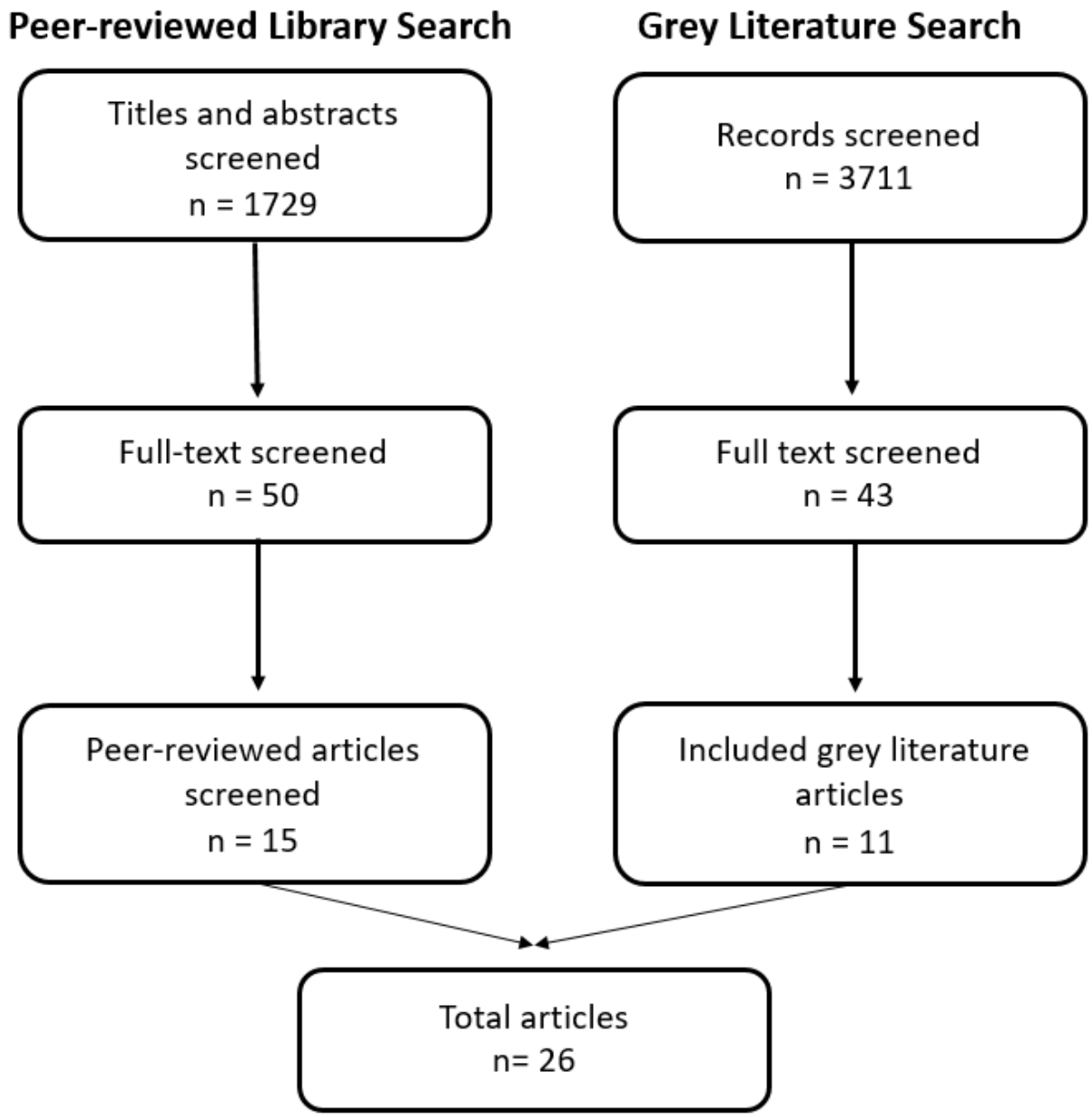
Ovid MEDLINE(R) ALL <1946 to May 12, 2020>

#	Searches	Results
1	("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 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").af.	13252
2	((novel or Wuhan or China or Chinese or "seafood market" or "2019" or outbreak* or epidemic* or pandemic*) adj5 (coronavirus* or "corona virus*" or betacoronavirus* or "beta coronavirus*" or "beta corona virus*" or pneumonia* or SARS or "severe acute respiratory syndrome")).af.	12608
3	((coronavirus* or "corona virus*" or betacoronavirus* or "beta coronavirus*" or "beta corona virus*" or SARS or "severe acute respiratory syndrome") adj5 pneumonia*).af.	3480
4	1 or 2 or 3	19333
5	Ebolavirus/ or Epidemics/ or Hemorrhagic Fever, Ebola/ or Influenza A Virus, H1N1 Subtype/pc or Influenza Pandemic, 1918-1919/ or Pandemics/ or ((Disasters/ or Disaster Planning/ or Emergencies/ or Emergency Shelter/ or Mass Casualty Incidents/ or Medical Countermeasures/ or Relief Work/ or Strategic Stockpile/) and (Disease Transmission, Infectious/ or Influenza, Human/ or Pneumonia, Viral/)) or (pandemic* or ((diseas* or global* or world* or international*) adj2 outbreak*) or epidemic*).kf,kw,ti. or ((SARS or H1N1 or "severe acute respiratory syndrome" or "spanish flu" or "spanish influenza" or "asian flu" or "asian influenza" or "swine flu" or "swine influenza" or "hong kong flu" or "hong kong influenza" or "black death" or plague or "public health emergency of international concern" or PHEIC).kf,kw,ti. and (pandemic* or outbreak* or epidemic*).ti,ab,kf,kw.)	67095
6	4 or 5	78552
7	Civil Defense/ or *Communicable Disease Control/mt, og or Government Regulation/ or *Infection Control/mt, og or Law Enforcement/ or *Public Health/mt or Public Policy/ or Social Control, Formal/ or Social Control Policies/ or Social Isolation/ or Quarantine/ or	187340

	(("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*)).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*)).ab. /freq=2	
8	((close* or closur* or closing* or "shut down" or shutdown or shut-down or discontinu* or cease or reduc* or decreas* or suspend*) adj2 (school* or daycare* or child care* or park* or playground* or librar* 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,ab,kf,kw.	4722
9	7 or 8	191786
10	Adolescent Health/ or Adolescent/ or Adverse Childhood Experiences/ or Child Abuse/ or Child Behavior/ or Child Care/ or Child Day Care Centers/ or Child Development/ or Child Health Services/ or Child Health/ or Child, Preschool/ or Child/ or Domestic Violence/ or Family Health/ or Fathers/ or Immunization Programs/ or Infant Behavior/ or Infant Care/ or Infant Health/ or Infant, Newborn/ or Infant/ or Intimate Partner Violence/ or Maternal Health Services/ or Maternal-Child Health Services/ or Mothers/ or Nurseries, Infant/ or Parents/ or Pediatric Obesity/ or Psychology, Child/ or Schools/ or Siblings/ or Single Parent/ or Spouse Abuse/ or Spouses/ or ((child* or child-care or toddler* or preschool* or preteen* or tween* or adolescent* or infant or infants or baby or babies or infancy or family or families or parent* or father* or mother* or caregiver* or spous* or husband* or wife or wives or partner* or marriag* or "adverse childhood experience").ti,kf,kw. not medline.st.) or ((child-care or toddler* or preschool* or preteen* or tween* or adolescent* or infant or infants or baby or babies or infancy or family or families or parent* or father* or mother* or caregiver* or spous* or husband or husbands or wife or wives or partner* or marriag* or "adverse childhood experience" or (child* adj2 ("under twelve" or "early years" or "school-aged" or "school aged" or preschool*))).ab. not medline.st.)	3929247
11	6 and 9 and 10	836
12	11 not (comment or editorial or letter or news).pt.	800

Appendix B: PRISMA Diagram

Figure 1: PRISMA Diagram



Citation

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

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