



COVID-19  
IMMUNITY  
TASK FORCE

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



CanCOVID

.....

Seminar Series | Research Results & Implications

# The importance of pediatric vaccination

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March 23, 2022 | 11:00 a.m. to 12:30 p.m. EDT

# Moderator

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**Tim Evans, MD, PhD**

Executive Director, COVID-19 Immunity Task Force



# CITF supports studies active across Canada

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# CITF: Priority areas of research



## SEROPREVALENCE STUDIES

Assess the extent of SARS-CoV-2 infection across Canada



## IMMUNE SCIENCE

Understand the nature of immunity arising from infection



## IMMUNE TESTING

Develop improved antibody testing methods



## VACCINE SURVEILLANCE

Help monitor the effectiveness and safety of vaccines



## BOOSTERS

Understand if and when different populations need booster shots



## PEDIATRIC VACCINATION

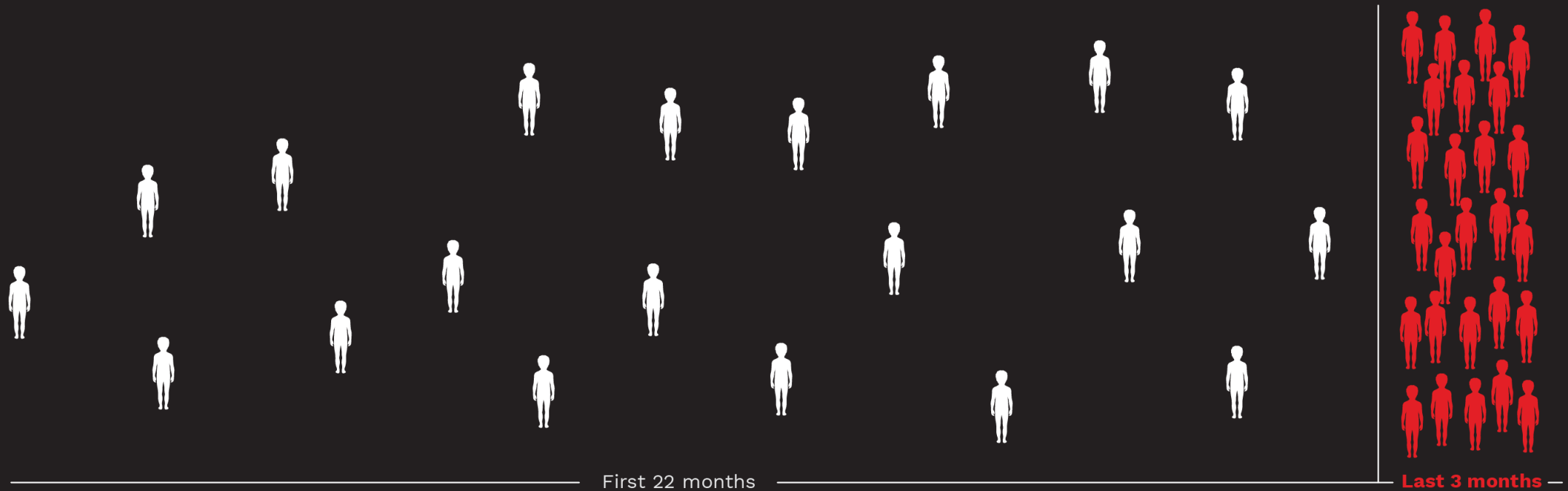
Research safety, effectiveness and immunogenicity of vaccines in children under 21



## IMMUNITY MODELLING

Model trends in overall immunity across Canada

# Omicron wave has resulted in a surge in pediatric hospitalizations



**56%** of COVID-related **pediatric hospitalizations** have occurred in the past **three months**, during the peak of the Omicron wave.

Despite the risks, pediatric vaccinations, which remain the best way of protecting children from COVID-19, remain low across Canada.

# Only 57%

of children between the ages of 5 and 11 have received at least one dose of the vaccine to date. In contrast, 88% of 12- to 17-year olds have received at least one dose.



# Speakers

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**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; PI, CITF-funded SPRING Study

**Jonathon Maguire, MD**, Professor, Department of Pediatrics, University of Toronto; Scientist, MAP Centre for Urban Health Solutions, Li Ka Shing Knowledge Institute; St. Michael's Hospital, Pediatrician, Department of Pediatrics, St. Michael's Hospital; Unity Health Toronto; PI, CITF-funded TARGetKids! Study

**Kate Zinszer, PhD**, Assistant Professor, l'École de santé publique, Université de Montréal; Researcher, Centre for Public Health Research (CReSP); PI, CITF-funded EnCORE Study

**Jim Kellner, MD**, Pediatric Infectious Diseases Specialist, Professor, Pediatrics, University of Calgary; Member, CITF Leadership Group, Leader, CITF Pediatric Network

MANISH SADARANGANI

# Disclosures

## Salary awards

BC Children's Hospital Foundation  
Michael Smith Foundation for Health Research  
Canadian Child Health Clinician Scientist Program

## Research/Project Funding

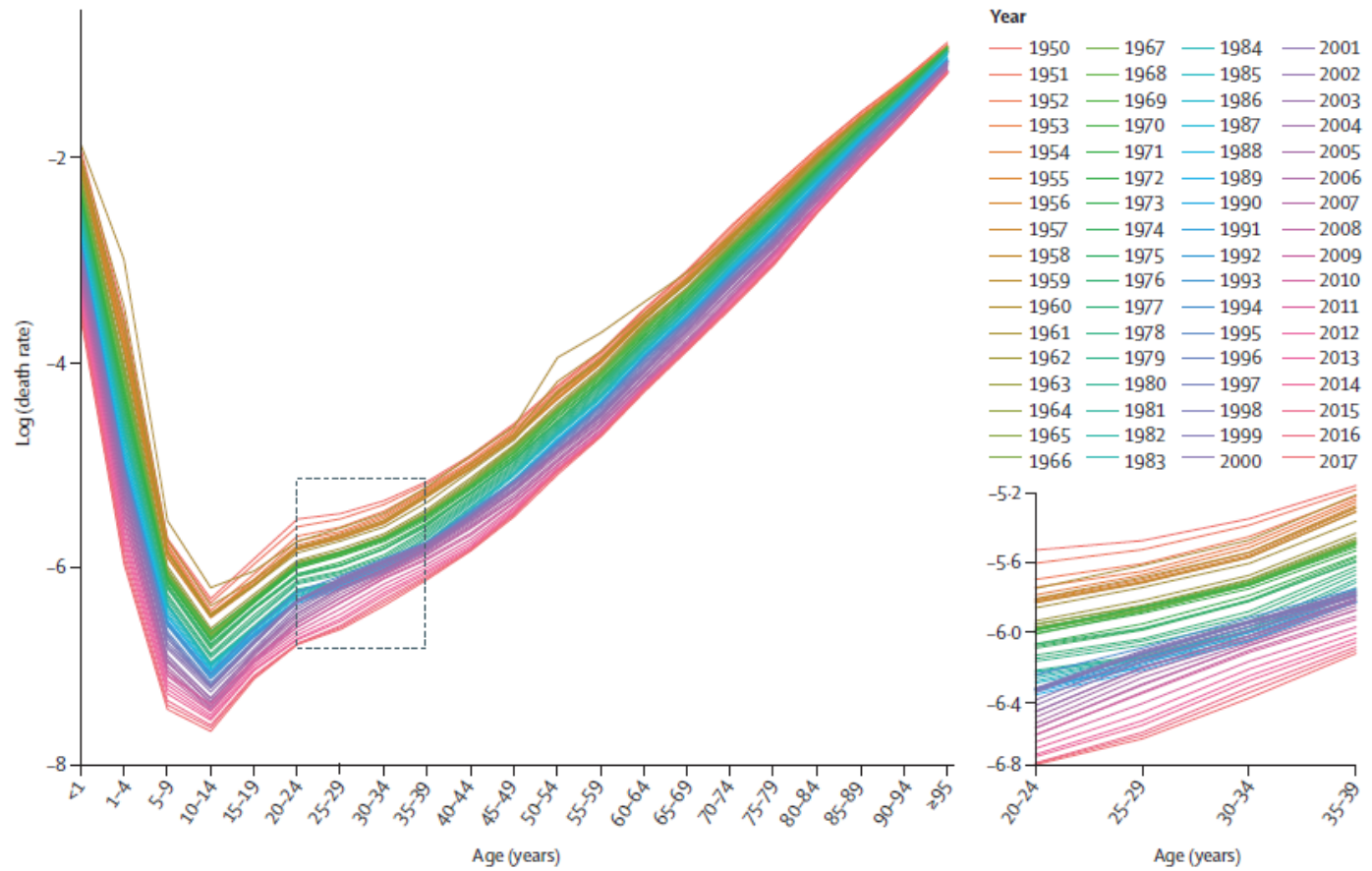
Merck, Moderna, VBI Vaccines, GlaxoSmithKline, Pfizer, Sanofi-Pasteur, Seqirus, Symvivo

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



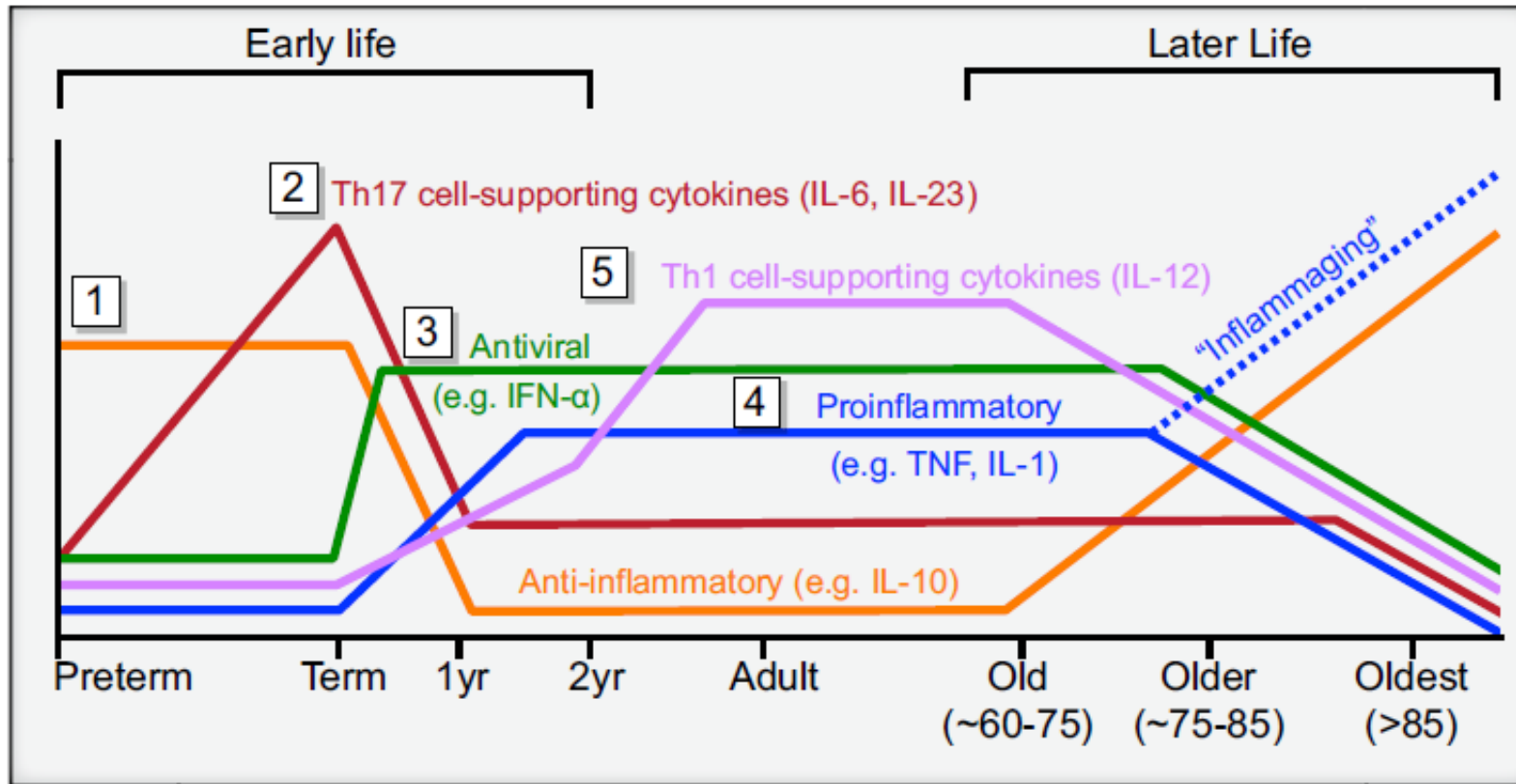
# Why are children important?



GBD Collaborators.  
*Lancet* 2018



# Different immunity → different interventions



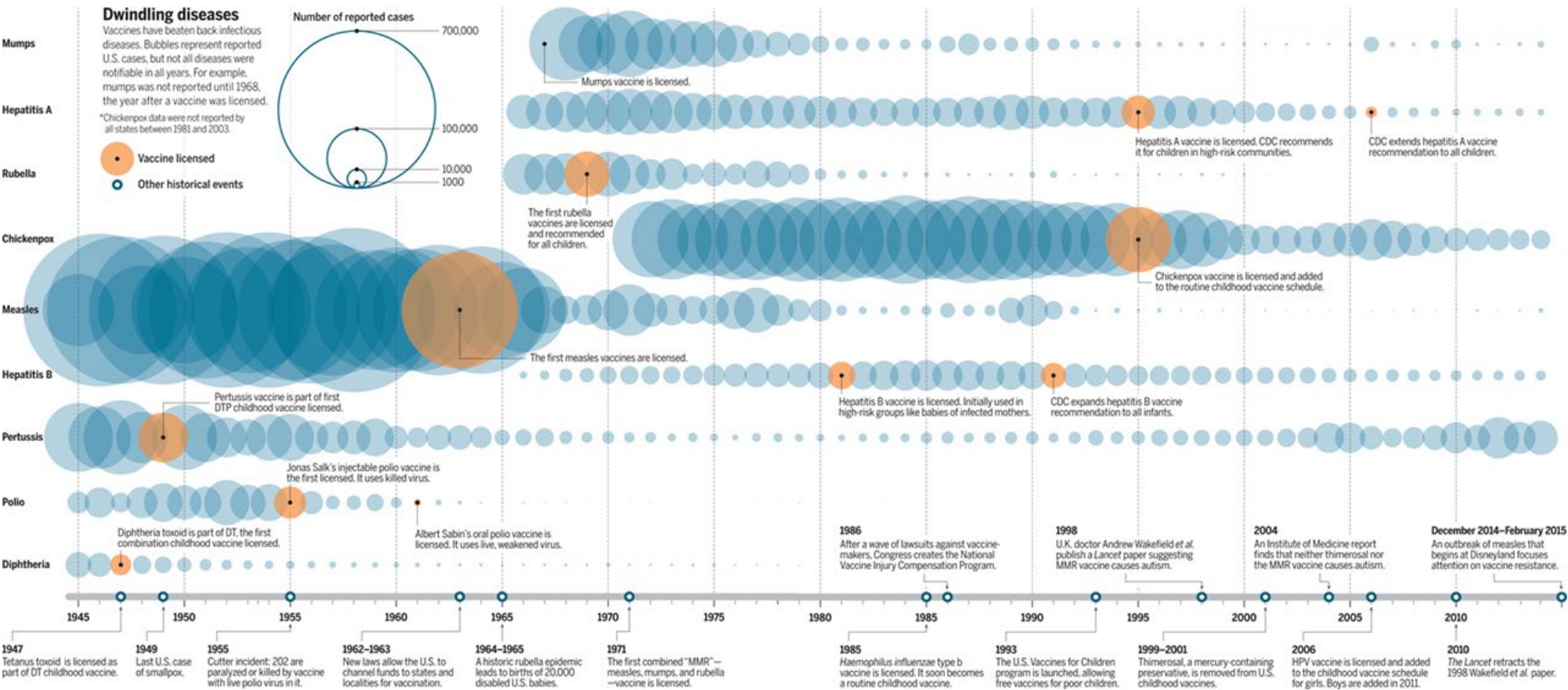
Kollmann et al.  
*Immunity* 2012

# Different immunity → different vaccines

But it's complicated... same vs. **lower** vs. **higher** doses may be required

Vaccine	<12 months	1-11 years	12-17 years	≥18 years
COVID-19	Not available	<b>2 lower doses (5-11y)</b>	2 doses	3 doses
Varicella (Chickenpox)	Not used	2 doses	2 doses	2 doses
Hepatitis B	3 doses	3 doses <b>(2 high doses in 11-15y)</b>	<b>3 high doses (≥20y)</b>	
Human papillomavirus	Not used	2 doses (9-14y)		<b>3 doses (≥15y)</b>
Inactivated influenza	<b>2 doses (≥6m)</b>	<b>2 doses (1-8y)</b>	1 dose (≥9y)	1 dose
Tetanus/Diphtheria/Pertussis	DTaP	DTaP (1-6y)	Tdap (7-17y)	Tdap

# The most effective health intervention?

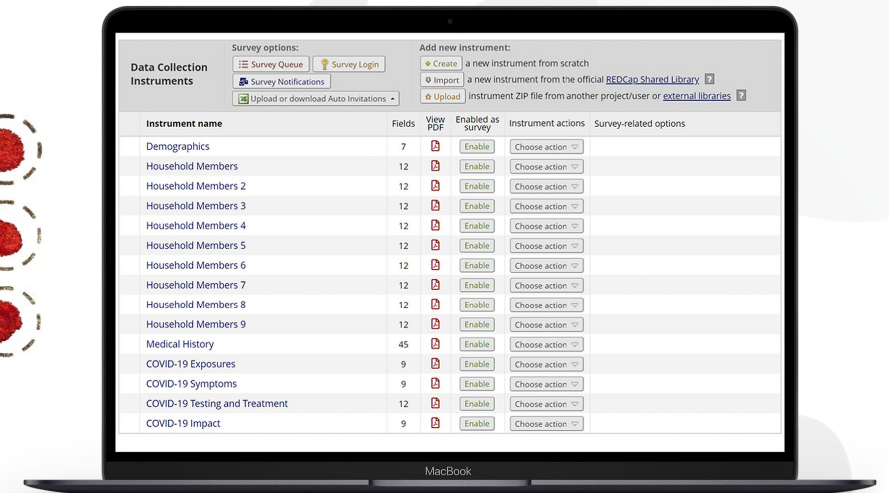


Wadman.  
*Science* 2017

# COVID-19 in children: The SPRING Study

Severe acute respiratory syndrome-Related coronavirus 2 prevalence in children and young adults in British Columbia: an observational study

- ▶ Cross-sectional snapshots of children/young adults in BC
- ▶ Longitudinal follow-up of COVID-19 positive cases
- ▶ Mostly healthy children
- ▶ Aim to be representative across BC in terms of geographic distribution, sex and ethnicity
- ▶ Inclusion: Age <25 years; Resident in BC
- ▶ Electronic COVID-19 Survey
- ▶ Samples: dried blood spots; MSD V-Plex pan-CoV panel



# COVID-19 infection in children

## Nov 2020 – May 2021

Age group	Total sample	% seropositive (95% CI)
0-4	347	3.17 (1.78, 5.59)
5-9	416	4.09 (2.57, 6.45)
10-14	463	3.24 (1.97, 5.28)
15-19	469	3.84 (2.44, 5.98)
20-24	471	7.22 (5.21, 9.92)

## Jun 2021 – Mar 2022

Age group	Total sample	% seropositive (95% CI)
0-4	399	7.65 (4.52, 12.64)
5-9	537	5.72 (3.84, 8.44)
10-14	416	Vaccinated
15-19	308	
20-24	380	

JONATHON MAGUIRE

# Disclaimer

I have no COIs to declare related to this study.





# TARGetKids!

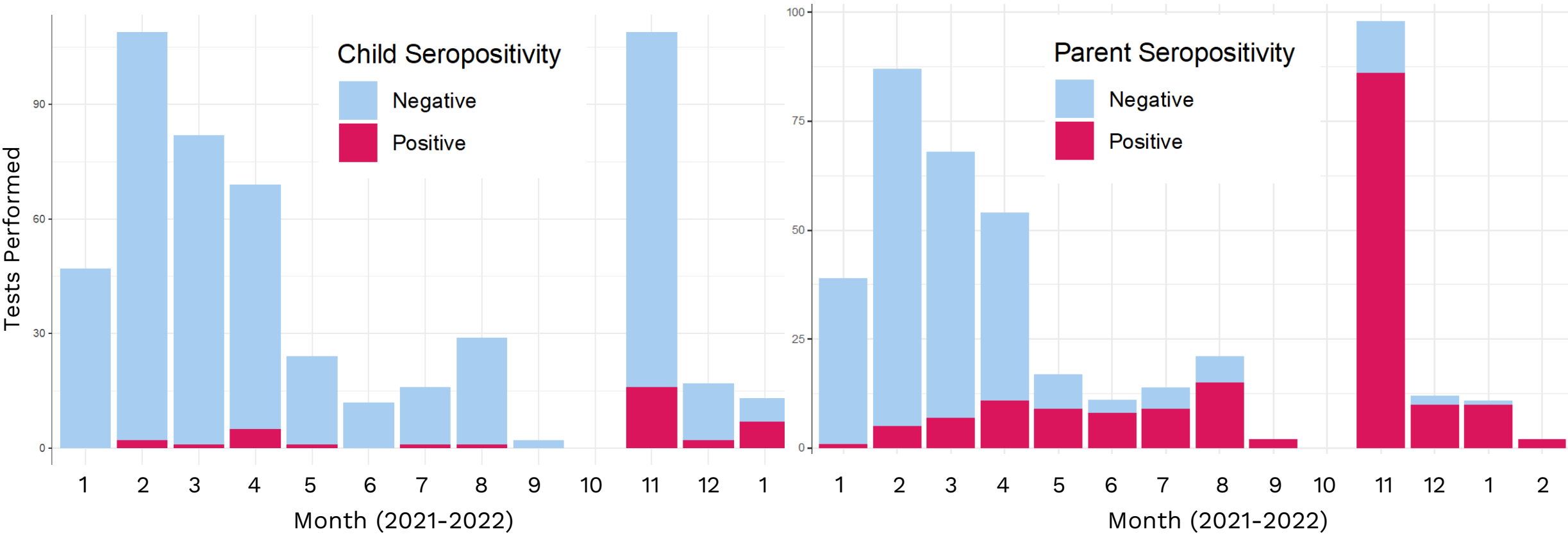
The Applied Research Group

- ▶ The largest primary care research network in Canada
- ▶ Ongoing longitudinal data collection at well-child visits
- ▶ Over 11,500 children and their parents enrolled since 2008
- ▶ 14 large practices across GTA, Montreal and Kingston

Visit us at [www.targetkids.ca](http://www.targetkids.ca)



# Seropositivity (due to infection and/or vaccination)



KATE ZINSZER

# Disclaimer

I have no COIs to declare related to this study.

# Seroprevalence due to infection, by study population characteristics

		Baseline (n=1,632) % (95% CI)	F/u 1 (n=933) % (95% CI)	F/u 2 (n=716) % (95% CI)
<b>Seropositive</b>		5.8 (4.8 - 7.1)	10.1 (8.3 - 12.2)	10.8 (8.7 - 13.3)
<b>Sex</b>	Female	6.9 (5.3 - 8.8)	11.7 (9.0 - 15.0)	12.7 (9.6 - 16.7)
	Male	4.8 (3.5 - 6.5)	8.6 (6.4 - 11.5)	9.1 (6.5 - 12.5)
<b>Chronic disease</b>	Present	4.9 (1.8 - 11.1)	12.0 (7.1 - 19.2)	11.0 (5.7 - 19.8)
	Absent	5.9 (4.8 - 7.2)	9.8 (7.9 - 12.0)	10.9 (8.6 - 13.6)
<b>Ethnic minority</b>	Yes	10.9 (7.3 - 16.1)	17.7 (11.7 - 25.8)	11.7 (6.1 - 21.0)
	No	5.2 (4.1 - 6.5)	9.2 (7.3 - 11.4)	10.7 (8.5 - 13.3)
<b>Neighbourhood</b>	West Island	3.4 (2.1 - 5.4)	6.5 (4.1 - 10.1)	3.2 (1.3 - 7.1)
	HOMA	7.8 (5.4 - 11.1)	11.5 (7.9 - 16.5)	11.7 (7.6 - 17.4)
	Montreal North	9.3 (6.2 - 13.7)	16.2 (10.9 - 23.3)	16.9 (11.2 - 24.8)
	Plateau	5.2 (3.6 - 7.5)	9.6 (6.8 - 13.5)	13.0 (9.3 - 17.9)

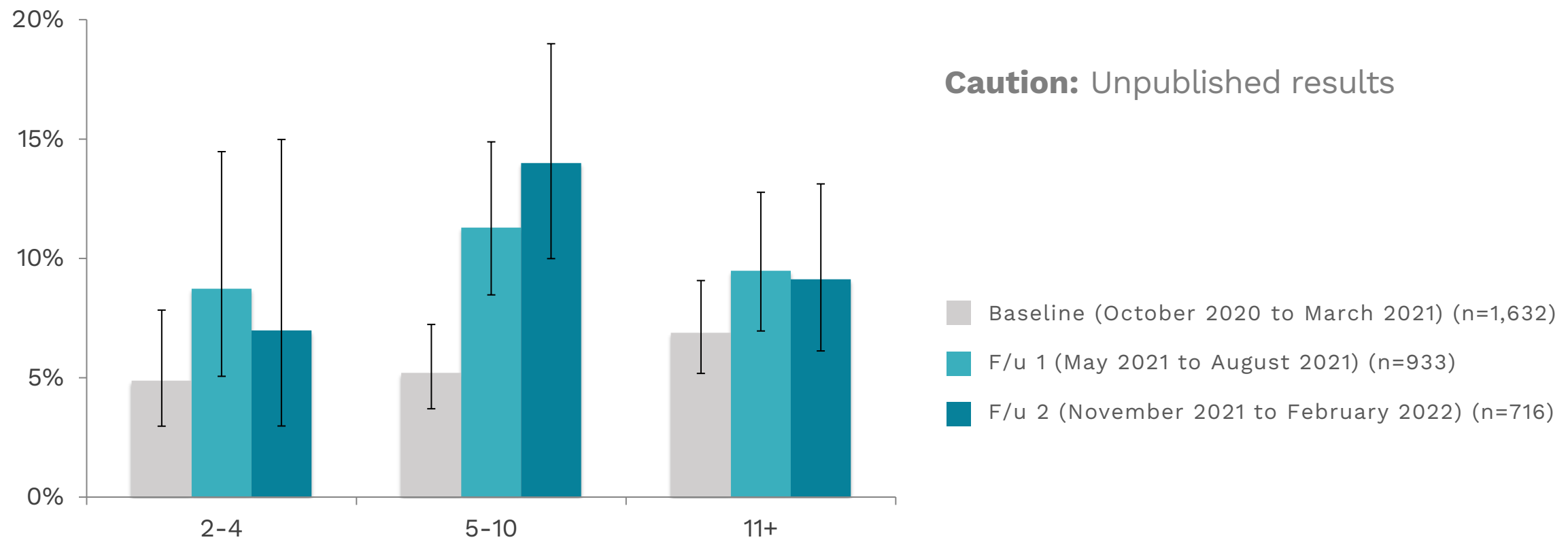
**Caution:**  
Unpublished  
results

Baseline (October  
2020 to March 2021)  
(n=1,632)

F/u 1 (May 2021 to  
August 2021)  
(n=933)

F/u 2 (November  
2021 to February  
2022) (n=716)

# Seroprevalence due to infection, by age group and round of data collection



# Seropositivity due to infection

		Adjusted prevalence	Adjusted prevalence ratio	95% CI
Age group	2-4 years	5.89	0.70	0.47-1.03
	5-10 years	9.30	1.10	0.86-1.42
	11-17 years	8.43	REF	
Sex	Female	9.70	1.42	1.12-1.80
	Male	6.84	REF	
Ethnic minority group	Yes	11.03	1.43	1.05-1.96
	No	7.70	REF	
Parental education level	Less than Bachelor's	6.71	REF	
	Bachelor's	8.23	1.23	0.88-1.71
	Master's degree or higher	9.44	1.41	1.00-1.97
HH density (HH members per bedroom)	less than 1 pp bedroom	7.08	REF	
	1 to less than 2 pp bedroom	8.39	1.19	0.90-1.57
	2+ pp bedroom	11.43	1.61	1.05-2.49

**Caution:**  
Unpublished  
results

# Seroconversion



On average, following 100 children over 1 year, **more than 12** will go from testing negative for SARS-CoV-2 infection to testing positive.

Overall rate of seroconversion for SARS-CoV-2 infection

Total f/u time (years)	# of seroconverted children	Rate per 100 children per year (95% CI)
1,562	194	12.42 (10.73 - 14.30)

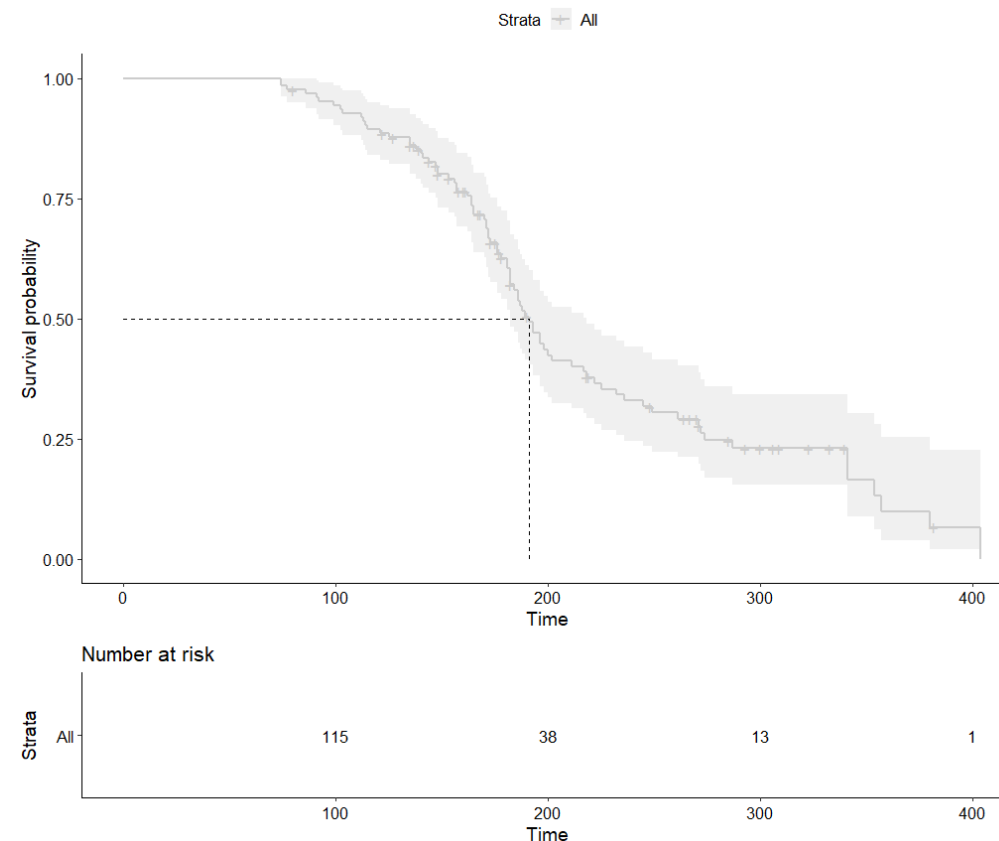
**Caution:** Unpublished results

# Seroreversion and time to seroreversion among children who were ever seropositive for a SARS-CoV-2 infection

		# ever positive	# who seroreverted	Median time to seroreversion (days)
<b>Seropositive</b>		123	81	191 (182 - 218)
<b>Age</b>	2 - 4	17	12	196 (164 - unknown*)
	5 - 10	53	28	191 (173 - 261)
	11+	53	41	193 (182 - 222)

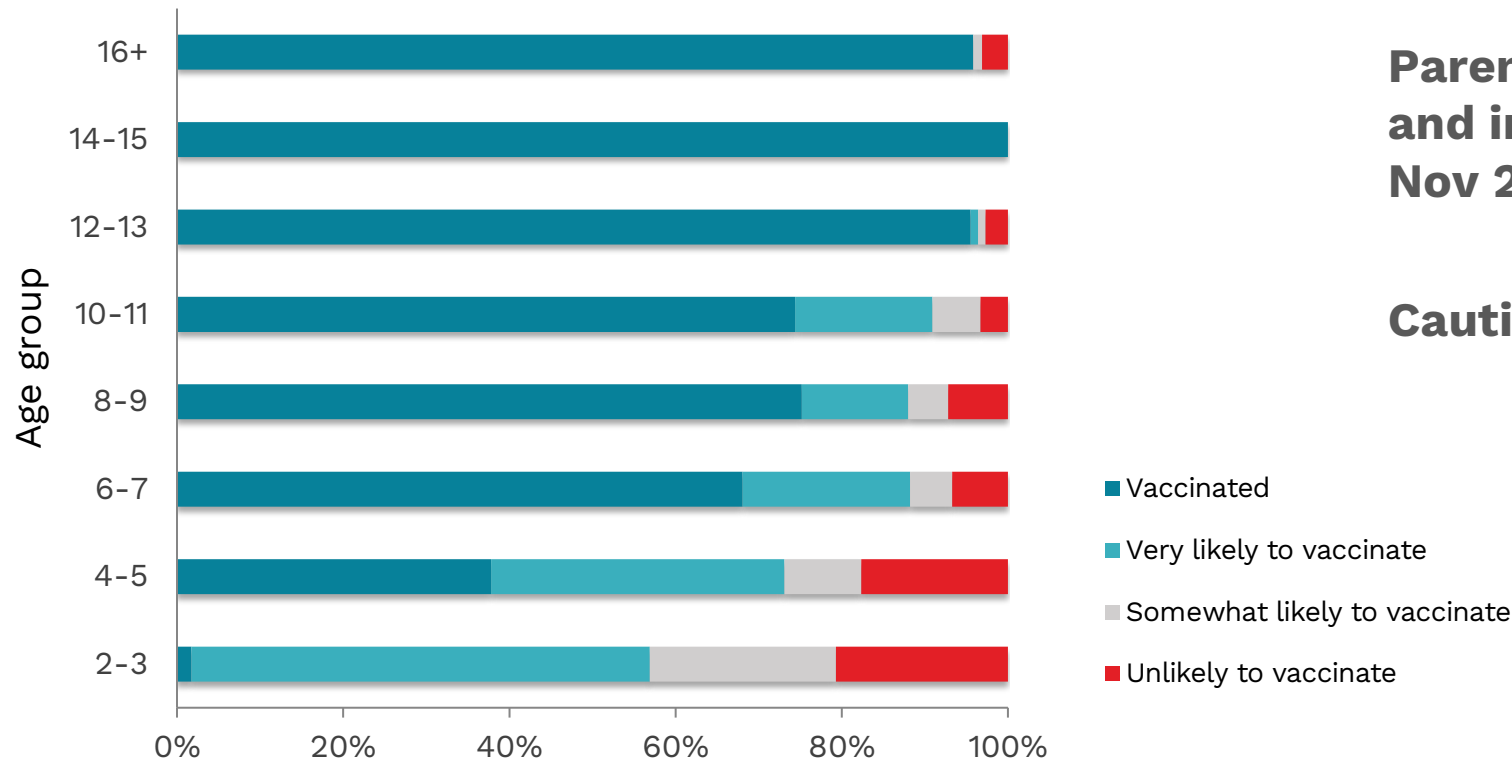
\*Could not be estimated due to limited sample.

## Seroreversion from SARS-CoV-2 infection over time (days)



**Caution:** Unpublished results

# Vaccine hesitancy



Parent-reported vaccination status and intention to vaccinate by child age  
Nov 2021 – Jan 2022 (n=864)

**Caution:** Unpublished results



# Vaccine hesitancy

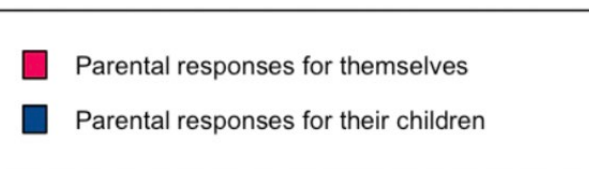
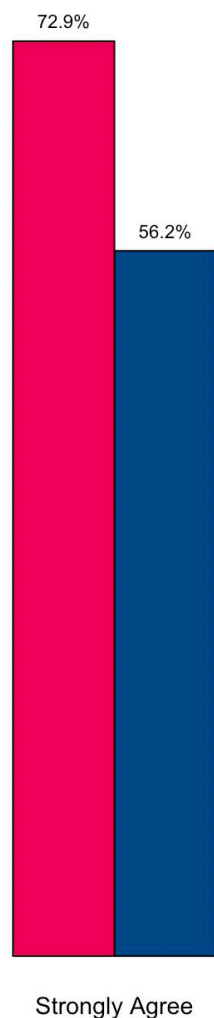
## Prevalence of vaccine hesitancy (reluctance to vaccinate)

		F/u 1 (May to Aug 2021)		F/u 2 (Nov 2021 to Feb 2022)	
		Adjusted prevalence	Adjusted ratio (95% CI)	Adjusted prevalence	Adjusted ratio (95% CI)
Parental education level	Master's degree or higher	6.8	1 (ref)	5.4	1 (ref)
	Bachelor's	10.4	1.5 (0.7 - 2.3)	8.1	1.5 (0.7 - 2.3)
	Less than a bachelor's	18.5	2.7 (1.7 - 4.3)	10.8	2.0 (0.7 - 3.3)
Neighbourhood	West Island	7.0	1 (ref)	6.4	1 (ref)
	HOMA	8.9	1.3 (0.4 - 2.1)	5.6	0.9 (0.3 - 1.6)
	Montreal North	13.4	1.9 (0.6 - 3.2)	7.5	1.2 (0.2 - 2.1)
	Plateau Mont-Royal	12.9	1.8 (0.7 - 3.0)	9.5	1.5 (0.5 - 2.5)
Ethnic minority group	White	8.4	1 (ref)	5.9	1 (ref)
	Ethnic minority group	27.4	3.3 (1.8 - 4.7)	20.7	3.5 (1.7 - 5.3)

**Caution:** Unpublished results

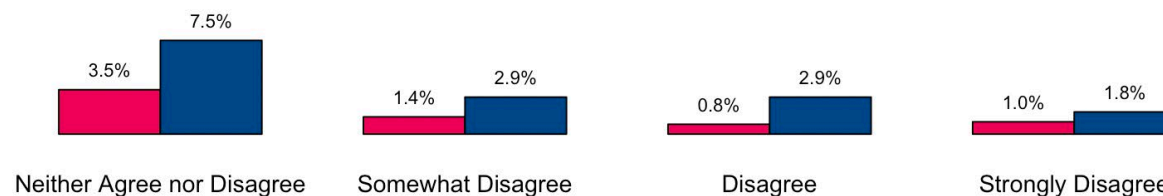
# Vaccine hesitancy

**“I am convinced of the importance of COVID-19 vaccines”**



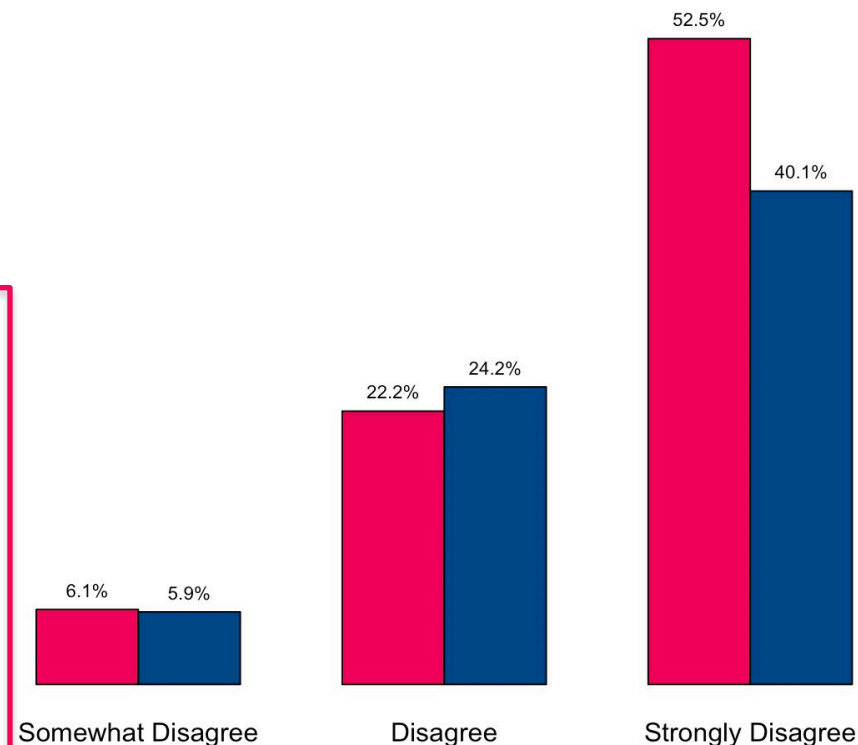
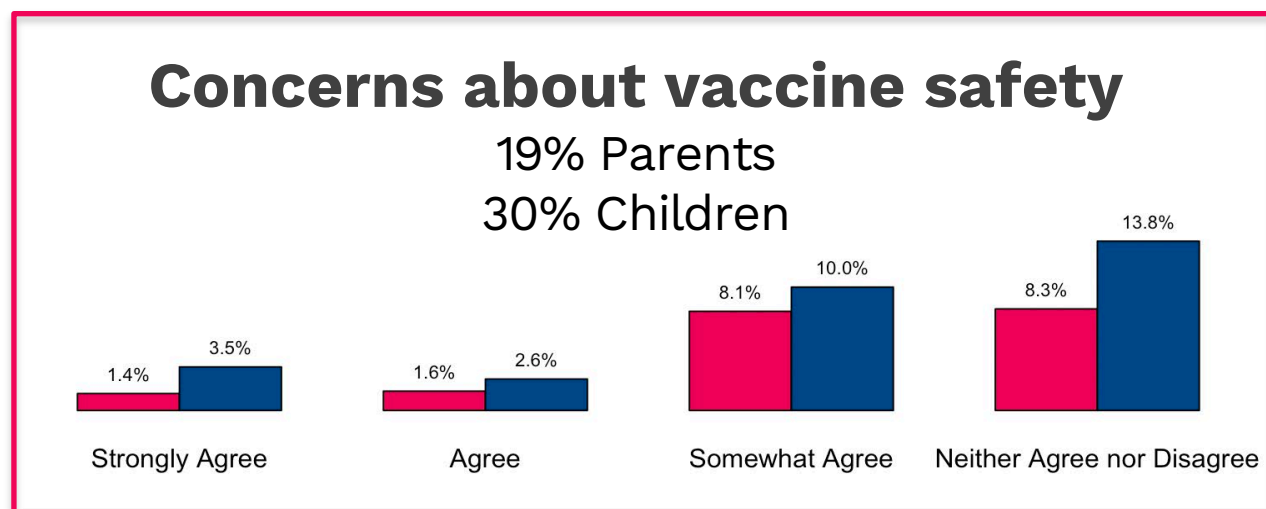
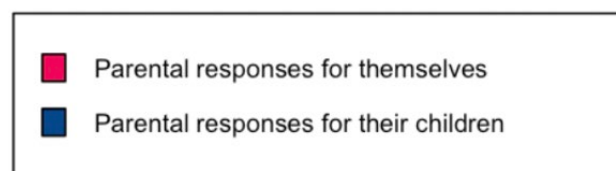
## Concerns about vaccine importance

7% Parents  
19% Children



# Vaccine hesitancy

**“I worry that COVID-19 vaccines will do more harm than good”**

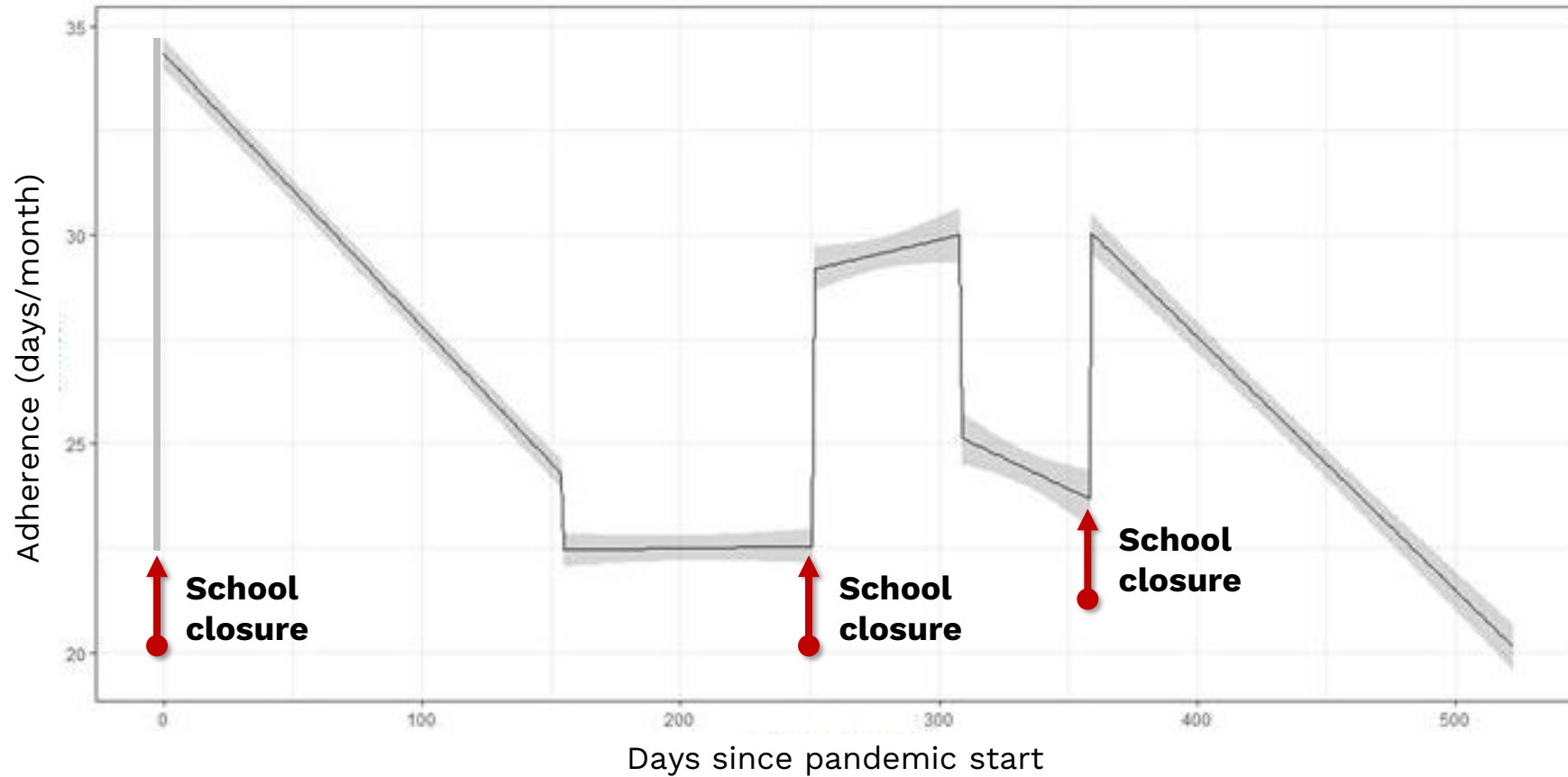


# Vaccine hesitancy

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- Beliefs about COVID-19 vaccine importance and safety for parents were associated with similar beliefs about COVID-19 vaccine importance and safety for children ~70% of the time ( $p < 0.001$ ).
- Lower family income was associated with:
  - ▶ 3-fold higher odds that parents believed that COVID-19 vaccines are not safe for themselves and their children ( $p < 0.001$ )
  - ▶ 4-fold higher odds that parents believed COVID-19 vaccines are important and safe for themselves but not their children ( $p < 0.001$ )
- Non-university education associated with:
  - ▶ 3-4 fold higher odds that parents believed that COVID-19 vaccines are not important ( $p = 0.002$ ) and not safe ( $p < 0.001$ ) for both themselves and their children.

# Adherence to public health measures



# Summary

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- Seropositivity in children is lagging behind seropositivity for parents due to lower vaccination rates and/or fewer infections
- School closures were associated with higher adherence to public health measures which diminished over time.
- 19% of parents had concerns about vaccine importance and 30% had concerns about vaccine safety for children.



JAMES D. KELLNER

# Disclaimer

## **Research grants and clinical trial contracts**

All funding managed by and paid to University of Calgary to support research operations;  
no personal funding to investigator.

Granting agencies: CIHR, 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 & meningococcal vaccine clinical trials)

## **Other influential affiliations**

Leadership Group COVID-19 Immunity Task Force (CITF)

Alberta Advisory Committee on Immunizations

Data Safety Monitoring Board VIDO-InterVac COVID-19 vaccine trials

Principal Investigator Alberta Childhood COVID-19 Cohort (AB3C) Study

# COVID-19 vaccine safety in children

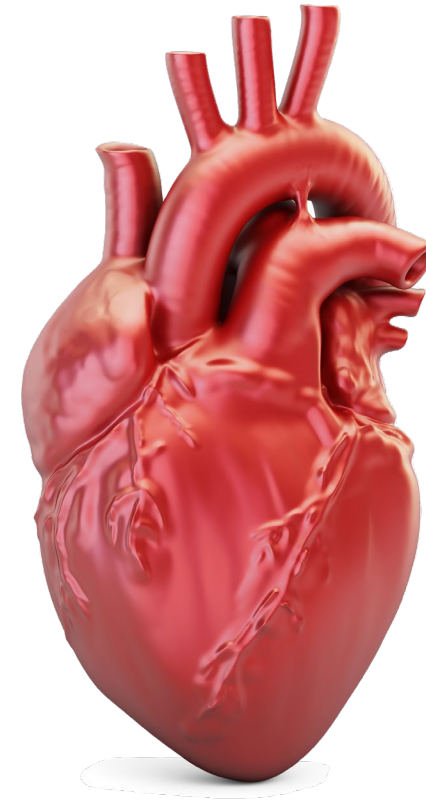
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- Vaccine safety will be the primary focus of next month's webinar with review of Canadian and international data (see [covid19immunitytaskforce.ca/events](https://covid19immunitytaskforce.ca/events))
- In general, adverse events after vaccination in children are uncommon and similar to adults:
  - ▶ More frequent after 2<sup>nd</sup> dose, but less frequent overall
  - ▶ Most often temporary local symptoms at injection site – redness, swelling, pain
  - ▶ Generalized symptoms – flu-like symptoms, headache, fever, nausea, vomiting, diarrhea
  - ▶ Severe reactions like anaphylaxis very rare ~5 cases/million doses, all ages
- Review myocarditis/pericarditis today



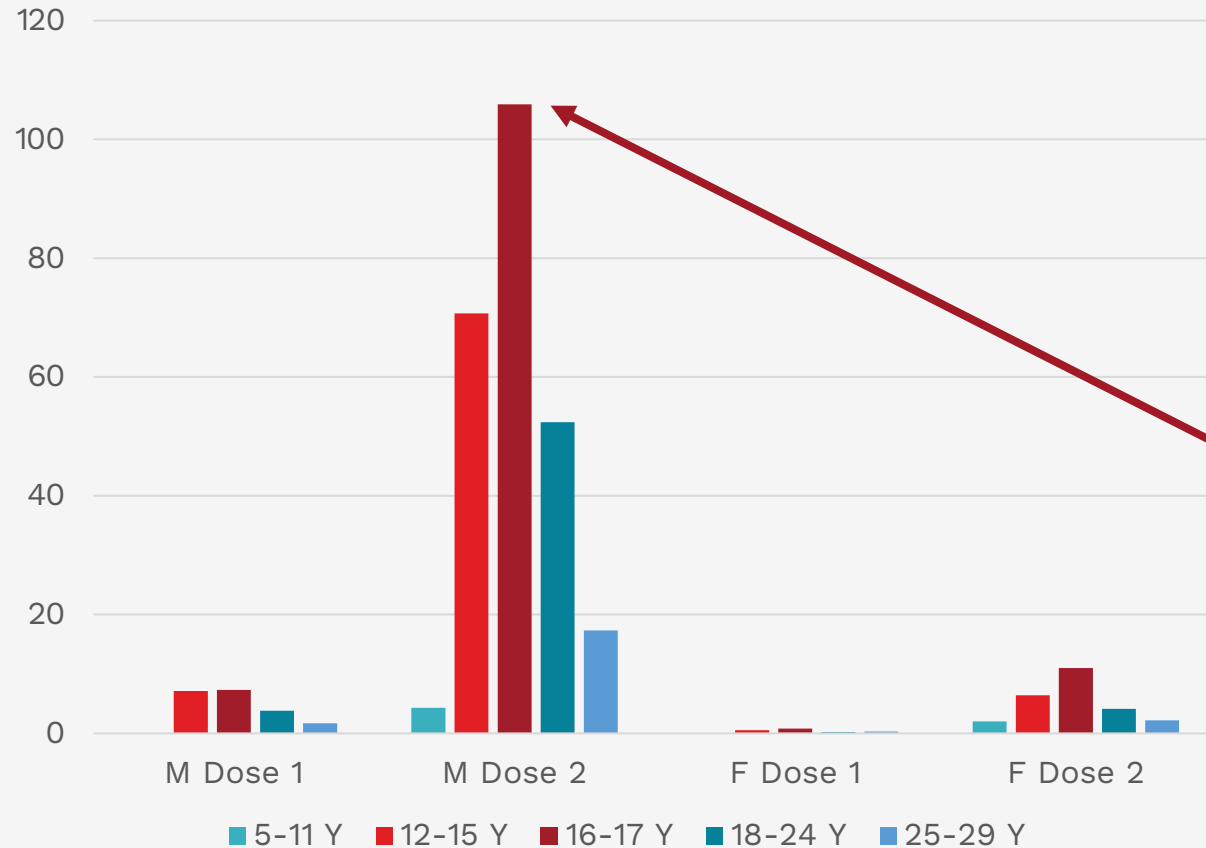
# Myocarditis/pericarditis after COVID-19 vaccines

- Post-vaccine cases generally mild (compared with cases after COVID-19 or other infections)
  - ▶ Acute chest pain, shortness of breath, palpitations, typically 1-3 days after vaccine
- To date, fundamentally associated with mRNA vaccines
  - ▶ Moderna (100 µg), Pfizer (30 µg)
- More common:
  - ▶ Adolescents & young adults
  - ▶ Males vs females ~5 X
  - ▶ After 2<sup>nd</sup> dose ~6-12 X
  - ▶ After COVID-19 infection rather than vaccination ~6 X



[CANVAS-COVID.ca](https://canvas-covid.ca),  
[Canada.ca Vaccine Safety](https://canada.ca/vaccine-safety),  
*JAMA* 2022;327(4):331-340.  
doi:10.1001/jama.2021.24110

## Myocarditis/pericarditis incidence per million doses, USA (Pfizer only)

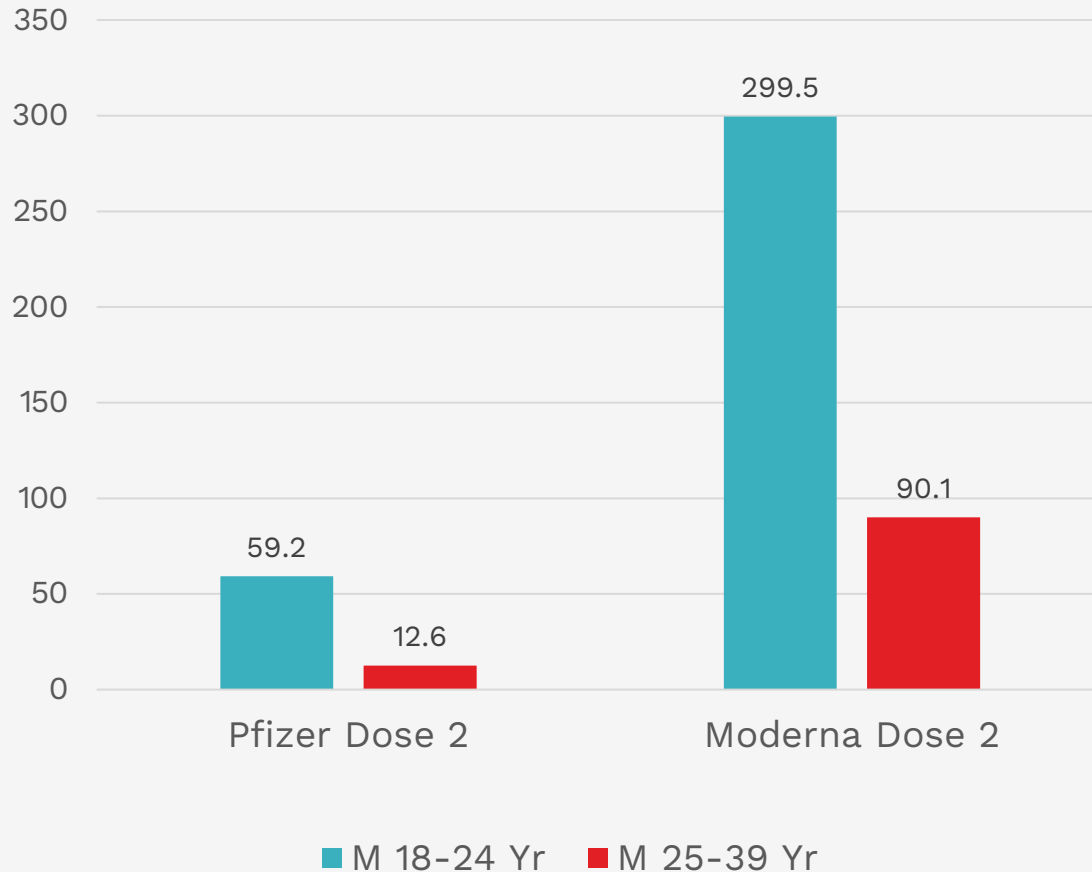


## Incidence of myocarditis/pericarditis peaks in late adolescence

- USA, adjudicated VAERS (Vaccine Adverse Event Reporting System) data
- Recent data for 5-11-year-old children
- **Peak in late adolescence, dose #2, lower in younger & older persons**
  - ▶ Mirrors age & gender distribution for myocarditis after viral infections

*JAMA* 2022;327(4):331-340. doi:10.1001/jama.2021.24110,  
[CDC presentation to ACIP Meeting Jan 5, 2022 \(slide 13\)](#)

### Myocarditis/pericarditis incidence per million doses, Ontario

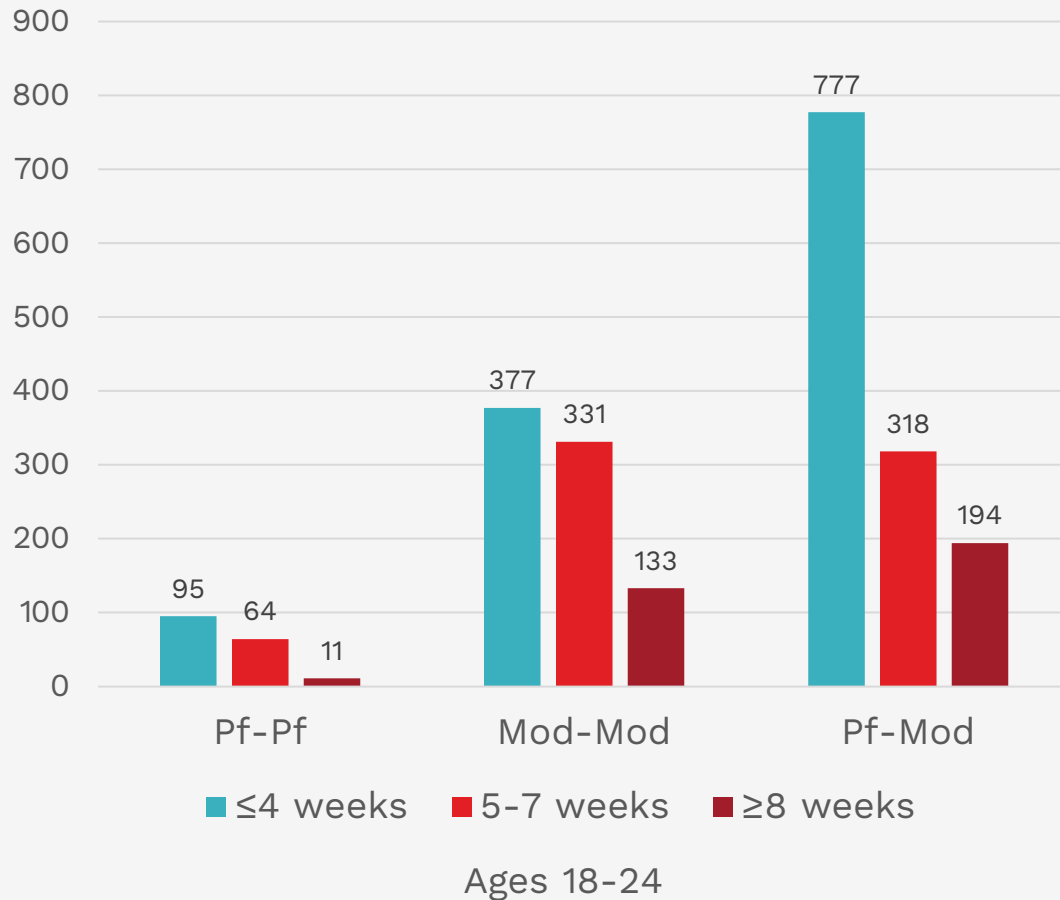


## Myocarditis risk highest after higher dose Moderna vaccine

- Ontario – males, 2<sup>nd</sup> dose only
  - ▶ Moderna not given <18 yr
  - ▶ Limitations of small sample sizes and so large confidence intervals
- Rate difference after Moderna vs Pfizer
  - ▶ 18-24 Yr: **5.1 X**
  - ▶ 25-39 Yr: **7.2 X**

Buchan et al. Preprint medRxiv Dec 2021 doi.org/10.1101/2021.12.02.21267156

## Myocarditis/pericarditis incidence per million doses, Ontario



## Myocarditis risk lower after longer dose interval

- ▶ Regardless of vaccine used, the risk of myocarditis/pericarditis was 65% - 88% lower when 2<sup>nd</sup> dose given 8 weeks after the 1<sup>st</sup> dose vs giving it after 3-4 weeks
- ▶ Risk of myocarditis highest after Moderna vs Pfizer

Buchan et al. Preprint medRxiv Dec 2021 doi.org/10.1101/2021.12.02.21267156

# Ways to reduce risk of myocarditis

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- ▶ Ongoing surveillance and follow-up of myocarditis/pericarditis cases
- ▶ **Pfizer vaccine preferred for those under 30, including lower dose formulation for those under 12**
  - ▶ 30 µg adult dose for 12-29 yrs
  - ▶ 10 µg pediatric dose for 5-11 yrs
- ▶ **Increased (over 8 weeks) dosing interval is preferred between the first 2 doses** (vs 21 days) at all ages
- ▶ Future possibility for use of different vaccines



# COVID-19 in children: The SPRING Study

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# Thank you



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ÉTUDE

**encore**  
STUDY

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**EnCORE children and parents, daycares, schools and school boards**



ÉTUDE

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STUDY

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# Bottom line messages from experts about vaccines

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- Infection-acquired seroprevalence has **gone up** over time
  - ▶ Hard to interpret due to seroreversion
  - ▶ Association with lower-income neighbourhoods and households with more people per bedroom
- Vaccine hesitancy
  - ▶ Correlation between a parent's vaccination status and the likelihood they would vaccinate their children
  - ▶ Studies also found that higher vaccine hesitancy was associated with:
    - Lower parental education
    - Lower family income
    - Ethnic minority groups



# Bottom line messages from experts about vaccines (cont.)

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- Vaccines overall are **protecting children and teens** against hospitalization and severe disease
- Vaccines are **safe**: no vaccine-related deaths and few cases of severe adverse events
- Myocarditis/pericarditis:
  - ▶ Risk is 5 x lower in vaccinated vs. unvaccinated\*
  - ▶ Lower dose mRNA vaccine has reduced risk
  - ▶ Longer dosing intervals have reduced risk

\*<https://www.medrxiv.org/content/10.1101/2021.07.23.21260998v2>



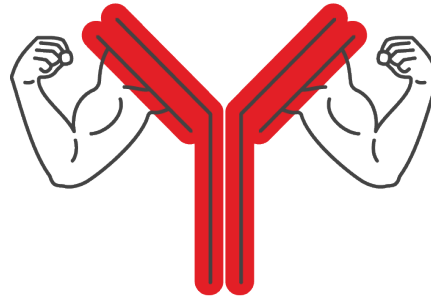
# Bottom line messages from experts about vaccines (cont.)

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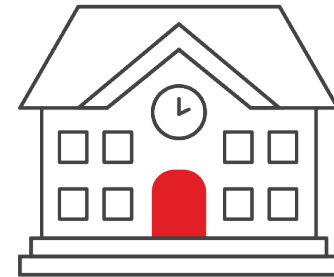
- Vaccines also provide other benefits:



**Protecting** against  
severe outcomes



**Strengthening immunity**  
in children with previous  
SARS-CoV-2 infection



Allowing for **normalcy**  
that supports healthy  
child development

# Discussion: While pediatric vaccination is recommended, questions remain

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## 1. What measures of vaccine effectiveness/protection should we be focussing on?

- ▶ Breakthrough infections or degree of illness (mild to severe)?
- ▶ Risks to household contacts, i.e. parents, grandparents

## 2. For those under 5 years old, are vaccines needed?

## 3. Given the number of unvaccinated and partially vaccinated children under 12, can we protect them against SARS-CoV-2 infection?

- ▶ 5-11 years:
  - Fully vaccinated kids: 36%
  - Partially vaccinated: 21%
  - Unvaccinated kids: 43%

## 4. For the 12 to 17 year age group: high vaccine coverage, should they be boosted and when?

- Fully vaccinated: 84%, with 11% of those boosted
- Partially vaccinated: 4%





**Questions?**





You'll find our  
summary of this  
seminar at

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A stylized graphic of a virus or network, featuring a central grey maple leaf shape with numerous thin grey lines radiating outwards to small grey dots, resembling a molecular structure or a network diagram.