COVID-19 IMMUNITY TASK FORCE
GROUPE DE TRAVAIL SUR L'IMMUNITÉ FACE À LA COVID-19

Seminar Series | Research Results & Implications

COVID-19's youngest victims

March 27, 2023 | 11:30 a.m. to 1:00 p.m. EST

Moderator

Tim Evans, MD, DPhil

Executive Director, COVID-19 Immunity Task Force

Inaugural Director and Associate Dean, School of Population and Global Health and Associate Vice-Principal, McGill University

Land Acknowledgement

I am speaking to you from my place of work at McGill University, which is on land which has long served as a site of meeting and exchange amongst Indigenous Peoples, including the Haudenosaunee and Anishinabeg nations. I would like to acknowledge and thank the diverse Indigenous Peoples whose presence marks this territory on which peoples of the world now gather.

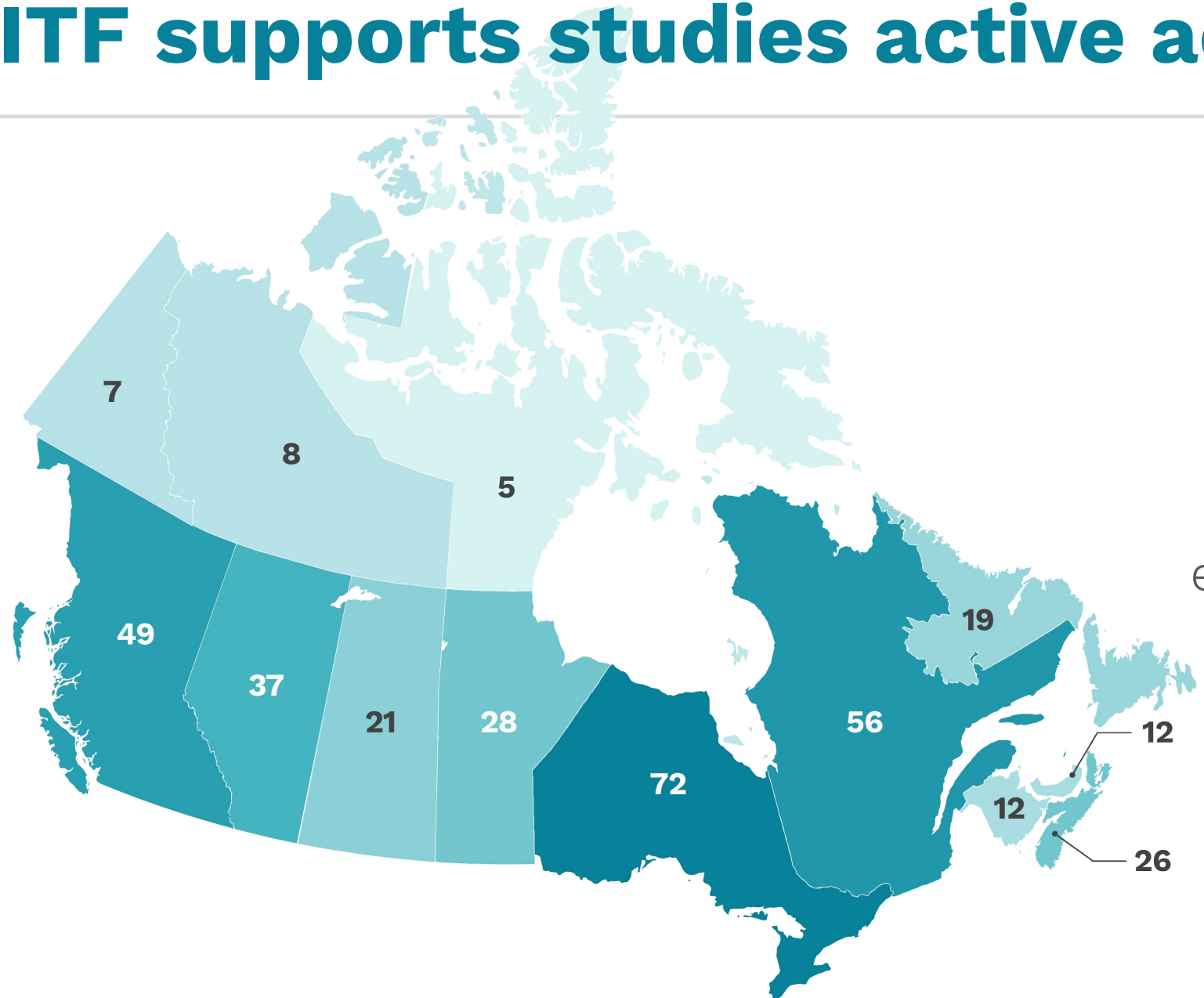
COVID-19 Immunity Task Force mandate

Established by the Government of Canada in April 2020

Mandate:

Catalyze, support, fund, and harmonize knowledge on SARS-CoV-2 immunity for federal, provincial, and territorial decision-makers to inform their efforts to protect Canadians and minimize the impact of the COVID-19 pandemic.

CITF supports studies active across Canada



120 studies

14 of which focus exclusively on pediatric populations

Panelists

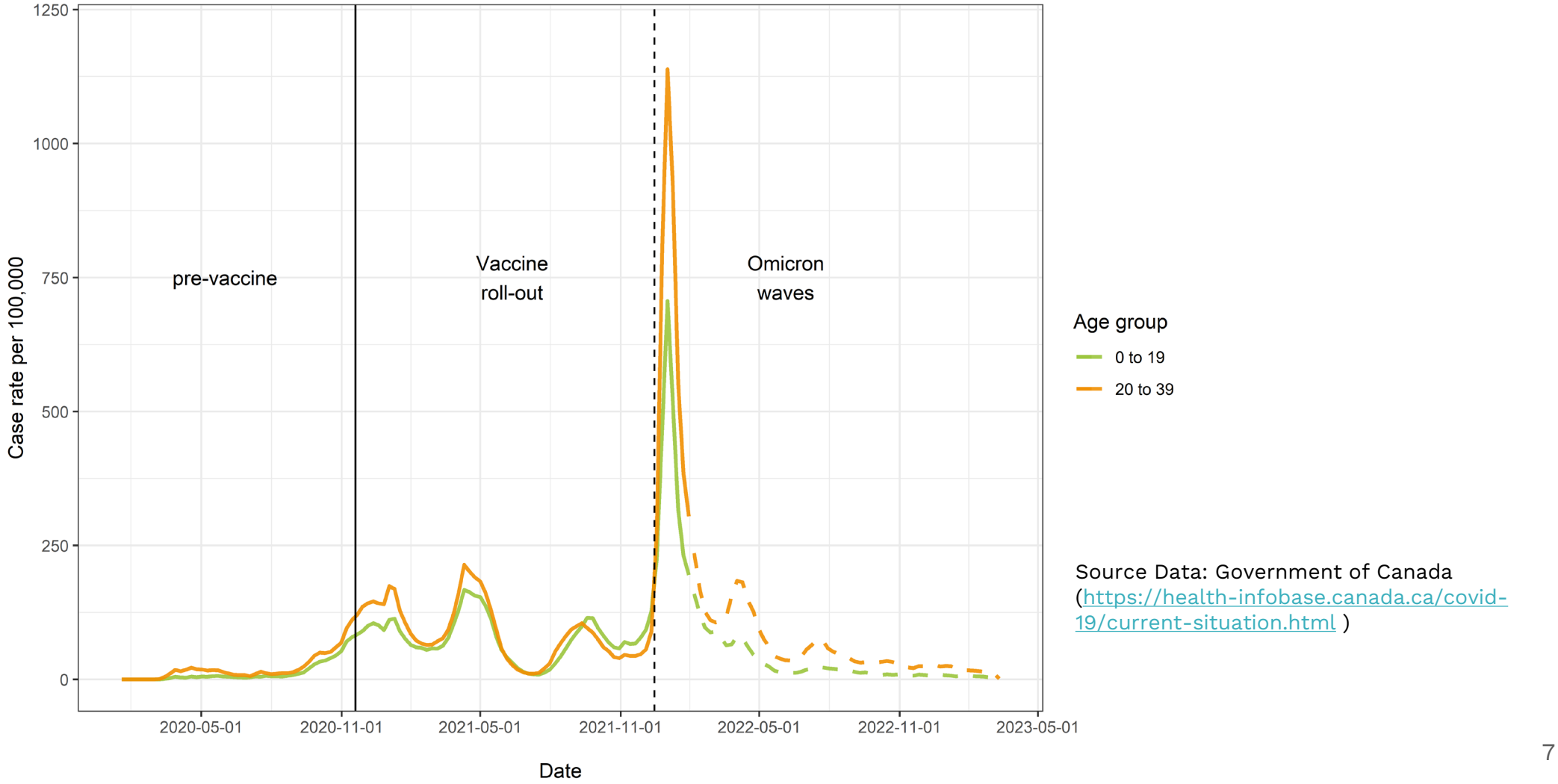
Stephen Freedman, MDCM, MSC, Alberta Children's Hospital Foundation Professor in Child Health and Wellness & Professor of Pediatrics and Emergency Medicine, Cumming School of Medicine, University of Calgary; Pediatric Emergency Medicine Physician, Alberta Children's Hospital.

Manish Sadarangani, BM, BCH, DPHIL, Director, Vaccine Evaluation Center, BC Children's Hospital Research Institute; Associate Professor, Division of Infectious Diseases, Department of Pediatrics, UBC; Physician Lead, Family Immunization Clinic, BC Children's Hospital.

Caroline Quach-Thanh, OQ, MD, FRCPC, MSC, Professor, Department of Microbiology, Infectious Diseases and Immunology and Department of Pediatrics, Université de Montréal; Pediatric Infectious Diseases & Medical Microbiologist, CHU Sainte-Justine; Medical Lead, Infection Prevention & Control, CHU Sainte-Justine.

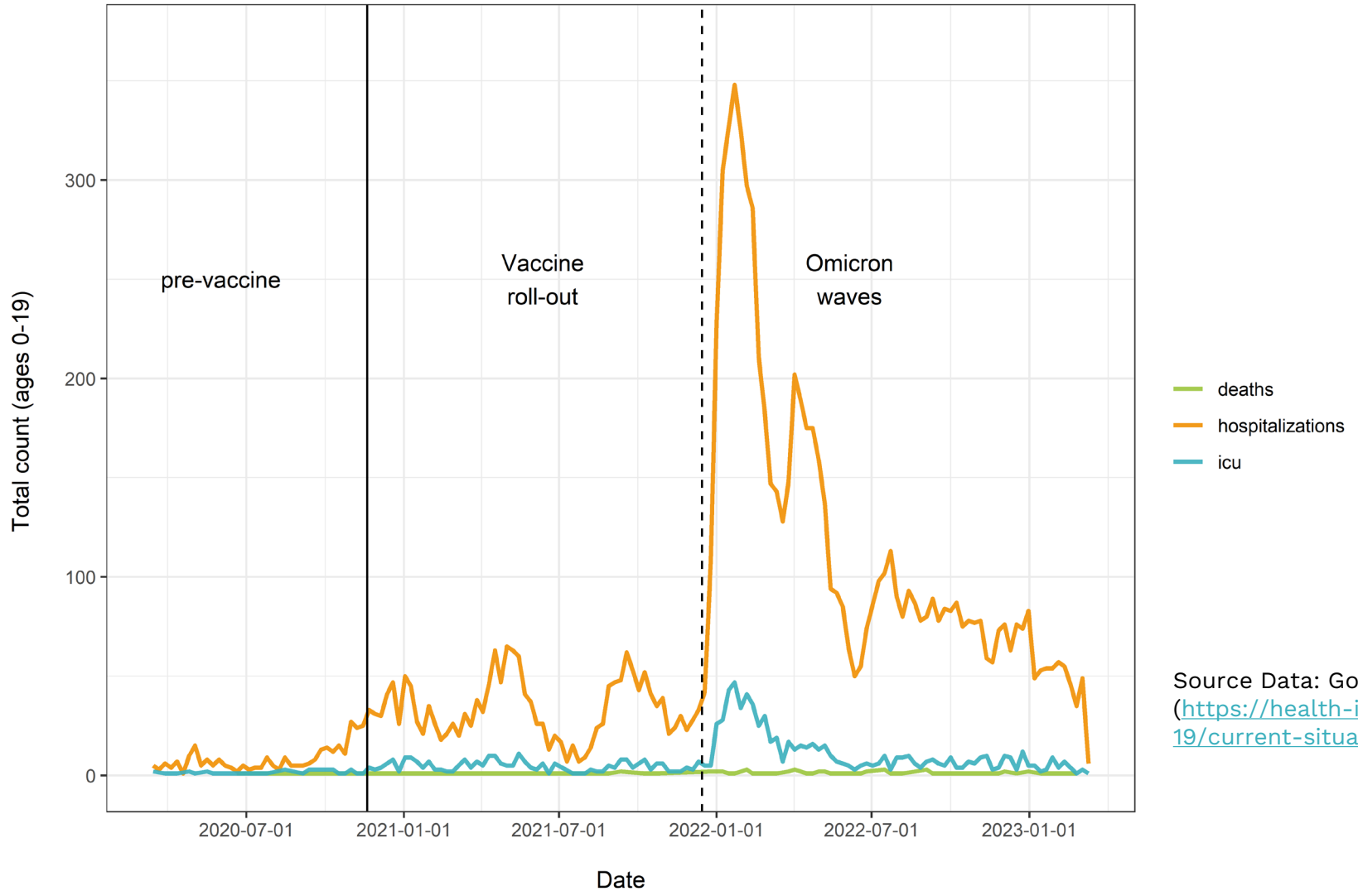
Jim Kellner, MD, Pediatric Infectious Diseases Specialist; Professor, Pediatrics, University of Calgary; Leader, CITF Pediatric Network.

Enormous spike in # of infections among children & young adults in Canada with the onset of Omicron



Source Data: Government of Canada (https://health-infobase.canada.ca/covid-19/current-situation.html)

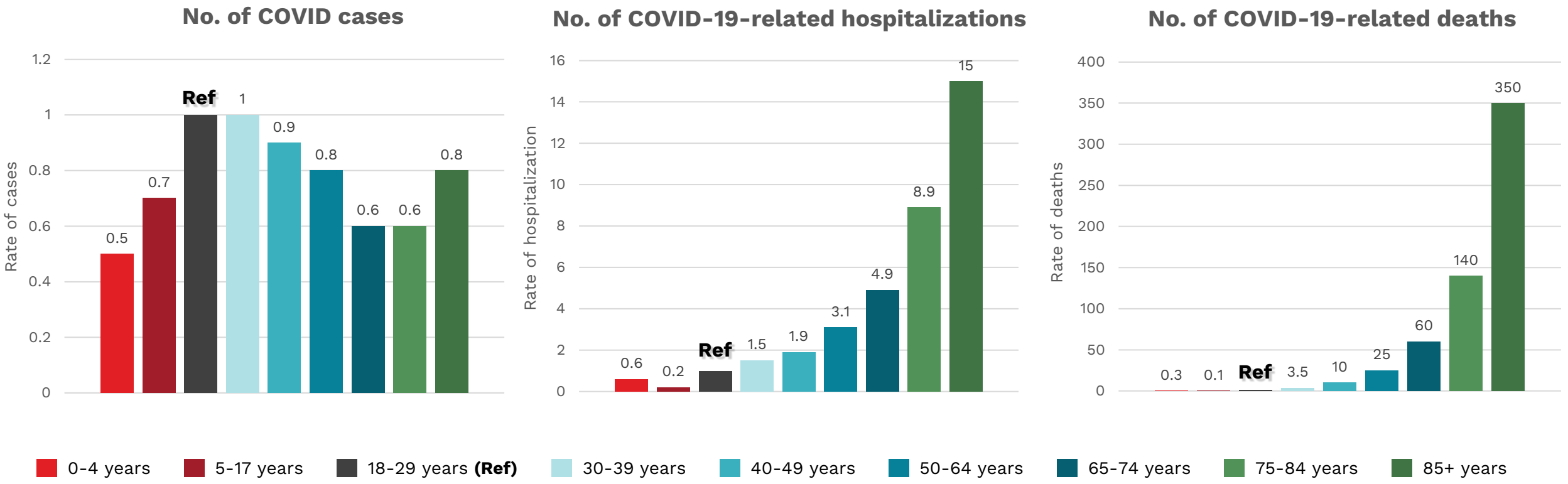
Omicron also sent children & teens in Canada to hospital and the ICU



Source Data: Government of Canada (https://health-infobase.canada.ca/covid-19/current-situation.html)

Risk of SARS-CoV-2 infection & COVID-19 hospitalization and death by age-group

Reference age-group 18-29 years



Source: Centres for Disease Control and Prevention (CDC), February 6, 2023

The SPRING Study

British Columbia

Dr. Manish Sadarangani

Director, Vaccine Evaluation Center, BC Children's Hospital Research Institute

Associate Professor, Division of Infectious Diseases, Department of Pediatrics, UBC

Physician Lead, Family Immunization Clinic, BC Children's Hospital

UBC

Vaccine Evaluation Center

BC Children's Hospital Research Institute

Land acknowledgement

BC Children's Hospital Research Institute operates on the traditional, ancestral, and unceded territory of the Coast Salish peoples — xʷməθkʷəyʼəm (Musqueam), Sḵwxw̱ú7mesh (Squamish), and Səlʼilw̓ətaʔ/Selilwitulh (Tsleil-Waututh) Nations.

Disclosures

Salary awards

BC Children's Hospital Foundation

Health Research to Michael Smith Health Research BC

Research/Project Funding

Merck, Moderna, VBI Vaccines, GlaxoSmithKline, Pfizer, Sanofi-Pasteur, Seqirus, Symvivo

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All funds have been paid to my institute, **no personal payments** have been received.

Objectives

Severe acute resPiratory syndrome-Related coronavirus 2 prevalence In children and youNG adults in British Columbia: An observational study

- Estimate age-specific prevalence of SARS-CoV-2 infection in children and young adults based on the presence of serum anti-SARS-CoV-2 IgG antibodies
- Explore factors associated with higher seroprevalence, as well as the relationship between reported symptomatic history and seroprevalence

Study design

Prospective observational study across two initial phases

Phase 1:
November 2020 – March 2021

Phase 2:
June 2021 – May 2022

Phase 3 (extension):
June 2022 – present

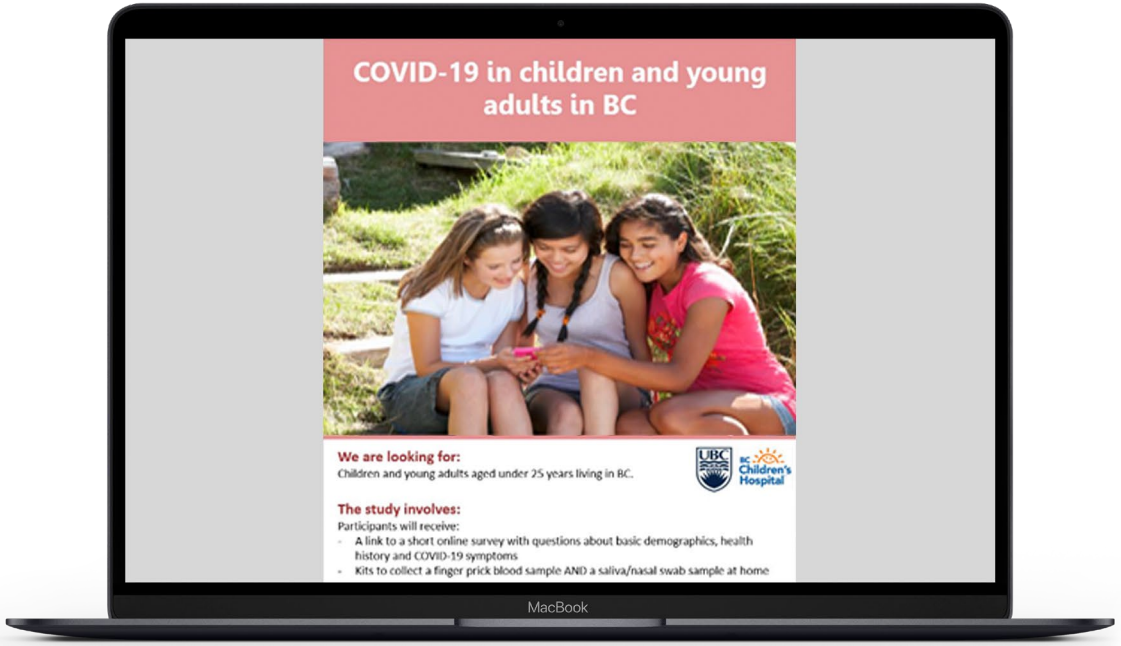
Inclusion criteria:

- Parent/guardian/participant willing and able to give informed consent and/or assent
- Age <25 years
- Resident of BC
- **Phase 2:** Analysis restricted to unvaccinated kids ages 0–9
- **Phase 3:** All ages, including vaccinated youth ages 15–24

Exclusion criteria:

- No specific exclusion criteria

Methods


COVID-19 in children and young adults in BC
We are looking for:
Children and young adults aged under 25 years living in BC.
The study involves:
Participants will receive:
- A link to a short online survey with questions about basic demographics, health history and COVID-19 symptoms
- Kits to collect a finger prick blood sample AND a saliva/nasal swab sample at home
MacBook

During phases 1 and 2, young adults aged 20-24 and children under 5 had the highest seroprevalence rates

Characteristics of seropositive children and young adults:

- Female 55%; male 45%
- 84% had no underlying conditions
- Ethnicity: white 59%, Chinese 4%, South Asian 3%, mixed 14%, unknown 21%
- VCH 42%, Fraser 35%, Interior 9%, Northern 3%, Island 11%
- 14% reported exposure to someone with a positive acute COVID-19 test
- 1147 participants (40%) had an acute COVID-19 test, of which 3% were positive

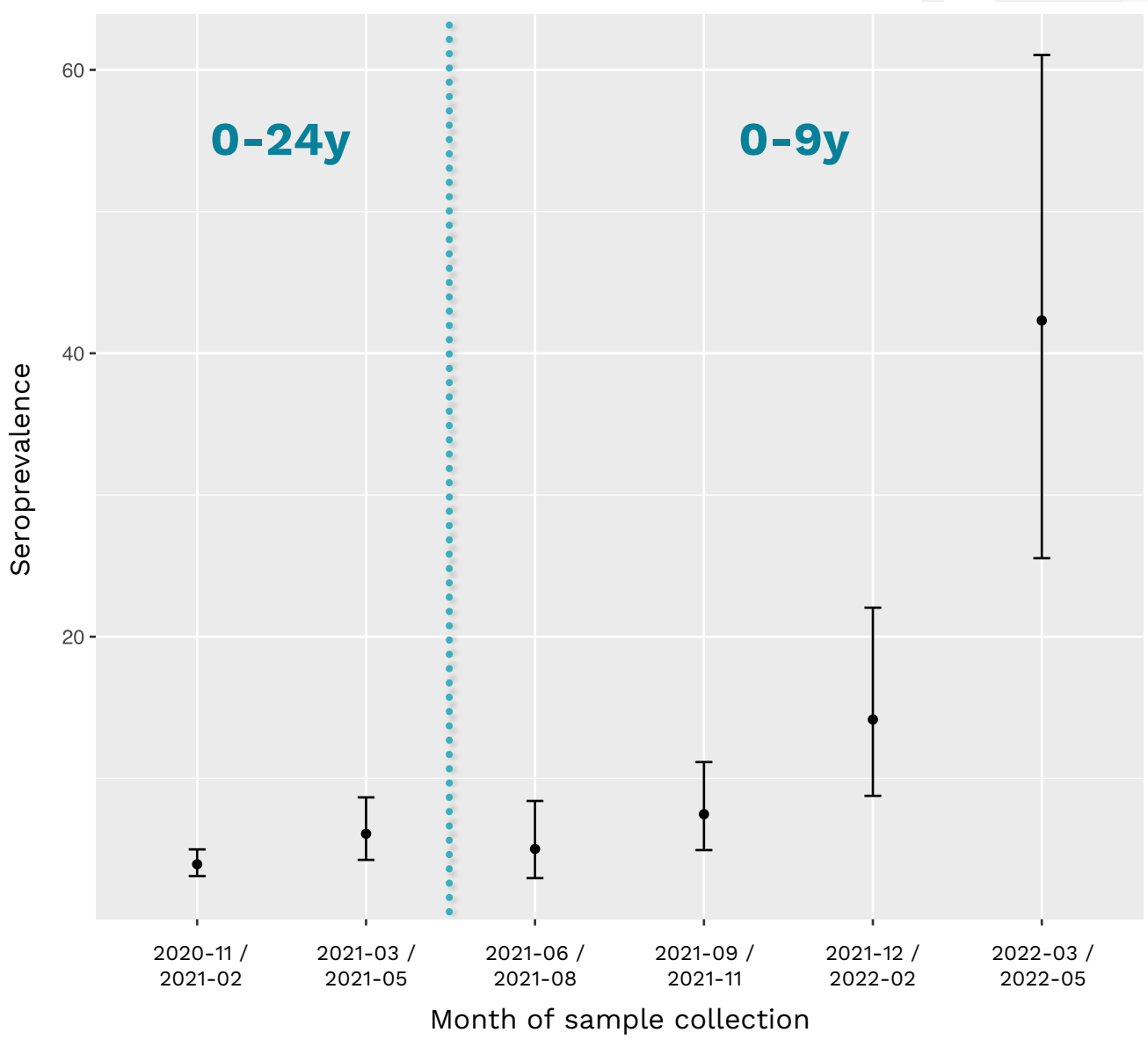
During phases 1 and 2, young adults aged 20-24 and children under 5 had the highest seroprevalence rates

		Total N (% of known)	Positive COVID-19 Antibodies, N=156	Seroprevalence (95% CI)
Age (N=2864)	0-4	615 (21.5)	43	6.99 (5.23, 9.29)
	5-9	845 (29.5)	47	5.56 (4.21, 7.32)
	10-14	464 (16.2)	14	3.02 (1.81, 5)
	15-19	469 (16.4)	18	3.84 (2.44, 5.98)
	20-24	471 (16.4)	34	7.22 (5.21, 9.92)
Area (N=2182)	Vancouver Coastal Health	910 (41.7)	42	4.62 (3.43, 6.18)
	Fraser Health	771 (35.3)	55	7.13 (5.52, 9.17)
	Interior Health	189 (8.7)	8	4.23 (2.16, 8.13)
	Northern Health	69 (3.2)	2	2.9 (0.8, 9.97)
	Vancouver Island Health	243 (11.1)	12	4.94 (2.85, 8.43)

Infection-acquired seroprevalence in the unvaccinated cohort during phases 1 and 2

		Total N	Seroprevalence (95% CI)
Nov 1, 2020 – Feb 28, 2021	0-9 years old	501	3.79 (2.44, 5.85)
	10-19 years old	748	3.61 (2.49, 5.2)
	20-24 years old	401	4.74 (3.05, 7.28)
Mar 1 2021 – May 31, 2021	0-9 years old	235	3.83 (2.03, 7.12)
	10-19 years old	165	3.03 (1.3, 6.9)
	20-24 years old	60	23.33 (14.44, 35.44)
Jun 1, 2021 – Aug 31, 2021	0-9 years old	259	5.02 (2.96, 8.4)
Sept 1, 2021 – Nov 30, 2021	0-9 years old	281	7.47 (4.94, 11.15)
Dec 1, 2021 – Feb 28, 2022	0-9 years old	106	14.15 (8.77, 22.04)
Mar 1, 2022 – May 31, 2022	0-9 years old	26	42.31 (25.54, 61.05)

Infection-acquired seroprevalence was 42% in unvaccinated children aged 0-9 by the end of phase 2



Infection-acquired seroprevalence:

Highest in those who are South Asian and who only travelled internationally

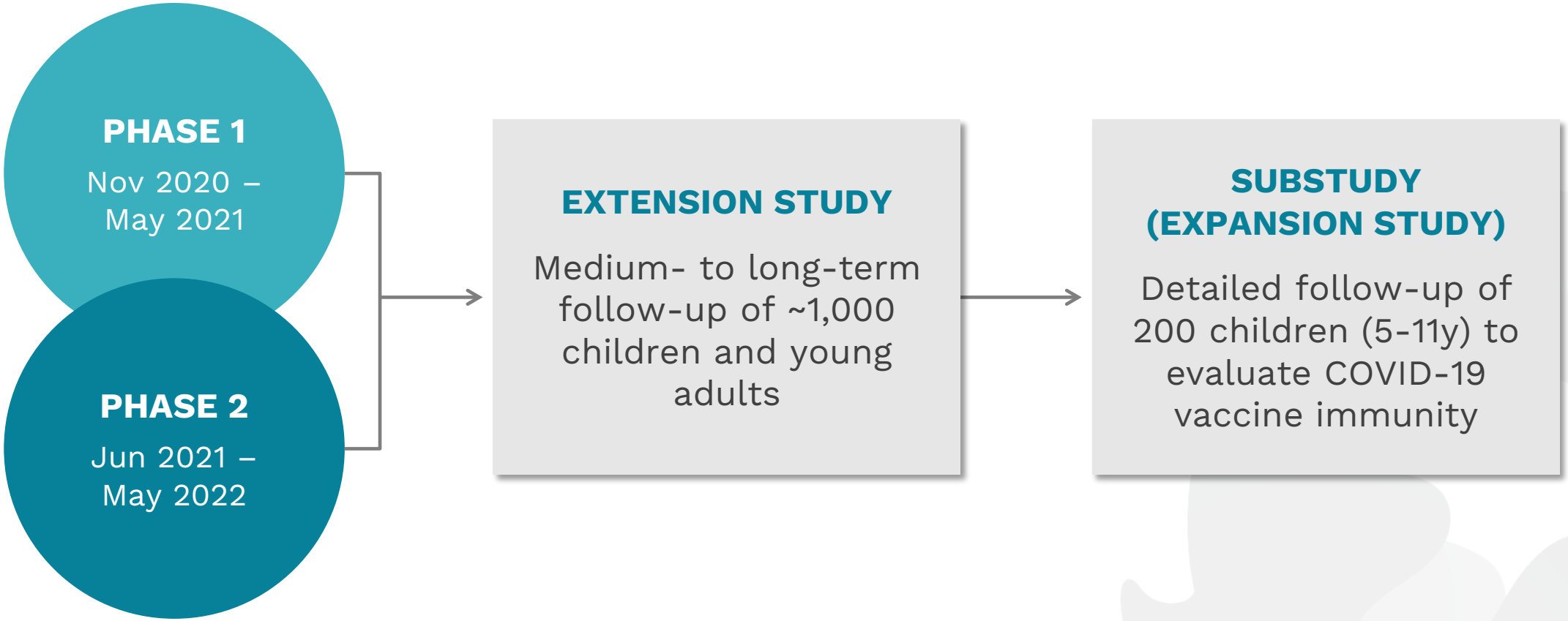
Lowest in 10-19-year-olds

Characteristic	Odds Ratio	95% Confidence Interval	P-value
Age groups			
00 - 4	ref	ref	ref
05 - 9	0.79	0.51, 1.21	0.2818
10 - 14	0.41	0.22, 0.77	0.0053
15 - 19	0.57	0.32, 1.03	0.0627
20 - 24	1.11	0.67, 1.84	0.676
Ethnicity			
White	ref	ref	ref
Chinese	0.48	0.15, 1.58	0.2276
South Asian	2.95	1.44, 6.04	0.0031
Mixed	1.23	0.76, 1.98	0.4019
Other	1.46	0.96, 2.22	0.08
Travel			
No travel	ref	ref	ref
Travel within Canada only	0.69	0.35, 1.35	0.2757
Travel internationally only	1.62	1.03, 2.55	0.0359
Travel within Canada and internationally	1.58	0.47, 5.33	0.4586

Added value of DBS

	Seropositive	Seronegative	Total
Prior acute COVID-19 test positive	36	2	38
Prior acute COVID-19 test negative	**43**	1,059	1,102
No prior acute COVID-19 test	**76**	1,636	1,712
Total	**155**	**2,697**	**2,852**

Ongoing work



52% of study participants (0-19 years) were positive for infection-acquired antibodies by November 2022

Month (2022)	Ages 00-04	Ages 05-09	Ages 10-14	Ages 15-19	Ages 20-24
June	5/12 (41.7%)	5/19 (26.3%)	9/17 (52.9%)	8/17 (47.1%)	12/25 (48%)
July	19/38 (50%)	22/38 (57.9%)	28/48 (58.3%)	6/18 (33.3%)	25/45 (55.6%)
August	10/21 (47.6%)	10/31 (32.3%)	20/36 (55.6%)	12/25 (48%)	11/25 (44%)
September	3/4 (75%)	7/16 (43.8%)	12/23 (52.2%)	4/8 (50%)	4/13 (30.8%)
October	4/7 (57.1%)	13/24 (54.2%)	10/16 (62.5%)	10/15 (66.7%)	5/15 (33.3%)
November	1/2 (50%)	7/10 (70%)	11/16 (68.8%)	7/9 (77.8%)	5/7 (71.4%)
Total	42/84 (50%)	64/138 (46.4%)	90/156 (57.7%)	47/92 (51.1%)	62/130 (47.7%)

For each age group by month of assay, N positive / Total N (%)

Discussion

- Higher seropositivity compared to the provincially reported data
- Highest seropositivity amongst young adults aged 20-24 and young children under 5
- Low overall rate of seropositivity through 2021 despite returns to in-person schooling; significant rise in seropositivity in 2022 with Omicron VOC

Discussion

- Higher rates amongst South Asian participants
  - Numbers in other ethnic groups are relatively small, limiting further analysis
  - May have unintended selection bias in who volunteered to participate in the study
- Low recruitment of participants living in the north and Indigenous communities
- Identified large numbers of cases not detected via provincial surveillance
- Lower sensitivity of DBS vs. serum – may not detect low levels of antibody

Study Team

Name	Institute
Manish Sadarangani (PI)	Vaccine Evaluation Center (VEC), BC Children's Hospital (BCCH) Department of Pediatrics, University of British Columbia (UBC)
Bahaa Abu-Raya	
Julie Bettinger	
Adriana Cabrera	
Gabrielle Gaultier	
Vivek Gill	
Amy Lee	
Brynn McMillan	
Laura Sauvé	
Hennady Shulha	
Sarah Silverberg	VEC, BCCH; Department of Pediatrics, University of Toronto
David Goldfarb	Department of Pathology and Laboratory Medicine, BCCH; UBC
Sofia Bartlett	Public Health Laboratory, BC Centre for Disease Control (BCCDC)
Agatha Jassem	
Mel Krajden	
Muhammad Morshed	
Inna Sekirov	
Danuta Skowronski	Influenza & Emerging Respiratory Pathogens Lead, BCCDC
Daniel Coombs	Department of Mathematics, UBC
Soren Gantt	VEC, BCCH; Centre de recherche du CHU Sainte-Justine, Montreal

Vaccine Evaluation Center

BC Children's Hospital Research Institute

BC Centre for Disease Control

UBC

Michael Smith Health Research BC

COVID-19 IMMUNITY TASK FORCE

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Public Health Agency of Canada

Agence de la santé publique du Canada

ÉTUDE encore STUDY

Montreal

Caroline Quach, MD

Professor, Department of Microbiology, Infectious Diseases and Immunology and Department of Pediatrics, Université de Montréal

Pediatric Infectious Diseases & Medical Microbiologist, CHU Sainte-Justine

Medical Lead, Infection Prevention & Control, CHU Sainte-Justine

On behalf of

Kate Zinszer, PhD

Associate Professor, School of Public Health, Université de Montréal

Center for Public Health Research, Université de Montréal

ESPUM
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CReSP
Centre de recherche en santé publique

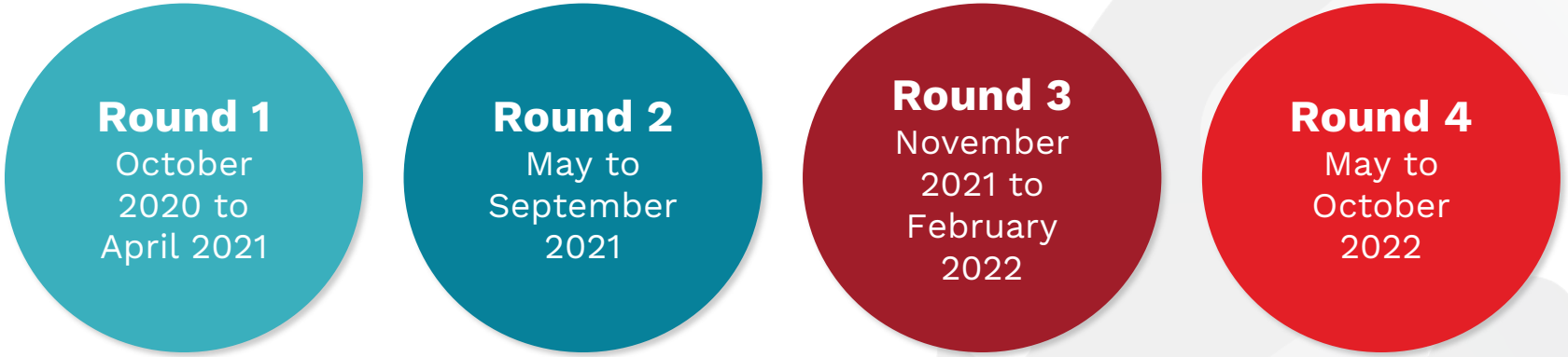
CHU Sainte-Justine
Le centre hospitalier universitaire mère-enfant
Université de Montréal

Disclaimer

Prof. Zinszer and I have no COIs to declare related to this study.

Study objectives and methods

- Estimate seroprevalence, seroconversion, and seroreversion of infection-acquired SARS-CoV-2 antibodies
- Identify participant characteristics associated with increased risk of seroconversion
- Data collected longitudinally at four time points:



Study population characteristics

- ~10-14% of children had a parent who identified as a racial or ethnic minority
- ~20-30% came from households with annual income below $100,000

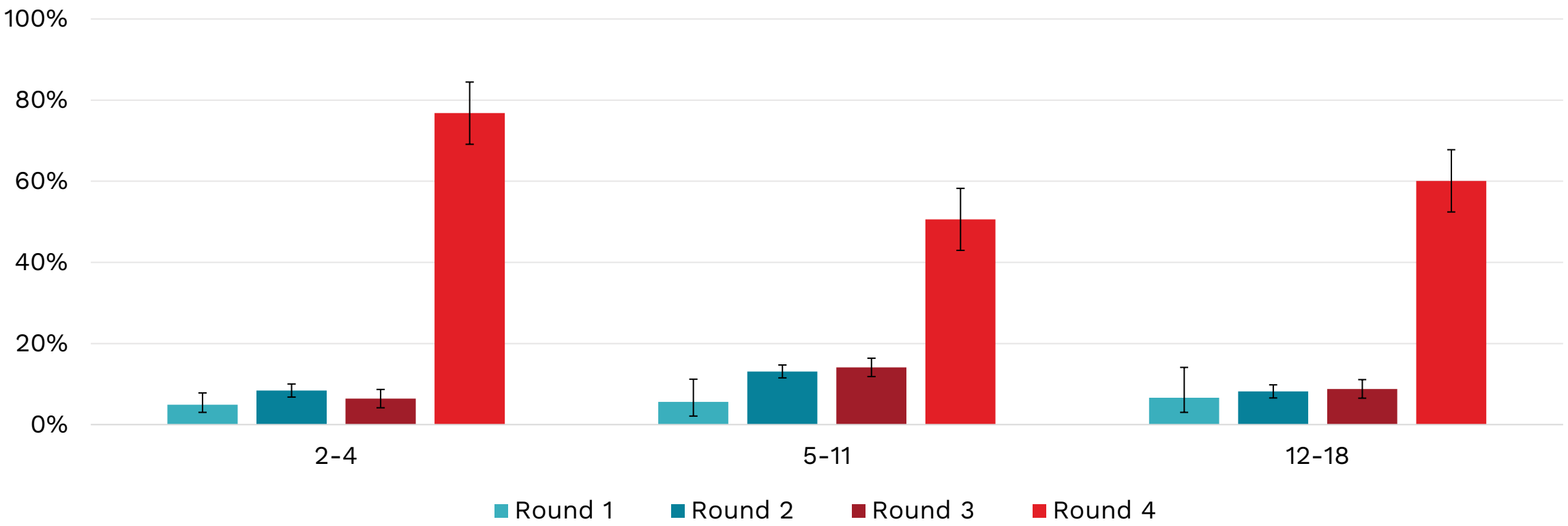
		Round 1 n (%)	Round 2 n (%)	Round 3 n (%)	Round 4 n (%)
Total		1632	936	723	726
Sex	**Female**	801 (49.1)	449 (48.0)	342 (47.3)	359 (49.4)
	Male	831 (50.9)	487 (52.0)	381 (52.7)	367 (50.6)
Age, years	**2-4**	329 (20.2)	151 (16.1)	89 (12.3)	105 (14.5)
	5-11	727 (44.5)	448 (47.9)	346 (47.9)	324 (44.6)
	12-18	576 (35.3)	337 (36.0)	288 (39.8)	297 (40.9)
Parental respondent's race and ethnicity	**Racial or ethnic minority**	201 (12.3)	110 (11.8)	76 (10.5)	101 (13.9)
	White	1406 (86.2)	815 (87.1)	640 (88.5)	614 (84.6)
Annual household income	**< $100,000**	329 (20.2)	270 (28.8)	202 (27.9)	173 (23.8)
	≥ $100,000	686 (42.0)	585 (62.5)	401 (55.5)	440 (60.6)

Infection-acquired seroprevalence

- Increased over time, especially with emergence of Omicron
- Significantly higher for children whose parent identified as a racial/ethnic minority and coming from households with annual income <$100,000

	Seroprevalence % (95% CI)			
	Round 1	**Round 2**	**Round 3**	**Round 4**
Total	5.8 (4.8-7.1)	10.5 (8.6-12.7)	11.0 (8.8-13.5)	58.4 (54.7-62.1)
Parental respondent's race and ethnicity [R1, R2, R4]				
Racial or ethnic minority	10.9 (7.3-16.1)	18.8 (12.3-27.7)	13.8 (7.5-24.0)	74.9 (65.3-82.6)
White	5.2 (4.1-6.5)	9.4 (7.5-11.7)	10.4 (8.2-13.1)	55.7 (51.6-59.7)
Annual household income [R1, R2, R4]				
< $100,000	11.9 (8.8-15.8)	14.9 (10.9-19.9)	12.8 (8.6-18.6)	68.9 (61.3-75.6)
≥ $100,000	5.8 (4.3-7.9)	8.3 (6.3-10.9)	10.3 (7.6-13.8)	57.3 (52.5-61.9)

Infection-acquired seroprevalence increased in children and teens, especially in 2- to 4-year-olds, with the emergence of Omicron



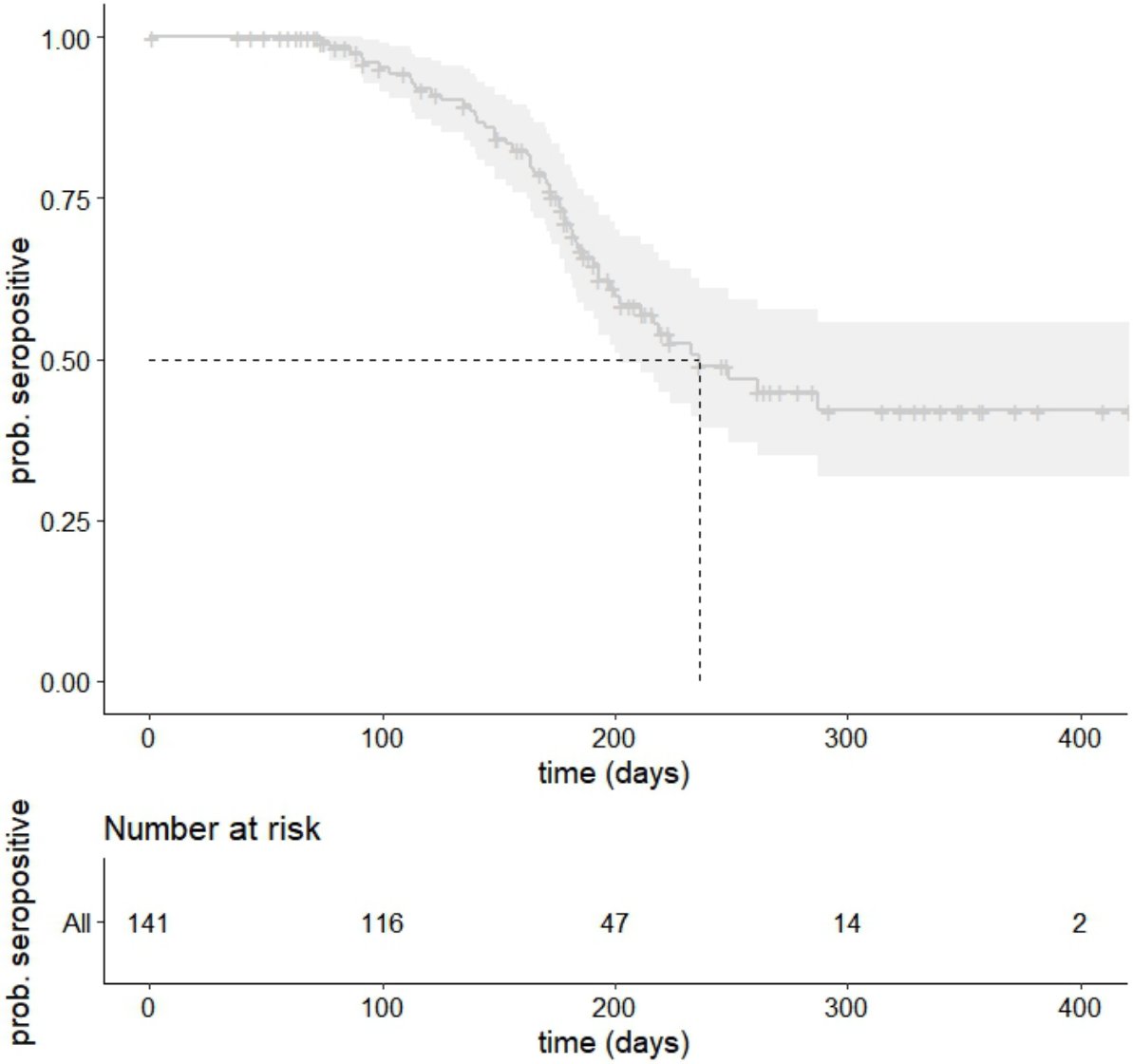
9 to 12 times more children and teens developed infection-acquired antibodies in the Omicron era

		Crude seroconversion rate per 100 person-years (95% CI)	Relative risk (95% CI)
Overall		138.9 (121.0-156.8)	
Sex	**Male**	118.8 (96.7-140.9)	Ref
	Female	150.3 (123.4-177.2)	1.3 (1.0-1.6)
Age, years	**2-4**	184.4 (121.5-247.3)	1.4 (1.0-1.8)
	5-11	115.2 (91.1-139.2)	0.8 (0.6-0.9)
	12-18	139.2 (113.2-165.3)	Ref
Parental respondent's race and ethnicity	**White**	127.3 (109.4-145.2)	Ref
	Racial or ethnic minority	179.3 (118.2-240.5)	1.4 (1.1-1.9)
Vaccinated prior to sample collection	**No**	211.7 (154.1-269.2)	Ref
	Yes	120.4 (102.7-138.0)	0.4 (0.3-0.6)

The median time to seroreversion of infection-acquired SARS-CoV-2 in the pre-Omicron era was estimated at about 8 months

Likelihood of remaining seropositive for infection-acquired SARS-CoV-2 (95% CI)

At six months	At twelve months
68% (60-77%)	42% (32-56%)



Conclusions

- Infection-acquired seroprevalence has risen from **5.8% to 58.4%,** reflecting the evolving pandemic.
- After the emergence of Omicron, the seroconversion rate (the rate of becoming seropositive for SARS-CoV-2 infection) was **9 to 12 times higher** than in the previous rounds of data collection.
- Before Omicron, the median time to seroreversion was about **8 months**. Further study data will explore antibody waning, reinfection, and hybrid immunity.

Acknowledgements

Children and parents of EnCORE, daycares, schools, and school boards

ÉTUDE encore STUDY

Katia Charland

Laura Pierce

Adrien Saucier

Islem Cheriet

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Co-Investigators

Britt McKinnon

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Marie-Ève Hamelin

Cat-Tuong Nguyen

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Québec
Direction régionale de santé publique

INSPQ
INSTITUT NATIONAL DE SANTÉ PUBLIQUE DU QUÉBEC

Observatory for Children's Education and Health

COVID-19 IMMUNITY TASK FORCE
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Hôpital de Montréal pour enfants
Centre universitaire de santé McGill
Montreal Children's Hospital
McGill University Health Centre

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Centre de recherche en santé publique

CHU Sainte-Justine
Le centre hospitalier universitaire mère-enfant
Université de Montréal

COVID-19 in Canada's pediatric emergency departments

On behalf of

perc
Pediatric Emergency Research Canada

Dr. Stephen Freedman

Professor of Pediatrics & Emergency Medicine
Cumming School of Medicine
University of Calgary

UNIVERSITY OF CALGARY

Objectives

To share the **breadth of pediatric COVID-19 research** done by the Pediatric Emergency Research Canada (PERC) Network

perc
Pediatric Emergency Research Canada

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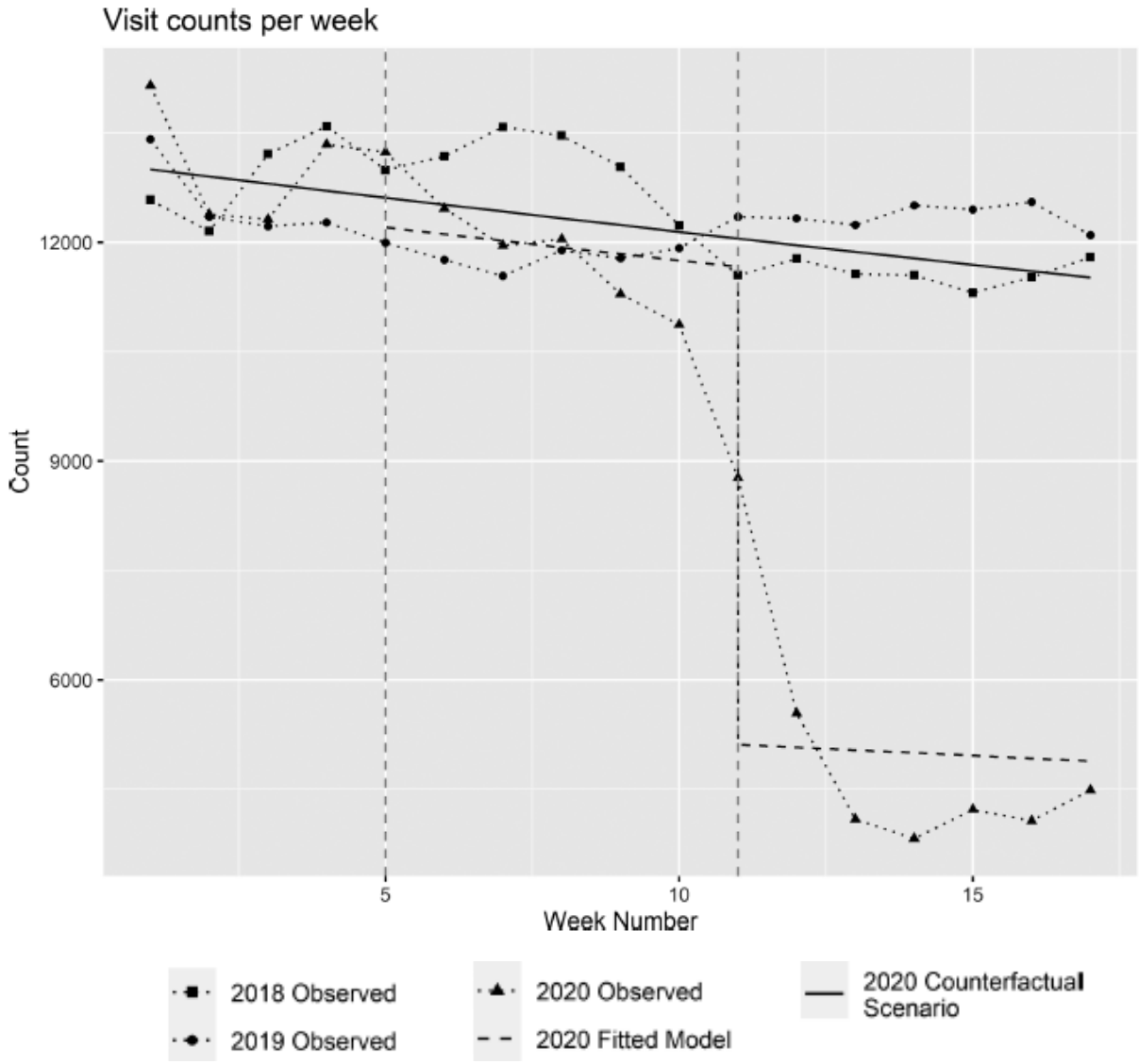
After declaration of COVID-19 pandemic, dramatic reductions in pediatric ED visits occurred across Canada

- Interrupted-time-series observational study
- 11 Canadian pediatric EDs
- Evaluated 3 time periods & compared to 2 preceding calendar years
  - Prepandemic (Jan 1, 2018 – Jan 27, 2020)
  - Peripandemic (Jan 28, 2020 – Mar 10, 2020)
  - Early Pandemic (Mar 11, 2020 – Apr 30, 2020)

Finkelstein. *Pediatr Emerg Care*. 2021



perc Pediatric Emergency Research Canada

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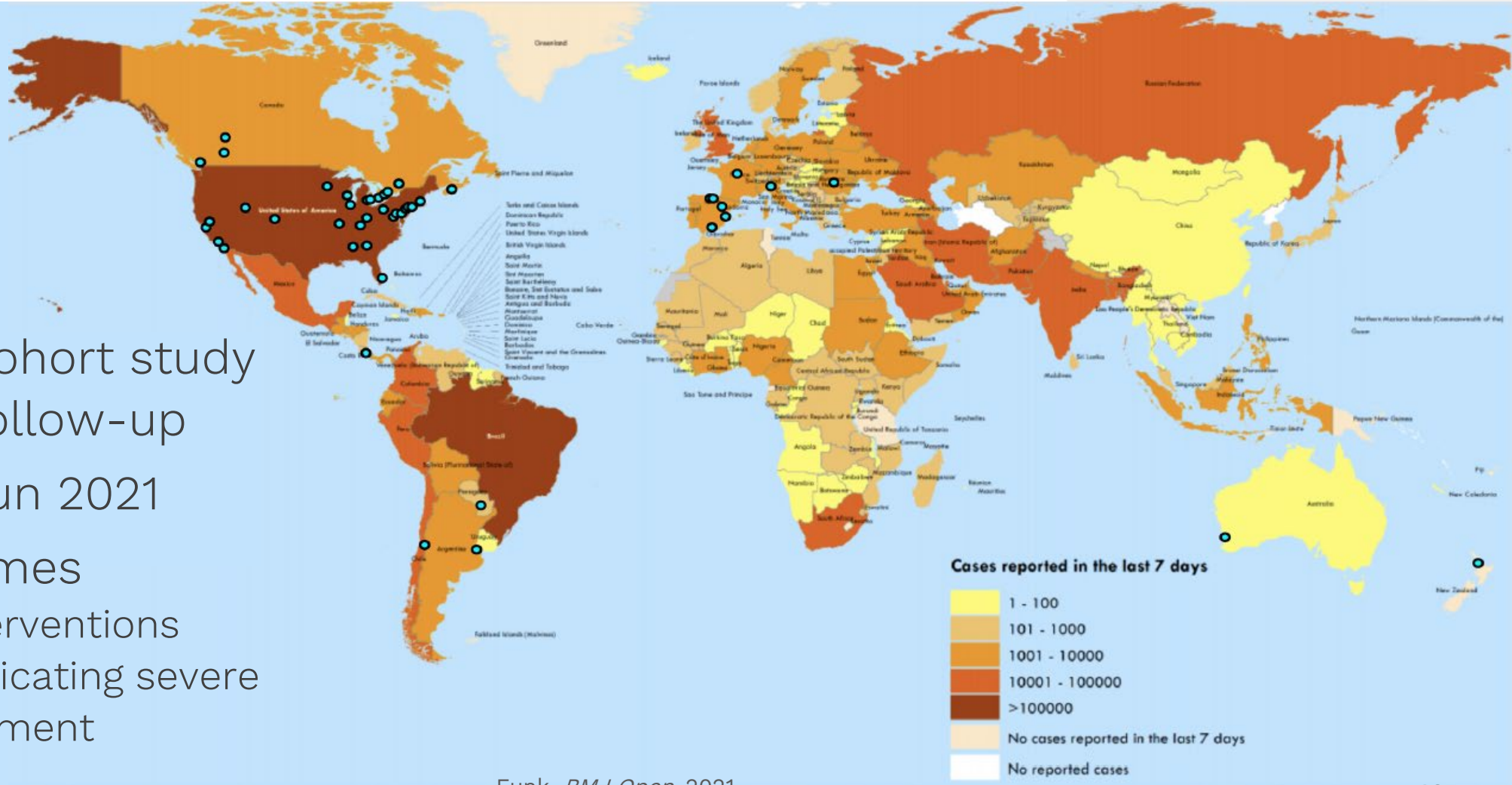
Outcomes of SARS-CoV-2 positive children in 41 EDs across 10 countries

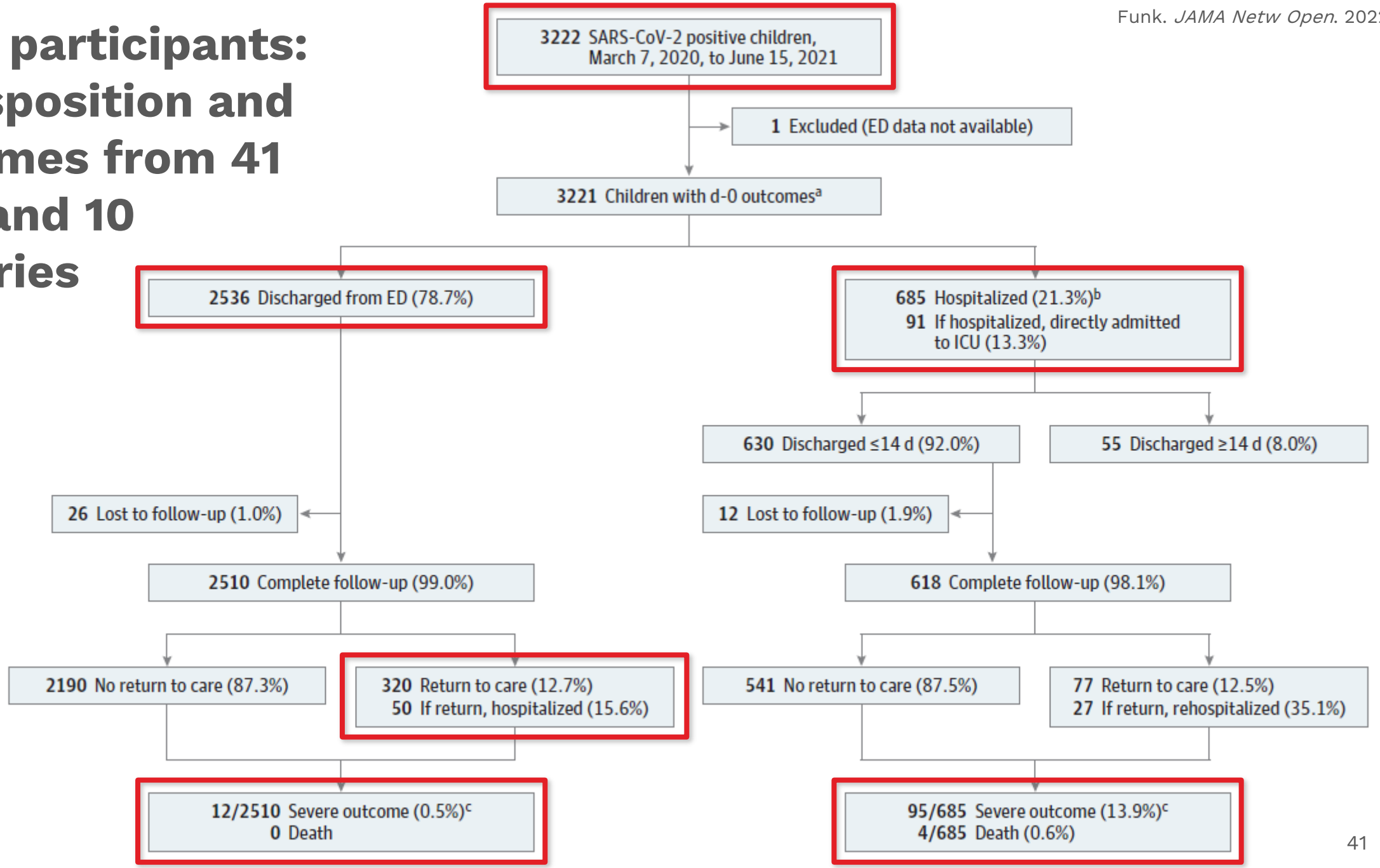
- Prospective cohort study with 14-day follow-up
- Mar 2020 – Jun 2021
- Severe outcomes
  - Intensive interventions
  - Diagnosis indicating severe
  - Organ impairment
  - Death



Funk. *BMJ Open*. 2021

Study participants: ED disposition and outcomes from 41 sites and 10 countries

Funk. *JAMA Netw Open*. 2022



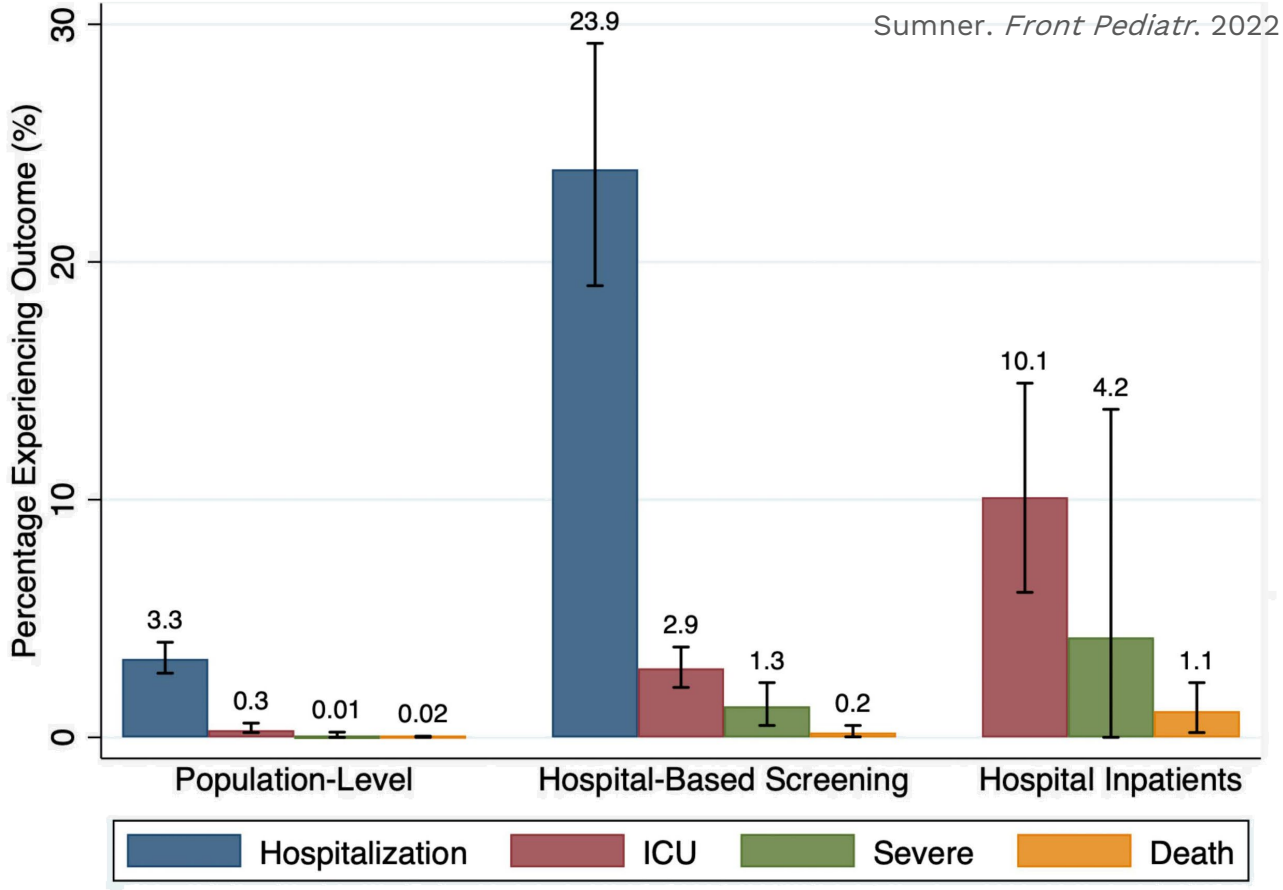
Risk factors such as **age, underlying chronic illness, and symptom duration** are associated with **severe outcomes** among SARS-CoV-2-positive youth tested in pediatric EDs

Funk. *JAMA Netw Open*. 2022

	Participants, No./Total No.	aOR (95% CI)	*P* value
Country[c]			
Canada	2/529	0.11 (0.05-0.23)	<.001
Costa Rica	19/420	1.76 (1.05-2.96)	.03
Paraguay	2/35	1.43 (0.78-2.61)	.25
Spain	3/152	0.51 (0.27-0.98)	.05
United States	81/2005	[Reference]	[Reference]
Sex			
Female	46/1448	[Reference]	[Reference]
Male	61/1586	1.32 (0.83-2.12)	.24
Age category, y			
<1	14/806	[Reference]	[Reference]
1 to <2	8/416	1.00 (0.47-2.13)	>.99
2 to <5	19/537	1.66 (0.95-2.90)	.07
5 to <10	20/553	1.60 (1.09-2.34)	.02
10 to <18	46/829	2.39 (1.38-4.14)	.002
Chronic condition			
No	72/2664	[Reference]	[Reference]
Yes	35/477	2.34 (1.59-3.44)	<.001
Previous pneumonia			
No	84/2921	[Reference]	[Reference]
Yes	23/220	3.15 (1.83-5.42)	<.001
Asthma			
No	89/2727	[Reference]	[Reference]
Yes	18/414	0.65 (0.39-1.08)	.10
Symptom duration before testing, d			
Asymptomatic	9/156	2.31 (0.81-6.59)	.12
0-3	31/1369	[Reference]	[Reference]
4-7	35/702	2.22 (1.29-3.82)	.004
≥8	11/16	2.13 (0.86-5.28)	.10
Unknown	21/698	1.44 (0.84-2.45)	.18
Date of index ED visit			
Mar-May 2020	14/204	1.87 (0.63-5.51)	.26
Jun-Aug 2020	29/790	[Reference]	[Reference]
Sep-Nov 2020	27/733	0.90 (0.53-1.53)	.69
Dec 2020-Feb 2021	25/701	1.02 (0.43-2.42)	.97
Mar 2021-Jun 2021	12/606	0.75 (0.37-1.48)	.40

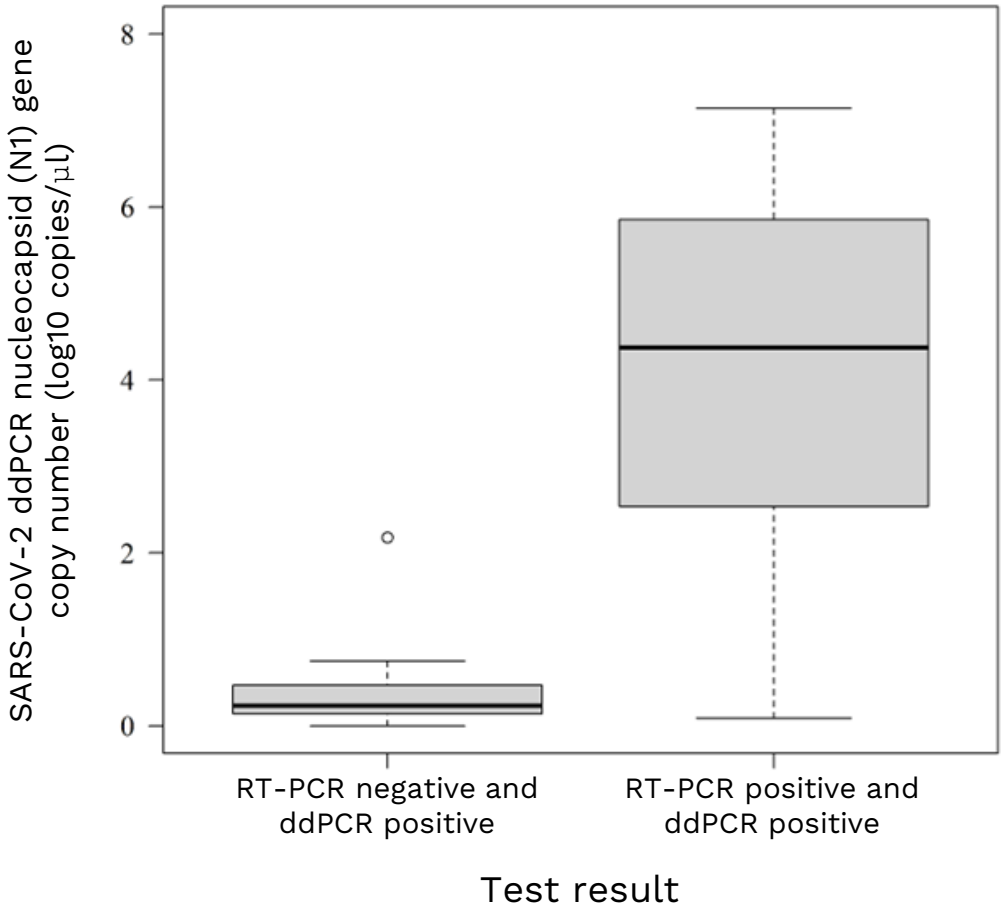
Among SARS-CoV-2 positive children tested in outpatient settings prior to Omicron, only 3% were hospitalized

- Objective
  - To estimate the proportion of SARS-CoV-2 infected children experiencing hospitalization, ICU admission, severe outcomes, and death
- Design
  - Systematic review
- Results
  - Included 118 studies (December 1, 2019 and May 28, 2021)
  - 3,324,851 SARS-CoV-2 positive children



RT-PCR sensitivity is sub-optimal at low SARS-CoV-2 viral loads

- Digital droplet PCR (ddPCR)
  - Potentially more sensitive approach to identify SARS-CoV-2 infection
- Compared RT-PCR to ddPCR
  - RT-PCR: Sensitivity: 84% (95% CI: 74, 91)
  - ddPCR: 97% (95% CI: 89, 99)
- Concordant positive specimens had higher median gene copy number



Freedman. *Pediatr Infect Dis J*. 2022

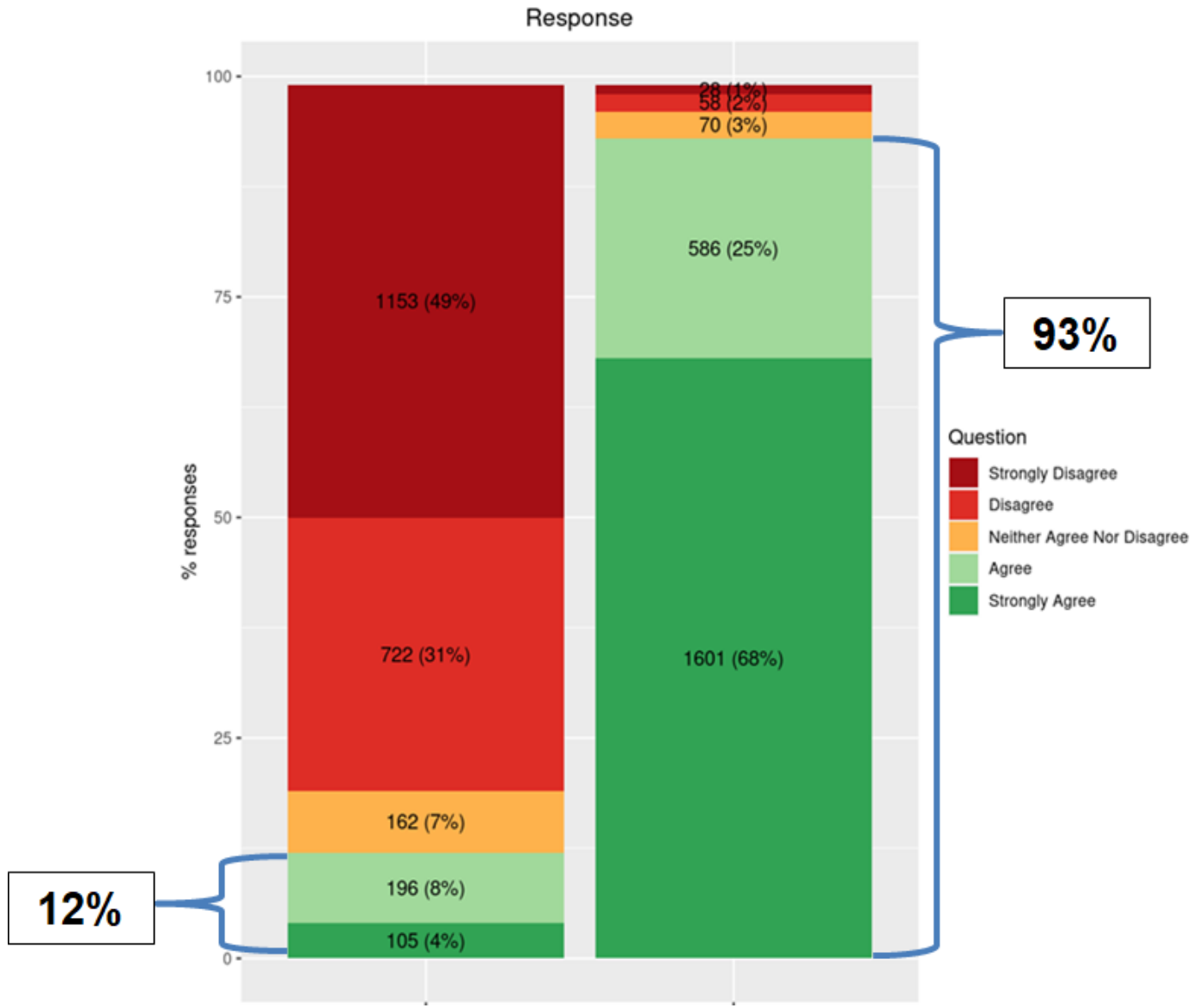
Sensitivity of point-of–care, self-buccal swabs is sub-optimal

- Objective
  - Evaluate sensitivity of buccal swab testing using Abbott ID NOW
- 2,882 children in 15 Canadian pediatric EDs
- All had caregiver/self-performed buccal swab and NP swab
  - Tested with lab-based PCR and ED-based point-of-care PCR

	Percent (95% CI)
Sensitivity	58% (53, 63)
Specificity	99% (99, 100)
Positive predictive value	94% (90, 96)
Negative predictive value	94% (93, 94)
Accuracy	94% (93, 95)

But the buccal swab was less painful!

- The COVID-19 swab was associated with minimal pain and discomfort for my child:



Post-COVID condition is only minimally more frequent among SARS-CoV-2 infected children

- Objective
  - To estimate the proportion of test-positive children with PCC at 90 days
- 1,884 SARS-CoV-2 positive children with 90-day follow-up
  - 1,701 negative controls
- 5.8% (95% CI: 4.8, 7.0) had PCC
  - 9.8% (95% CI: 7.4, 13.0) among those hospitalized
- Compared to test-negative children
  - Difference: 1.6% (95% CI: 0.2, 3.0)

Funk. *JAMA Netw Open*. 2022

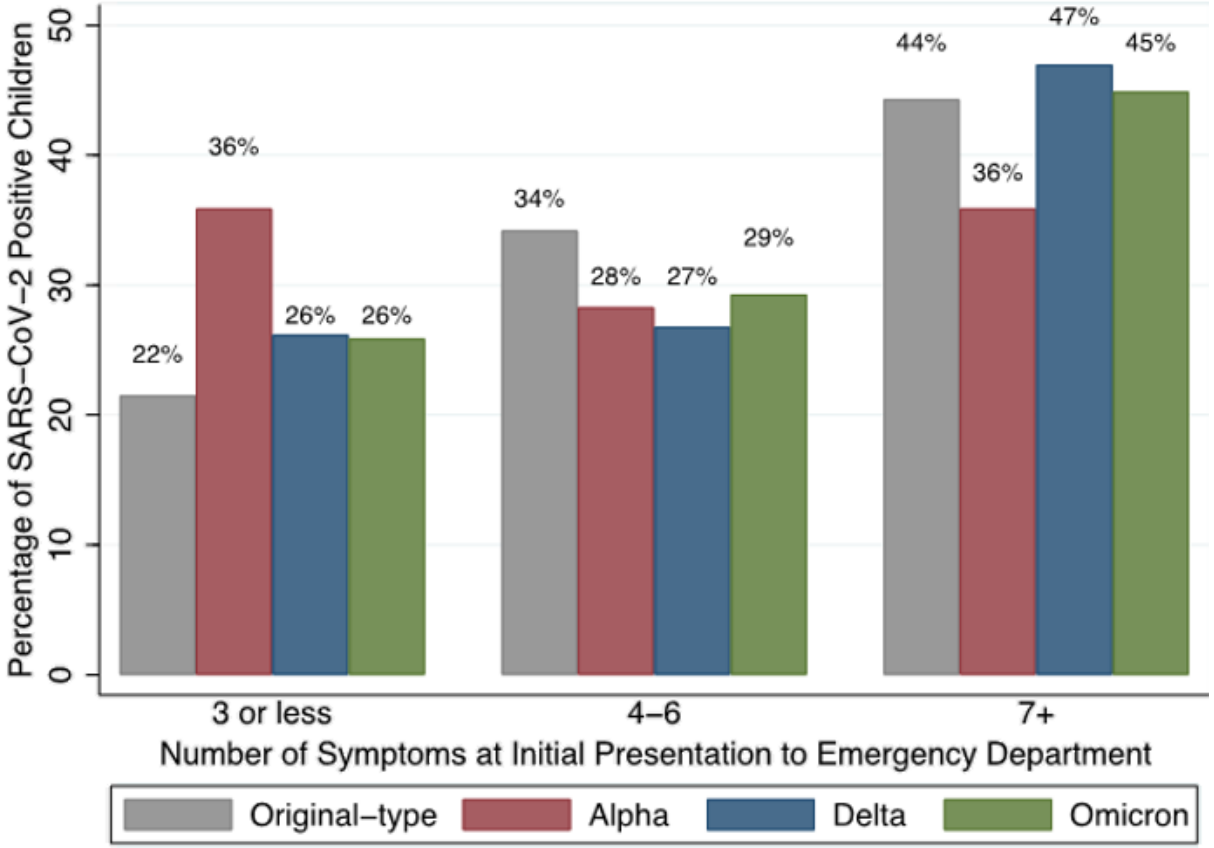
Age, number of symptoms and hospitalization were associated with **reporting PCC**

Multiple logistic regression model

Factor	No./total No.	aOR (95% CI)	*P* value
Region			
United States	79/1200	1 [Reference]	NA
Costa Rica	10/329	0.70 (0.33-1.46)	.34
Canada	16/170	1.61 (0.87-2.98)	.13
Spain	3/133	0.60 (0.18-2.01)	.41
Other[b]	0/43	Excluded	NA
Sex			
Male	51/987	1 [Reference]	NA
Female	57/888	1.38 (0.92-2.08)	.12
Age, y			
<1.0	19/488	1 [Reference]	NA
1.0 to <2.0	7/231	0.84 (0.34-2.06)	.71
2.0 to <5.0	9/291	0.84 (0.37-1.92)	.68
5.0 to <10.0	19/364	1.40 (0.71-2.75)	.33
10.0 to <14.0	20/238	1.91 (0.97-3.76)	.06
14.0 to <18.0	34/263	2.67 (1.43-4.99)	.002
Chronic condition (other than asthma)			
No	85 1065	1 [Reference]	NA
Yes	23/269	1.04 (0.62-1.76)	.88
No. of symptoms at ED presentation			
Asymptomatic	4/111	1.35 (0.44-4.19)	.60
1-3	17/752	1 [Reference]	NA
4-6	34/624	2.35 (1.28-4.31)	.006
≥7	55/388	4.59 (2.50-8.44)	<.001
Hospitalized for acute illness			
No	66/1437	1 [Reference]	NA
Yes, <48 h	10/148	2.07 (0.99-4.32)	.05
Yes, ≥48 h	32/290	2.67 (1.63-4.38)	<.001
Season of infection			
Spring 2020 (Mar-May)	6/186	0.47 (0.19-1.18)	.11
Summer 2020 (Jun-Aug)	30/696	1 [Reference]	NA
Fall 2020 (Sep-Nov)	41/616	1.25 (0.74-2.09)	.41
Winter 2020-2021 (Dec-Jan)	31/377	1.22 (0.69-2.14)	.50

Children infected with Delta and Omicron variants have more symptoms

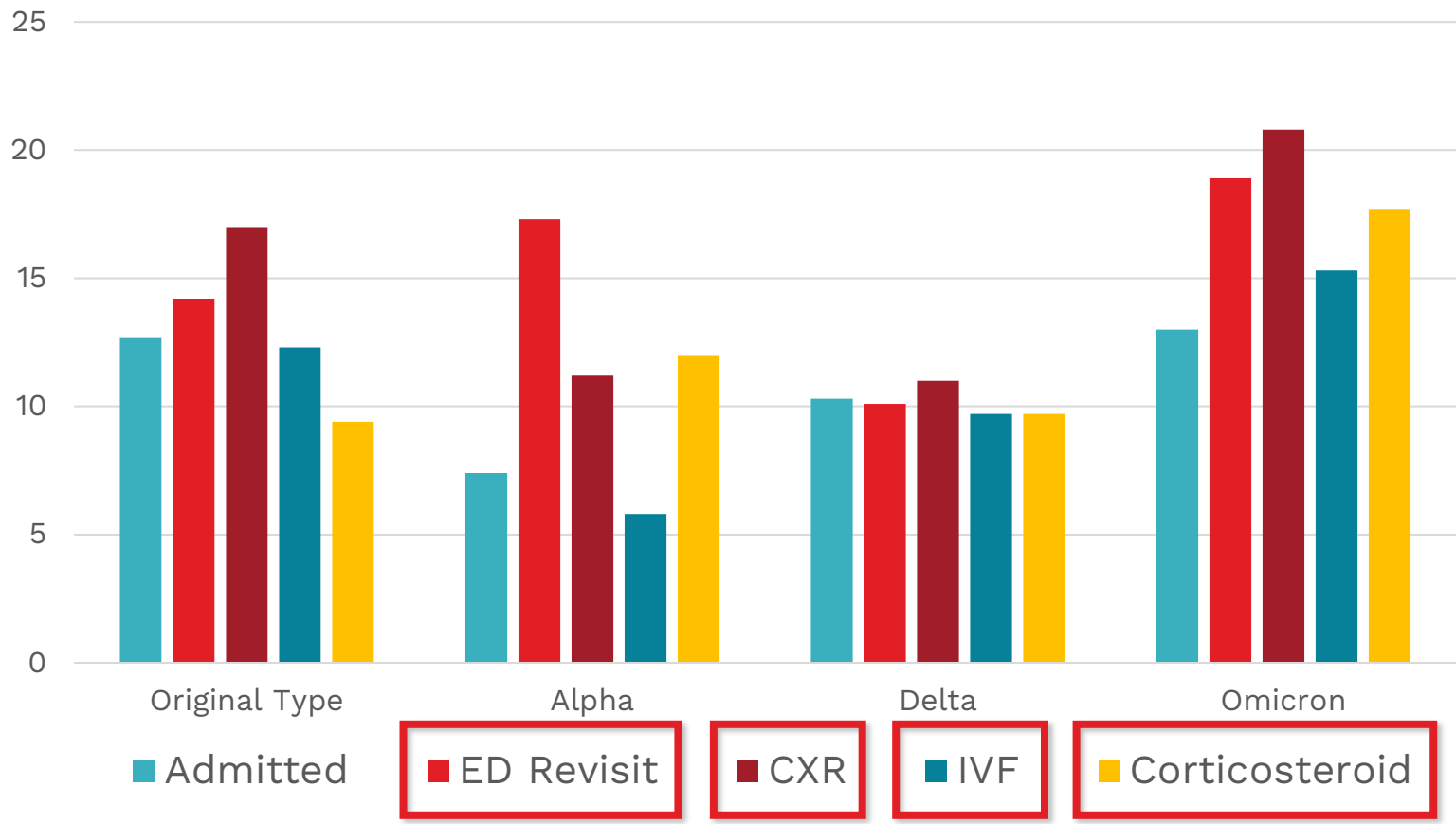
- Objective
  - To compare symptoms & health care resource use between VoC
- 1,440 SARS-CoV-2 positive children with 14-day follow-up
  - 14 Canadian pediatric EDs
- Alpha had fewer symptoms than other VoCs



Sumner. *JAMA Netw Open*. 2022

Omicron-infected children were more likely to undergo testing, receive treatment and revisit the ED

Outcome	P Value
Admit	0.23
ED Revisit	0.04
CXR	0.004
IVF	0.01
Steroids	<0.001



Conclusions

- Pediatric prospective ED-based multi-centre research has shed light on COVID-19 in children
  - Impact of the pandemic in ED visits
  - Predictors of severe outcomes
  - Frequency of severe outcomes
  - Sensitivity of RT-PCR
  - Post-COVID Condition
  - Variants of Concern

Thank you to our amazing study team!

- Pediatric Emergency Research Canada (PERC) network
- National coordinators
- Site investigators & coordinators
- Participants and their families

Thank you to our funders!

Health Canada Santé Canada

CIHR IRSC

Public Health Agency of Canada Agence de la santé publique du Canada

Alberta Children's Hospital Research Institute

COVID-19 IMMUNITY TASK FORCE GROUPE DE TRAVAIL SUR L'IMMUNITÉ FACE À LA COVID-19

Alberta Children's Hospital Foundation

Alberta Childhood COVID-19 Cohort (**AB3C**) Study

Longitudinal study with 1035 children and youth <18 years, Calgary, AB

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Alberta Health Services

I would like to acknowledge the traditional territories of the people of the Treaty 7 region in Southern Alberta, which includes the Blackfoot Confederacy (comprising the Siksika, Piikani, and Kainai First Nations), as well as the Tsuut'ina First Nation, and the Stoney Nakoda (including the Chiniki, Bearspaw, and Wesley First Nations). The City of Calgary is also home to Métis Nation of Alberta, Region 3.

Disclaimer

RESEARCH GRANTS AND CLINICAL TRIALS

All funding paid to U of Calgary to support research operations, no funding to investigator

- Granting agencies: CIHR, PHAC, Genome Alberta, Alberta Children's Hospital Foundation
- Pharmaceutical companies: Moderna (COVID-19 vaccine clinical trial), Pfizer (pneumococcal surveillance grant), Merck (pneumococcal vaccine clinical trial), GSK (rotavirus & meningococcous vaccine clinical trials)

OTHER INFLUENTIAL AFFILIATIONS

- COVID-19 Immunity Task Force: Leadership Group member, Co-Chair Field Studies Working Party, Pediatric Network Lead
- Member, Alberta Advisory Committee on Immunizations
- Principal Investigator, Alberta Childhood COVID-19 Cohort (AB3C) Study

AB3C study objectives and procedures

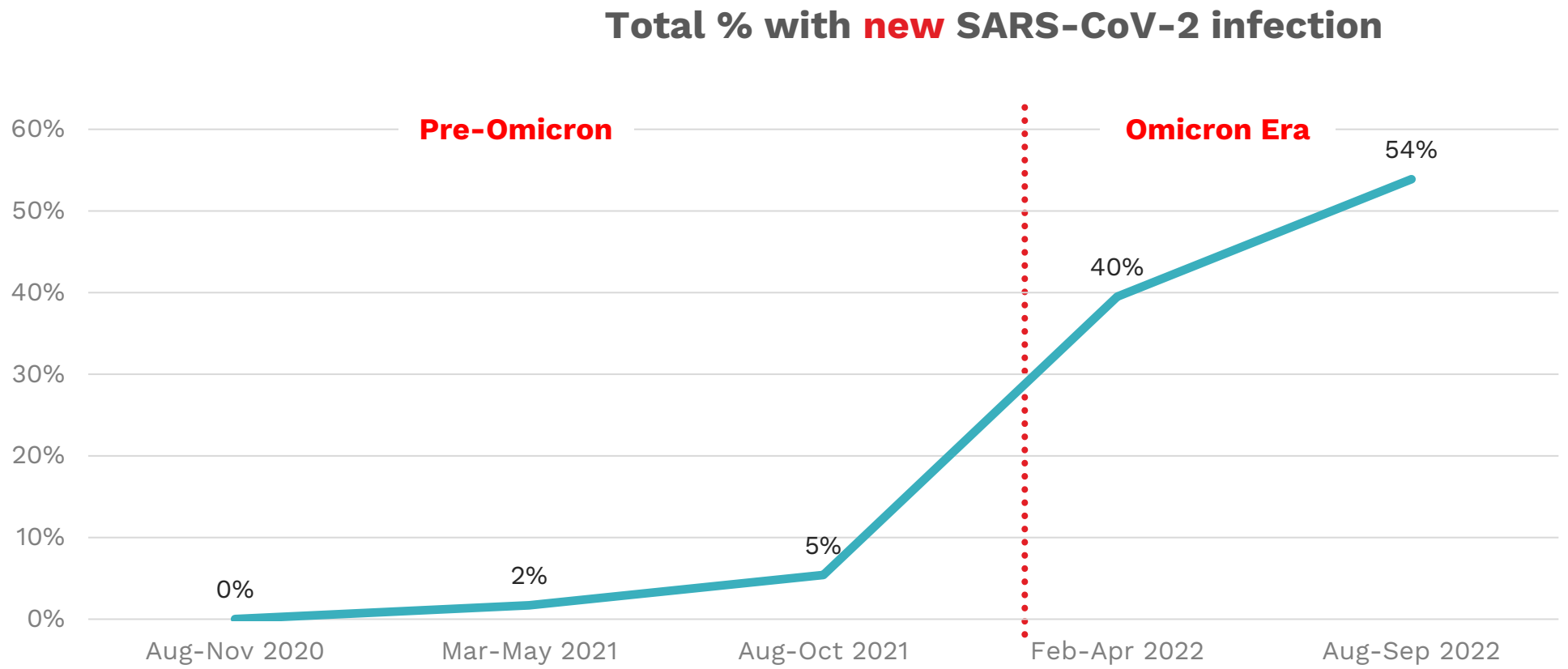
Objectives

- Measure SARS-CoV-2 infections
- Measure seropositivity over time
- Survey COVID-19 vaccination attitudes, beliefs and behaviours

Study procedures

- 1035 children and youth <18 years enrolled summer 2020
  - 118 with prior COVID-19, 917 without prior infection
- 5 visits to Alberta Children's Hospital ~6-monthly, to September 2022
- At each visit
  - Venous blood collection for antibody tests
  - Survey
  - Review of laboratory data and vaccination registry
- 89% of participants completed 4 or 5 visits

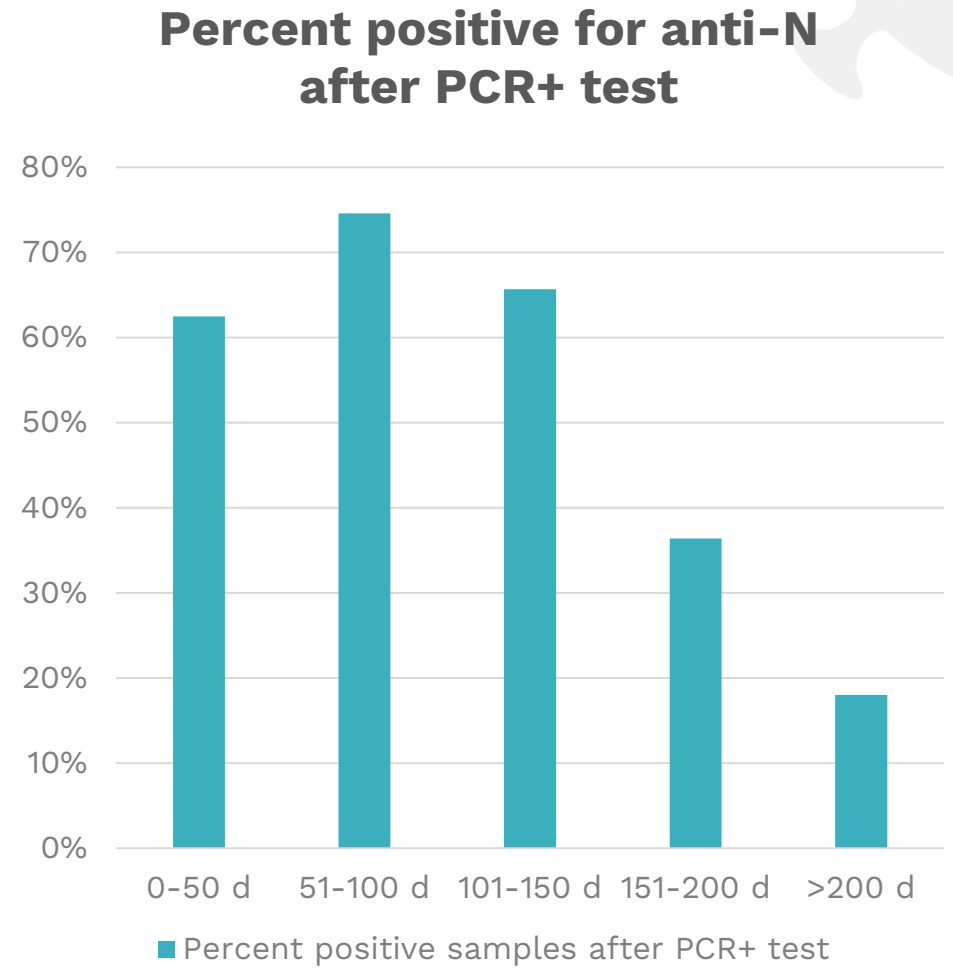
Very few children got SARS-CoV-2 infections before Omicron, then many did



7% had **reinfections** during study

Nucleocapsid antibodies decline after 5 months

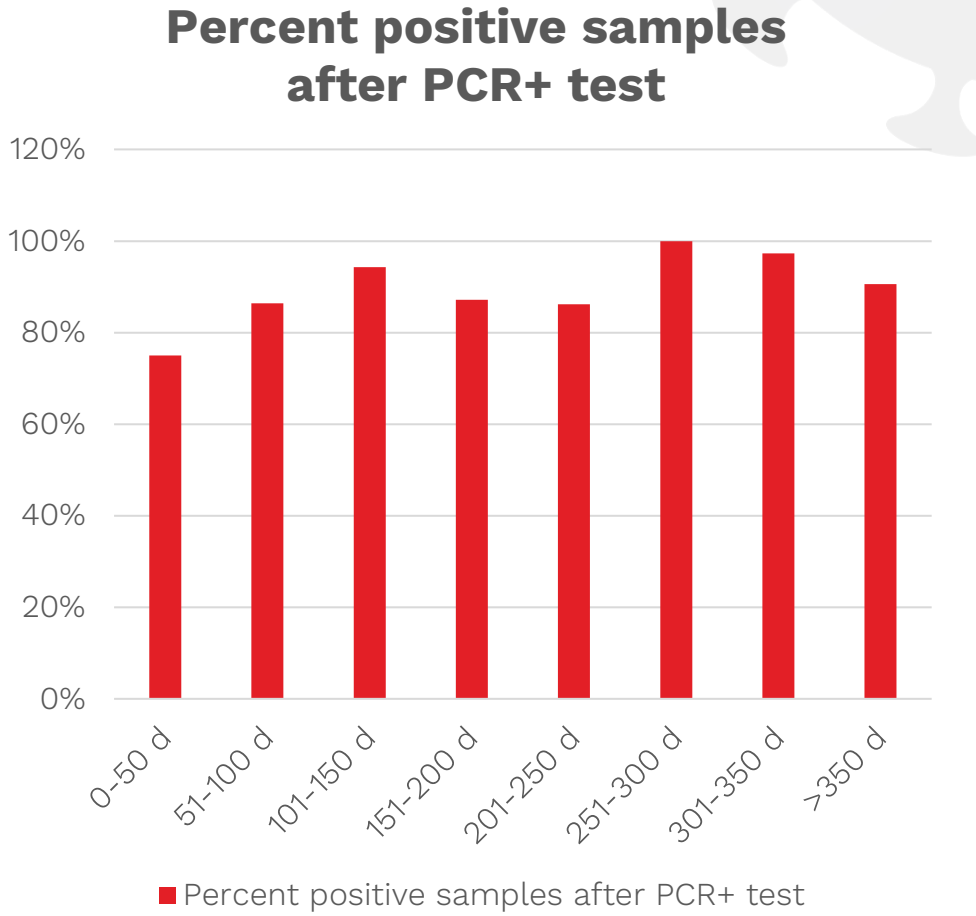
- Nucleocapsid antibodies (anti-N) are formed after SARS-CoV-2 infection but **not** after vaccination
- Don’t always develop, fewer positive after 5 months
- A few still had anti-N 2.5 years after infection



Abbott ARCHITECT assay used to detect IgG antibodies to nucleocapsid antigen from SARS-CoV-2 virus

Spike antibodies persist indefinitely in most so far

- Spike antibodies (anti-S) are formed after SARS-CoV-2 infection **and** after vaccination
- Almost always initially positive after infection or vaccination
- Some still had anti-S from 2.5 years after infection **and/or** vaccination



Abbott ARCHITECT assay used to detect IgG antibodies to receptor binding domain of S1 subunit of spike protein from SARS-CoV-2 virus

Vaccination most likely in older children and if no prior COVID-19

- COVID-19 vaccines for children:
  - May 2021: 12+ yrs
  - Nov 2021: 5-11 yrs
  - Jul 2022: 6 mos-4 yrs
- By Sept 2022, 88% of participants aged 5 y & older had 1+ doses (almost all had 2 doses)
  - 80% 5-11 yrs
  - 94% 12-18 yrs

Factors associated with receiving COVID-19 vaccination*

Multivariate analysis factors	Likelihood of vaccination (odds ratio)	Significance (P-value)
12-18 y *vs* 5-11 y	Higher – 4.9	P<0.001
Previous COVID-19 infection *vs* no previous infection	Lower – 0.1	P<0.001
2+ previous flu vaccines *vs* no previous flu vaccines	Higher – 9.7	P<0.001
Asian & other non-Black *vs* white	Higher – 6.3	P<0.003

* Non-significant factors: Black (vs white); income, underlying health conditions, BMI

Parental concerns about COVID-19 vaccines before vaccines were available

Concerns in Spring 2021 (before vaccines approved for children)	Vaccinated by Sept 2022 (n=758)	Not vaccinated by Sept 2022 (n=101)
Vaccine side effects (safety)	48%	69%
Not enough people have received vaccine	24%	54%
Vaccines developed too quickly	17%	46%
Important information not made public	12%	35%
Not necessary for my child	6%	27%
Not sure if vaccine works	11%	21%
No concerns	27%	8%

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Parental concerns about COVID-19 vaccines at end of study

Concerns	Not vaccinated concerns in Spring 2021	Not vaccinated concerns in Summer 2022
Not necessary for my child	27%	46%
Vaccine side effects (safety)	69%	45%
Already had COVID-19	Not asked in 2021	36%
Lack of research in children	Not asked in 2021	30%
Important information not made public	35%	26%
Not enough people have received vaccine	54%	21%
Vaccines developed too quickly	46%	21%
Not sure if vaccine works	21%	19%

Conclusions

- COVID-19 uncommon in children before Omicron wave starting in December 2021; then most children - but not all - had infections
- Anti-spike antibodies remain positive indefinitely (so far) in most children after vaccination +/- infection
- Anti-nucleocapsid antibodies decline a few months after infection
- Despite reasonable concerns about COVID-19 vaccines, most were vaccinated
  - The main factors associated with reduced likelihood of vaccination were prior COVID-19 infection (despite recommendations) and younger age

AB3C Study Team

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Contributions to conceptualization of the sero-epidemiology study:

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Alberta Health Services

Funding

Alberta Government

Alberta Children's Hospital Research Institute

GenomeAlberta

Questions?

You'll find our summary of this seminar at

covid19immunitytaskforce.ca

Thank you to all presenters & participants

After 17 seminars over the past two years,
this will have been our last one.

Thank you to all **66 researchers and experts** who
have participated in one or more of our seminars!

Thank you to the **thousands of people**
who have attended!

Discover us!

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