

Maintaining Immunizations for School-Age Children During COVID-19

Expert and Stakeholders Roundtable Report



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Attendees

Roundtable invitees included a range of public health and clinical researchers and practitioners, as well as leadership from health organizations at local, provincial, and national levels. Please see the roundtable attendee and observer lists in Appendix A.

Transparency statements

The Centre for Vaccine Preventable Diseases is supported by the Dalla Lana School of Public Health (DLSPH), which receives funding from government, philanthropic, not for profit and private sector organizations. Private sector funding sources include vaccine manufacturers. A set of governance processes are in place at the DLSPH to ensure independent operation of the Centre. All funding is received under agreements that are aligned with policies of the University of Toronto and DLSPH that safeguard academic freedom of faculty and students. Decisions on private sector support are made in consultation with the Dean, relevant faculty, and Advancement. In addition, the Centre for Vaccine Preventable Diseases receives oversight from the Dean of the DLSPH and a Senior Advisory Committee of the University of Toronto.

A note on the conceptualization and planning of the roundtable

Merck Canada representatives approached the Dalla Lana School of Public Health and McMaster University to inquire if plans to catch up on school-based immunization programming are known. After separate discussions, their suggestion about a discussion group, this Roundtable and recommendation report was formed. They were offered an invitation due to their part in introducing the concept. However, they were not involved in the planning and development of the roundtable program.

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Executive Summary

The COVID-19 pandemic has created challenges in delivering routine and school-based vaccinations to school-age children (age 4-18), resulting in delayed and missed vaccinations for many children across Ontario. Though the precise extent to which routine immunizations for school-age children have been impacted by the pandemic in Ontario is still unclear, school disruptions and ongoing public health measures have likely led to missed and delayed vaccines for children and youth across multiple student cohorts. In implementing a catch-up strategy to ameliorate these gaps in vaccination and prevent falling vaccine coverage rates, three critical steps are highly recommended.

- 1) Engage various stakeholders (caregivers, public health units, primary care, pharmacy, schools) in a model of shared responsibility to identify vaccine coverage gaps. Note the term ‘caregiver’ will be used throughout the document to denote parents and/or guardians. Leverage existing information systems (e.g. *Panorama*) to involve stakeholders in reporting up to date vaccination information to identify missed doses.
 - a. **Financial investment in a centralized electronic immunization registry** that can be linked to sociodemographic data for actionable surveillance of under-immunized children that could be accessed by multiple stakeholders including caregivers.
- 2) Deliver catch-up vaccination in multiple settings to ensure that barriers to access do not become impediments to vaccination. For instance, provide vaccination in school-based, community-based, primary care, and pharmacy sites, and leverage short-term mass vaccination clinics to accommodate the needs of families whose children continue to pursue remote learning, for whom primary care access presents logistical challenges, and those who may feel more comfortable in community-based settings.
 - a. Collaboration and coordination from multiple levels of government and public health to utilize lessons learned from COVID-19 vaccine delivery.
 - b. Provincial government funding to provide the resources for vaccinations – regardless of the setting – to be undertaken safely, including physical distancing measures and Personal Protective Equipment (PPE) as required based on current levels of community-based transmission of SARS-CoV-2.
- 3) Develop a clear and unified set of key messages, led by the Ministry of Health, to unite all stakeholders in catch-up vaccination plans. At the local level, key messages should be tailored to the strengths and needs of the communities served. Communication should be clear and delineate the role that caregivers, primary care, public health, pharmacies, schools, and the provincial government will play in the catch-up process. Provide caregivers with information about catch-up vaccination options, seeking input from children, youth and caregivers to improve and design respectful and safe vaccination experiences. Engage community leaders from underserved communities in planning and developing both the communication and immunization catch-up strategies.
 - a. Ministry of Health create a clear catch-up vaccination schedule to guide immunizers and to minimize vaccine wastage.

These recommendations underscore the importance of Ontario being back on track with action items prioritized with the *Immunization 2020 Roadmap to Ontario* provincial agenda. These efforts include improving access to vaccination for underserved communities, connecting system partners to provide integrated and coordinated systems of vaccination delivery, and

providing communication and educational resources to empower the public in making immunization decisions based on the best available evidence.

Rationale and Goals of the Roundtable

The COVID-19 pandemic has had significant impacts on healthcare systems around the world and has disrupted many universal vaccination programs (1,2). Ongoing vaccination is crucial to keeping our communities healthy by preventing the spread of serious and highly transmissible infectious diseases across the lifespan. Disruptions to immunizations secondary to COVID-19 have already led to an increase in cases of measles in certain countries, highlighting the current risks to Canadian children and their communities (3).

Routine vaccination programming in Ontario, like many other jurisdictions, was disrupted due to the pandemic; most impacted were school-based vaccination programs for hepatitis B (HepB), meningococcal disease (Men-C-ACYW135), and human papillomavirus (HPV9) (4). Due to school closures beginning in early 2020 and ongoing public health measures, significant disruptions to public health-led school-based immunizations have been experienced to varying degrees across the province. Despite the National Advisory Committee on Immunization's interim guidance recommending the maintenance of routine immunization (5), evidence suggests that visits to primary care clinics have also dropped (6).

Prior to the pandemic, the aim of the *Immunization 2020 Roadmap to Ontario* provincial agenda was to develop a high performing, integrated immunization system with 20 action items that spanned issues of access, communication strategies, and performance monitoring (7). Key findings of the report include goals of enhancing access, connecting stakeholders across the vaccination system, informing improved vaccine education and communication, monitoring and enhancing existing data systems, and integrating an equity lens across all immunization programming (7).

Vaccine coverage for routine childhood vaccines has remained below national targets, even prior to the pandemic (8). One strategy that has been used to address sub-optimal vaccine coverage in the school-age population is the Immunization of School Pupils Act (ISPA), introduced in 1982, which currently mandates proof of immunization against nine infectious diseases (diphtheria, tetanus, polio, measles, mumps, rubella, meningococcal disease, pertussis, varicella) for school attendance or a valid exemption (9,10). Despite the introduction of this legislation more than 30 years ago, sub-optimal vaccination rates persist in Ontario, suggesting that optimal vaccine coverage may be a public health challenge that cannot be addressed through policy alone. Furthermore, more than half of the students with no vaccination records in a cohort of 7- to 17-year old students in 2016-2017 lived in neighbourhoods in the two lowest quintiles of material deprivation, suggesting that structural barriers to access may be a contributing factor to sub-optimal vaccine coverage rates (11). In some cases, incomplete vaccination may be related to a lack of access to primary care, a lack of familiarity or connection with healthcare to navigate immunization schedules and catch-up programs, or challenges related to foreign immunization record assessments. Due to missed primary care visits and limited school-based immunization clinics, there is a risk that these existing disparities may worsen in the context of the pandemic. The decentralized approach to vaccination planning in Ontario has presented challenges in the COVID-19 vaccine rollout and could exacerbate disparities in childhood vaccination if not considered in planning catch-up programming (12).

Gaps in routine immunization for school-age children need to be addressed to ensure the health and safety of in-person schooling and to address vaccine coverage gaps. In the planning and implementation of catch-up vaccination for school-age children, MacDonald and colleagues suggest that three components are essential to effective vaccine catch-up in Canada: 1) integrating equitable approaches to identify who has been missed; 2) developing tailored, multipronged strategies to address these gaps; and 3) communicating, documenting, evaluating, and readjusting immunization programs to the evolving reality of the COVID-19 pandemic (13).

The objectives of the roundtable session were to identify opportunities:

- To uncover vaccine coverage gaps effectively and efficiently
- To highlight best practices from Ontario and other jurisdictions regarding the implementation of school-based vaccinations during the pandemic
- To identify potential solutions to support an equitable Ontario-wide approach to alleviate vaccination gaps exacerbated by the COVID-19 pandemic for the 2021-2022 school year

Roadmap To Catch-Up

1.1 Identification of Under-immunized Students

Identifying students who have missed vaccinations since the start of the COVID-19 pandemic is a critical first step to catch-up programming (14,15). ISPA places the responsibility to maintain vaccinations required for school entry on caregivers. Public health units subsequently capture caregiver-reported information on vaccinated students in Ontario in the immunization repository *Panorama* (9). This repository is inaccessible to non-public health immunizers; therefore, reporting by primary care physicians is inconsistent and remains voluntary. This, along with a lack of routine linkage with population registries and provider-centric electronic medical records (EMR), makes it difficult to accurately identify students who have missed vaccinations and differentiate between students who have missed vaccinations from those who have not had their vaccination information updated with the public health unit. In the absence of a centralized electronic registry of vaccinated and unvaccinated students, four stakeholders will be key to identifying students who have missed vaccinations: 1) caregivers; 2) schools; 3) primary care health care providers; and 4) public health units.

With the return of in-person learning for the 2021/22 academic year, we recommend schools, at the point of school enrolment, inform caregivers that certain immunizations are required and direct caregivers to the local public health unit to report their child's immunizations. Schools will not capture student immunization records themselves but will be critical in directing caregivers to local public health units to report and update immunization records. These caregiver reports can help identify and enumerate a cohort of students who are under-immunized or have not received their school-based immunizations (i.e. lack of entry in *Panorama*) for which public health can subsequently plan a school-based catch-up program around. Caregivers may need to follow-up with primary healthcare providers or public health to confirm the accuracy of their child's immunization records. Further, a call from the provincial government for primary care health providers and public health units to contact their school-age patients and follow-up on vaccination status may help mobilize caregivers to seek options to vaccinate their children. With financial support from the provincial government to expand catch-up vaccination efforts, primary healthcare providers and public health units should be prepared to offer multiple avenues for

vaccination (e.g. via a public health-hosted community clinic, at the physician's office or participating pharmacies). This approach complements school-based catch-up clinics but is less equitable. Not all students have primary health care providers and, unlike school-based programs, the preferred method for catch-up, the onus falls on the caregivers to arrange the appointment. Therefore, it is important to leverage vaccination status reported by caregivers, primary healthcare providers and public health units in catch-up programming for school-age children. Each approach alone is imperfect, but together work towards an equitable and comprehensive catch-up program for school-age children.

1.2 Investment in Technology Integration

The lack of a uniform immunization registry has been identified as a general weakness in the Canadian health system for more than two decades (16). The fragmentation of existing electronic record keeping systems for school-age immunization series precludes the rapid and easy identification of under-immunized students. For example, the immunization registry *Panorama* was launched in 2013 for public health units, but is not accessible to primary care physicians, community nurse practitioners, and pharmacists who provide immunization services in the absence of public health unit intervention. Interactions with school-age children for which immunization statuses are unknown and cannot be confirmed in a centralized registry are missed opportunities for possible catch-up on their immunizations. This barrier has been exacerbated by the COVID-19 pandemic and necessitates catch-up programming to leverage multiple platforms and stakeholders to identify under-immunized students. This approach, however, is resource-intensive and is not sustainable for the long-term, in which the need to rapidly and easily identify under-immunized students will remain.

Investment in technology integration to establish a universal and centralized electronic immunization registry is a high priority recommendation. Similar to the new COVaxON platform to record COVID-19 immunizations, a registry that is accessible by all healthcare providers and public health units and integrated with physician EMRs would benefit all stakeholders and vaccination programming, providing the opportunity for all immunizers to also report vaccinations. Further, immunization information could be linked to a health card number, acknowledging that this would not be perfectly equitable, as some living in Ontario do not have health card numbers. This would however facilitate inter-system and user identification of under-immunized students. Another benefit of a centralized electronic immunization registry would be the possible linkage to existing databases in Ontario, including sociodemographic data, which would inform actionable surveillance of under-immunized children. Exploration of options for Ontarians to access their immunization records through a secure, online portal was an action item of the Immunization 2020 roadmap and has, in fact, been rolled out to allow caregivers to access their children's immunization records in some jurisdictions. Currently, the *ICON* and *CanImmunize* information systems have this capacity and could be leveraged to allow public users to access records on immunizations already received and reported. In partnership with Ontario Medical Association (OMA), OntarioMD, and eHealthOntario, there is an opportunity to invest in technology integration that is person-centred, mobile-friendly and builds on the foundation that *Panorama* provides (e.g. linking COVaxON and Panorama) to advance the vision of an accessible and efficient provincial immunization registry. Although such technology will need to take into account the specific context of Ontario, some lessons can be drawn from experiences acquired in other jurisdictions, such as the province of Alberta.

Alberta: Immunization and Adverse Reaction to Immunization database (Imm/ARI) (16–19)

In Alberta, public health nurses (PHNs) administer all routine childhood immunizations accessed via community-based clinics and school immunization clinics. All immunization administrations are entered into an electronic medical/public health record system (EMR) that Alberta Health Services (AHS) uses. Immunization data then flows from the AHS Public Health EMR into Alberta's immunization data repository, known as *Imm/ARI*. Data submission follows guidelines to ensure data quality and completeness.

Imm/ARI is Alberta's single repository for immunization information. *Imm/ARI* contains data for all provincially funded and privately purchased vaccines. It also contains historical data for both non-provincially funded vaccines and provincially funded vaccines administered through Alberta Health Services (AHS), vaccines provided by pharmacy, physicians, and other immunizers i.e. Occupational Health services. Immunization rates and coverage for the province are determined using data sets from *Imm/ARI*.

According to Alberta's Immunization Regulation, as of January 2021, all health care professionals who administer an immunization must report the immunization event into *Imm/ARI*. Alberta Health has worked with a number of EMR vendors to establish a system-to-system connection between their EMR and *Imm/ARI*. For health care professional who do not have a system that can electronically submit immunization information events to *Imm/ARI*, Alberta Health has established the Immunization Direct Submission Mechanism (*IDSM*). The *IDSM* is a standalone web application that facilitates the electronic submission of the immunization and assessment event information through a web browser. Integration of the *IDSM* with other electronic medical records (EMRs) is currently not possible.

General access to immunization records is currently available in the province through Alberta Netcare (<https://www.albertanetcare.ca/>; an e-health record database). Alberta Netcare is a secure and confidential electronic system where provincial immunization data from *Imm/ARI* is accessible by AHS staff, health care providers and the public.

2.1 Facilitating Access to Vaccination

Aside from identifying unvaccinated and under-vaccinated children and youth, a vaccination catch-up strategy must involve ensuring access to vaccination for families with a particular lens on equity in access. Despite universal free access to early childhood vaccines, prior to the pandemic, socioeconomic inequalities result in poorer vaccine coverage among children from single parent families, families with lower parental education, and families with lower household incomes (19). Though the precise reasons for these differences are not well understood, these discrepancies are likely in large part due to multiple barriers. For some families, access to vaccination is complicated by instrumental factors including transportation, lack of childcare, and difficulties taking time off during work hours, which present logistical barriers to accessing primary care-delivered vaccines (20–23). Targeted interventions to address access have been demonstrated to increase vaccine uptake. For example, in Simcoe-Muskoka health unit, increasing clinic hours and introducing school-based catch-up vaccination clinics resulted in an increase in vaccine coverage from 23% to 71% in a single year (24). Similarly, adding additional clinics with weekend and evening hours and permitting drop-in appointments resulted in an improvement in vaccine coverage in Chilliwack, British Columbia from 60% to

80% (24). School-based immunization programs can also achieve higher coverage rates than community-based delivery by reducing barriers to access and providing vaccine delivery that is more equitable for families (5,25). School personnel are also valuable partners in this approach by recognizing the importance of immunizations to keep schools safe from vaccine-preventable diseases and may liaise with families to get children immunized. Although school-based vaccination settings should not prohibit the presence of caregivers for their child's immunizations, infection prevention and control measures that follow usual guidance for school settings should be maintained, guided by public health units and the level of SARS-CoV-2 community transmission.

Beyond logistical barriers to vaccination, families may also experience barriers to vaccination access that are socio-cultural, including language barriers and a lack of trust in the healthcare system based on a history of marginalization, structural racism, and trauma, particularly among Indigenous and Black communities (25). In addition, children without a primary care provider are less likely to be up-to-date on early childhood vaccines (26). Overcoming these barriers to access must involve the delivery of healthcare services that are responsive to community needs (27). This could include partnerships with community organizations, newcomer centres, and places of worship involving trusted community leaders and allies in vaccination promotion. In addition to community-based means of vaccination administration, providing training to immunizers to assist them in engaging with diverse populations will be critical to maintaining equitable vaccine coverage. Other solutions to provide increased access to immunizations in a culturally competent manner include the involvement of community ambassadors and direct outreach initiatives in specific communities, executing catch-up campaigns that involve pop-up or mobile teams to provide vaccines to clusters of under-immunized children.

The COVID-19 pandemic has generated further barriers to immunization services for families in primary care settings. A survey study of family physicians and pediatricians across Ontario early in the pandemic revealed that the pandemic has had a substantial impact on physicians' immunization services (6). From a total of 475 survey respondents, 45% of physicians who usually provide vaccination to children acknowledged a negative impact from the pandemic on provision of immunization services in their practice. This impact ranged from temporary closures of their practice to postponement of vaccines in certain age groups, especially in the 4- to 6-year-old age group. Additionally, for vaccines usually administered as part of school-based immunization programs (HepB, HPV9, and Men-C-ACYW135), many of the survey participants reported not providing these vaccines and instead leaving the missed doses to be administered by the public health units when they resume school-based immunization clinics. Finally, the survey identified several barriers to providing immunization services in primary care settings, including parental concerns about COVID-19 exposure and lack of personal protective equipment (PPE). It is unclear whether these barriers will remain significant during the coming years, as they will likely depend on the changing epidemiology of COVID-19.

Plans for catch-up of routine immunizations may be further impaired by the COVID-19 vaccine campaign, which has started in children aged 12 to 17 years and is expected to start in the upcoming months in children under 12 years. Currently, the National Advisory Committee on Immunization (NACI) recommends that COVID-19 vaccines should not be given simultaneously with other live or inactivated vaccines at this time, and that other vaccines should not be given within 14 days before a COVID-19 vaccine, or 28 days after a COVID-19 vaccine (28). It should be noted that there are exceptions to this NACI recommendation, which includes 'risk of the individual being unable to complete an immunization series due to limited access to health services or being unlikely to return later'. NACI is set to discuss the issue again in the early Fall,

therefore; an updated recommendation may be forthcoming. The U.S. Centers for Disease Control (CDC) have also recently changed their guidance, not advising against the coadministration of COVID-19 vaccines and other vaccines (29). Allowing the simultaneous administration of routine immunizations and COVID-19 vaccines would facilitate the planning of catch-up programs for under-immunized students.

Other barriers related to immunization include pain, fear, and anxiety (the immunization stress-related response) (30). Concerns related to pain and fear of needles may account for vaccine hesitancy in close to 10% of the population (31). While infection prevention and control measures that follow usual guidance for school settings should be maintained, caregivers should also be accommodated and allowed to be present during their child's vaccine injections, to increase comfort and trust in the immunization process (32). Having flexible clinic vaccination hours including clinics that start later and continue into the evening or with weekend hours may provide increased opportunities for caregivers to attend their child's immunizations.

Lastly, provincial standards holding public health units accountable for wastage of school-based vaccines may also cause further barriers, as this may limit the distribution of vaccine doses in primary care settings. As per the Vaccine Storage and Handling Protocol, the maximum vaccine wastage rates shall not exceed 5% for any vaccine product, and healthcare providers are not allowed to store more than a one-month supply of vaccines (33). These standards may preclude the broad distribution of vaccines to multiple providers in an effort to minimize wastage and ensure that vaccine quantities meet the demand. Reconsideration of such thresholds in the context of the COVID-19 pandemic may facilitate the distribution of vaccines to healthcare providers and improve access to immunization for patients.

2.2 Build Multi-Sectoral Partnerships

Implementing a comprehensive catch-up vaccination strategy necessitates partnerships between the Ontario government, local public health units, schools, school boards, primary care providers, and pharmacies (see Table 1 for a summary of the potential roles of each stakeholder). Given the challenge of catching up many Ontario students with missed school-based vaccines as well as routine vaccines typically delivered in the primary care setting, the task of immunizing will likely need to be shared among school-based and community-based public health nurses, primary care providers, and pharmacists to maximize efficiency and to overcome barriers that may prevent children from accessing vaccination in particular settings. To promote collaboration and facilitate buy-in from schools who will need to be actively involved in supporting these catch-up vaccination programs, school and school board officials should be involved in planning and implementation efforts. For children who continue to pursue remote learning in 2021-22, catch-up vaccination at a primary care office or pharmacy may be the most feasible option for accessing vaccination. For other families, as described above, community or school-based immunization program to deliver routine vaccines may likely be the most accessible option.

As part of this shared implementation strategy, providing a catch-up schedule to guide immunizers in delivering missed vaccinations will be critical, including guidelines around co-administration with COVID-19 vaccines. In addition, ensuring that primary care providers are given adequate vaccine supply to meet the needs of their practice will be an essential step. Outside the primary care setting, additional vaccination locations including restarting school-based clinics and re-purposing pop-up and mass vaccination clinics used for COVID-19 vaccination would likely reduce the burden on primary care providers. Incentivizing pharmacy

owners to increase vaccination service hours will also assist in making vaccination accessible particularly for children who do not have a primary care provider and within communities who experience other logistical barriers to vaccination access.

Table 1 summarizes the potential role of stakeholders in catch-up vaccination programming. It also highlights the required partnerships between stakeholders needed to drive equitable and comprehensive solutions.

Table 1. The potential role of stakeholders in catch-up vaccination programming

Stakeholder Group	Identification of unvaccinated student(s)	Improved access	Communication strategy
 <p>Caregivers</p>	<ul style="list-style-type: none"> Report immunizations to local public health unit after each vaccination and whenever public health contacts the caregiver for immunization record updates. When needed, follow-up with health care provider who administered vaccine(s) (e.g. public health or primary care physician) 		
 <p>Community leaders</p>		<ul style="list-style-type: none"> Work with local public health unit and provincial government to plan vaccination sites which are responsive to community needs and conceived with logistical and structural access barriers in mind 	<ul style="list-style-type: none"> Collaborate with public health unit and provincial government to develop and disseminate key messages related to vaccination that are tailored to community needs and concerns
 <p>Schools</p>	<ul style="list-style-type: none"> At the point of school enrolment, inform caregivers that certain immunizations are required and direct caregivers to the local public health unit to report their child's immunizations 	<ul style="list-style-type: none"> Work closely with public health unit to provide strategies to students for catch up programming (e.g., host school-based program (most equitable) or in absence of school-based program, direct unvaccinated students to primary care physician or participating pharmacies) Foster partnerships with public health unit to create a safe, physically distanced space for school-based vaccination. 	<ul style="list-style-type: none"> Increase awareness about school-age immunization catch-up programming, including options for catch-up. Consistently implement provincial government's communications (e.g., regarding the safety of vaccines). Work with community leaders/ community-based organization to create tailored communications related to immunization catch-up programs

 <p>Primary Care</p>	<ul style="list-style-type: none"> • Contact and follow-up with caregivers of school-age children, offer solutions for catch-up programming based on local options and public health unit directives (e.g., via a public health-hosted clinic, at the physician's office or participating pharmacy). 	<ul style="list-style-type: none"> • Scale up supply from public health and administration of school-age vaccines to meet demand of catch-up programming (e.g., pre-bookings to reduce vaccine wastage). 	<ul style="list-style-type: none"> • Increase awareness about school-age immunization catch-up programming, included options for catch-up. • Consistently implement provincial government's communications (e.g., regarding the safety of vaccines).
 <p>Pharmacies</p>		<ul style="list-style-type: none"> • Involving pharmacies in catch-up immunization strategies, especially for patients who do not have a primary care provider. Increasing vaccination service hours will also assist in making vaccination accessible particularly within communities who experience logistical barriers to access. 	<ul style="list-style-type: none"> • Increase awareness about school-age immunization catch-up programming, including options for catch-up. • Consistently implement provincial government's communications (e.g., regarding the safety of vaccines).
 <p>Public Health</p>	<ul style="list-style-type: none"> • Leverage <i>Panorama</i> to contact and follow-up with caregivers of school-age children, offer solutions for catch-up programming based on local options and public health unit directives (e.g., via a public health-hosted clinic or at the physician's office). 	<ul style="list-style-type: none"> • Leverage existing distribution systems for COVID-19 vaccines into pharmacies for school-age immunizations • Scale up distribution of school-age immunization to primary care health care physicians and other providers (currently, on a request only basis). • Increase clinic hours and sites, while permitting drop-ins • Introduce unique school-based catch-up vaccination clinics (e.g., at grade 9 orientation) • Adapt COVID-19 vaccination clinics and/or offer pop-up clinics for catch-up programming • Provide training to immunizers to be responsive to community needs. 	<ul style="list-style-type: none"> • Provide stakeholders not usually responsible for school-age immunizations (e.g., pharmacists) with communications and technical support (e.g., FAQs sheets to address caregiver vaccine safety concerns). • Leverage COVID-19 vaccination clinics, which caregivers and school-age children are currently visiting to receive COVID-19 vaccines, as education opportunities for catch-up immunization (e.g., by way of brochures or an information desk).

	<ul style="list-style-type: none"> • Invest in technology integration (e.g., <i>Panorama</i> with EMR) to create a centralized, electronic immunization registry of vaccinated and unvaccinated students accessible to all health care providers and public health units. 	<ul style="list-style-type: none"> • Fund relevant stakeholders to expand efforts for school-age vaccination catch-up • Address policy barriers that limit school-based vaccination programs (e.g., lower thresholds of unvaccinated students which trigger public health unit intervention) • Address policy barriers that limit willing pharmacy-involvement as immunization sites 	<ul style="list-style-type: none"> • Urgently develop and disseminate a locally-adaptable communications strategy, led by the provincial government, delineating the role of caregiver, primary care physician, pharmacist, and public health unit stakeholders in catch-up programming (in accordance with guidelines for co-administration of the COVID-19 vaccine).
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3. Communication

A communications strategy, led by the provincial government, delineating the potential role of caregivers, primary care physicians, pharmacists, public health units and community leader stakeholders in catch-up immunization programs is urgently needed. We recommend that these communication strategies include a government-supported protocol to guide immunizers through their role in catch-up programming and provide guidance on how childhood and school-based vaccines are to be co-administered with COVID-19 vaccines. The overall strategy should be adapted locally and can lead to different activities operationalized by different stakeholders depending on the community's specific needs and resources. For example, the expansion of childhood immunization providers to include willing pharmacists needs to be accompanied with communications, training (if required), and technical support. Community and religious leaders could also play an active role in developing vaccination communication, providing input into key messages and educational material as well as disseminating this information into their communities in order to reach unvaccinated/under-immunized children within underserved populations.

Communication strategies focused on vaccine safety are of critical importance in catch-up programming in order to mitigate student and caregiver vaccine hesitancy. The significant health risks from vaccine preventable diseases in comparison to rare adverse events following immunizations (AEFIs) should be highlighted. Moreover, caregivers and students should be made aware that Ontario has strong safety surveillance systems to capture any possible AEFIs. Such messaging is especially important given the recent rollout of COVID-19 vaccines, to mitigate any possible spillover from COVID-19 vaccine hesitancy to other routine childhood vaccinations (34). In addition to educating caregivers and students on the safety of vaccines, and addressing other common drivers of vaccine hesitancy (e.g. mistrust in the medical establishment), information about catch-up vaccination options (e.g. locations, providers) should be clearly communicated. COVID-19 vaccination clinics, which caregivers and school-aged children are currently visiting to receive COVID-19 vaccines, can be leveraged as opportunities to educate caregivers and school-age children on catch-up immunizations by way of brochures, websites or information desk. For example, clear communication to caregivers via mail outs and

social media with respect to vaccination timing and caregiver involvement was central to Huron-Perth Public Health Unit's catch-up vaccination programming (see case study below).

Huron-Perth Public Health Unit

The Huron Perth Public Health Unit implemented a multi-pronged strategy starting in the summer of 2020 to efficiently catch-up on the immunization of children resulting from school closures. These strategies have included the following:

- The use of mass immunization clinics (MIC) to deliver catch-up vaccines to eligible students.
 - o *Panorama* reports facilitated the identification of students, and a temporary online booking system was used to book patients at clinics.
 - o Mail outs to families, as well as social media through the school board allowed for promotion of the clinics.
- Clear messaging to school boards, caregivers, and students on catch-up programs through the Huron Perth Public Health website.
 - o This included messaging that delaying the second dose of school-based vaccines (HepB or HPV-9) does not require restarting the immunization series.
- Partnerships with primary care providers to assist with the provision of catch-up doses of school-based vaccines.
 - o The absence of a centralized, integrated system for viewing, recording, and reporting immunizations for both primary care and public health has been identified as a challenge.
- Partnerships with school boards to facilitate the organization of catch-up programs in schools starting in Fall 2021.
- Involvement of caregivers.
 - o Caregivers appreciated being able to be present for the child's immunizations, and nurses found that there were less behavioral and anxiety-related issues with students.

Key Recommendations

In line with the key priorities, Ontario's provincial catch-up vaccination plan should consider the following key recommendations:

1. Engage key stakeholders (caregivers, public health, primary care, pharmacy) in participating in reporting of vaccinations received during the pandemic period for the purpose of planning and implementing catch-up vaccination programs. Consider investing in technology integration which would allow for the creation of a universal and centralized electronic immunization registry which could be integrated with EMRs and accessed by public health, primary care providers, and pharmacies to record and assess patient's immunization records.
2. Ensure equity in access to vaccination by offering catch-up immunization in multiple settings by leveraging existing immunization infrastructure, including school and community-based programs, primary care, pharmacy-based clinics and mass immunization clinics. Provide the necessary resources to allow for the safe implementation of catch-up vaccination including provision of PPE and spaces which will allow for appropriate physical distancing measures.

3. Develop a top-down communication strategy that delineates the roles of caregivers, public health, primary care, schools and pharmacy in catch-up programming that can be adapted to the local context by public health units. Equip immunizers with training to communicate confidently about vaccination, improve and ensure a respectful vaccination experience, and to respond to questions related to adverse events following immunization (AEFIs) to increase vaccine confidence.

Conclusion

The global pandemic has had a significant impact on the provision of routine childhood vaccines in both school-based and primary care settings, precipitating the need for a comprehensive catch-up strategy to close these gaps in vaccination coverage and prevent disease outbreaks. To eliminate the potential for barriers to access that will prevent Ontario children from accessing catch-up vaccination, an integrated, multi-pronged transparent approach that engages caregivers, public health, schools, primary care, and pharmacies must be undertaken to ensure equitable and efficient access to vaccination.

References

1. Causey K, Fullman N, Sorensen RJD, Galles NC, Zheng P, Aravkin A, et al. Estimating global and regional disruptions to routine childhood vaccine coverage during the COVID-19 pandemic in 2020: a modelling study. *The Lancet* [Internet]. 2021 Jul 14 [cited 2021 Jul 26];0(0). Available from: [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(21\)01337-4/abstract](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(21)01337-4/abstract)
2. Piché-Renaud P-P, Ji C, Farrar DS, Friedman JN, Science M, Kitai I, et al. Impact of the COVID-19 pandemic on the provision of routine childhood immunizations in Ontario, Canada. *Vaccine*. 2021 Jul 13;39(31):4373–82.
3. Rana MS, Alam MM, Ikram A, Salman M, Mere MO, Usman M, et al. Emergence of measles during the COVID-19 pandemic threatens Pakistan's children and the wider region. *Nat Med*. 2021 Jul;27(7):1127–8.
4. Sell H, Assi A, Driedger SM, Dubé E, Gagneur A, Samantha BM, et al. Continuity of routine immunization programs in Canada during the COVID-19 pandemic. 2021 Mar 26; Available from: <https://www.medrxiv.org/content/medrxiv/early/2021/03/26/2021.03.22.21254121.full.pdf>
5. National Advisory Committee on Immunization (NACI). Interim guidance on continuity of immunization programs during the COVID-19 pandemic [Internet]. Government of Canada. 2020 [cited 2021 Jul 27]. Available from: <https://www.canada.ca/en/public-health/services/immunization/national-advisory-committee-on-immunization-naci/recommendations-use-covid-19-vaccines.html>
6. Piché-Renaud P-P, Ji C, Farrar DS, Friedman JN, Science M, Kitai I, et al. Impact of the COVID-19 pandemic on the provision of routine childhood immunizations in Ontario, Canada. *Vaccine*. 2021 Jul 13;39(31):4373–82.
7. Ministry of Health and Long Term Care. Immunization 2020: Modernizing Ontario's Publicly Funded Immunization Program [Internet]. Ontario: Government of Ontario; 2020 p. 26.

Available from:

https://www.health.gov.on.ca/en/common/ministry/publications/reports/immunization_2020/immunization_2020_report.pdf

8. Public Health Agency of Canada, Health Canada. National Immunization Strategy: Objectives 2016 – 2021 [Internet]. Government of Canada. 2017 [cited 2021 Jul 19]. Available from: <https://www.canada.ca/en/public-health/services/publications/healthy-living/national-immunization-strategy-objectives-2016-2021.html>
9. Government of Ontario. Immunization of School Pupils Act, R.S.O. 1990, c. 1.1 [Internet]. Apr 19, 2021. Available from: <https://www.ontario.ca/laws/statute/90i01/v9>
10. Government of Ontario M of H and L-TC. Immunization [Internet]. Government of Ontario, Ministry of Health and Long-Term Care; [cited 2021 Jul 30]. Available from: <https://www.health.gov.on.ca/en/pro/programs/immunization/ispa.aspx>
11. Wilson SE, Murray J, Bunko A, Johnson S, Buchan SA, Crowcroft NS, et al. Characteristics of immunized and un-immunized students, including non-medical exemptions, in Ontario, Canada: 2016–2017 school year. *Vaccine*. 2019 Apr 24;37(23):3123–32.
12. Snowdon AW, Wright A, Saunders M. An Evidence-Based Strategy to Scale Vaccination in Canada. *Healthc Q* [Internet]. 2021 Apr;24(1). Available from: <https://www.longwoods.com/content/26468/healthcare-quarterly/an-evidence-based-strategy-to-scale-vaccination-in-canada>
13. MacDonald NE, Comeau JL, Dubé É, Bucc LM. COVID-19 and missed routine immunizations: designing for effective catch-up in Canada. *Can J Public Health*. 2020 Aug;111:469–72.
14. eHealth Ontario. Digital Health Immunization Repository Specification – FHIR (Release 4) [Internet]. eHealth Ontario. 2021 [cited 2021 Jul 28]. Available from: <https://ehealthontario.on.ca/en/standards/digital-health-immunization-repository-specification-fhir-release-4>
15. Ling J. Provinces are working with outdated vaccine tracking systems, hindering national data. *The Globe and Mail* [Internet]. 2021 Feb 21 [cited 2021 Jul 28]; Available from: <https://www.theglobeandmail.com/canada/article-provinces-working-with-outdated-vaccine-tracking-systems/>
16. Wilson SE, Quach S, MacDonald S, Naus M, Deeks SL, Crowcroft NS, et al. Immunization information systems in Canada: Attributes, functionality, strengths and challenges. A Canadian Immunization Research Network study. *Can J Public Health*. 2016 Nov 1;107(6):e575–82.
17. Brisson M. Alberta’s Personal Health Portal. *Healthc Manage Forum*. 2011 Sep 1;24(3):137–40.
18. Graham TA, Ballermann M, Lang E, Bullard MJ, Parsons D, Mercuur G, et al. Emergency Physician Use of the Alberta Netcare Portal, a Province-Wide Interoperable Electronic

- Health Record: Multi-Method Observational Study. *JMIR Med Inform.* 2018 Sep 25;6(3):e10184.
19. Wilson K, Atkinson KM, Deeks SL, Crowcroft NS. Improving vaccine registries through mobile technologies: a vision for mobile enhanced Immunization information systems. *J Am Med Inform Assoc.* 2016 Jan 1;23(1):207–11.
 20. Lemstra M, Neudorf C, Opondo J, Toye J, Kurji A, Kunst A, et al. Disparity in childhood immunizations. *Paediatr Child Health.* 2007 Dec;12(10):847–52.
 21. Bates AS, Wolinsky FD. Personal, Financial, and Structural Barriers to Immunization in Socioeconomically Disadvantaged Urban Children. *Pediatrics.* 1998 Apr 1;101(4):591–6.
 22. Brenner RA, Simons-Morton BG, Bhaskar B, Das A, Clemens JD, GroupFNa the N-DCIIW. Prevalence and Predictors of Immunization Among Inner-City Infants: A Birth Cohort Study. *Pediatrics.* 2001 Sep 1;108(3):661–70.
 23. Lannon C, Brack V, Stuart J, Caplow M, McNeill A, Bordley WC, et al. What Mothers Say About Why Poor Children Fall Behind on Immunizations: A Summary of Focus Groups in North Carolina. *Arch Pediatr Adolesc Med.* 1995 Oct 1;149(10):1070–5.
 24. Hapuhennedige S. Vaccination debates may obscure access issues. *CMAJ News* [Internet]. 2020 Jul 24; Available from: <https://cmajnews.com/2020/07/24/vaccinepoverty-1095888/>
 25. Mosby I, Swidrovich J. Medical experimentation and the roots of COVID-19 vaccine hesitancy among Indigenous Peoples in Canada. *CMAJ.* 2021 Mar 15;193(11):E381–3.
 26. Dempsey AF, Schaffer S, Singer D, Butchart A, Davis M, Freed GL. Alternative Vaccination Schedule Preferences Among Caregivers of Young Children. *PEDIATRICS.* 2011 Nov 1;128(5):848–56.
 27. Saint-Girons M, Joh-Carnella N, Lefebvre R, Blackstock C, Fallon B. Equity Concerns in the Context of COVID-19: A Focus on First Nations, Inuit, and Métis Communities in Canada [Internet]. Toronto, Ontario: Canadian Child Welfare Research Portal; 2020 [cited 2021 Jul 26]. Available from: <https://cwrp.ca/publications/equity-concerns-context-covid-19-focus-first-nations-inuit-and-metis-communities>
 28. National Advisory Committee on Immunization (NACI). Recommendations on the use of COVID-19 vaccines [Internet]. Public Health Agency of Canada; 2021 Jul. Available from: <https://www.canada.ca/en/public-health/services/immunization/national-advisory-committee-on-immunization-naci/recommendations-use-covid-19-vaccines.html>
 29. Centers for Disease Control and Prevention. Interim Clinical Considerations for Use of COVID-19 Vaccines [Internet]. 2021 [cited 2021 Jul 27]. Available from: <https://www.cdc.gov/vaccines/covid-19/clinical-considerations/covid-19-vaccines-us.html>
 30. World Health Organization. Immunization stress related response. A manual for program managers and health professionals to prevent, identify and respond to stress related responses following immunization. [Internet]. Geneva: World Health Organization; 2019. Available from: <https://www.who.int/publications/i/item/978-92-4-151594-8>

31. Taddio A, Ipp M, Thivakaran S, Jamal A, Parikh C, Smart S, et al. Survey of the prevalence of immunization non-compliance due to needle fears in children and adults. *Vaccine*. 2012 Jul 6;30(32):4807–12.
32. Shen C, Dubey V. Addressing vaccine hesitancy. *Can Fam Physician [Internet]*. 2019;65(3):175-181.
33. Ministry of Health and Long Term Care. *Vaccine Storage and Handling Protocol*, 2018. 2018;33.
34. Goldman RD, McGregor S, Marneni SR, Katsuta T, Griffiths MA, Hall JE, et al. Willingness to Vaccinate Children against Influenza after the Coronavirus Disease 2019 Pandemic. *J Pediatr*. 2021 Aug;228:87-93.e2.

Appendix

Appendix A – Roundtable Attendee and Observer Lists

Attendees:

First Name	Last Name	Role	Organization
Leslie	Alderman	Manager, Vaccine Preventable Diseases	Niagara Public Health
Kate	Allan	Postdoctoral Fellow	University of Toronto
Jessica	Bartoszko	PhD Candidate	McMaster University
Karen	Beckermann	Associate Director, Vaccine Preventable Diseases	Toronto Public Health
Nicole	Blackman	Provincial Director	Indigenous Primary Healthcare Council
Adalsteinn	Brown	Professor and Dean	Dalla Lana School of Public Health, University of Toronto
Elizabeth	Brown	Nurse Consultant, Immunization and Vaccine Preventable Diseases	Public Health Ontario
Lucie	Bucci	Senior Manager	Immunize Canada
Leanne	Clarke	Chief Executive Officer	Ontario College of Family Physicians
Catherine	Clasadonte	Policy Advisor	Office of the Deputy Premier and Minister of Health
Michele	Di Leo	Policy Advisor	Office of the Minister of Education
Shaza	Fadel	Assistant Professor, Director of Operations	Dalla Lana School of Public Health, and Centre for Vaccine Preventable Diseases, University of Toronto
Barbara	Fallon	Professor, Faculty of Social Work	University of Toronto
Crystal	Frenette	Acting Director, Communicable Diseases	Region of Peel
Amanda	Fung	Regional Liaison Lead, Education Reopening Secretariat	Ministry of Education
Helen	Groves	Paediatric Infectious Diseases Fellow	The Hospital for Sick Children
Michelle	Halligan	Director, Prevention	Canadian Partnership Against Cancer
Mary Ann	Holmes	Acting Vice President, Immunization Department	Simcoe Muskoka District Health Unit
Victoria	Ip	Manager, Professional Affairs	Ontario Pharmacists Association
Catherine	Ji	Family Physician	Toronto Western Family Health Team, University Health Network
Susan	MacLean	Associate Director, Policy & External Affairs	Merck Canada
Shannon	MacDonald	Assistant Professor, Faculty of Nursing	University of Alberta
Kavita	Mehta	Chief Executive Officer	Association of Family Health Teams Ontario
Jacqueline	McCarles	National Associate Director Public Health Policy - Vaccines and AMR	Merck Canada
Shaun	Morris	Clinician Scientist	The Hospital for Sick Children
Lynette	Okado-Katsivo	Director, Health Policy and Promotion	Ontario Medical Association
Jeffrey	Pernica	Head of Division of Infectious Disease, and Associate Professor, Department of Pediatrics	McMaster University
Pierre-Philippe	Piché-Renaud	Paediatric Infectious Diseases Fellow	The Hospital for Sick Children
Hannah	Sell	Research Assistant	University of Alberta
Anna	Taddio	Professor, Faculty of Pharmacy	University of Toronto
Jacqui	Tam	Public Health Manager	Huron Perth Public Health

Joshua	Tepper	Strategic Advisor	Ontario Ministry of Education
Jeff	Kwong	Interim Director	Centre for Vaccine Preventable Diseases, Dalla Lana School of Public Health, University of Toronto
Daniel	Warshafsky	Associate Chief Medical Officer of Health	Office of the Chief Medical Officer of Health
Sarah	Wilson	Public Health Physician	Public Health Ontario

Observer:

First Name	Last Name	Role	Organization
Robert	Lerch	Manager, Immunization Policy and Programs Unit	Ontario Ministry of Health