Impact of the COVID-19 pandemic on immunization services: Results from a survey of physicians in Ontario.

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July 29th, 2021

Disclosures

Pfizer Global Medical Grants (Investigator-led)
Competitive Grant Program for the assessment of on-time immunization coverage in children under 2 years of age in Canada during COVID-19 (Co-I)

Creative Professional Grant
The Hospital for Sick Children (Co-I)

Plan

- Global perspective: Impact of the pandemic on vaccine coverage worldwide
- Results from a survey study of physicians
- Vaccine coverage in Ontario
- Discuss possible solutions

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RESEARCH ARTICLE

The differential impact of pediatric COVID-19 between high-income countries and low- and middle-income countries: A systematic review of fatality and ICU admission in children worldwide

Taito Kitano[1]*, Mao Kitano[2], Carste
Rachelle Lee-Krueger[3], Rose Douli
Hiromi Hibino[4], Bettina Camara[5], Mar
Philippe Piché-Renaud[1], Michael Kos
Nao Matsuda[10], Quenby Mahood[11], A

As of December 2020:
3,788 pediatric deaths
3,118 ICU admissions

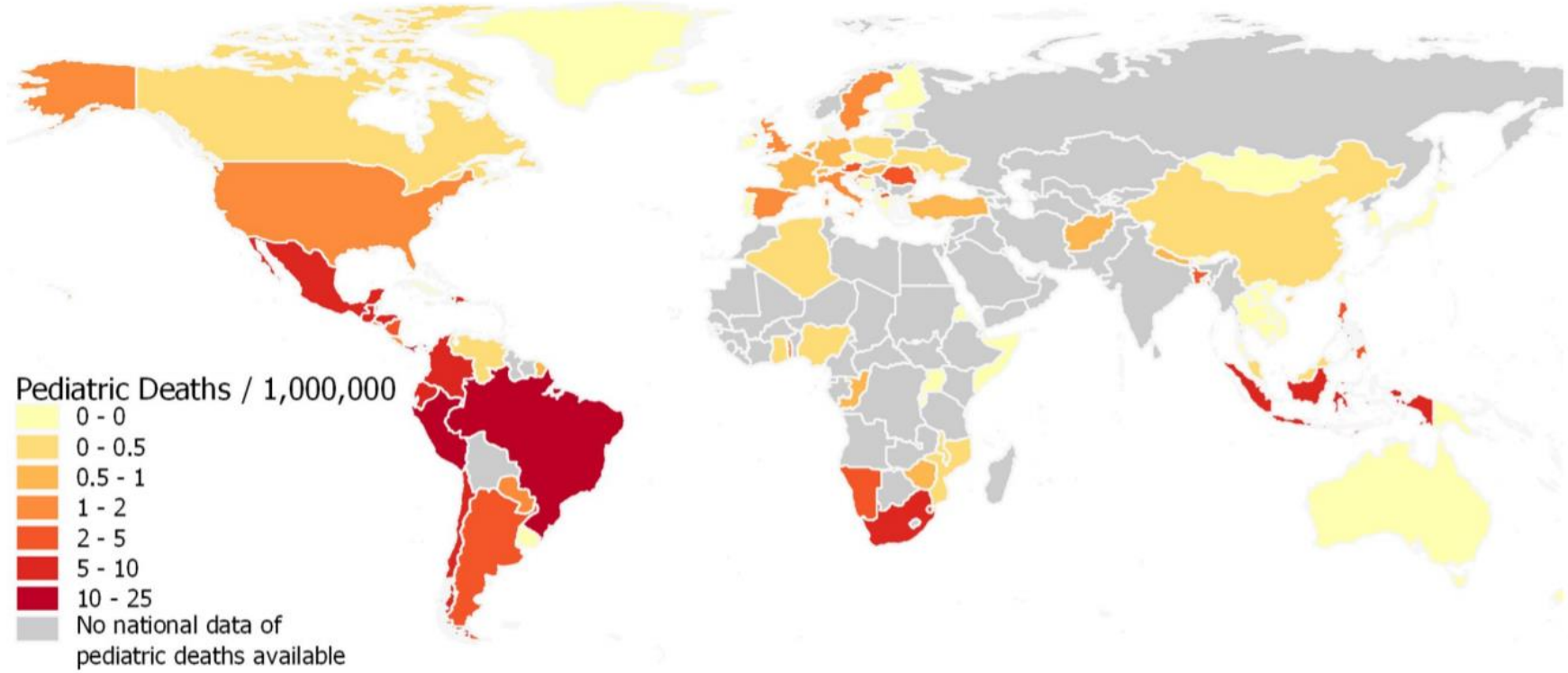


Fig 2. World map of national pediatric COVID-19 deaths (/1,000,000 children). The map was built with the geographic information system QGIS (v3.10, https://qgis.org) and the World Bank Official Boundaries Data Set (https://datacatalog.worldbank.org/dataset/world-bank-official-boundaries). Deaths are presented per million children. Countries of no pediatric case reported includes the country clearly report that there was no confirmed case in children in the national report as of December 7, 2020. National reports published more than 2 months before December 7 were included, if the countries were CDC COVID-19 Level 1 (low transmission) since the date of report.

Early estimates of the indirect effects of the COVID-19 pandemic on maternal and child mortality in low-income and middle-income countries: a modelling study

Timothy Roberton, Emily D Carter, Victoria B Chou, Angela R Stegmuller, Bianca D Jackson, Yvonne Tam, Talata Sawadogo-Lewis, Neff Walker

Lancet Glob Health 2020; 8: e901–08

Published Online May 12, 2020

Worst case scenario (Strict and prolonged lockdowns): additional child deaths

Tetanus toxoid vaccination:	6,610 (5%)
Measles vaccine:	3,160 (1%)
Diphtheria-tetanus-pertussis vaccine:	2,890 (2%)
Hemophilus influenzae type b vaccine:	1,720 (1%)
Pneumococcal conjugate vacc	1,410 (1%)
Meningococcal A vaccine:	380 (<1%)
Rotavirus vaccine:	190 (<1%)
	Total: 16,360 (12%)

COVID-19
As of December 2020:
3,788 pediatric deaths
3,118 ICU admissions

Routine childhood immunisation during the COVID-19 pandemic in Africa: a benefit–risk analysis of health benefits versus excess risk of SARS-CoV-2 infection

Kaja Abbas, Simon R Procter*, Kevin van Zandvoort, Andrew Clark, Sebastian Funk, Tewodaj Mengistu, Dan Hogan, Emily Dansereau, Mark Jit, Stefan Flasche, LSHTM CMMID COVID-19 Working Group†*

Lancet Glob Health 2020;
8: e1264–72

Published Online
July 17, 2020

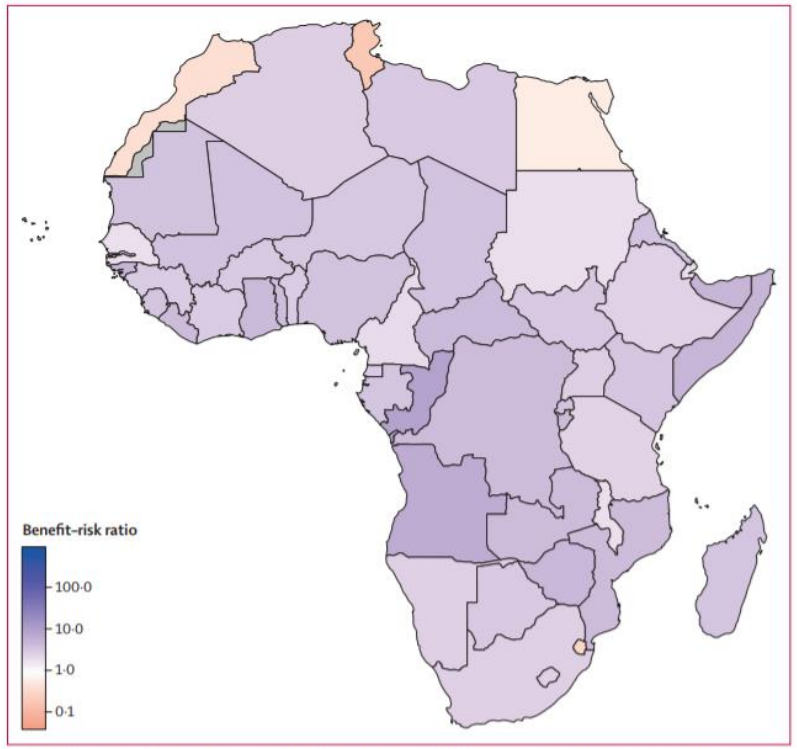


***Figure 2*: Benefit–risk ratios of sustaining routine childhood vaccination, with a minimal chance of a measles outbreak and no other vaccine-preventable outbreaks, during the COVID-19 pandemic in Africa**
In this scenario, we assumed that, in the absence of immunisation, herd immunity would protect children missing vaccination for all diseases except measles. We assumed that the chance of a measles outbreak during the 6-month suspension of immunisation was 12·5%, and no other vaccine-preventable disease outbreaks occurred. Countries shaded in grey had missing data.

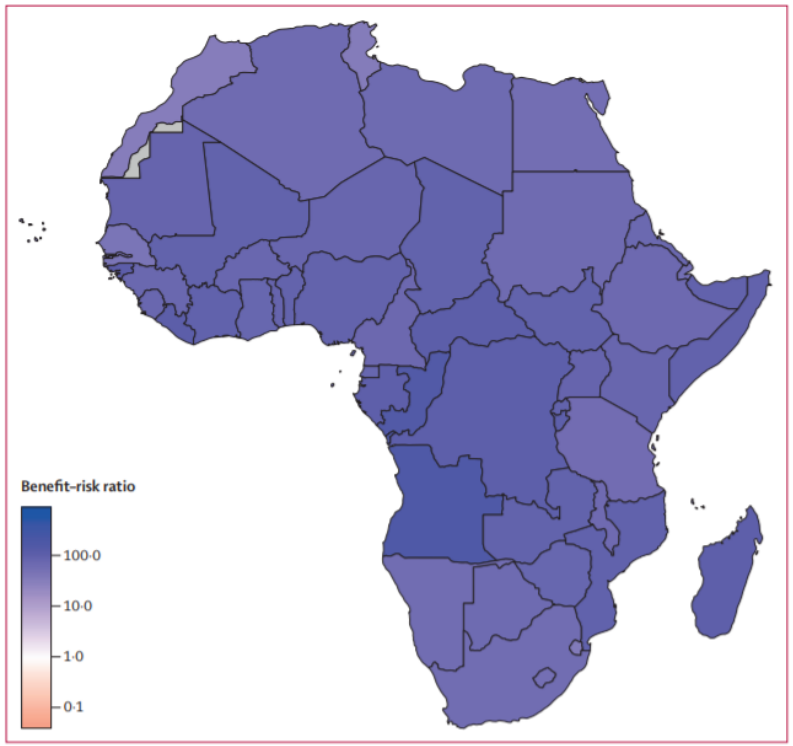
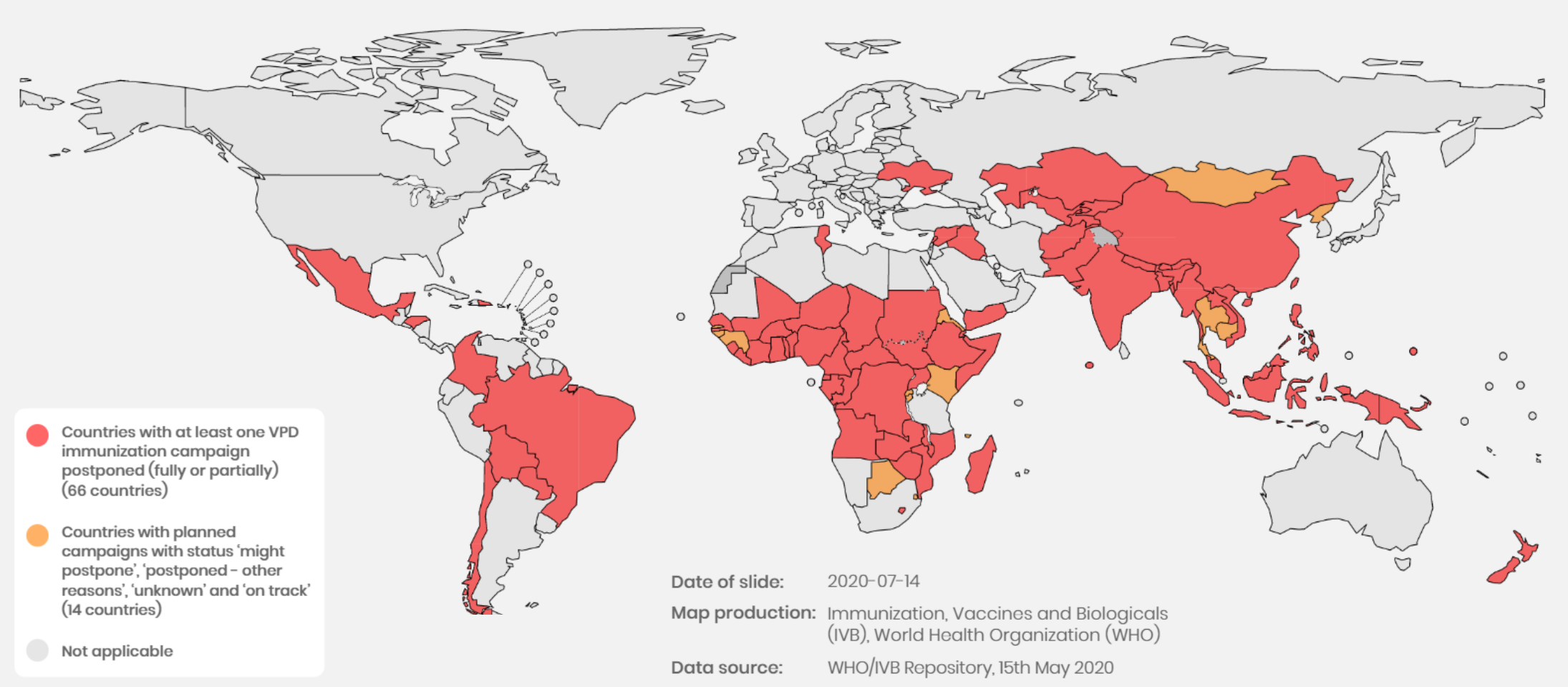


***Figure 1*: Benefit–risk ratios for sustaining routine childhood immunisation during the COVID-19 pandemic in Africa**
In this scenario, we assume that the suspension of immunisation will result in a cohort of unvaccinated children who have the same risk of disease as children in a completely unvaccinated population, and their vulnerability persists until they are 5 years old (ie, no catch-up campaigns). A benefit–risk ratio greater than 1 indicates in favour of sustaining the routine childhood immunisation programme. Countries shaded in grey had missing data.

Impact on vaccination campaigns



Estimating global and regional disruptions to routine childhood vaccine coverage during the COVID-19 pandemic in 2020: a modelling study

Kate Causey, Nancy Fullman, Reed J D Sorensen, Natalie C Galles, Peng Zheng, Aleksandr Aravkin, M Carolina Danovaro-Holliday, Ramon Martinez-Piedra, Samir V Sodha, Martha Patricia Velandia-González, Marta Gacic-Dobo, Emma Castro, Jiawei He, Megan Schipp, Amanda Deen, Simon I Hay, Stephen S Lim, Jonathan F Mosser

Correspondence to:
Dr Jonathan F Mosser, Institute for Health Metrics and Evaluation, Department of Health Metrics Sciences,

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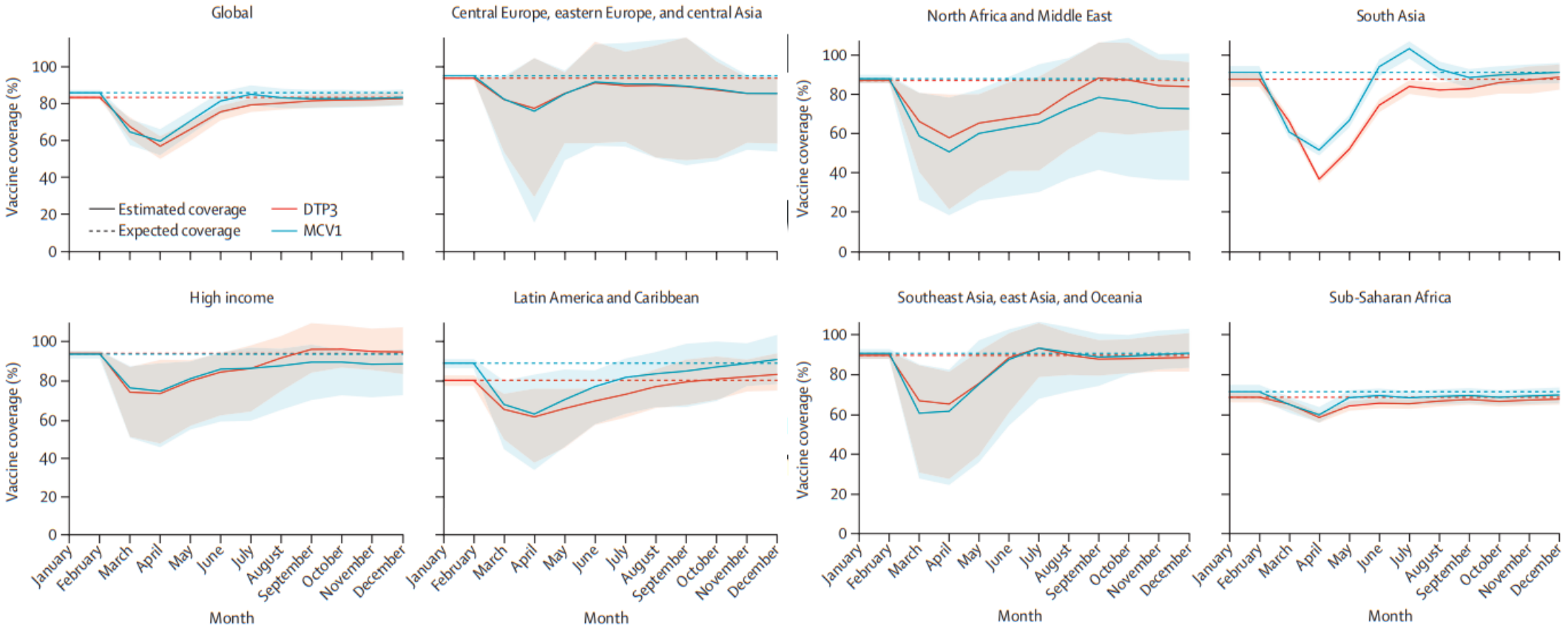
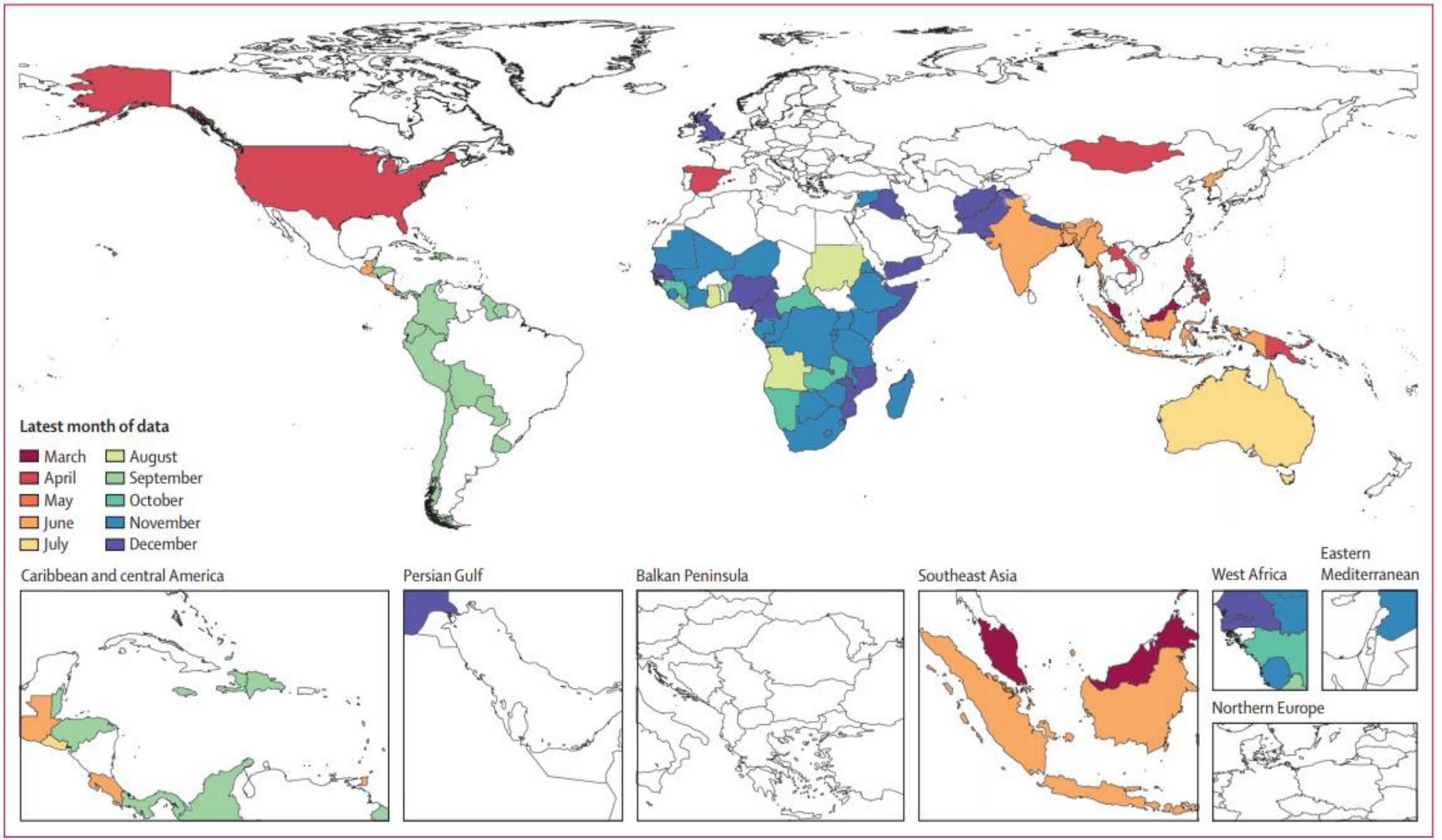
S0140-6736(21)01337-4



8.5 million children not vaccinated with DTaP, and **8.9 million** not vaccinated for measles 2nd to COVID-19

Estimating
childhood
in 2020: a r

Kate Causey, Nancy Fullm
Ramon Martinez-Piedra, S
Amanda Deen, Simon I Ha



8.5 million children not vaccinated with DTaP, and **8.9 million** not vaccinated for measles 2nd to COVID-19

Challenges of gathering data in Canada

- Different vaccine calendars in each province
- Identification of unimmunized and under-immunized individuals is not simple
- No fully integrated patient-centered health information systems that include immunizations
- Requires data triangulation
- Data on the impact of COVID-19 on immunizations in Canada is scarce

Plan

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Routine Schedule: Children Starting Immunization in Infancy

Vaccine \ Age	2 Months	4 Months	6 Months	1 Year Φ	15 Months	18 Months	4 Years	Grade 7	14 Years	24 Years	≥34 Years ♈	65 Years
DTaP-IPV-Hib Diphtheria, Tetanus, Pertussis, Polio, *Haemophilus influenzae* type b	◆	◆	◆			◆						
Pneu-C-13 Pneumococcal Conjugate 13	◆	◆		◆								
Rot-5 Rotavirus	▲	▲	▲									
Men-C-C Meningococcal Conjugate C				◆								
MMR Measles, Mumps, Rubella				■								
Var Varicella					■							
MMRV Measles, Mumps, Rubella, Varicella							■					
Tdap-IPV Tetanus, diphtheria, pertussis, Polio							◆					
HB Hepatitis B								●				
Men-C-ACYW Meningococcal Conjugate ACYW-135								●				
HPV-9 Human Papillomavirus								●				
Tdap Tetanus, diphtheria, pertussis									◆	◆		
Td (booster) Tetanus, diphtheria											◆ Every 10 years	
HZ Herpes Zoster												▌
Pneu-P-23 Pneumococcal Polysaccharide 23												■
Inf Influenza				*Every year in the fall								

Methods – Study design

- Cross-sectional study
- Online self-administered survey
- Pediatricians (1,313) and family physicians (1,983) throughout Ontario

- Survey had three sections
  1. Provider socio-demographic and practice characteristics
  2. Impact of COVID-19 on clinical practice
  3. Impact of COVID-19 on childhood immunization services
     - including open-ended question about potential solutions to maintain childhood immunization services

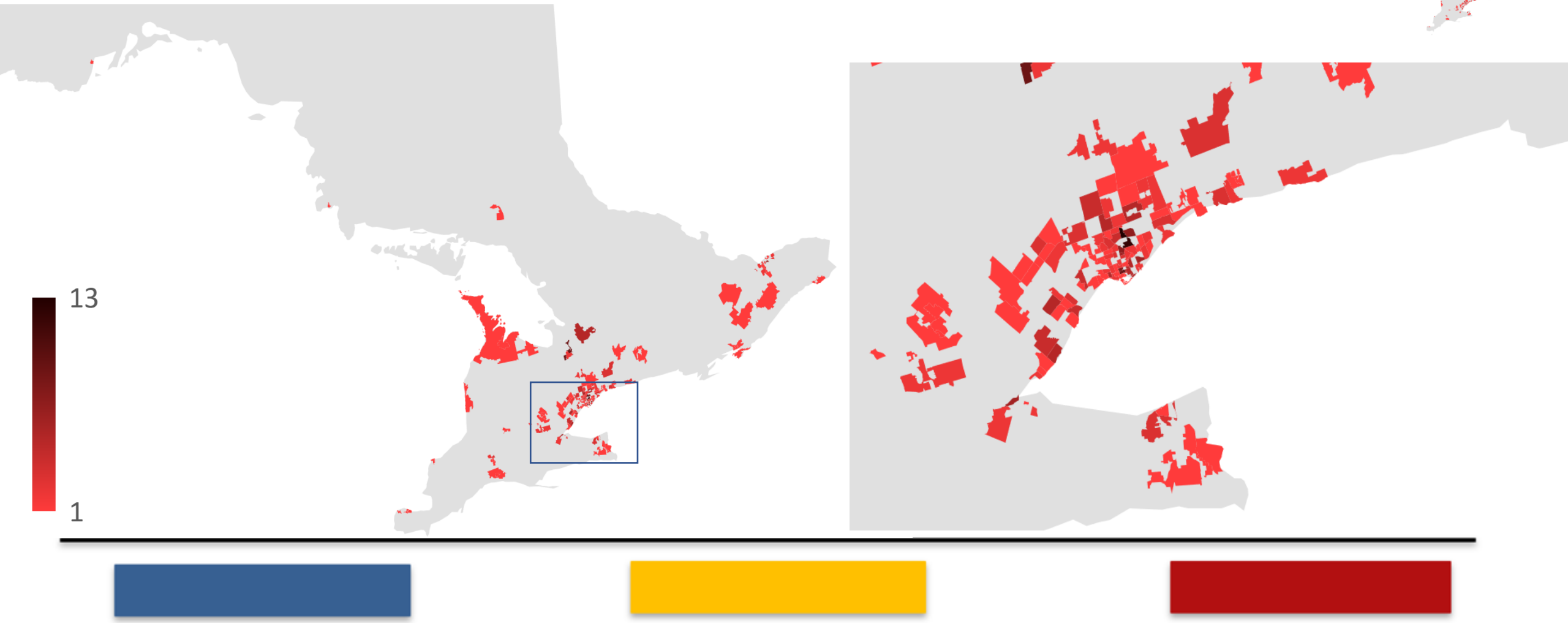
Results

Survey available from May 27 to July 5, 2020

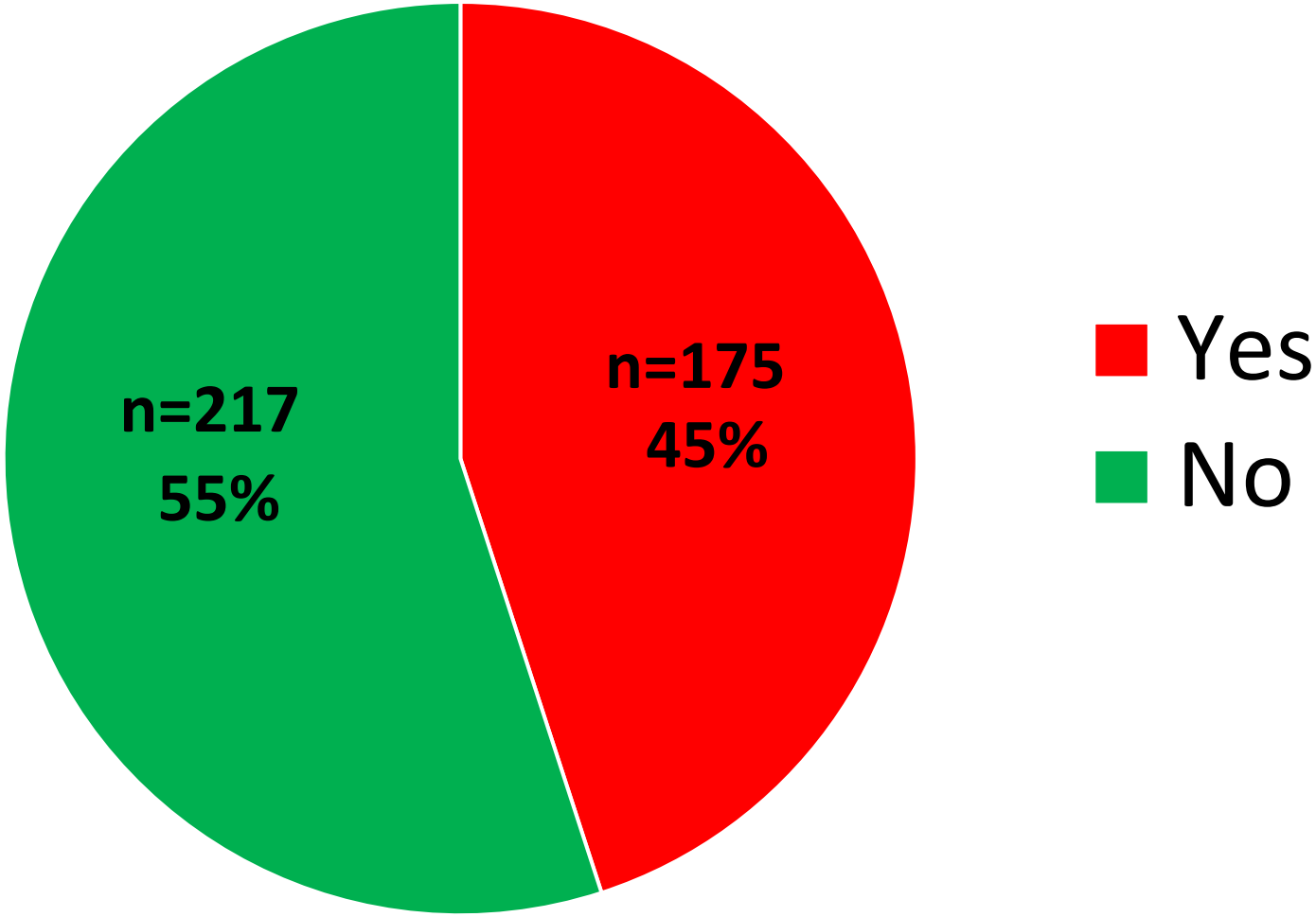
Table 1: Characteristics of respondents

Specialty	Total [n, (%)]	Pediatricians [n, (%)]	Family physicians [n, (%)]
	475 (100)	286 (60)	189 (40)
Number of years into practice			
Less than 5 years	55 (12)	35 (12)	20 (11)
5 – 20 years	209 (44)	119 (42)	90 (48)
More than 20 years	211 (44)	132 (46)	79 (42)
Sex			
Female	304 (64)	172 (60)	132 (70)
Male	168 (35)	111 (39)	57 (30)
Prefer not to say	3 (1)	3 (1)	0
Setting of practice			
Urban	313 (66)	187 (65)	126 (67)
Suburban	145 (31)	91 (32)	54 (28)
Rural or remote	17 (3)	8 (3)	9 (5)
Usually providing vaccines			
Yes	392 (83)	211 (74)	181 (96)
No	83 (17)	75 (26)	8 (4)

Distribution and number of survey participants by area

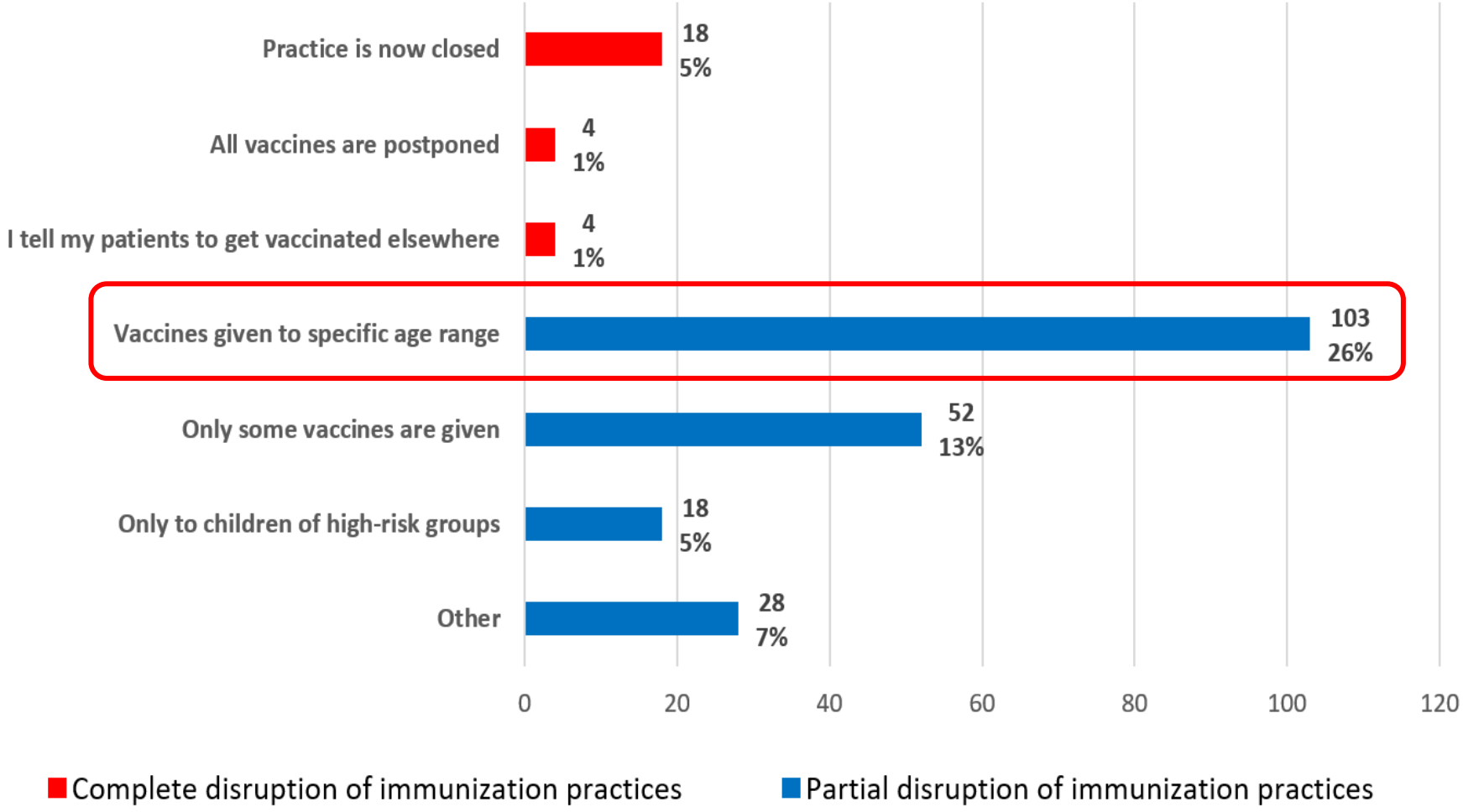


Impact of COVID-19 on immunization services



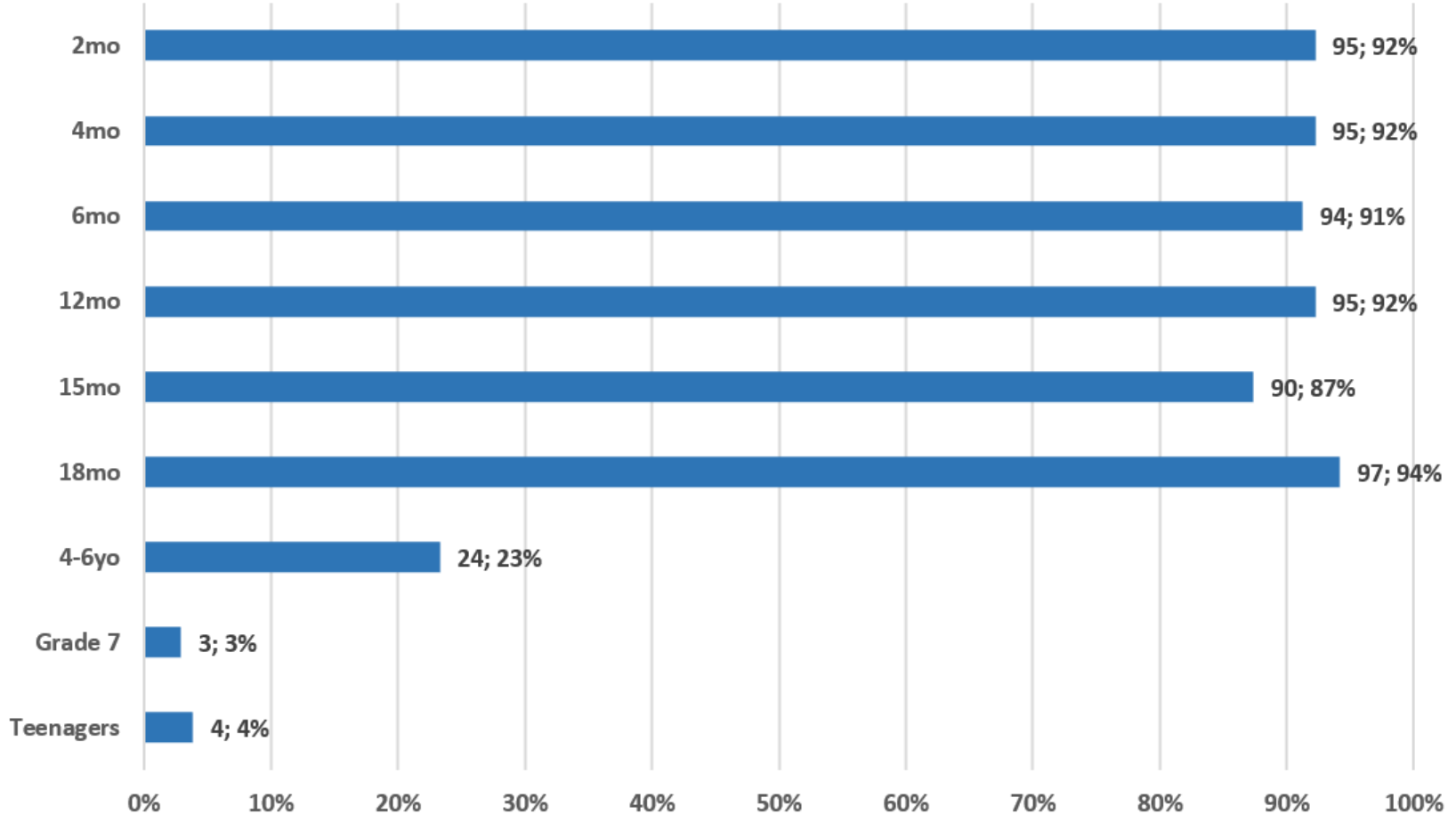
*NB percentages are based on physicians who usually provide vaccines to children (n=392).

Impact of COVID-19 on immunization services



*NB percentages are based on physicians who usually provide vaccines to children (n=392).

Specific age groups affected



*NB percentages are based on physicians who provide vaccines to specific age groups (n=103)

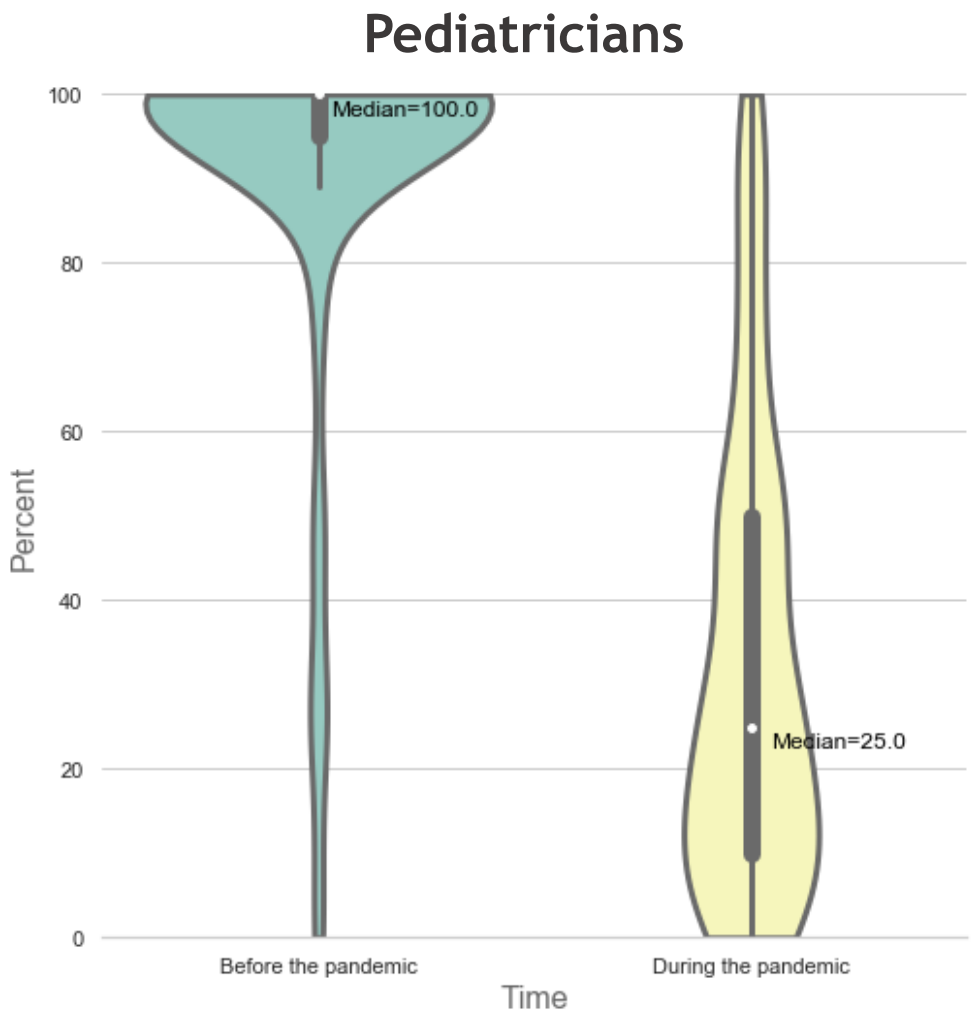
Government of Canada | Gouvernement du Canada

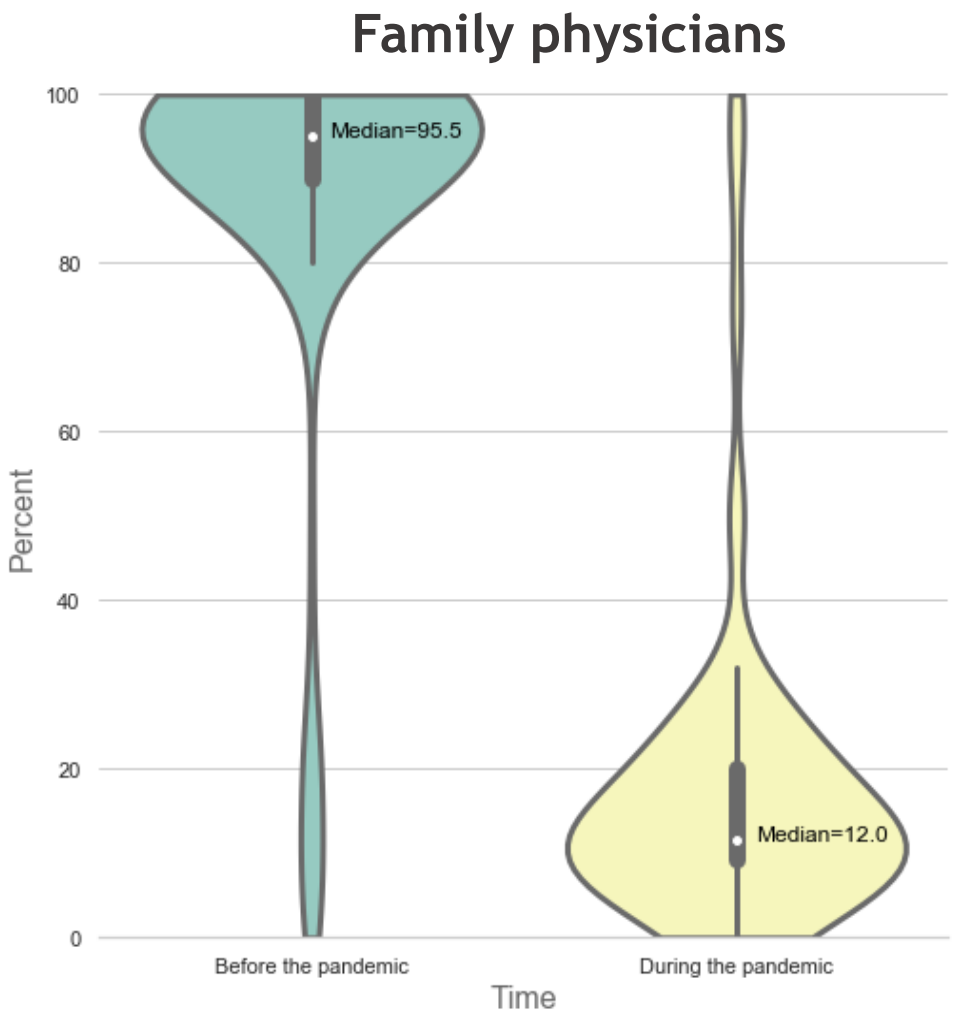
Interim guidance on continuity of immunization programs during the COVID-19 pandemic

Last updated: May 13, 2020

- Infant and toddlers: Prioritize primary immunization series (18 months and younger)
- Boosters given between 4-6 can be deferred, but administration should be prioritized if primary series not completed and before school entry.
- School-based immunizations to be given when schools re-open.

Proportion of in-person visits (%)





Predictors of modification of immunization practices

Table 2
Multivariable logistic regression of practitioner-level predictors of overall COVID-19 negative impact* on routine childhood immunization services.

Characteristics	Univariate analysis		Multivariate analysis	
	OR (95% CI)	p-value	aOR (95% CI)	p-value
Specialty				
Family physician	ref	–	ref	–
Pediatrician	1.73 (1.16–2.60)	**0.008**	2.08 (1.31–3.30)	**0.002**
Site of primary practice				
Community solo practice	ref	–	–	–
Community group practice	0.91 (0.56–1.48)	0.714	–	–
Academic practice (family health team)	0.90 (0.51–1.60)	0.726	–	–
Hospital	0.98 (0.28–3.42)	0.973	–	–
Years of practice				
<5 years	2.53 (1.24–5.16)	**0.011**	2.69 (1.30–5.56)	**0.008**
5–20 years	ref	–	ref	–
>20 years	0.89 (0.58–1.36)	0.589	0.75 (0.47–1.18)	0.208
Physician's sex				
Female	ref	–	ref	–
Male	1.06 (0.69–1.63)	0.796	1.25 (0.80–1.97)	0.327
Country of medical training				
Canada	ref	–	ref	–
Outside canada	1.06 (0.69–1.63)	0.796	0.72 (0.44–1.18)	0.192
Setting of primary practice				
Urban	ref	–	ref	–
Suburban	0.65 (0.42–1.01)	0.055	0.61 (0.39–0.97)	**0.037**
Rural or remote	0.78 (0.24–2.53)	0.682	1.10 (0.33–3.68)	0.873
Practice in gta				
No	ref	–	–	–
Yes	1.25 (0.83–1.89)	0.283	–	–

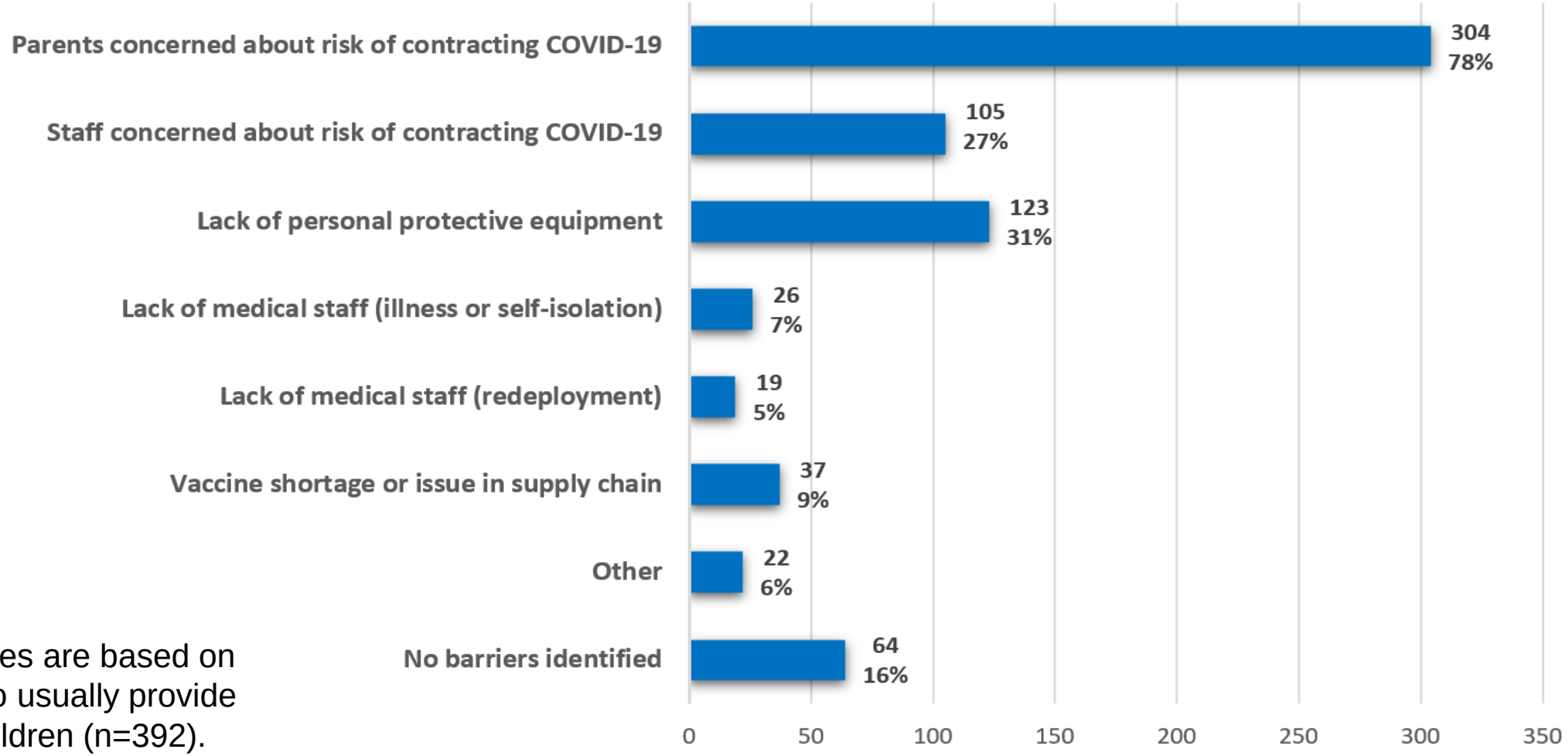
Responses of two physicians (0.5%) were excluded from the regression analyses due to missing data points.
* Impact defined as a modification in physicians' immunization practices or complete closure of the practice.

Other impacts

- In total, 118 respondents (30%) reported providing immunizations to patients from other clinics that were not offering this service anymore because of the pandemic.

- A majority of respondents (n=271, 57%) reported that they did not have a system in place to keep track of their patients who may have missed vaccine doses.

Barriers to immunization services



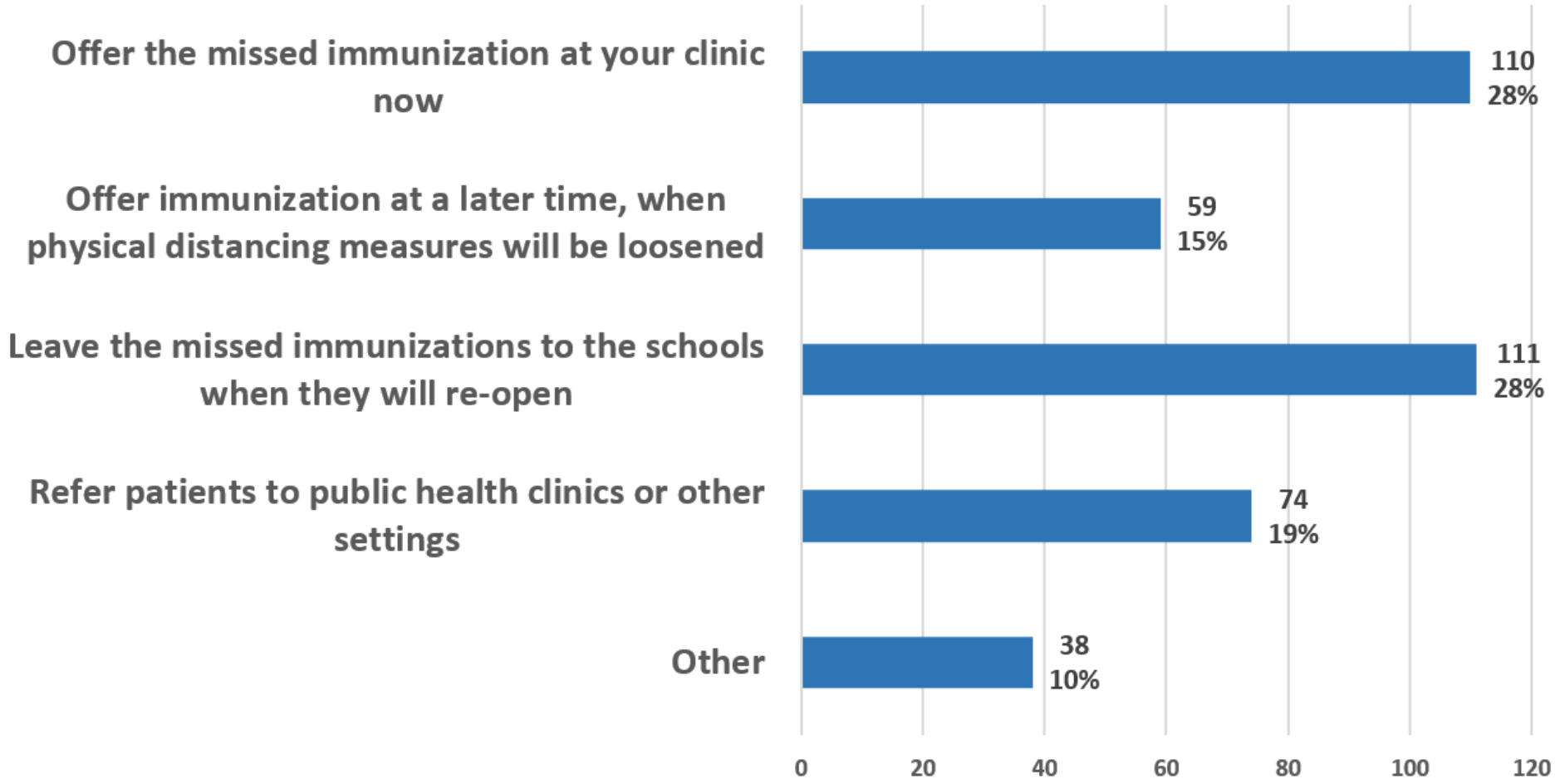
*NB percentages are based on physicians who usually provide vaccines to children (n=392).

Open-ended question: Barriers

Table 3
Barriers and impact to routine childhood immunization from respondents' qualitative input.

Barriers to immunizations	Number of related comments [n, (%)]	Illustrative comments
School closures	28 (20)*	School immunizations are impossible to keep up as no contact with public health about what is missed or started. Plus we do not have those immunizations in the office.
Vaccine supply issue	21 (15)	It has brought the fragmentation of our system to the forefront- e.g. we have continued, schools haven't, families are confused. Public health reduced our vaccine quantities even though we maintained full service. This was an unnecessary barrier we had to expend time and energy to overcome.
Parental concerns	20 (15)	Government puts such a fear into people of COVID-19 that parents can't see beyond one illness at present.
Lack of PPE	17 (13)	Initially had minimal to no PPE with closure of clinic to virtual visits only, eventually bought PPE to offer immunizations prioritizing 18 months under.
Significant delays for older children	16 (12)	We aren't able to bring in the older kids because we want to keep the office clean and safe for the newborns and infants. We have made this a priority because our group recognizes how important it is to vaccinate these children.
Reduced office hours	14 (10)	Immunization may be delayed because parents do not want to come to the clinic and because I have limited the hours in my clinic
Unpreparedness	14 (10)	At the start of the pandemic we didn't have a set way to deal with patients but as things evolved, we now have a smoother system.
Lack of support (Government, public health, etc.)	11 (8)	I do not feel the government has supported physicians at all. As well public health continues to send the important message to families about vaccinating children yet they are not supporting offices either with respect to PPE or even stepping up to provide vaccines to older children (ages 4–6) or the grade 7 cohort.
Visits taking longer	10 (7)	It takes me about 30–45 min per visit, because I disinfect the room between patients and have parents wait in the car.
Lack of public awareness / knowledge	7 (5)	PPE and staff safety are the major concerns, as well as lack of education for parents regarding immunization and COVID 19 risks.
Concerns for staff safety	7 (5)	Postponement may occasionally be necessary to protect me and staff if enquiry indicates that the parent(s), the patient, or house-hold members carry a risk of having Covid19 infection.
Practices' closure	6 (4)	Our government agencies and medical associations were very slow from the start making it clear that many pediatric offices remained open and that immunizations were still important. Many GP offices in our community were shut down and remain so. There was a local assumption by many that we were as well.
Total number of comments	137 (35)**	

Management of missed doses 2nd to school closures



*NB percentages are based on physicians who usually provide vaccines to children (n=392).

Free text comments: school-based immunizations

- *I don’t track the vaccination provided by public health in schools. I believe it is public health’s responsibility.*
- *In Toronto, the vaccines given in schools (Hep B/meningococcal/HPV) are NOT readily available in community practices-that is why we cannot give them.*
- *It has brought the fragmentation of our system to the forefront- e.g. we have continued, schools haven't, families are confused.*
- *School immunizations are impossible to keep up as no contact with public health re what is missed or started. Plus we do not have those immunizations in the office.*

Free text comments: school-based immunizations

- *We cannot make up for the missed school immunizations as we do not have access to the HepB and HPV vaccines from public health, otherwise we would administer them in office*
- *Routine vaccinations for babies and adolescents are still being done. Have not encountered missed immunizations due to school closures yet. Would provide them if public health provides the vaccines.*
- *We would be willing to give vaccines to school aged kids, but we must sign up for most.*

Limitations

- Response rate, convenience sampling
- Participant population did not include nurse practitioners, nurses and pharmacists
- Cross-sectional study design
- Not population-based

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Methods

- Retrospective, repeated cross-sectional study
- Primary care electronic medical records (EMR) data from UTOPIAN (University of Toronto Practice-Based Research Network)
- January 2019 to December 2020

- Inclusion criteria:
  - Children age 0-2 years old during the study period
  - Born on or after January 1, 2017
  - Rostered to family physicians included in UTOPIAN
  - Have a valid sex and date of birth in their EMR
  - Have had at least 2 visits recorded in EMR, with at least one visit after the second week of life to ensure continuity of care

Methods

Primary outcomes:

- Up-to-date (UTD) immunization coverage
  - Proportion of children who have received all valid doses required by specific milestone ages
- On-time immunization coverage
  - Proportion of children in a particular age cohort who have received all valid doses required by specific milestone ages, with a 30-day leeway period after the recommended date for vaccine administration

Recommended age	DTaP-IPV-Hib	Pneu-C-13	Rot	Men-C-C	MMR	Var
2 months	1	1	1	0	0	0
4 months	2	2	2	0	0	0
6 months	3	2	2 or 3	0	0	0
12 months	3	3	2 or 3	1	1	0
15 months	3	3	2 or 3	1	1	1
18 months	**4**	**3**	**2 or 3**	**1**	**1**	**1**

Data analysis

Comparison of coverage between 3 periods of time:

- T1 = baseline/pre-pandemic period from **January 1, 2019 to March 16, 2020**
- T2 = first wave/lockdown of the pandemic in Ontario from **March 17 to July 31, 2020**
- T3 = after first wave/lockdown from **August 1 to December 31, 2020**

Results

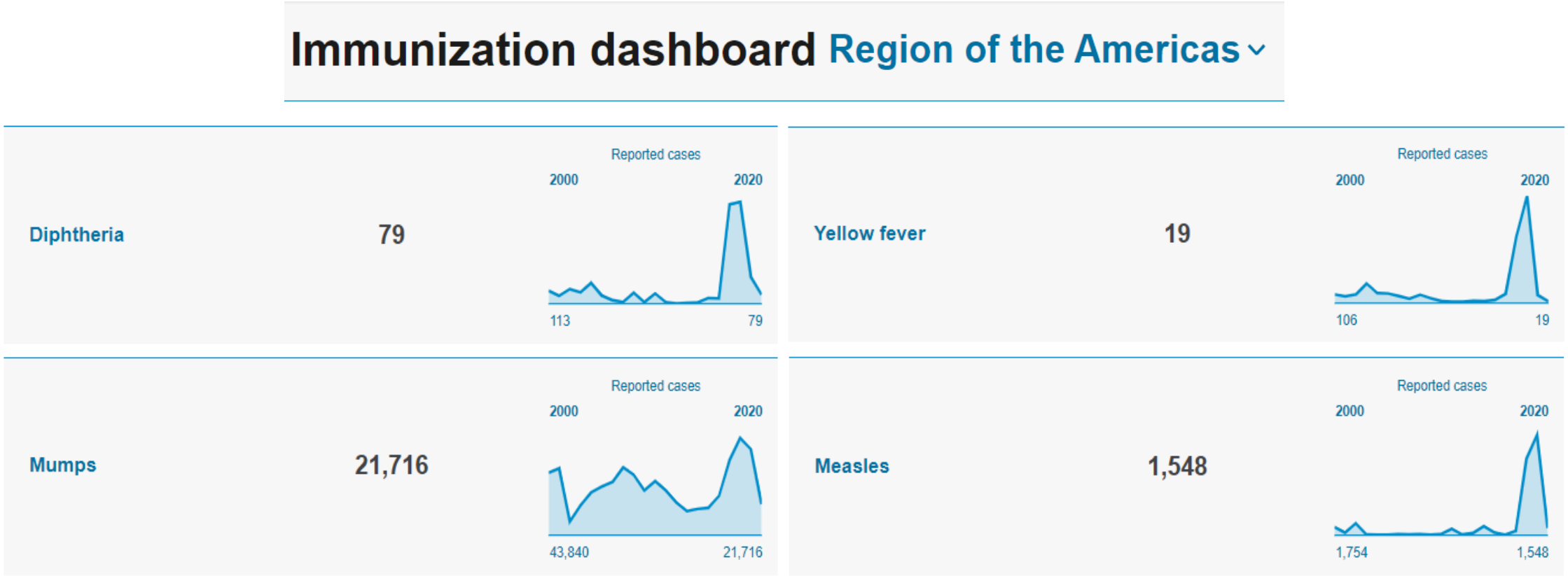
All included children N = 12,313	**N (%)**
Birth year	
2017	3,400 (27.6%)
2018	3,412 (27.7%)
2019	3,178 (25.8%)
2020	2,323 (18.9%)
Sex	
Female	5,972 (48.5%)
Male	6,341 (51.5%)
Location	
Urban	10,740 (87.2%)
Rural	1,092 (8.9%)
Missing	481 (3.9%)

Overall UTD coverage

Can/will such a decrease in vaccine coverage lead to changes in the epidemiology of vaccine-preventable diseases in children?



Impact on vaccine-preventable diseases

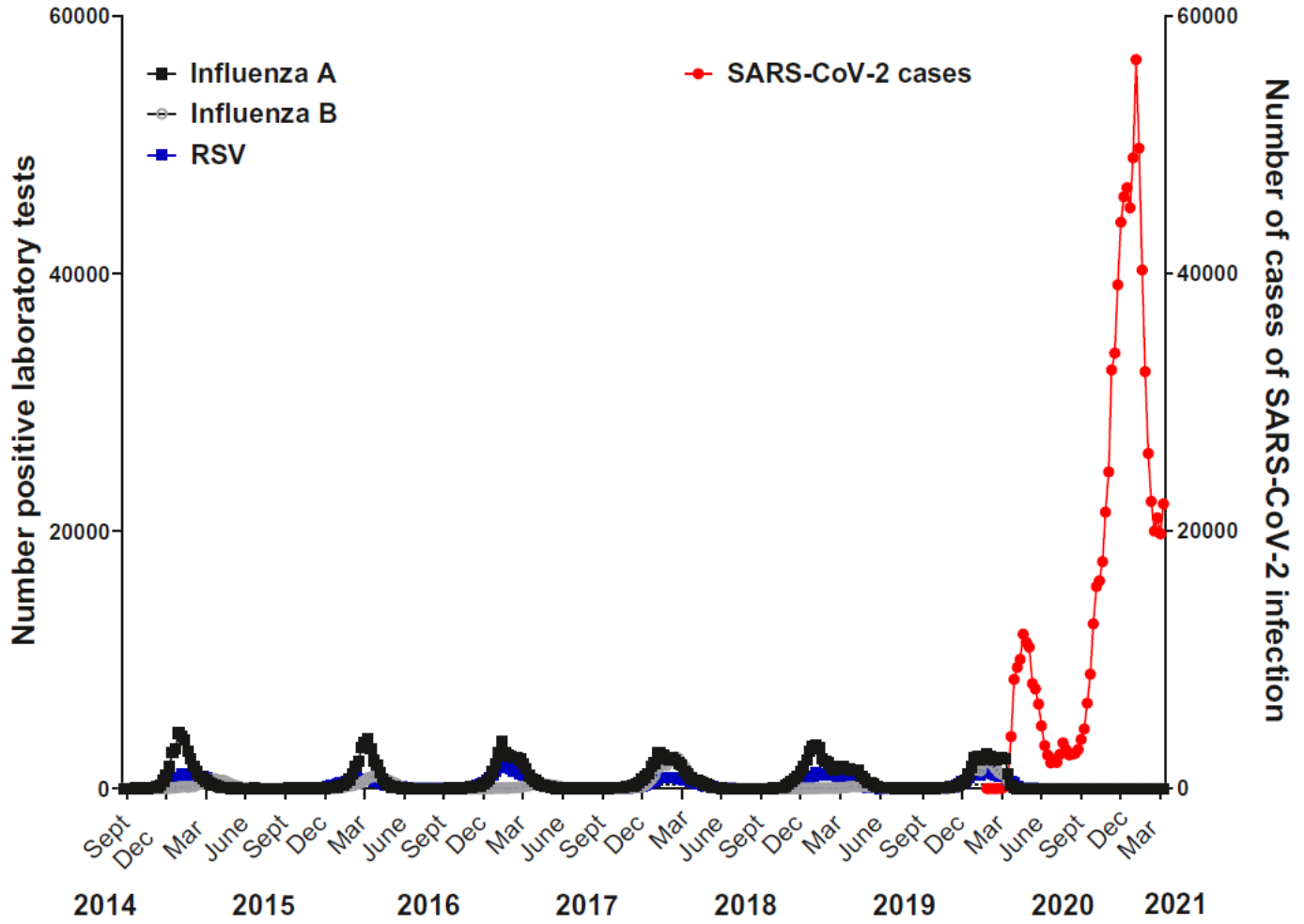


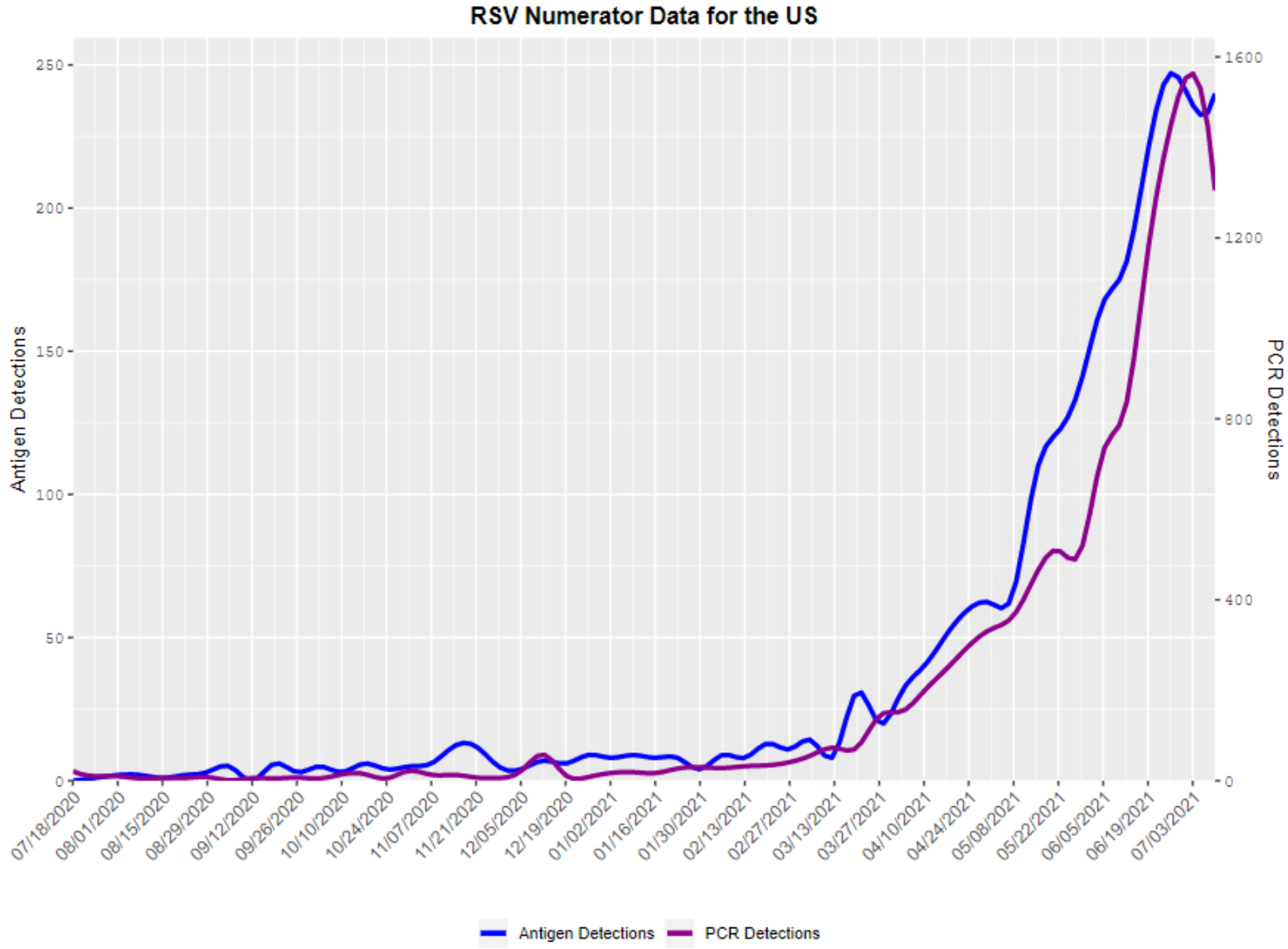
https://immunizationdata.who.int/pages/profiles/amr.html

The impact of the COVID-19 pandemic on influenza, respiratory syncytial virus, and other seasonal respiratory virus circulation in Canada: A population-based study

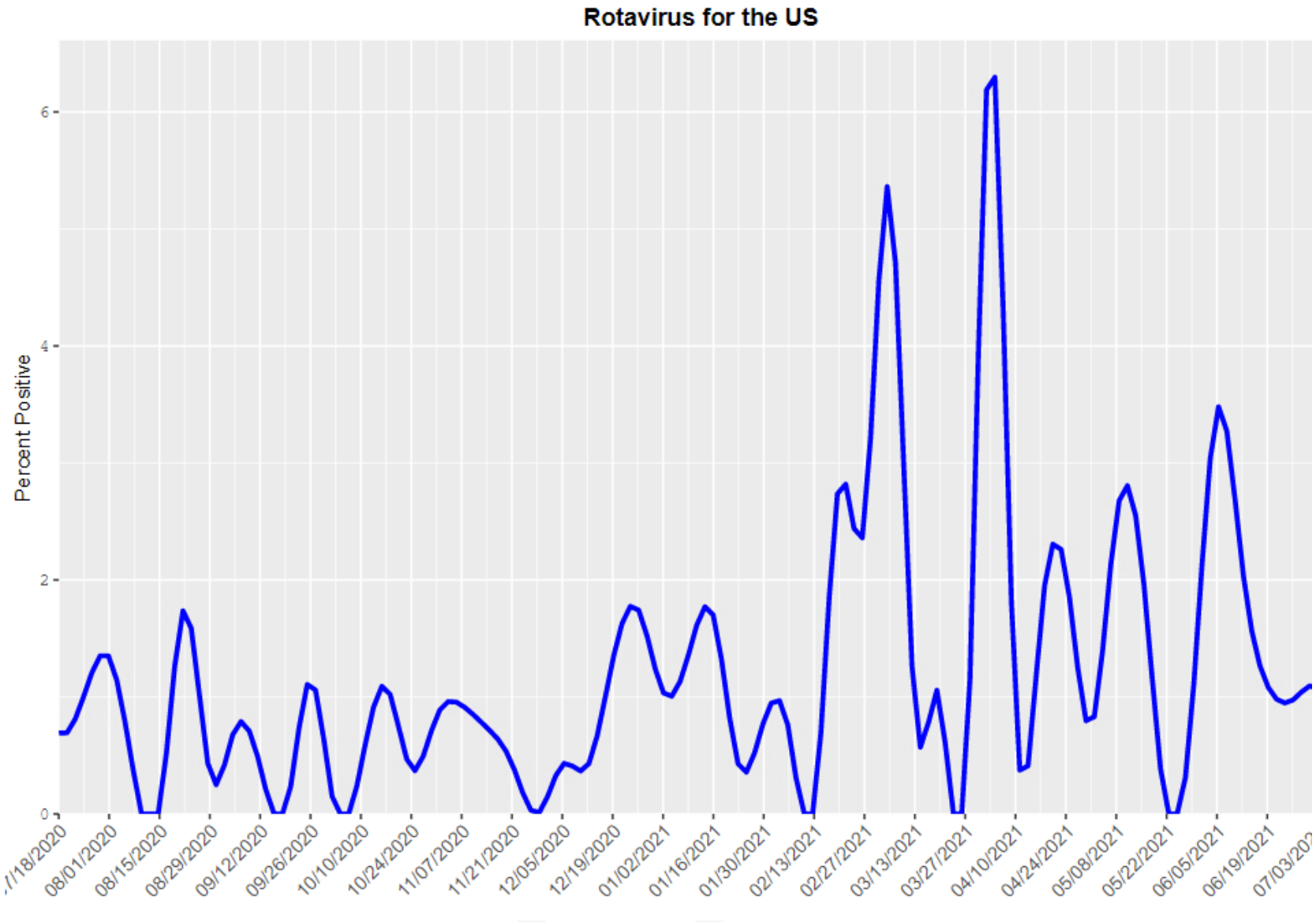
Helen E. Groves • Pierre-Philippe Piché-Renaud • Adria
Christina Bancej • Claire Sevenhuysen • Aaron Campigotto • J

Open Access • Published: July 16, 2021 • DOI: https://doi.org/





https://www.cdc.gov/surveillance/nrevss



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Open-ended question from survey study: Solutions

Table 4
Suggestions from respondents to safely maintain immunization coverage for children throughout the COVID-19 pandemic.

Possible solutions	Number of related comments [n, (%)]	Illustrative comments
Assistance in providing PPE to practices	65 (34)*	I have written letters to local businesses, the government and the OMA requesting assistance with obtaining PPE and have received no assistance or replies. Our clinic is supporting several other clinics in the area by providing pediatric care for their patients when other offices close. Without PPE, our office will also have to close.
Reorganising patient flow	48 (25)	One parent per child. Parents are called the previous day by me and I go through the child's development and answer all their questions. The following day is then only for the actual vaccination. It works about 85% of the time.
Dedicated centers or practices for vaccination	41 (22)	Trying to establish a community hospital site for routine vaccinations to make sure that primary care providers with closed offices have a simple alternative. I would love to see all childhood immunizations given at a centralized location and NOT in pediatrician's offices
Education campaigns targeting parents	31 (16)	The phone calls really help. We actively call parents and explain our precautions, and that we feel strongly that immunization should not be delayed.
Patient screenings	28 (15)	The patients appreciate when we screen them over the phone and go through the protocol used, bring reassurance that we are taking the appropriate measures.
Centralized guidance	14 (7)	Better guidance from groups like the CPS which has been virtually completely lacking during this pandemic. In addition, guidance for the next wave of COVID-19, and for the next pandemic, both of which will come.
Masking of patients and parents	12 (6)	Mom and dads must be masked when they come in, distancing, plexiglass at our reception.
Vaccines given outside of practices (e.g. drive-thru)	9 (5)	We offer vaccine administration in the parking lot where they can wait in their car after the shot to ensure no reaction. This option is appealing to most parents.
Subsidies for practices	7 (4)	We should reimburse pediatricians offices for the extra time and cost encountered by them to provide such service. I suggest adding Covid surcharge in amount of 30% to all immunization related visits
Ensure adequate vaccine supply	7 (4)	A centralized provincial clearinghouse for ordering vaccines and mailing of vaccines directly to our offices would decrease likelihood of shortages and delays in vaccine administration.
Simplify vaccine schedule	6 (3)	Give varicella and Pediacel during the same visit for 15–18 months old instead of 2 separate office visits. Give the 4–6 year-old vaccines at the same time as flu vaccine.
Centralized immunization record	4 (2)	Centralize the immunization data (should have already been done years ago, would be really helpful about now), so everybody knows accurately where they stand re: vaccines. Nobody should have to call a doctor's office to "find out" if their vaccines are up to date.
Total number of comments	189 (40)**	

Maintaining Immunizations for School-Aged Children During COVID-19

Expert and Stakeholders Roundtable Report

Center for Vaccine-Preventable Diseases
Dalla Lana School of Public Health, University of Toronto

Recommendations for healthcare providers

Identification of unvaccinated student(s)

- Contact and follow-up with caregivers of school-aged 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).

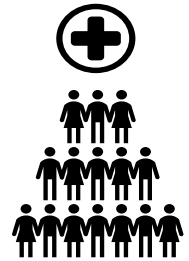
Improved access

- Scale up supply from public health and administration of school-aged vaccines to meet demand of catch-up programming (e.g. pre-bookings to reduce vaccine wastage).

Communication strategy

- Increase awareness about school-aged immunization catch-up programming, included options for catch-up.
- Consistently implement provincial government's communications (e.g. regarding the safety of vaccines).

Recommendations for Public Health



Identification of unvaccinated student(s)

- Leverage Panorama to contact and follow-up with caregivers of school-aged children, offer solutions for catch-up programming based on local options and public health unit directives.

Improved access

- Leverage existing distribution systems for COVID-19 vaccines into pharmacies for school-aged immunizations
- Scale up distribution of school-aged immunization to primary care physicians.
- 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 culturally competent healthcare services and training to immunizers, aligned with community needs.

Communication strategy

- Need to provide stakeholders not usually responsible for school-aged 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 parents and school-aged children are currently visiting to receive COVID-19 vaccines, as education opportunities for catch-up immunization.

Conclusion

- Substantial impact of COVID-19 on immunization worldwide, including in Ontario
- Decrease in immunization coverage could lead to an increase in VPD, especially with relaxing of physical distancing measures and travel restrictions
- Catch-up strategies should be implemented by multiple stakeholders, including healthcare providers, public health and governments

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