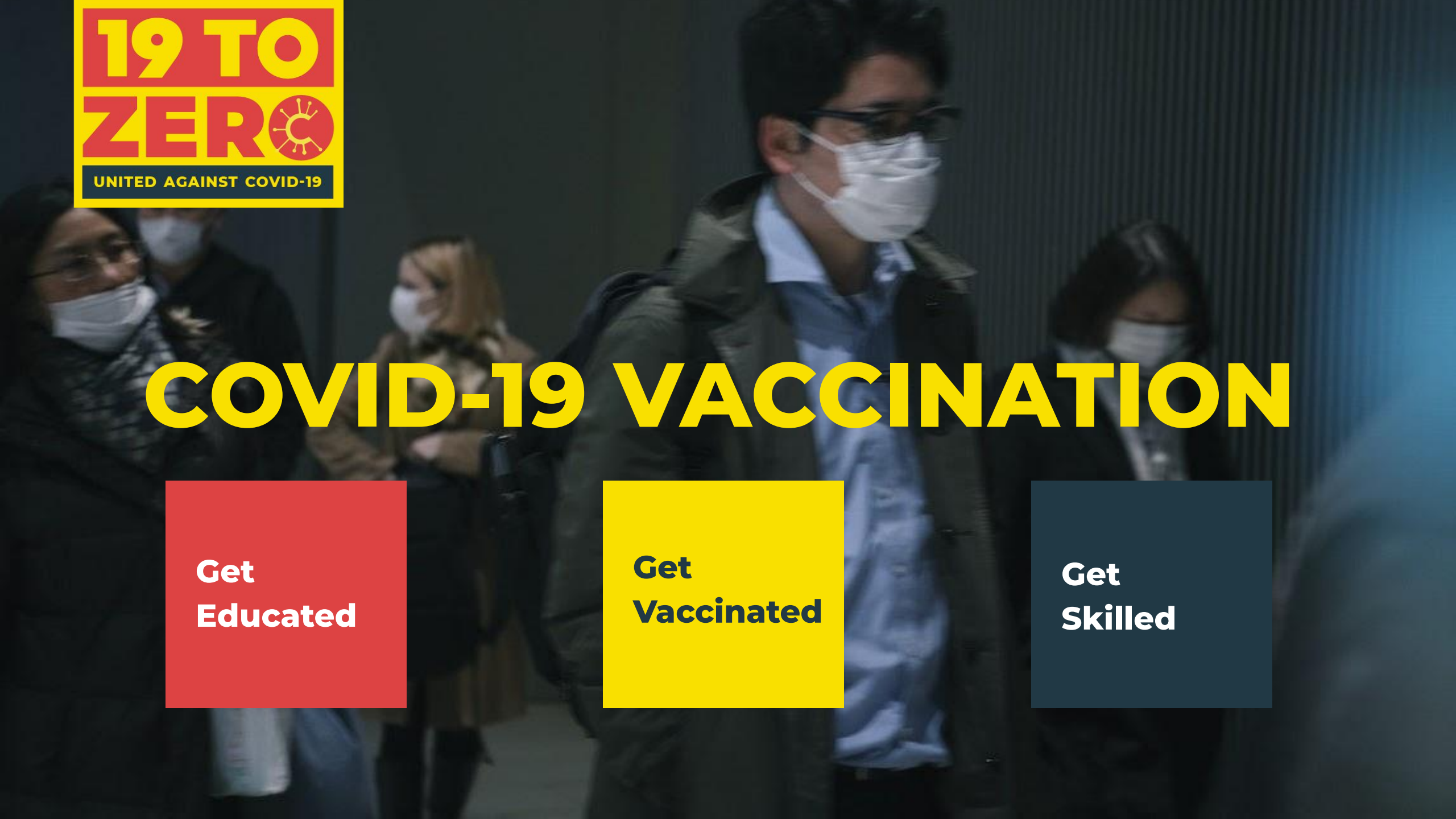

19 TO ZERO
UNITED AGAINST COVID-19
COVID-19 VACCINATION
Get Educated
Get Vaccinated
Get Skilled

About Us

19 To Zero is a group of health professionals and community members working to shift public perceptions around COVID-19 behaviours and vaccination. See 19ToZero.ca for more info.

This town hall was organised in collaboration with **[list community partners]**

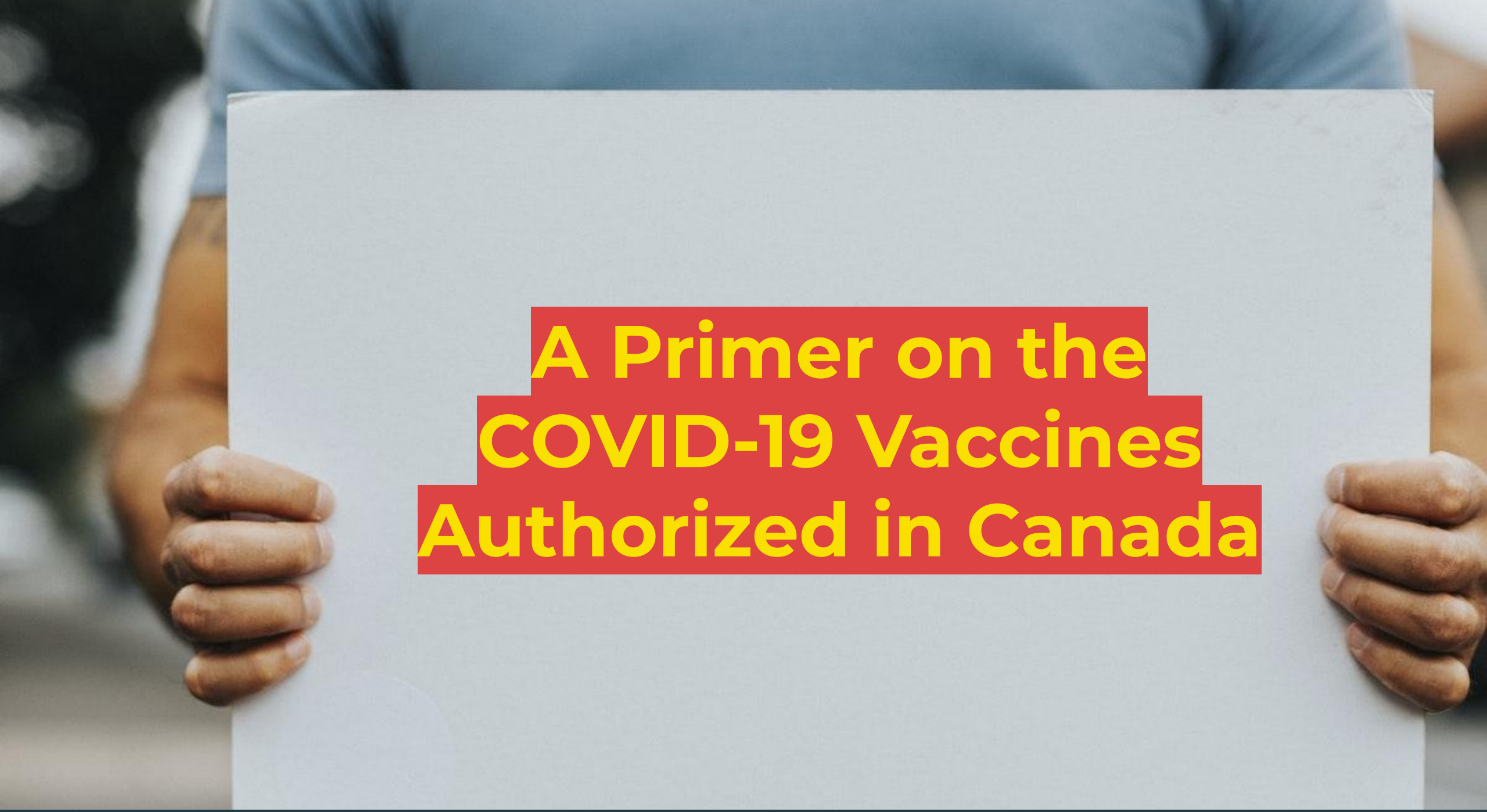
Presenters:
[list names]

Person putting on hand sanitizer

Objectives

At the end of this session, participants will be able to:

- List the four COVID-19 vaccines approved for emergency authorization in Canada
- Outline the contraindications and precautions of these vaccines and side effect profile
- Describe hesitancy around COVID-19 vaccine and have a communication framework to use in their practice
- Dispel common myths and misconceptions around these vaccines



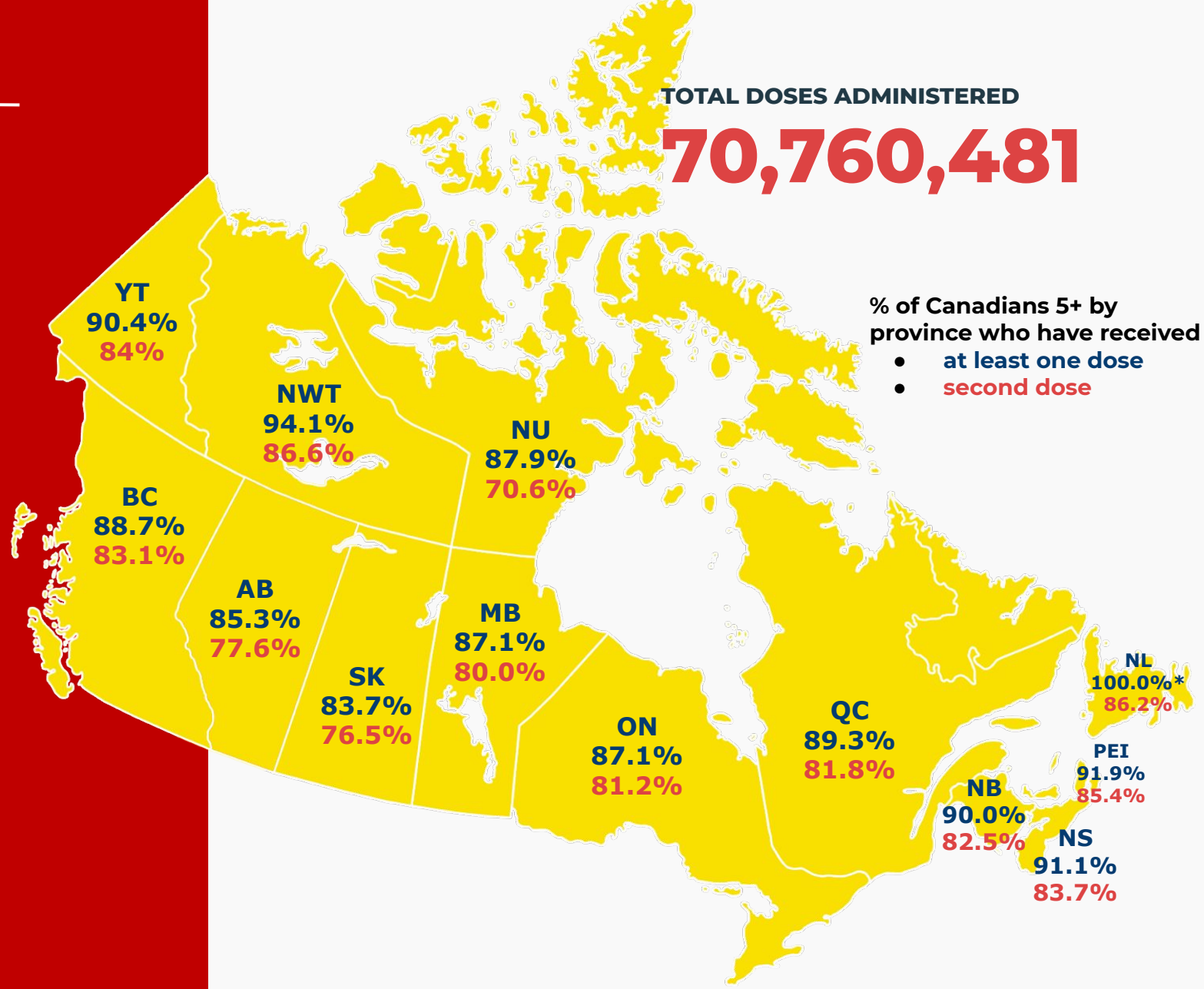
A Primer on the COVID-19 Vaccines Authorized in Canada

AS OF January 8, 2022:

Over 70 million doses have been administered in Canada

TOTAL DOSES ADMINISTERED

70,760,481



Map of Canada

% OF ELIGIBLE POPULATION (5+):
87.01% at least one dose; 81.18% fully vaccinated

COVID-19 Vaccines for Canada & Interim Authorization Status

Vaccine	Vaccine Type	Clinical Trial Efficacy to prevent COVID-19 Infection	Authorization
Pfizer	2 dose mRNA encoding spike	**95% efficacy** (≥7 days after 2nd dose) vs PCR+ infection Real world data: single dose was 72% (3 weeks after first dose) and 86% after 2 doses (14 days after second dose	✓ **Dec 9, 2020**
Moderna	2 dose mRNA encoding spike	**94% efficacy** (≥14 days after 2nd dose) vs PCR+ infection	✓ **Dec 23, 2020**
AstraZeneca Verity Pharma	2 dose viral vector with spike DNA	**63% overall efficacy** (post 2nd dose) vs PCR+ infection **82% if 2nd dose after 12 weeks** after first **US: 76% against symptomatic disease** and **100% against hospitalisation** *real world data for adults over 70, 1st dose 73% overall vs infection, 80-100% vs hospitalization	✓ **Feb 26, 2021**
Janssen/ **Johnson & Johnson**	1 dose viral vector with spike DNA	**66% overall efficacy** vs PCR+ and moderate/severe disease **85% efficacy vs severe disease**	✓ **Mar 5, 2021**
Novavax	2 dose recombinant spike nanoparticle	Press release: **90% overall efficacy** (7 days post 2nd dose) vs PCR+ infection 89% efficacy in UK (>50% variants), 49% efficacy in South Africa (>90% variants, 6% HIV+)	*Submitted* *Jan 29, 2021*
Medicago GSK	2 dose spike virus-like particle	Phase 2-3 RCTs have commenced	Not submitted
Sanofi & GSK	Protein subunit	Phase 1-2 trials – initial dose was not effective	Not submitted

Clinical trial efficacy for mRNA vaccines

Pfizer (BNT162b2) 40,000+ participants	Moderna (mRNA-1273) 30,000+ participants
95% protection from having the disease	**94.1% protection** from having the disease

Similar efficacy with different race, ethnicity and age

Polack, et al. (2020). Safety and efficacy of the BNT162b2 mRNA Covid-19 vaccine. N Engl J Med. 383:2603-2615.

Promising Interim Results from Clinical Trial of NIH-Moderna COVID-19 Vaccine. (2020). National Institutes of Health (NIH).

mRNA Vaccines

- Give instructions for our cells' ribosomes to make the "spike protein" found on the surface of the COVID-19 virus.
- Spike protein recognized by immune cells and antibodies against it are made.
- Every minute of every day, mRNA is used in our body to make proteins we need.

Abbasi, J. (2020). COVID-19 and mRNA Vaccines—First Large Test for a New Approach. *JAMA*, *324*(12), 1125.

CDC. (2021, March 4). Understanding mRNA COVID-19 Vaccines. Centers for Disease Control and Prevention.

Dolgin, E. (2019). Unlocking the potential of vaccines built on messenger RNA. Nature, 574(7778), S10–S12.

Kizzmekia, et al. (2020). SARS-CoV-2 mRNA vaccine design enabled by prototype pathogen preparedness. Nature. 586:567-71.

COVID-19 Vaccination in Alberta

Information as of January 8, 2022

Effectiveness

Vaccine	Vaccine Effectiveness: 1 dose	Vaccine Effectiveness: 2 doses
Moderna	**81% (95% CI: 80-82%)**	**91% (95% CI: 90-91%)**
Pfizer	**75% (95% CI: 74-76%)**	**90% (95% CI: 90-90%)**
AstraZeneca	**61% (95% CI: 58-63%)**	**89% (95% CI: 89-90%)**

Effectiveness against variants of concern

Variant	Vaccine Effectiveness: 1 dose	Vaccine Effectiveness: 2 doses
Alpha B.1.1.7 UK	**76% (95% CI: 75-77%)**	**90% (95% CI: 88-91%)**
Gamma P1 Brazil	**72% (95% CI: 67-76%)**	**88% (95% CI: 80-93%)**
Delta B.1.617	**57% (95% CI: 51-63%)**	**89% (95% CI: 89-90%)**

COVID-19 Vaccination in Alberta

Information as of January 8, 2022

Vaccines work!

Since Jan 1, 2021

- **0.4% of people** with one dose were diagnosed with COVID-19
- **2.3% of people** with two doses were diagnosed with COVID-19

Unvaccinated people or those diagnosed less than two weeks after their first dose made up:

69.9% of COVID-19 cases

80.5% of hospitalized cases

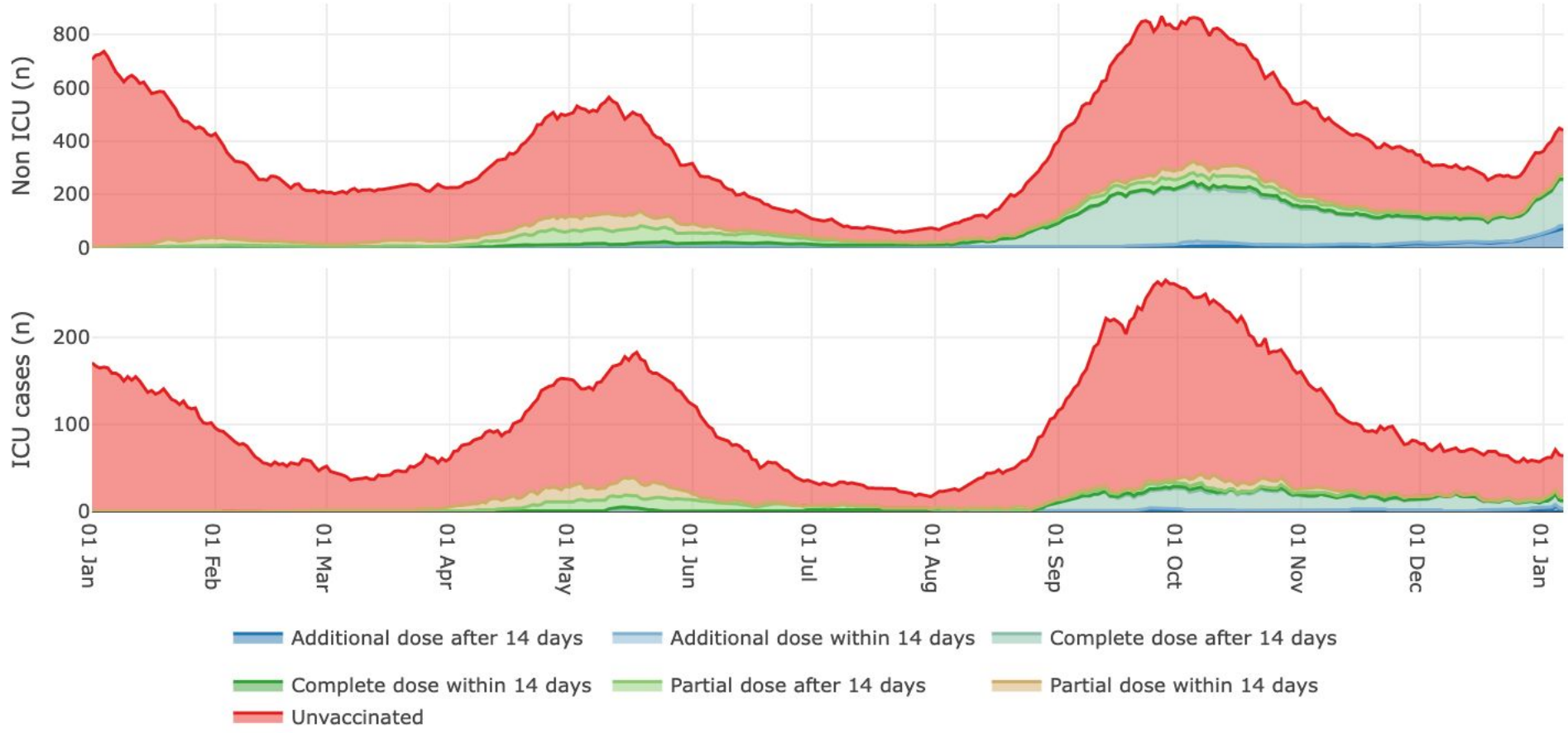
75% of COVID-19 deaths

COVID-19 Alberta Statistics

COVID-19 Vaccination in Alberta

Information available as of January 8, 2022

Vaccination and hospitalization




Children’s Data

Vaccination rates in Canada are high across most age ranges, except in the 11 and under age range

Table 2. Cumulative number and percent of people in Canada who have received a COVID-19 vaccine by age group and vaccination status, November 27, 2021

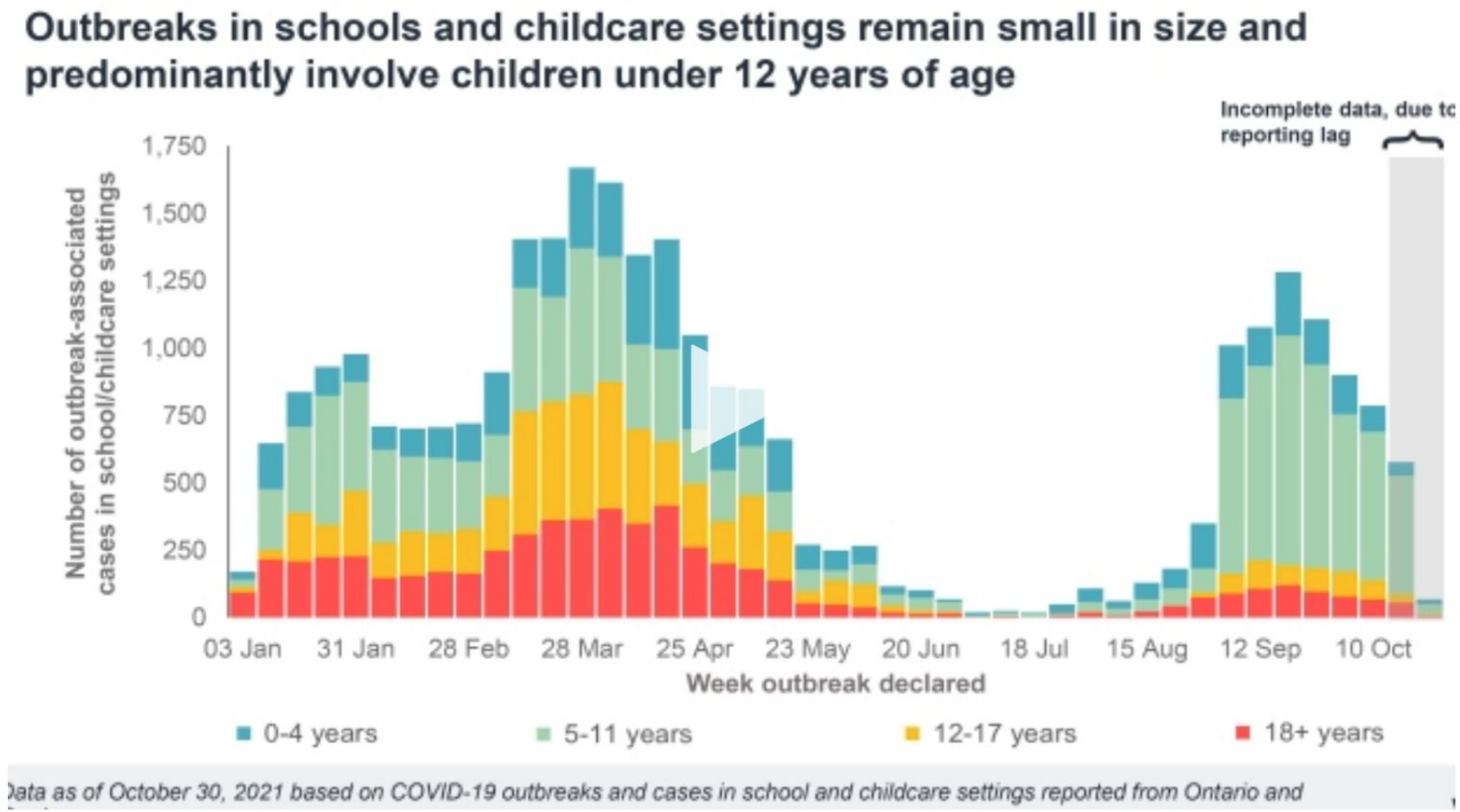
Age group (years)	At least 1 dose	Partially vaccinated	Fully vaccinated
0 to 4	0.01% (168)	0.01% (168)	0% (0)
5 to 11	5.80% (167,095)	4.47% (128,566)	1.34% (38,529)
12 to 17	87.97% (2,171,358)	4.66% (115,141)	83.30% (2,056,217)
18 to 29	86.49% (5,135,179)	5.01% (297,285)	81.48% (4,837,894)
30 to 39	85.85% (4,605,225)	3.88% (208,113)	81.97% (4,397,112)
40 to 49	88.82% (4,346,306)	2.85% (139,350)	85.97% (4,206,956)
50 to 59	90.36% (4,635,371)	2.21% (113,300)	88.15% (4,522,071)
60 to 69	92.65% (4,484,962)	1.63% (78,844)	91.03% (4,406,118)
70 to 79	94.35% (2,957,370)	1.33% (41,632)	93.03% (2,915,738)
80 and older	≥95% (1,629,199)	2.16% (37,087)	92.90% (1,592,112)
Not reported	n/a (0)	n/a (0)	n/a (0)
Unknown	n/a (87,475)	n/a (46,905)	n/a (40,570)

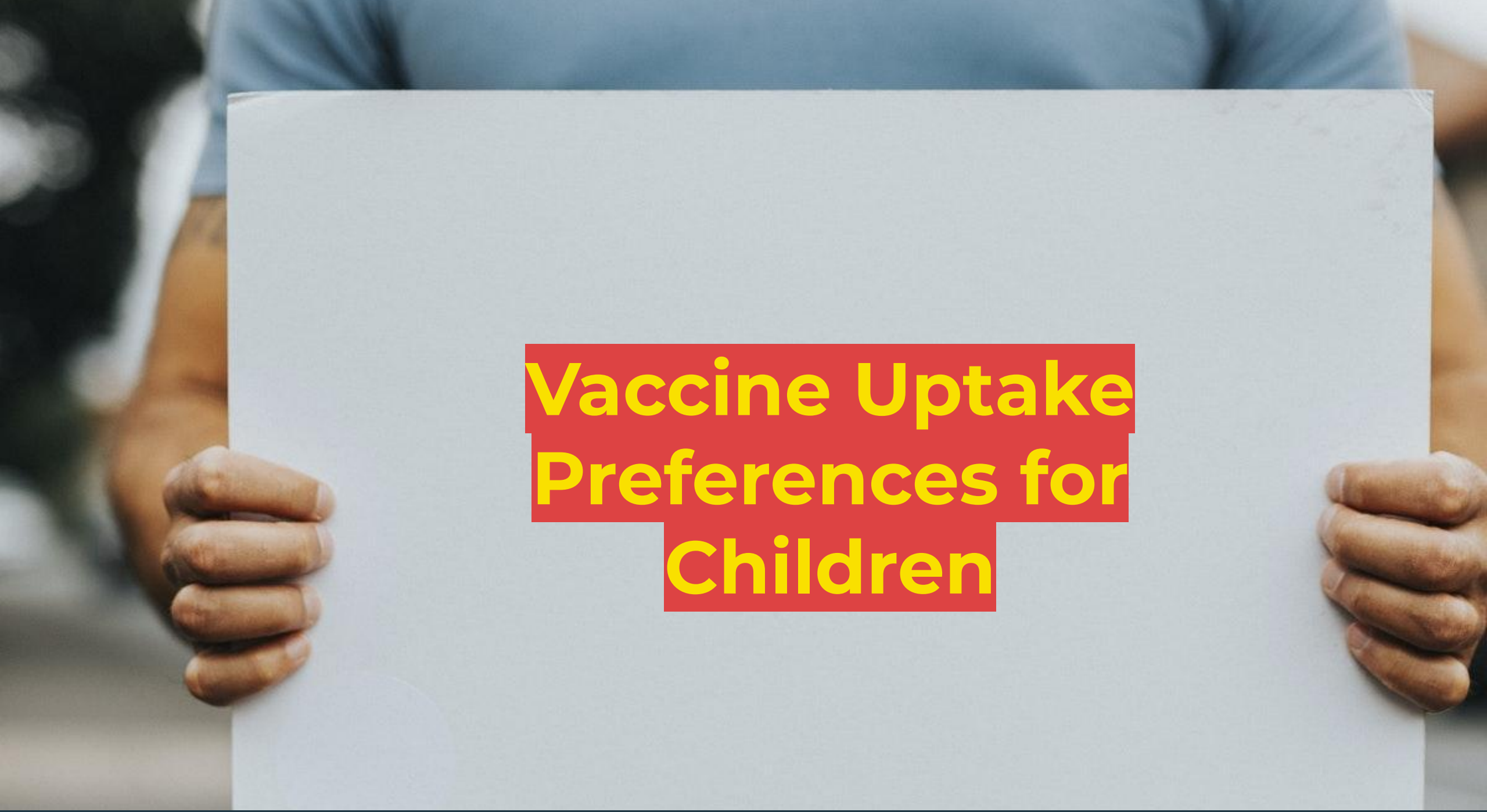
https://health-infobase.canada.ca/covid-19/vaccination-coverage/ accessed Dec 7, 2021

Children under 12 now account for highest number of new COVID-19 infections in Canada: PHAC

Hannah Jackson CTVNews.ca Writer
@hannahkeiko | Contact

Published Friday, November 5, 2021 9:21AM EDT
Last Updated Friday, November 5, 2021 12:08PM ED

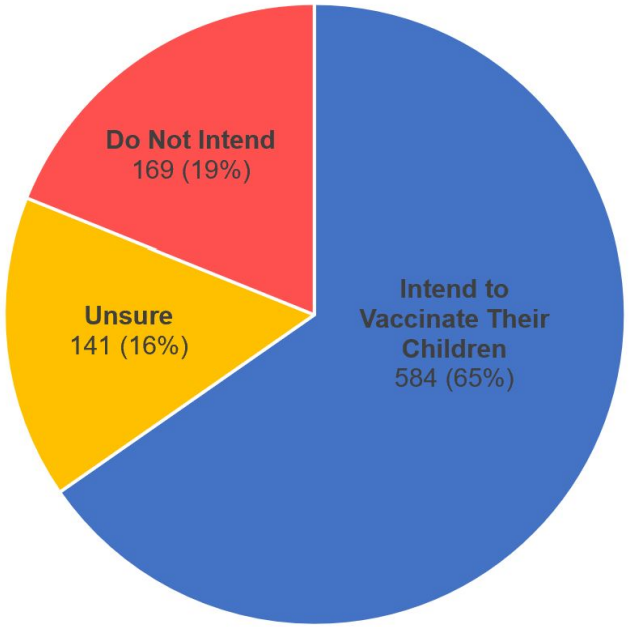




Vaccine Uptake Preferences for Children

About ⅔ of Canadian parents intend to vaccinate their children once a COVID-19 vaccine becomes available:

"Suppose one or more of the COVID-19 vaccines available for individuals 12 and older becomes available to children under 12. Would you have your child vaccinated?" n=594



Of those unwilling to vaccinate their children, the following reasons were selected:	Number of Respondents (%)
Children do not need vaccines as they are low risk of severe consequences due to COVID-19	55 (32.7%)
Other safety risks	47 (28.0%)
Natural immunity from previous COVID-19 infection is sufficient protection for my child	20 (11.9%)
Myocarditis risks	16 (9.5%)
Fertility risks	13 (7.7%)
Other reasons	17 (10.1%)

Among those unwilling to vaccine, concerns include:

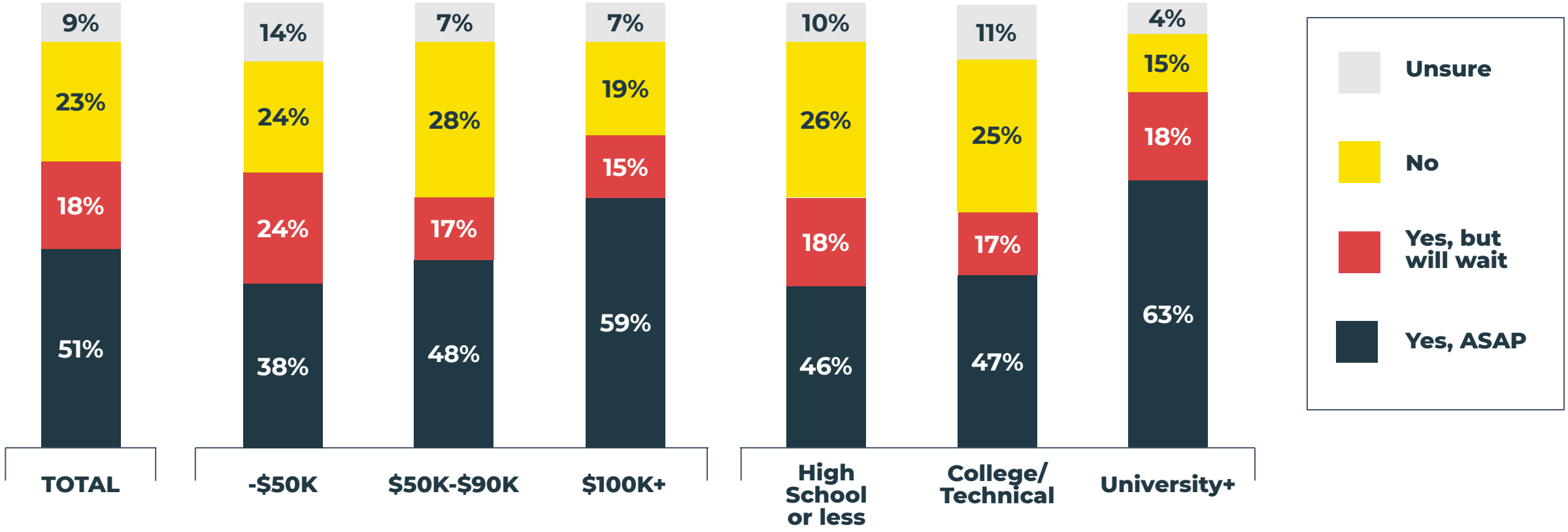
- Safety - myocarditis, fertility, or other (45%)
- Lack of concern due to low risk of serious COVID-19 in children (33%)
- Natural immunity from prior infection (12%), and
- Other (10%)

Source: 19 To Zero National Survey, October 2021

Willingness to vaccinate children in Canada

If a COVID-19 vaccine become available to your child(ren) aged five to 11, will you get them vaccinated?

Among Canadian parents with children in this age range (n = 812)



Source: Angus Reid Kids and COVID, Published online October 2021

COVID-19 can be severe in children

- Kids make up 20%-30% of COVID-19 cases in most jurisdictions in Canada and USA
  - In USA, more than 3.78M kids have been infected, over 500 kids have died

- **It's not the flu**: COVID-19 is currently in the **top 10 causes of death for children**
  - In Canada and USA, children account for 2% of hospitalizations
  - About 2000 Canadian children have ended up in hospital so far
  - Of those hospitalized, ⅓ had no pre-existing conditions
  - Long-COVID affects 2% of kids

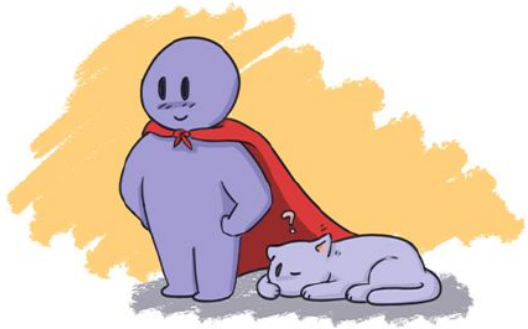
- Did you know: over 99% of Polio cases do not lead to paralysis.

FocusedCovid Communication

UNIVERSITY OF WATERLOO | SCHOOL OF PHARMACY

The Benefits of Vaccinating Children

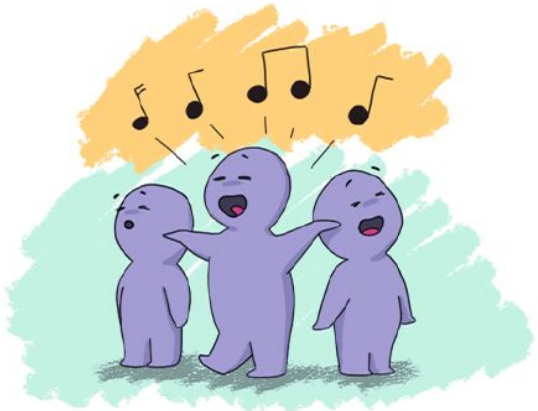
Against Covid-19



Reduced risk of illness

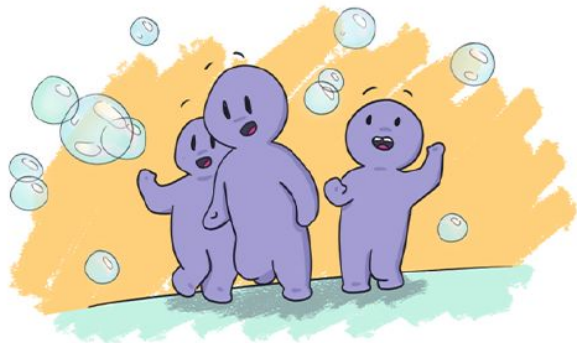
Not needing to miss school due to a case in the classroom

Reduced risk of spread to friends and family with weaker immune systems



Allowing all kids to return to clubs like choir

Allowing all kids to return to fun activities like hockey



Allow all kids to return to being kids again

Let's get all kids back to being kids.

The risks of Covid-19 may be even higher for disabled kids and those with weaker immune systems.
We're not back to normal until everyone is back to normal. Speak to your healthcare provider for advice.

COVID-19 vaccination in children aged 5-11

The **Pfizer BioNTech COVID-19 vaccine has been authorized by Health Canada** for kids 5-11y as a two-dose regimen of 10µg administered 3 weeks apart

Health Canada Statement. Health Canada authorizes use of Comirnaty (the Pfizer-BioNTech COVID-19 vaccine) in children 5 to 11 years of age. (November 19th, 2021)

Pfizer vaccine in children 5-11 years of age - Efficacy

Study Characteristics

- Randomized placebo-controlled Phase 2/3 study
- 4518 kids aged 5-11 (3018 vaccine; 1500 placebo), from Mar - Oct 2021 (when Delta present)
- 2 doses ***10µg*** each, 3 wks apart

Efficacy

- **Vaccine effectiveness was 90.7%** (against confirmed symptomatic COVID-19, assessed starting 7 days after dose 2)

Potential Impact

90% vaccine efficacy →
prevention of ~33600 cases and ~170 hospitalizations over 120 days, per million fully vaccinated children

Vaccines and Related Biological Products Advisory Committee Meeting Document. (2021 Oct 26) FDA.

Pfizer vaccine in children 5-11 years of age - Safety

Side Effects

- Consistent with older children

- Transient, mild side effects 1-2 days after dose with short resolution
- Most common: injection site pain

- No severe adverse effects related to the vaccine (some unrelated were observed, e.g., swallowing a penny!)

Vaccines and Related Biological Products Advisory Committee Meeting Document. (2021 Oct 26) FDA.

NACI recommends two 10µg doses of the Pfizer vaccine may be offered to children 5-11y

- ≥ 8 weeks between doses is recommended as:
  - longer intervals result in higher effectiveness that may last longer
  - may be associated with lower risk of myocarditis
- Children 11 years old who receive the 10µg dose but turn 12 before their 2nd dose may receive a 30µg dose
- Two doses of vaccine may be offered to children who have had COVID-19
- Children who had MIS-C should postpone vaccination until recovery or after 90 days since diagnosis
- The Pfizer vaccine should be given at least 14 days before or after another vaccine when feasible

National Advisory Committee on Immunization (NACI) rapid response: Recommendation on the use of the Pfizer-BioNTech COVID-19 vaccine (10 mcg) in children 5-11 years of age. November 19, 2021

General Side Effects from mRNA vaccines

- Immunization related stress responses such as fainting, fatigue and nausea
  - Treated by managing stress using pain and anxiety reducing strategies for children
- Myocarditis and Pericarditis <1 per 10,000 cases
  - More common after the second dose
  - Symptom onset between 1-7 days after vaccination
  - Mainly adolescent males
  - MAJORITY of cases were mild illness that responded well to non steroidal anti-inflammatory medications (such as ibuprofen) and rest

- **Benefits of COVID-19 vaccinations outweigh the risks of vaccine-caused myocarditis**

Wong, P McCrindle B, et cal. Clinical guidance for youth with myocarditis and pericarditis following mRNA COVID-19 vaccination. Canadian Paediatric Society Practice Point Sept 10 2021. https://www.cps.ca/en/documents/position/clinical-guidance-for-youth-with-myocarditis-and-pericarditis
Moore, D. COVID-19 Vaccine for Children. Canadian Paediatric Society. Position Statement. July 2021. https://www.cps.ca/en/documents/position/covid-19-vaccine-for-children

VAERS Reporting Rate for Myocarditis among males after mRNA COVID-19 vaccine

169,740,953 doses of mRNA vaccine administered to males as of Oct 6, 2021

Highest rates of myocarditis are among male adolescents 16-17y

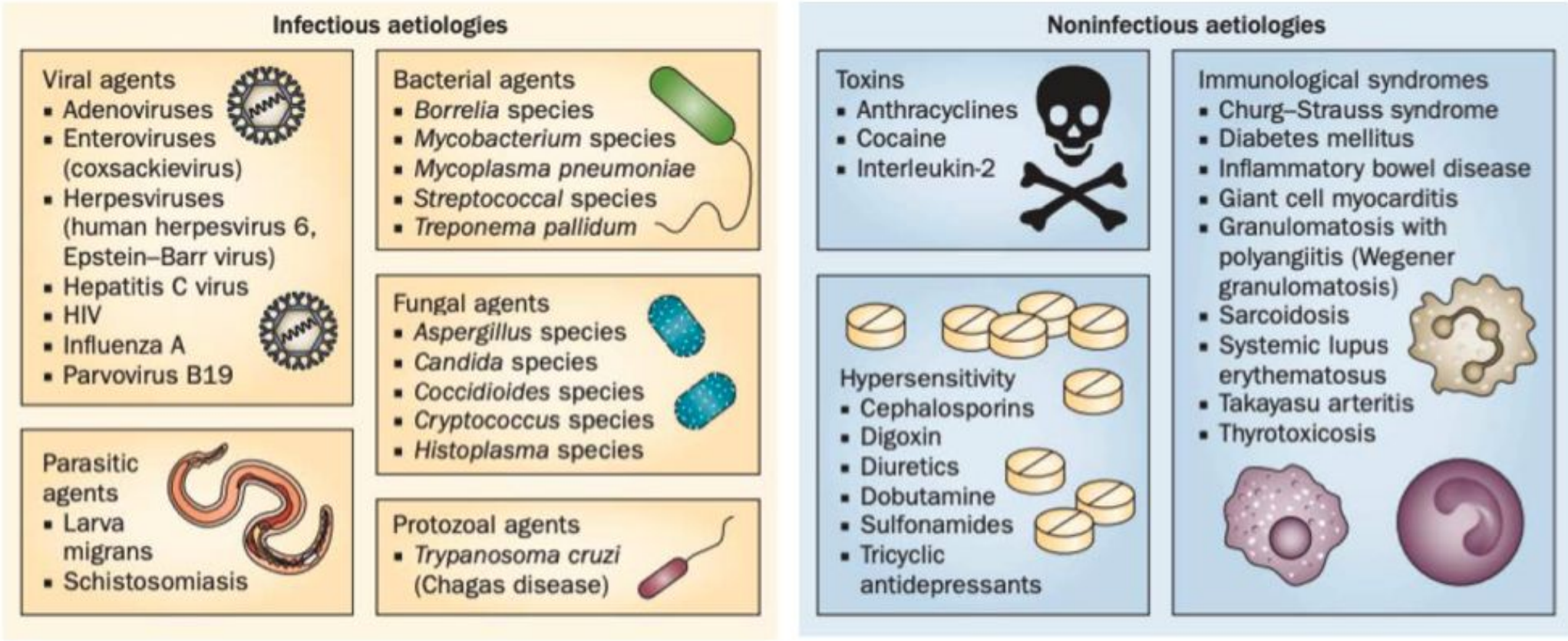
Myocarditis Rate per 1 million doses (n=797)

	Pfizer (Males)		Moderna (Males)	
Ages	**Dose 1**	**Dose 2**	**Dose 1**	**Dose 2**
12-15	**4.2**	**39.9**		
16-17	**5.7**	**69.1**		
18-24	**2.3**	**36.8**	**6.1**	**38.5**
25-29	1.3	**10.8**	**3.4**	**17.2**
30-39	0.5	**5.2**	**2.3**	**6.7**
40-49	0.3	**2.0**	0.2	**2.9**
50-64	0.2	0.3	0.5	0.6
65+	0.2	0.1	0.1	0.3

Reporting rates exceed background incidence

Vaccines and Related Biological Products Advisory Committee Meeting. mRNA COVID-19 Vaccine-Associated Myocarditis (2021 Oct 26) FDA.

Causes of myocarditis include viral infection as the most common cause

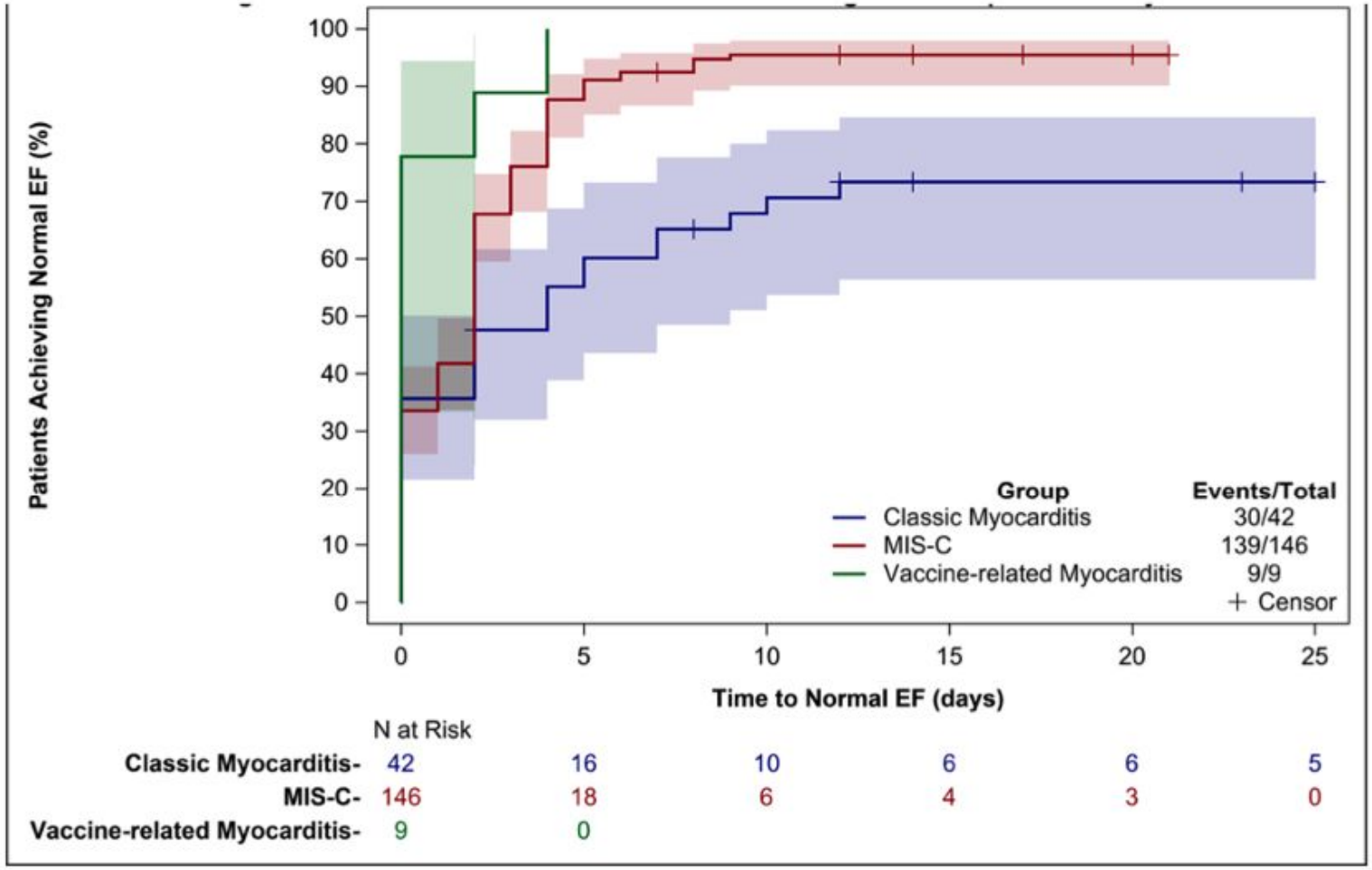


Vaccines and Related Biological Products Advisory Committee Meeting. mRNA COVID-19 Vaccine-Associated Myocarditis (2021 Oct 26) FDA.
Pollack, A. et al. Viral myocarditis—diagnosis, treatment options, and current controversies. Nat Rev Cardiol (2015).

Not all myocarditis is the same

- A retrospective cohort study (preprint) compared patients <21y with classic pre-pandemic viral myocarditis (n=43), MIS-C myocarditis (n=149) and COVID-19 vaccine-related myocarditis (n=9)

- Patients with vaccine-related myocarditis had **prompt resolution of symptoms and improvement in cardiac function**

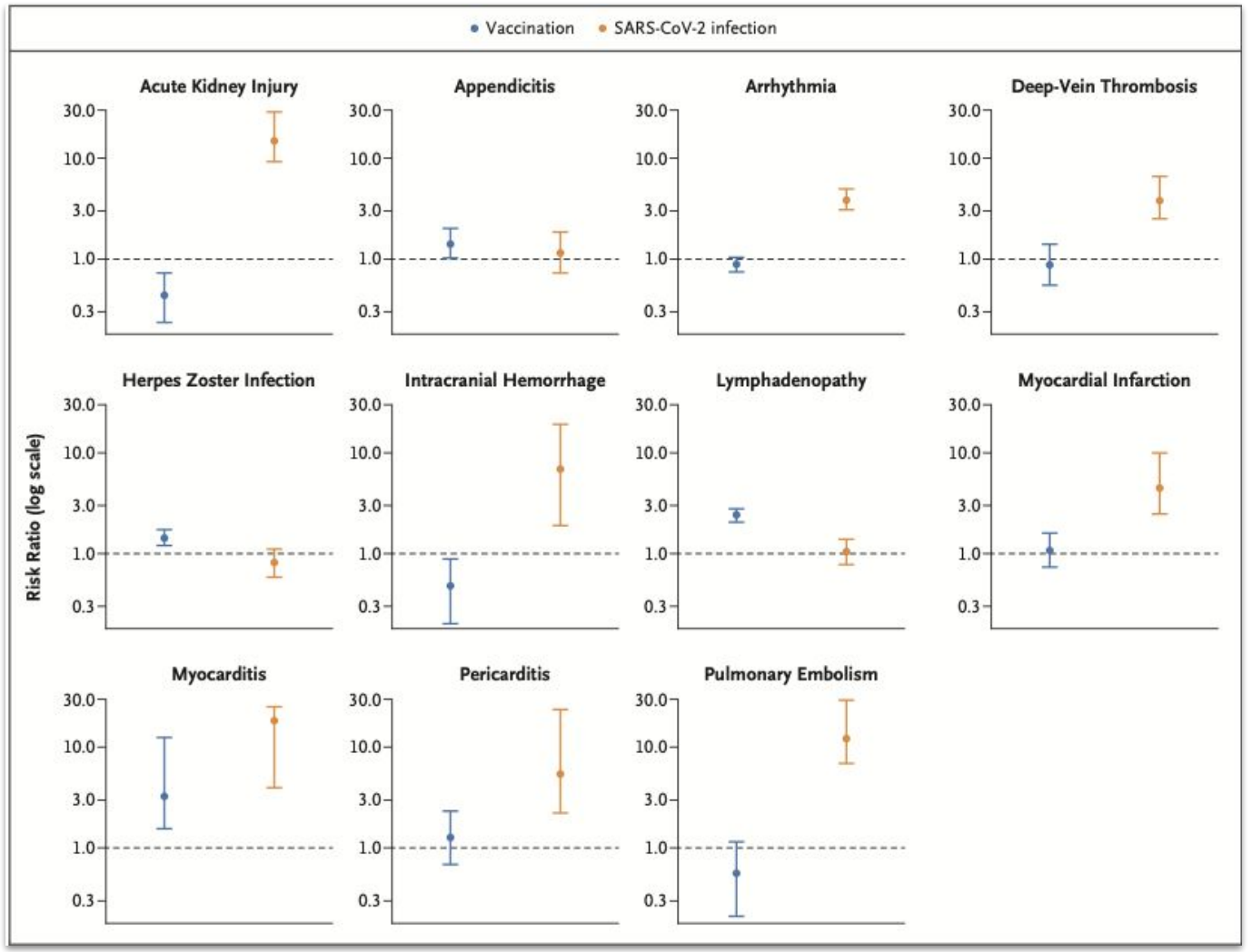


Vaccines and Related Biological Products Advisory Committee Meeting. mRNA COVID-19 Vaccine-Associated Myocarditis (2021 Oct 26) FDA.
Patel, T. et al. Comparison of MIS-C Related Myocarditis, Classic Viral Myocarditis, and COVID-19 Vaccine related Myocarditis in Children. medRxiv 2021

Adverse Events - *MUCH LOWER* for vaccination than for SARS-CoV-2 Infection (adult data)

SARS-CoV-2 infection was associated with a significantly increased risk of myocarditis, pericarditis, arrhythmia, deep-vein thrombosis, kidney injury, pulmonary embolism, myocardial infarction, intracranial hemorrhage, and thrombocytopenia compared to those who received the **COVID-19 vaccine**.

Choosing to gain immunity from infection rather than from vaccination is not a good bet



Barda N, Dagan N, Ben-Shlomo Y, et al. Safety of the BNT162b2 mRNA Covid-19 Vaccine in a Nationwide Setting. *N Engl J Med*. 2021;10.1056/NEJMoa2110475.

Other vaccine preventable diseases:

Deaths per year prior to recommended vaccines

	Hepatitis A[1]	Meningococcal (ACWY)[2]	Varicella[3]	Rubella[4]	Rotavirus[5]	COVID-19
Age	<20 years	11–18 years	5–9 years	All ages	<5 years	5–11 years
Time period	1990–1995	2000–2004	1990–1994	1966–1968	1985–1991	Oct 2020–Oct 2021
Average deaths per year	**3**	**8**	**16**	**17**	**20**	**66**

CDC ACIP Meeting November 2, 2021. EtR Framework: Pfizer-BioNTech COVID-19 vaccine in children aged 5-11 years. 1. Vogt TM et al. J Infect Dis2008; 197:1282–8. 2. NNDSS Enhanced Meningococcal Disease Surveillance Report for 2015-2019. 3. Meyer PA et al. *J Infect Dis.* 2000;182(2):383-390. 4. Roush SW et al. JAMA2007; 298:2155–63.5 Glass RI et al. J Infect Dis. 1996 Sep;174 Suppl 1:S5-11.

MODERNA's vaccine in children 6-12 years of age - early press release information

- Moderna announced the vaccine is safe and highly effective in children aged 6-12y using a two dose regime of 50 µg, given 28 days apart. (Phase 2/3 KidCOVE)
- The vaccine elicited a strong immune response evidenced by robust neutralizing antibody levels comparable to young adults.
- The vaccine was well-tolerated. AE were mild to moderate.
- Most common AE were fatigue, headache, fever and injection site pain.
- Moderna plans to submit results to the US FDA and other regulatory agencies in the near term.

Moderna Announces Positive Top Line Data from Phase 2/3 Study of COVID-19 Vaccine in Children 6 to 11 Years of Age. October 25, 2021

HCW slide deck continued

Protection for those with prior COVID-19 infection

- Retrospective cohort study of 150, 325 patients suggested those with prior COVID-19 infection had low rates of reinfection **but protection is not as good as vaccination**
- Protection due to previous infection was 81.8% and against symptomatic infection was 84.5%

Sheehan et al. (2021) Reinfection Rates Among Patients Who Previously Tested Positive for Coronavirus Disease 2019: A Retrospective Cohort Study. Clinical Infectious Diseases.

Natural Immunity vs. Vaccination-acquired Immunity

Effectiveness against Delta Variant

- Preprint, retrospective observational study in Israel
- Compared rates of breakthrough infection in vaccinated individuals with rates of reinfection in unvaccinated individuals
- Natural immunity conferred lasting protection against reinfection with the Delta variant
- However, **unvaccinated individuals were twice as likely to contract the infection again**, compared with those who had been infected and had received one dose of the Pfizer vaccine

Gazit S, et al. (2021) Comparing SARS-CoV-2 natural immunity to vaccine-induced immunity: reinfections versus breakthrough infections. medRxiv; 10.1101/2021.08.24.21262415

CDC MMWR: Comparing infection-induced immunity to vaccine-induced immunity

- Multistate analysis of hospitalizations for COVID-19-like illness among ≥18 years (Jan - Sep 2021)
- Fully vaccinated with mRNA vaccine, previously uninfected (n=6,328) vs. unvaccinated, previously infected (n=1,020)

Results

- Infection-induced immunity conferred significantly less protection against subsequent infections, compared to vaccination-induced immunity
- Previously infected people were **5.49 times more likely** to have a lab-confirmed positive COVID-19 result
    - Similar findings before and during Delta variant dominance
- Secondary analyses showed:
    - greater protective effect of vaccination for ≥65 yrs than 18-64 yrs (19.57 vs. 2.57 adjusted OR)
    - greater protective effect for Moderna full vaccination versus Pfizer (7.30 vs 5.11 aOR)

Bozio et al. DOI:10.15585/mmwr.mm7044e1. Oct 29, 2021.

Herd immunity

Herd immunity is dependent on a number of factors

- Transmissibility of the virus
  - Intrinsic properties of the virus and **variants**
  - Public health measures
- Vaccine supply, rollout, and uptake
- How long vaccine immunity lasts

While it was originally reported that we would need 75-80% of the population to be vaccinated in order to achieve herd immunity, **this number is likely higher (~80-90%)**.

Around 29 million people in Canada have said they will get vaccinated, but this is not enough to reach herd immunity

To reach herd immunity, Canadians must be vaccinated with two doses of the vaccine and children will also need to receive the vaccine.

Pfizer Vaccine Waning Immunity

Preprint

- n=56 healthy volunteers who received 2 doses of Pfizer vaccine demonstrated waning of antibody and T cell immune responses at 6 months
- Significant proportion of participants had antibody levels below detection limit

Implications: a 3rd booster shot may be warranted to improve immune responses

[Preprint] Suthar et al. (Sept 2021). Durability of immune responses to the BNT162b2 mRNA vaccine. bioRxiv

FDA Approval

On August 23, 2021 the US Food and Drug Administration formally approved the Pfizer-BioNtech vaccine for prevention of COVID-19 disease in individuals 16 years of age and older.

The vaccine continues to be available for individuals 12-15 years of age through Emergency Use Authorization.

Can the virus still spread after vaccination

Data from Israel: After 2 doses, asymptomatic infection was reduced by 90%. The vaccine prevents people from getting infected without symptoms, meaning they are less likely to spread it.

Data from the UK: One dose of mRNA vaccines or the AstraZeneca vaccine reduce symptomatic infection by 60-70%. A single dose also prevented spread by 50%.

This evidence and data showing rapid spread of variants in households is another reason to get vaccinated.

Good news for being able to lift restrictions as more Canadians get immunized.

Vaccines cut household COVID-19 transmission by up to a half, English data shows. (2021). Reuters.

Effectiveness of vaccination incentives

A study in the US compiled information on statewide incentive programs and daily doses administered

- No significant difference in vaccination trends between states with and without incentives in any of the 14 days before or after incentives were introduced
- Daily vaccination rates declined in the 14 days post-incentives (351/100,000) compared to 14 days pre-incentives (486/100,000)
- Incentives programs were associated with a non-significant decline in daily vaccination rates of 8.9 per 100,000 individuals
- **Small rewards (e.g. $5-$50) or low-probability lotteries may be insufficiently persuasive to unvaccinated individuals**

Thirumurthy et al. Association Between Statewide Financial Incentive Programs and COVID-19 Vaccination Rates. 2021 http://dx.doi.org/10.2139/ssrn.3912786

Changes in isolation and quarantine period in the US

On Dec 27 2021, the CDC shortened the isolation period from 10 days to 5 days, followed by masking for additional 5 days

CDC's recommendation was based on review of 113 studies from 17 countries on prior variants, showing that COVID transmission mainly occurs early in the illness course

- Infectiousness peaks around 1 day before symptom onset and declines within 1 week of symptom onset
- Average period of infectiousness occurs between 2-3 days before and 8 days after symptom onset
- Omicron has a shorter time between becoming infected and symptom onset (incubation period) at 2-4 days compared to previous variants

What We Know About Quarantine and Isolation. Jan 4 2022. CDC

Controversy around shortened isolation period

According to CDC, changes to the isolation period relate to practical reasons of social wellbeing, return to work, and low rates of adherence to isolation

- Studies found that 25-30% people isolated for the full previously recommended 10 days

The decision to not require testing at end of isolation is because PCR tests can be positive long after one's infectious period (up to 12 weeks)

However, emerging evidence shows that people with Omicron infections may shed virus for longer than previous variant infections, based on its higher replication efficiency in the nose while reduced in the lower respiratory tract (pre-print)

What We Know About Quarantine and Isolation. Jan 4, 2022. CDC.
Meng B et al. SARS-CoV-2 Omicron spike mediated immune escape, infectivity and cell-cell fusion. Dec 21, 2021. bioRxiv

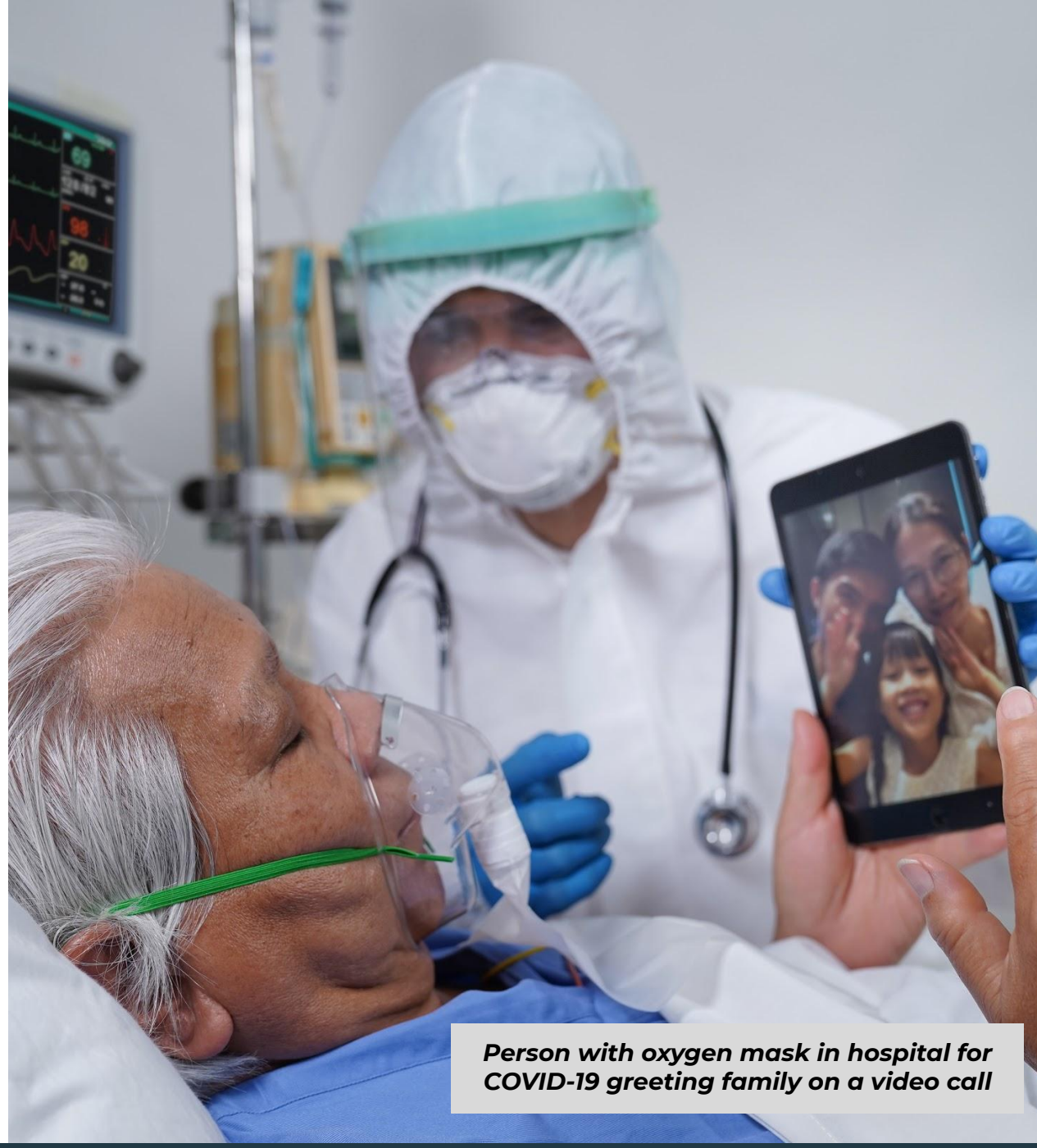

Variants of Concern

Delta (B.1.617.2) Variant

- Responsible for most COVID-19 cases
- **More transmissible** (~50% more than the Alpha variant), and ***may*** lead to more severe disease as indicated by increased risk of hospitalization
- Greatest risk of transmission is among unvaccinated people
- People infected with the Delta variant may spread the virus before developing symptoms compared to people infected with other variants

- **Number of Spike Mutations:** 11-15
- **Receptor binding domain mutations:** (K417N* - detected in some sequences but not all), L452R, T478K, P681R?
- **Attributes:** Increased transmission, potential reduced Ab efficacy, reduced neutralization by vaccine sera

Kang et al. Transmission dynamics and epidemiological characteristics of Delta variant infections in China. medRxiv. (2021)
Scobie, H. Update on Emerging SARS-CoV-2 Variants and COVID-19 vaccines. ACIP meeting. August 13, 2021.



Person with oxygen mask in hospital for COVID-19 greeting family on a video call

Vaccine Effectiveness against Delta Variant

Vaccine	Effectiveness against emergency department or urgent care visits	Effectiveness against hospitalization
Pfizer	**80% (95% CI: 73-85%)**	**77% (95% CI: 74-80%)**
Moderna	**95% (95% CI: 92-97%)**	**92% (95% CI: 89-93%)**
Johnson & Johnson	**60% (95% CI: 31-77%)**	**65% (95% CI: 56-72%)**

Effectiveness among adults ages 18 and older during June-August 2021 in the US when the Delta variant became the predominant strain.

Grannis, S. et al. (2021) Interim Estimates of COVID-19 Vaccine Effectiveness Against COVID-19–Associated Emergency Department or Urgent Care Clinic Encounters and Hospitalizations Among Adults During SARS-CoV-2 B.1.617.2 (Delta) Variant Predominance — Nine States, June–August 2021. MMWR

Omicron (B.1.1.529) Variant

- On November 26, the WHO declared the Omicron variant a variant of concern
- This variant has a large number of mutations on the spike protein
- The Omicron variant is likely to spread more easily than previous variants
    - Omicron appears roughly 2-3 times as likely to spread as Delta (preprint).
- Current vaccines are expected to protect against severe illness, hospitalizations, and deaths
- Breakthrough infections can occur as Omicron can evade vaccine-induced immunity. However, full vaccination plus a booster provide strong protection against infection with Omicron.

WHO November 26, 2021. Classification of omicron (B.1.1.52) SARS-CoV-2 VOC
Pfizer December 8, 2021. Pfizer and BioNTech Provide Update on Omicron Variant.
Andrews, N. et al. Effectiveness of COVID-19 vaccines against Omicron VOC. *Preprint*
Lyngse, F. P. et al. SARS-CoV-2 Omicron VOC Transmission in Danish Households. *medRxiv (Preprint)*.

Person with oxygen mask in hospital for COVID-19 greeting family on a video call

Dosing Intervals and Mixing of COVID-19 Vaccines

NACI Recommendation on Interchangeability of Vaccines

Interchangeability: you can receive one vaccine product for your first dose and a different vaccine product for your second dose to complete the vaccine series

NACI recommendation:

As of June 17, 2021, the National Advisory Committee on Immunization is recommending that **an mRNA vaccine is now preferred as a second dose for individuals who received a first dose of the AstraZeneca vaccine. This recommendation was based on:**

- **Emerging evidence of a better immune response with this pairing**
- **Mitigating any potential risk associated with rare blood clotting complications**

Individuals who received 2 doses of AstraZeneca are still well protected, especially against new variants like the delta variant.

Mix-and-match vaccination

NACI recommendation on mixing mRNA vaccines (Pfizer and Moderna)

If you received Pfizer or Moderna for your first dose, it is recommended that you receive the same vaccine for your second dose.

If the same vaccine is not readily available, a different mRNA vaccine can be used for the second dose to complete the series.

Men with masks and backpacks walking

Vaccine Mixing

Spain: CombivacS trial

- 676 participants who had already received first dose of AZ vaccine.
- 66% of participants received the Pfizer vaccine as their second dose.
- Mix-and-match group showed strong immune response evidenced by high titres of neutralizing antibodies
- Mild effects were common in group receiving Pfizer vaccine as second dose, similar to homologous vaccine regimes. No severe effects were reported.

Borobia, AM, et al. (2021) Immunogenicity and reactogenicity of BNT162b2 booster in ChAdOx1-S-primed participants (CombiVacS): a multicentre, open-label, randomised, controlled, phase 2 trial. Lancet.

Vaccine Mixing

UK: Com-COV study

- Adults > 50 years (n = 463) randomised across eight groups to receive AZ/AZ, Pfizer/Pfizer, Pfizer/AZ or AZ/Pfizer administered at 28 day intervals
- **Endpoint of interest:** geometric mean ratio of serum SARS-CoV-2 anti-spike IgG levels at 28 days post second dose in homologous (Pfizer/Pfizer, AZ/AZ) and heterologous schedules (Pfizer/AZ, AZ/Pfizer)

Key findings

Immune response:
(SARS-CoV-2 anti-spike IgG and neutralizing antibodies)

- AZ/Pfizer was superior to the AZ/AZ schedule
- Pfizer/Pfizer was superior to Pfizer/AZ

- Higher reactogenicity observed overall in heterologous schedules.

Liu X, et al. (2021). Safety and immunogenicity report from the Com-COV study – A single-blind randomised non-inferiority trial comparing heterologous and homologous prime-boost schedules with an adenoviral vectored and mRNA COVID-19 vaccine. Lancet.

Vaccine Mixing Data from Canada

BC

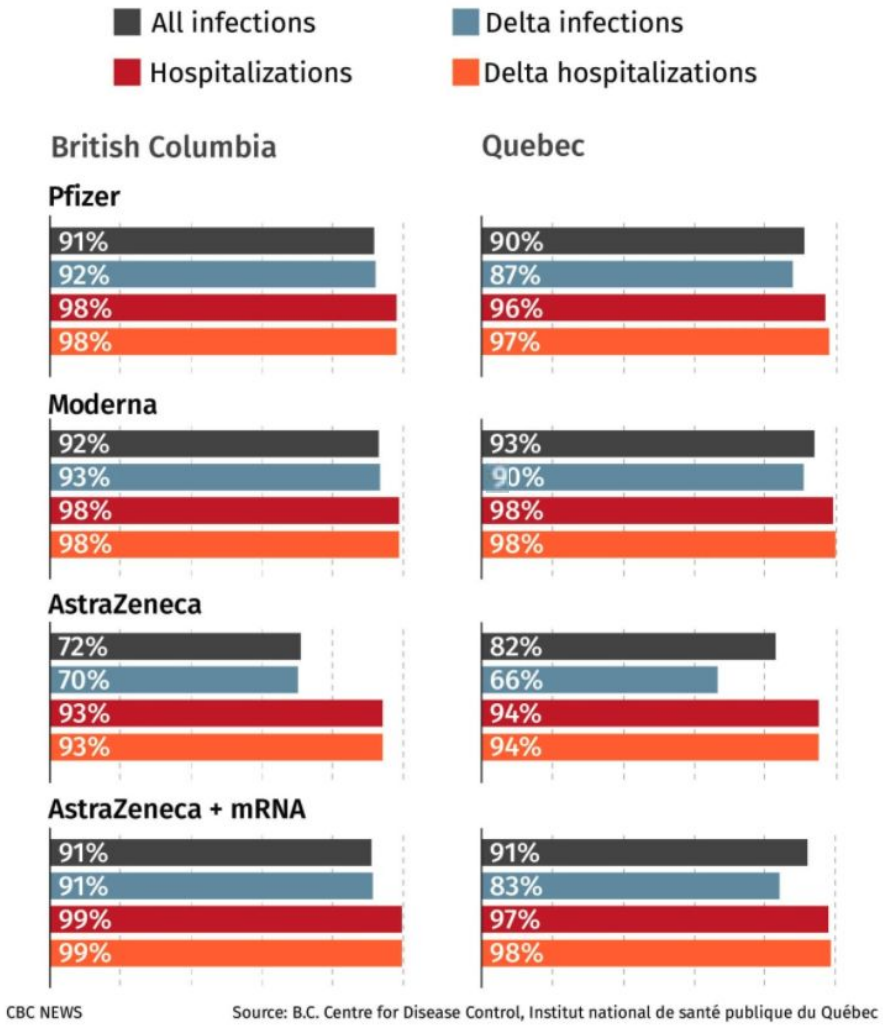
- Vaccinated adults > 18y (n = 246,656) from May 30 - Sept 11 who received any two doses (Pfizer, Moderna, AZ or AZ + mRNA)
- 95% effectiveness against hospitalization, regardless of the vaccine combination
- AZ + mRNA recipients had protection as good as with two mRNA doses
- Protection was even stronger when people received their second dose >6 weeks after dose 1 (83% vs. 93%)
- Effectiveness of >80-90% was maintained for at least 4 months after dose 2

Quebec

- Vaccinated adults > 18y (n = 1.3 million) from Mar 13 - Sept 11
- Effectiveness against death was 97% and against hospitalization was 92% for all vaccines
- Effectiveness remained high up to 5 months after dose 2

Two doses of any of the vaccine combinations offer very good and lasting protection against severe COVID-19.

Vaccine effectiveness in BC and Quebec



BCCDC (2021). Two doses prevent about 95 per cent of COVID-19 hospitalizations: B.C. COVID-19 vaccine effectiveness results
INSPQ (2021). Efficacité de deux doses de vaccin contre la COVID-19 chez les adultes québécois vivant dans la communauté.

CBC News Oct 9, 2021 New data suggests Canada's 'gamble' on delaying, mixing and matching COVID-19 vaccines paid off

Third Dose vs. Booster Dose

Third or additional dose after primary vaccine series:
Administration of an initial vaccine dose when the initial immune response following the first and second doses (series) is likely to be insufficient.

Booster:
Administration of a vaccine dose when the initial **sufficient** immune response to the primary series (dose 1 and 2) has likely to have waned over time. Whether we will need a booster has not yet been determined.

Booster Dose

US: The CDC ACIP is currently recommending boosters for everyone 12+ years of age

Israel: A booster dose was found to be 93% effective in preventing hospitalization, 92% in preventing severe disease and 81% in preventing death compared to receiving two doses at least 5 months ago.

Health Canada:
Authorized the use of Pfizer-BioNTech Comirnaty 30 mcg (Nov 9, 2021) and Moderna Spikevax 50 mcg (Nov 12, 2021) as booster doses in those 18 years of age and older at least 6 months after completion of the primary series

Barda et al. 2021 Effectiveness of a third dose of the BNT162b2 mRNA COVID-19 vaccine for preventing severe outcomes in Israel: an observational study. The Lancet.

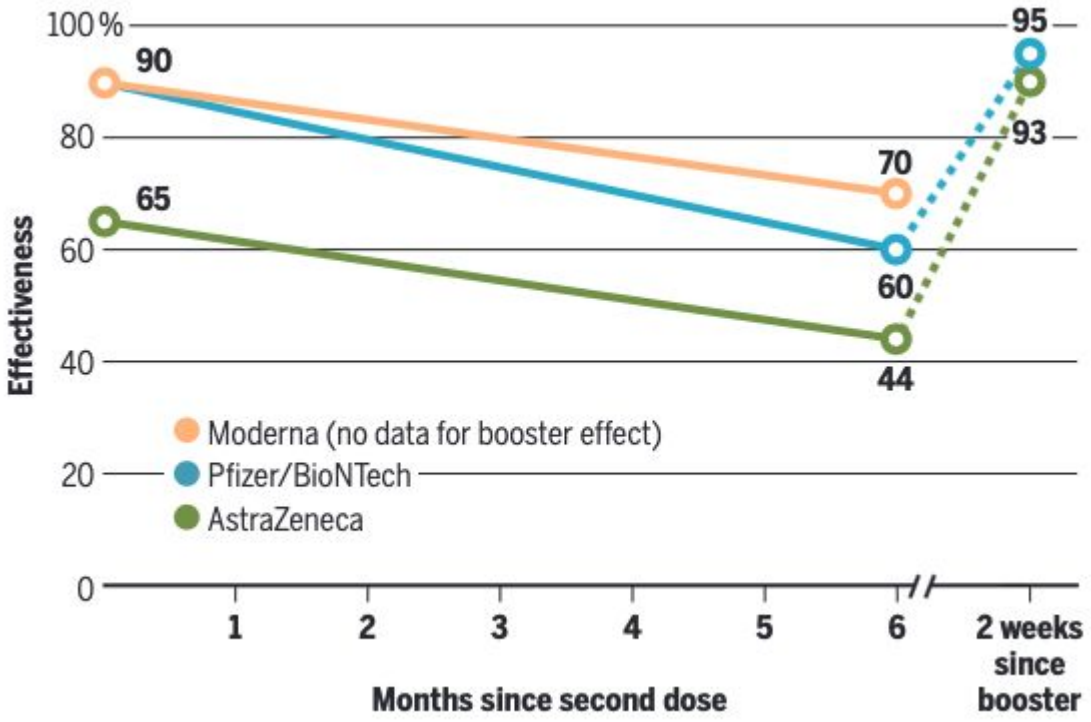
Why boost?

- New variants such as Omicron
- Decrease in vaccine effectiveness with time from second dose
  - A differential in decrease between symptomatic infection and severe disease

Percentage point decline in VE from 1 to 6 months	Disease severity
18.5% (95% CI: 8.4 to 33.4)	SARS-CoV-2 infection
25.4% (95% CI: 13.7 to 42.5)	Symptomatic COVID-18
8.0% (95% CI: 3.6 to 15.2)	Severe disease

Why boost?

- Vaccine protection can wane over time. A booster dose has been shown to restore effectiveness to >90% and provide protection against emerging VOC.



Gupta, R. & Topol, E. J. COVID-19 vaccine breakthrough infections. Science. 2021.

Safety of boosters

Safety profile comparable to that observed after the second dose of the vaccine

Israel: rates of myocarditis/pericarditis following the booster dose of Pfizer-BioNTech Comirnaty (30mcg) (given at least five months after the primary series and primary series 3 weeks apart in 12 yo and older)

- Lower than the elevated rates seen after the second dose, but higher than the rates seen after the first dose

NACI Recommendation on COVID-19 Vaccine Boosters

Boosters can offer enhanced protection and are safe, with a similar safety profile as primary series.

NACI **strongly** recommends an mRNA booster ≥6 months after a primary series for populations at high risk:

- 50+, long term care residents, recipients of viral vector vaccine series, First Nations, Inuit & Métis and frontline HCW

NACI also recommends an mRNA booster may be offered to adults 18-49 years of age ≥6 months after a primary vaccine series

National Advisory Committee on Immunization (NACI) statement: Guidance on booster COVID-19 vaccine doses in Canada. December 3, 2021

What vaccine to use as booster?

Population	Vaccine type and dose for booster doses
18-29 year olds	Pfizer-BioNTech Comirnaty (30 mcg)
≥70 year olds Adults living in long-term care homes for seniors or other congregate living settings that provide care for seniors Moderately to severely immunocompromised adultsb (after the recommended 3-dose primary series)	Either Moderna Spikevax or Pfizer Comirnaty (30mcg) may be considered. If Moderna Spikevax vaccine is being used as the booster product, a 100 mcg dose may be preferred, based on clinical discretion.
For all other populations in whom booster doses are recommended that have not been specified above.	Either Moderna Spikevax (50 mcg) or Pfizer-BioNTech Comirnaty (30 mcg) are suitable products as a booster dose

National Advisory Committee on Immunization (NACI) statement: Guidance on booster COVID-19 vaccine doses in Canada. December 3, 2021


Vaccine side effects/Expected immune response

Side Effect Comparisons

Side effects	Shingrix	Moderna	Pfizer-BioNTech	Johnson & Johnson	Oxford- AstraZeneca	Flucelvax
Local Pain	88.4%	90.1%	77.8%	58.6%	54.2%	45.4%
Redness	38.7%	9.0%	5.9%	9.0%	N/A	13.4%
Swelling	30.5%	12.6%	6.3%	7.0%	N/A	11.6%
Myalgia	56.9%	61.3%	37.3%	39.1%	48.6%	15.4%
Fatigue	57%	67.6%	59.4%	43.8%	62.3%	17.8%
Headache	50.6%	62.8%	51.7%	44.4%	57.5%	18.7%
Chills	35.8%	48.3%	35.1%	2%*	31.9%	6.2%
Fever	27.8%	17.4%	15.8%	12.8	33.6%	0.8%
Overall Grade 3	**5.2%**	**4.1%**	**1.5%**	**0.54%**	**N/A**	**0.45%**
Overall incidence of SEs	**48%**	**46%**	**36%**	**27%**	**N/A**	**15%**

What should I remember from the side effects of this vaccine?

- 8 in 10 people complain of sore arm
  - **BUT** only 1 in 100 call that soreness severe
- 5 in 10 people complain of fatigue and headache
  - **BUT** only 1 in 10 need Advil or Tylenol
- Some reaction to the vaccine is to be expected, but the majority are mild and easily manageable at home

Side effect profile of the Pfizer-BioNTech vaccine at the population level

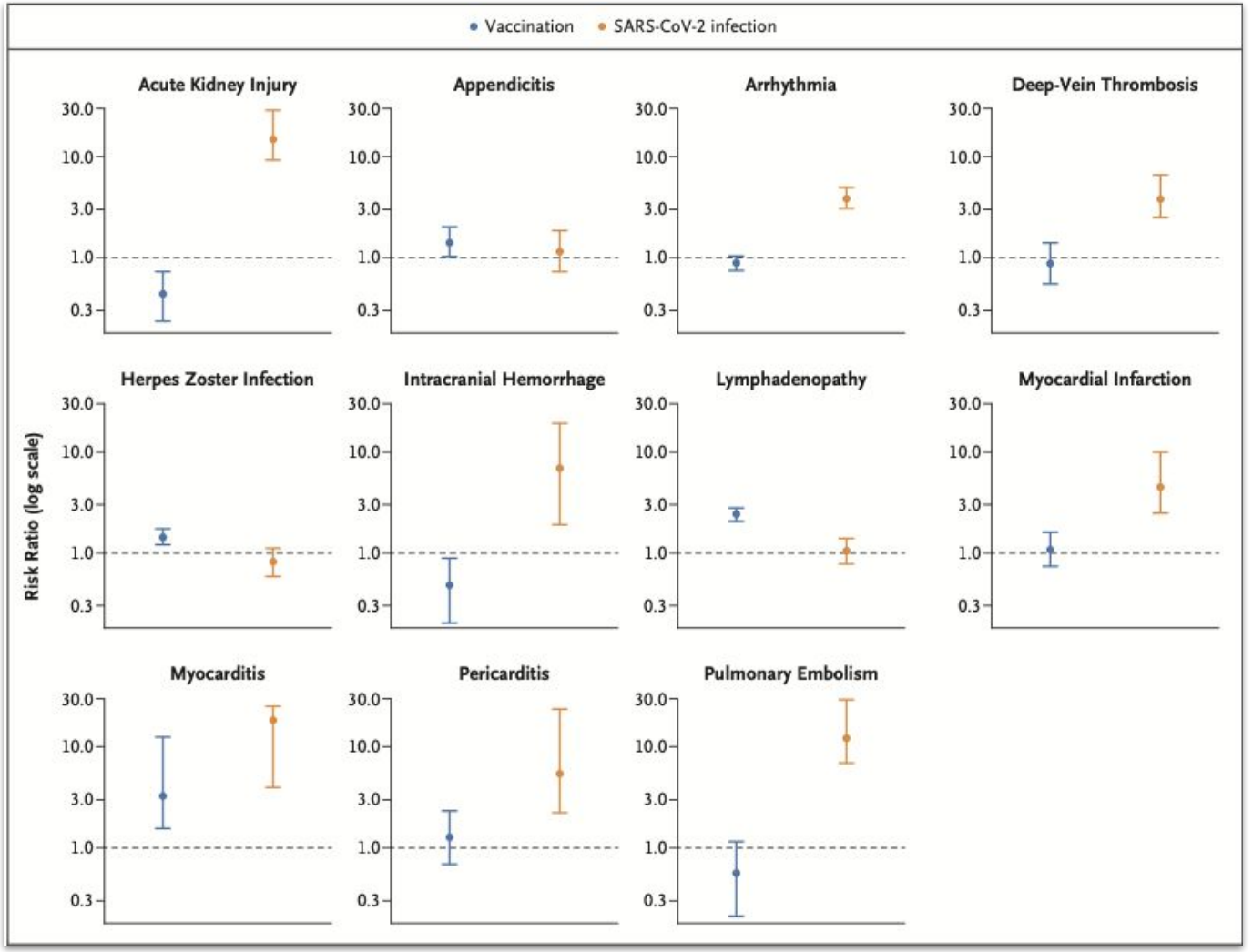
Study on safety of Pfizer vaccine in Israel including close to 900,00 vaccinated individuals and 233,392 people infected with SARS-CoV-2 >16 years of age

- The Pfizer vaccine was not associated with an elevated risk of most of the adverse events examined
- The Pfizer vaccine was associated with an excess risk of myocarditis (1-5 events per 100,000 persons). However, the risk of myocarditis was substantially increased after contracting COVID-19. (Risk ratio for myocarditis was 3.24 after vaccination and 18.28 after COVID-19)

Barda N, Dagan N, Ben-Shlomo Y, et al. Safety of the BNT162b2 mRNA Covid-19 Vaccine in a Nationwide Setting. *N Engl J Med*. 2021;10.1056/NEJMoa2110475.

Risk Ratios for Adverse Events after Vaccination or SARS-CoV-2 Infection

SARS-CoV-2 infection was associated with a significantly increased risk of myocarditis, pericarditis, arrhythmia, deep-vein thrombosis, kidney injury, pulmonary embolism, myocardial infarction, intracranial hemorrhage, and thrombocytopenia compared to those who received the **COVID-19 vaccine**.



Barda N, Dagan N, Ben-Shlomo Y, et al. Safety of the BNT162b2 mRNA Covid-19 Vaccine in a Nationwide Setting. *N Engl J Med*. 2021;10.1056/NEJMoa2110475.

Regulatory Systems & Surveillance

Adverse Effects Following Immunization (AEFI) in Canada

- Vaccines on the market in Canada are monitored continuously
- An AEFI is a medical incident that may occur following immunization
    - AEFI's are reported and reviewed by PHAC
- The Canadian Vaccine Safety Network (CANVAS) assesses vaccine safety immediately after implementation of vaccine campaigns

AEFI Monitored in Real Time: Canada

WHAT YOU NEED TO KNOW *up to and including December 31, 2021*

No new safety signals have been identified in Canada (three continue to be monitored)

98 total new AEFI reports since last update (41 new non-serious and 57 new serious)

32,514 total AEFI reports (0.048% of all doses administered)

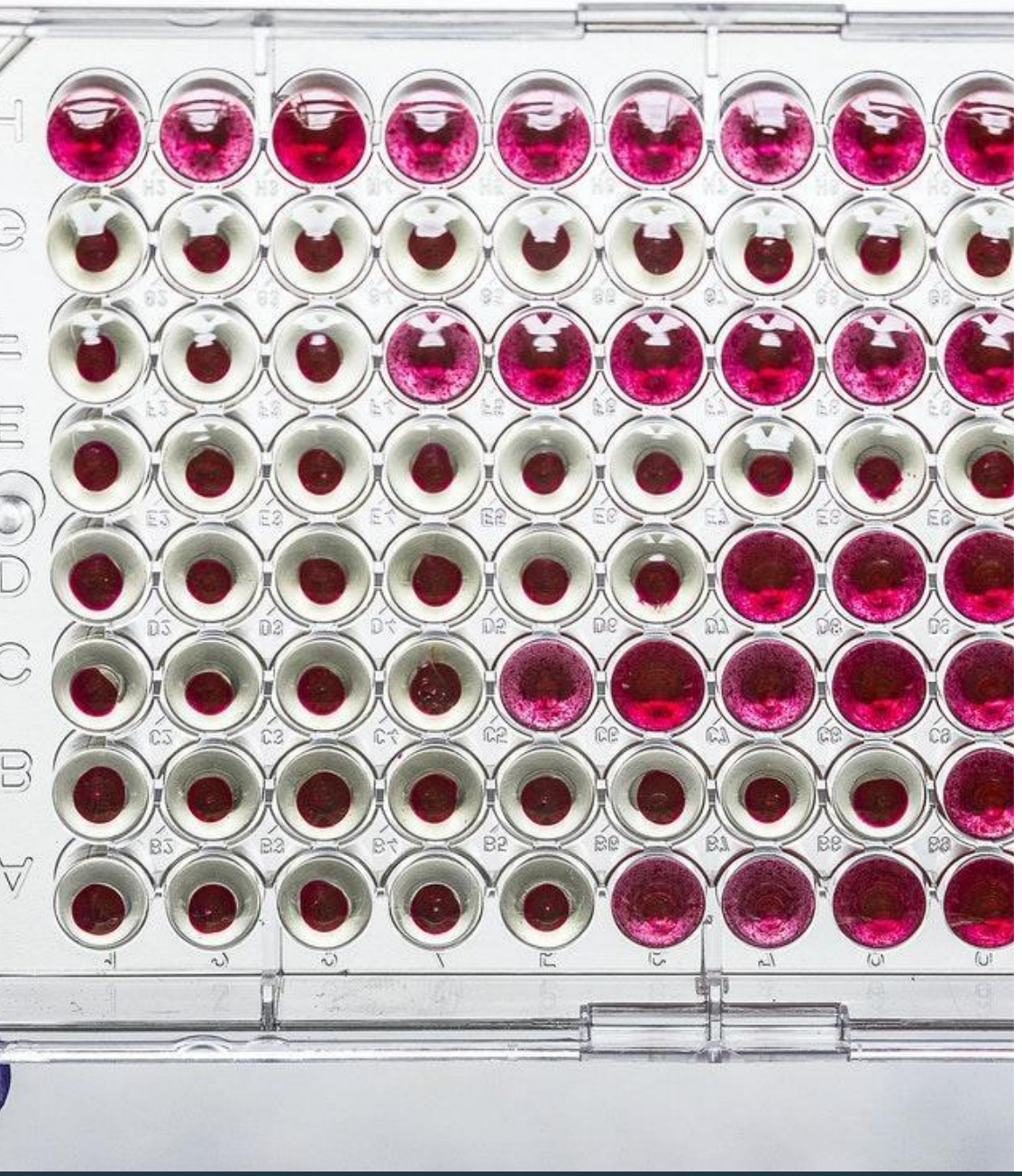
25,388 total AEFI reports were non-serious (0.037% of all doses administered)

6,443 total AEFI reports were serious (0.011% of all doses administered)

68,229,041 total doses administered as of Dec 31, 2021

Public Health Agency of Canada (2021). COVID-19 vaccine safety: Weekly report on side effects following immunization [Datasets;statistics;education and awareness]. Aem.

Special Circumstances & Populations



COVID-19 Vaccine Contraindications

- Severe allergic reaction after previous administration of these or any mRNA vaccines.
- Proven immediate or anaphylactic hypersensitivity to any component of the vaccine or its container, including polyethylene glycol and polysorbate.

COVID-19 Vaccination Recommendations for Special Populations. (2021). Ontario Ministry of Health.

COVID-19 Vaccine Testing & Administration Guidance for Allergists/Immunologists from the CSACI. (2021). Canadian Society of Allergy and Clinical Immunology.

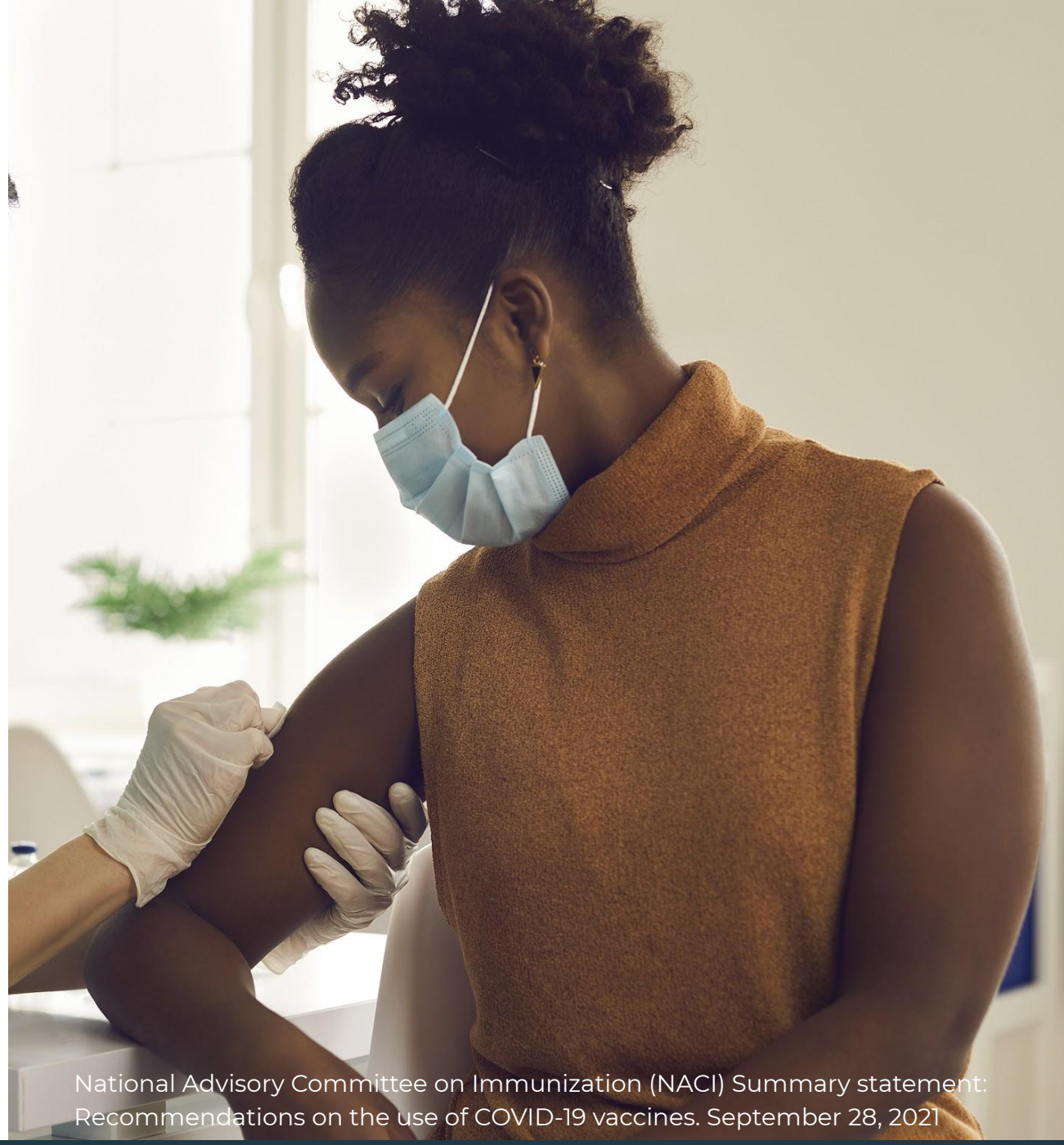
Precautions for COVID-19 vaccines

- New NACI statement recommends that there be no waiting period between COVID vaccine and other vaccines. They can be administered simultaneously.

NACI Recommendation on Use of Influenza and COVID-19 Vaccines

COVID-19 vaccines may be given at the same time as, or any time before or after, other vaccines, including live, non-live, adjuvanted or unadjuvanted vaccines

- NACI's previous precautionary recommendation to space out COVID-19 vaccine administration ≥28 days before, 14 days after other vaccines no longer necessary
- No specific safety concerns have been identified when routine vaccines were given at same time or within days of COVID-19 vaccine, however possibility of increased temporary side effects
- COVID-19 and influenza vaccine same-visit, different injection sites administration is preferred



National Advisory Committee on Immunization (NACI) Summary statement: Recommendations on the use of COVID-19 vaccines. September 28, 2021

Influenza and COVID-19 vaccination

Concomitant vaccination with both influenza and COVID-19 vaccines was found to be safe in adults

Findings:

- Pre-print of a large randomized controlled trial in UK (n = 679) followed adults in 6 cohorts randomized to 2 main groups: COVID-19 vaccine+influenza vaccine or COVID-19 vaccine+placebo
- Median age ranged from 51 - 69 years for each cohort
- No new safety concerns with concomitant vaccination
- Most reactions were mild or moderate and systemic reactions were similar between groups
- The immunogenicity of both vaccines was preserved

Interpretation:

Vaccination with both COVID-19 and influenza vaccines over the immunization season may safely confer protection from both viruses for those in need

[Preprint] Lazarus et al. (Sep 2021). The Safety and Immunogenicity of Concomitant Administration of COVID-19 Vaccines (ChAdOx1 or BNT162b2) with Seasonal Influenza Vaccines in Adults: A Phase IV, Multicentre Randomised Controlled Trial with Blinding (ComFluCOV). The Lancet.

Vaccination for those with previous COVID-19 infection

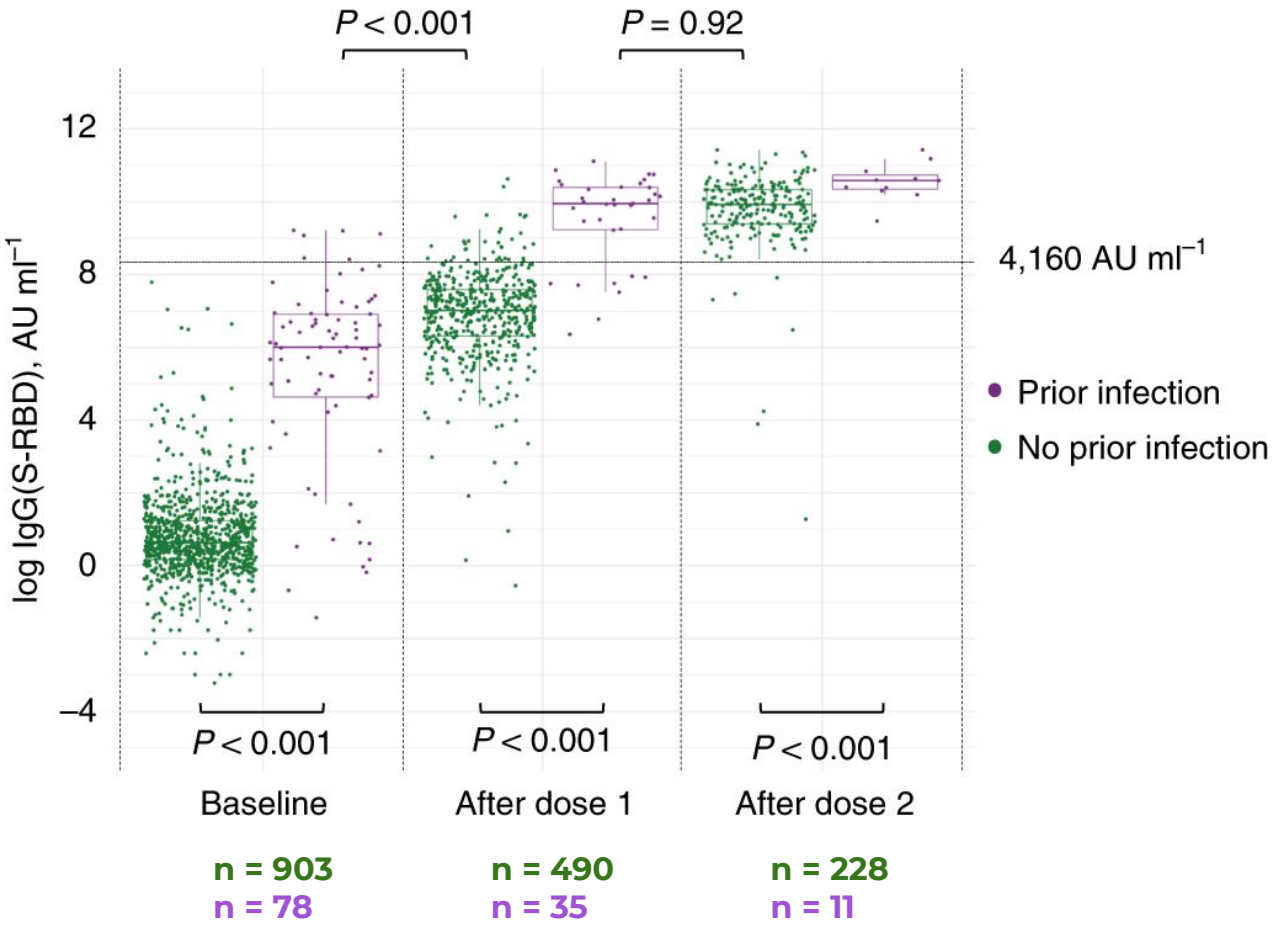
- Safe for those with previous COVID-19 infection but not while they are infectious
- A 90 day period is recommended for:
  - People who have received convalescent plasma
  - People who have received antibody treatment specific for COVID-19

Ebinger JE, et al. (2021). Antibody responses to the BNT162b2 mRNA vaccine in individuals previously infected with SARS-CoV-2. Nature Medicine, 1–4.

Dosage for those with previous COVID-19 infection

- Cohort of 1,090 individuals who received the Pfizer-BioNTech vaccine
- Individuals with confirmed prior infection were compared to those without prior evidence of infection.
- Individuals who had prior COVID-19 infection (n=35) had similar protection after one dose of vaccination compared to those who received two doses of the vaccine and had no prior infection (n=228)

IgG (S-RBD) antibody response to mRNA SARS-CoV-2 vaccination in individuals with and without prior SARS-CoV-2 infection



Ebinger et al. (2021). Antibody responses to the BNT162b2 mRNA vaccine in individuals previously infected with SARS-CoV-2. Nature Medicine.

COVID-19 vaccination in people with cancer

UK: 54 healthy controls and 151 mostly elderly patients with solid and haematological malignancies

- Three weeks after one dose of the Pfizer vaccine, they measured antibody-seroconversion, T cell responses and neutralizing antibodies (immune efficacy)
- 13% of people with blood cancer showed neutralizing antibody response
- Even patients with blood cancers NOT undergoing therapy had significantly reduced antibody responses
- 39% of solid cancer patients
- Solid cancer patients immune efficacy boosted to 95% with second dose
- Compared to 97% healthy people antibody response

Monin et al. (2021) Safety and immunogenicity of one versus two doses of the COVID-19 vaccine BNT162b2 for patients with cancer: interim analysis of a prospective observational study. Lancet Oncology.

COVID-19 vaccination in people with cancer

233 patients, used a validated antibody assay against spike protein, completed TWO doses of vaccine (mRNA or J&J)

- Overall 94% seroconversion rate
- 98% seroconversion in solid tumors
- 85% seroconversion in hematological malignancies
- 73% seroconversion stem cell transplants

Lower IgG titres with J&J vs mRNA (Moderna higher than Pfizer)

Prior COVID diagnosis had heightened antibody responses (22 patients)

Comparative Effectiveness of Moderna, Pfizer-BioNTech, and Janssen (Johnson & Johnson) Vaccines in Preventing COVID-19 Hospitalizations Among Adults Without Immunocompromising Conditions — United States, March–August 2021

COVID-19 vaccination in people with transplants

658 SOT recipients

Semi-quantitative serologic assays, Roche

Three weeks after one dose of the Pfizer vaccine, compared to 97% healthy people antibody response:

- 15-17% of SOT recipients mounted a positive antibody response after one dose mRNA vaccine
- 54% of patients with solid organ transplants showed antibody response

Boyarsky et al. 2021 Immunogenicity of a single dose of SARS-CoV-2 messenger RNA vaccine in solid organ transplant recipients. JAMA

COVID-19 vaccination in people with transplants

Case series of 30 SOT recipients receiving a third dose of vaccine against COVID-19 (J&J, Moderna or Pfizer/BioNTech)

All had previously received two doses of an mRNA vaccine

14-17 days after the third dose:

- Of 6 patients that had low-positive antibody titers after two doses, all had high-positive antibody titers
- Of 24 patients with negative antibody titers after two doses, 6 (25%) had high-positive antibody titers, 2 (8%) had low-positive antibody titers and 16 (67%) remained negative

Webel et al. (2021) Safety and Immunogenicity of a Third Dose of SARS-CoV-2 Vaccine in Solid Organ Transplant Recipients: A Case Series. Annals of Internal Medicine.

Immunocompromised and vaccine choices

Clinical judgement

- Moderna Spikevax vaccine (100 mcg) may be considered for adolescents and adults 12 to 29 years of age who are moderately to severely immunocompromised
- New evidence that the Moderna Spikevax vaccine (100 mcg) may have:
- Slightly higher vaccine effectiveness
- Longer protection against infection and severe COVID-19 outcomes compared to the PfizerBioNTech Comirnaty vaccine (30 mcg).

NACI Updated recommendation on the use of authorized COVID-19 vaccines in individuals aged 12 years and older in the context of myocarditis and pericarditis reported following mRNA COVID-19 vaccination. December 3, 2021

Third Dose for Immunocompromised People

Immunocompromised people: Defined as people with a medical condition(s) or people receiving treatment associated with compromise to the immune system.

Immunocompromised people

- Are more likely to get severe illness from COVID-19
- Are at higher risk for prolonged SARS-CoV-2 infection and shedding, viral evolution during infection and treatment
- Have lower Ab/neutralization titers to SARS-CoV-2 variants compared to non-immunocompromised people
- Are more likely to transmit to household contact
- Are more likely to experience breakthrough infection (40-44% of hospitalized breakthrough cases are immunocompromised people in one US study).

Other considerations

- Lower vaccine effectiveness (59-72%) among immunocompromised people vs. non-immunocompromised people after second dose (over 90%)
- Among immunocompromised people who had no detectable antibody response to an initial mRNA vaccine series, 33-50% developed an Ab response to an additional (third) dose. No serious adverse events reported after administration of the third dose and no acute rejection episodes occurred.

NACI Recommendation on Additional Dose for Immunocompromised People

- Moderately to severely immunocompromised individuals who had previously received a primary COVID-19 vaccine series should be offered an additional dose of an authorized mRNA COVID-19 vaccine

- Moderately to severely immunocompromised individuals who have not yet been immunized, should receive a primary series of three doses of an authorized mRNA vaccine

National Advisory Committee on Immunization (NACI) rapid response: Additional dose of COVID-19 vaccine in immunocompromised individuals following 1- or 2- dose primary series. September 10, 2021

Third Dose for Immunocompromised People (AB)

Albertans with specific conditions are now eligible to receive a follow-up vaccine a minimum of eight weeks after their second dose. (A similar program already exists in Ontario).

Conditions that qualify include:

- Transplant recipients including solid organ transplant and hematopoietic stem cell transplants
- Individuals with chronic kidney disease who are receiving regular dialysis
- Individuals in active cancer treatment (chemotherapy, immunotherapy or targeted therapies) excluding those receiving only hormonal therapy, radiation therapy or surgery
- Individuals on medication for autoimmune diseases including rituximab, ocrelizumab and ofatumumab

Seniors living in congregate care are also eligible to receive a third dose. This cohort will be eligible to receive their third dose approximately five months after their second dose.

Can these vaccines be given to pregnant and breastfeeding women?

The Society of Obstetricians & Gynecologists of Canada recommends the vaccine for pregnant and breastfeeding women.

- Pregnant women with COVID-19 are at higher risk for severe disease, hospitalization and ICU admissions as well as pregnancy complications
- Large studies suggest 7-11% of pregnant women will require hospitalization for COVID-related morbidity and 1-4% of pregnant women require ICU admission
- There are no increases in miscarriage, preterm or stillborn births or congenital anomalies after vaccination

Poliquin et al. SOGC Statement on COVID-19 Vaccination in Pregnancy

Are mRNA vaccines safe in pregnancy?

YES. mRNA vaccines **do not** increase the risk of adverse pregnancy and neonatal outcomes compared to women who were pregnant pre-pandemic/unvaccinated

US: CDC V-Safe registry 2,456 pregnancies with at least one dose of mRNA vaccine

- Baseline riks for miscarriage is between 13-23%
- The risk of miscarriage in vaccine recipients was 12.8%

Norway: Rates of spontaneous abortion/miscarriage are equal in mRNA vaccinated individuals vs. unvaccinated individuals (n=18477 pregnancies, 5% vaccinated)

Magnus et al. NEJM October 20, 2021

Are mRNA vaccines safe in pregnancy?

mRNA vaccines **do NOT** increase the risk of congenital malformations, preterm birth, small for gestational age or neonatal deaths

- Among 35,691 v-safe participants in the US, calculated proportions of adverse pregnancy and neonatal outcomes in people vaccinated were similar to incidences reported in studies before the pandemic

Shimabukuro T et al. NEJM May 2021

How are mRNA vaccines tolerated in pregnancy?

Pregnant individuals tolerate mRNA vaccines better that non-pregnant individuals.

- 17000 women (8000 pregnant, 7000 lactating and 3000 planning pregnancy)
- 85% had received two doses of vaccine
- Risk of adverse effects was 50% lower compared with non-pregnant adults and they also have lower rates of fever

Kachikis A et al. JAMA Network Open. 2021;4(8):e2121310-e.

Pfizer-BioNTech vaccine in pregnant individuals

- Large retrospective observational study including pregnant individuals in Israel (n = 15,060)
- Pregnant women vaccinated between Dec 2020 - Feb 2021 matched to unvaccinated women
- Mean age: 31.1 years

Results:

- Cumulative incidence was 1.85% among those vaccinated and 3.90% among unvaccinated women. COVID-19-related hospitalization rates were 0.2% in vaccinated women and 0.3% in unvaccinated women
- Risk reduction rose over time post-vaccination
- No severe adverse events
- No differences in preeclampsia, intrauterine growth restriction, infant birth weight, stillbirth, miscarriage, maternal death or pulmonary embolism in the vaccinated vs unvaccinated

Estimated vaccine effectiveness of 78%

Goldshtein et al. (July 2021). JAMA.

Vaccine Risks vs Disease for Pregnant Women

INTERCOVID STUDY

Multinational prospective, longitudinal cohort study

- n = 656 women with lab confirmed COVID-19; n = 1424 women without COVID-19

Women with COVID-19 diagnosis had

- **Higher rates of pregnancy-induced hypertension Preeclampsia/eclampsia**
- **Infections requiring antibiotics**
- **Greater risk of admission to ICU** and **referral to higher level care**

Pregnant women with COVID-19 were 22 times more likely to die compared to women without COVID-19

The risk of severe neonatal morbidity index was higher in neonates born to women with a COVID-19 diagnosis

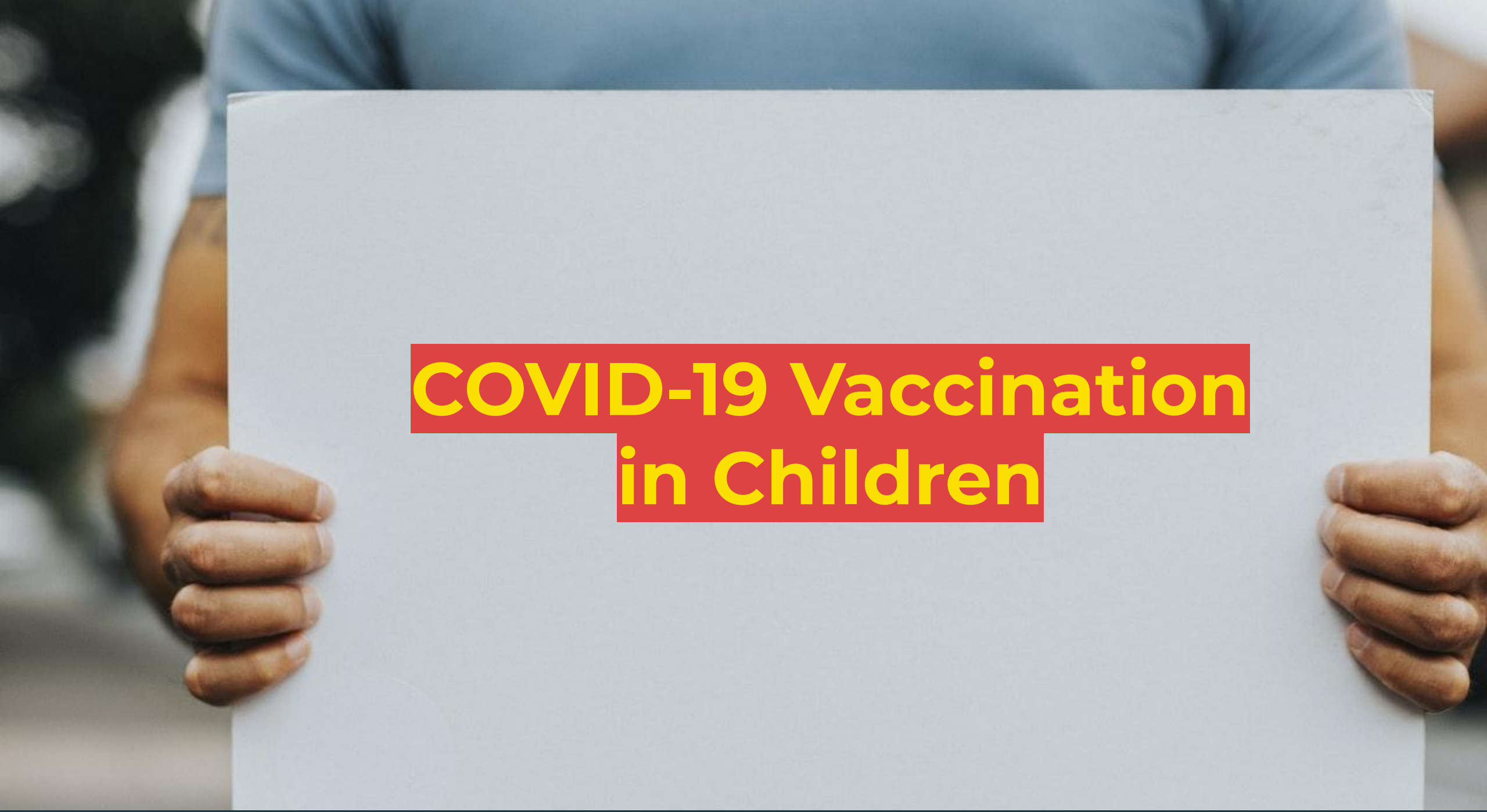
COVID-19 infection poses serious risks to the health of pregnant individuals and their children.

Villar J, et al. (2021). JAMA Pediatr.

What about fertility?

- Early rumor that antibodies against the spike protein will also target a protein in the placenta of pregnant mothers, syncytin-1.
- There is no data suggesting that these antibodies will affect syncytin-1, as they are different proteins.
- If this was true, you would expect COVID-19 infection to be associated with increased rates of miscarriage.
- Whereas COVID-19 in pregnant women leads to severity and ICU admissions, it is NOT associated miscarriages.
- Recent study that looked at placentas of vaccinated and unvaccinated women: no damage from the vaccine to the placenta (no placental histopathological lesions)

Shanes et al. 2021 Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Vaccination in Pregnancy. Obstetrics & Gynecology



COVID-19 Vaccination in Children

Why do children need to be immunized?

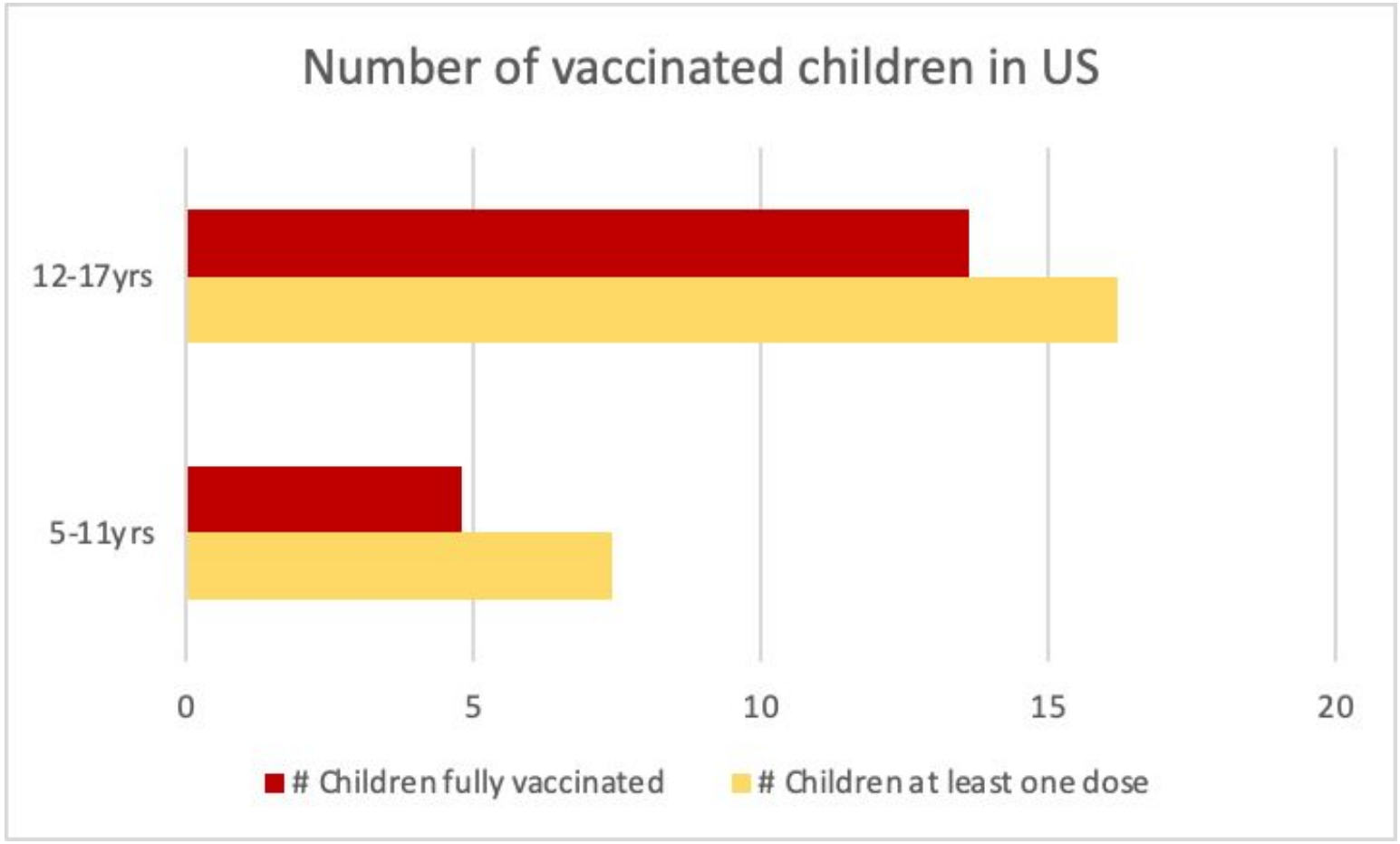
To protect their health: While COVID-19 infection is usually milder in adults, some kids can become very sick and develop complications or long-lasting symptoms

To prevent virus transmission: Children can transmit the virus to family members and friends even if they are asymptomatic.

To protect the broader community: Each child or adult infected provides a chance for the virus to mutate and new variants to develop.

To return to in-person learning: To return to school with fewer restrictions, it is important children receive the vaccine. Some schools may require your child to receive a COVID-19 vaccination.

In the US >7.4 million children 5-11y have received at least one dose of the Pfizer vaccine and 4.7 million have been fully vaccinated



CDC Covid data tracker vaccination demographic. January 8th, 2022

In Alberta, for the 5-11 yo age group

- In Alberta, 16% of 5-11 kids (total population 391,430) have been vaccinated

- Very different rural (8-15%) vs urban (25-30%)

COVID-19 cases and severity in children

- Kids make up 20%-30% of COVID-19 cases in most jurisdictions in Canada and similarly in the USA
- COVID-19 is in the top 10 causes of death for kids currently
- In USA, more than 3.78M kids have been infected and over 790 kids have died

https://www.cdc.gov/mmwr/volumes/70/wr/mm7036e2.htm

COVID-19 cases and severity in children

- In Canada and USA, kids make up 1-2% of hospitalisations
  - Of those hospitalised, ⅓ had no pre-existing conditions or comorbidities
- In the USA, unvaccinated teens were 10x more likely to be hospitalised than vaccinated teens
- MIS-C is highest in 5-11 yo age group, 60-70% admission to ICU, 1-2% death
- 7-8% of kids experience long covid

https://www.cdc.gov/mmwr/volumes/70/wr/mm7036e2.htm

COVID-19 vaccination in children 12+

The **Pfizer BioNTech** and **Moderna** vaccines have been authorized by Health Canada for kids 12 and older

The Pfizer vaccine was found to be 100% effective in preventing COVID-19 in a phase 3 trial (n = 2,260) conducted in children ages 12-15 years old.

The Moderna vaccine trial (TeenCOVE study) showed the vaccine 100% effective in preventing COVID-19 after two doses (n = 3,700)

Pfizer-BioNTech Announce Positive Topline Results of Pivotal COVID-19 Vaccine Study in Adolescents | pfpfizeruscom. (March 31, 2021).

COVID-19 vaccination in children 12-15y: Pfizer-BioNTech

Efficacy

- Immune response to this vaccine in SARS-CoV-2 50% neutralizing titers in 12-15 year olds exceeded the immune response seen in young adults
- **100% efficacy** was observed for those without evidence of prior infection and for those with evidence of prior infection (95% CI 75.3% to 100.0%)
- Phase 3 study ongoing to collect information on the long-term safety and efficacy of the vaccine.

Perez JL. (2021). COVID-19 Vaccine BNT162b2. Safety, Immunogenicity and Efficacy in Subjects 12-15 years old. Pfizer.

COVID-19 vaccination in children 12-15y: Pfizer-BioNTech

Safety

- 98.3% had ≥1 month of follow-up, & 57.9% had ≥2 months of safety follow-up after Dose 2
- Overall, solicited adverse reactions (AR), within 7 days after any dose, included (frequency in %):
  - pain at injection site (90.5%), fatigue (77.5%), headache (75.5%), chills (49.2%), muscle pain (42.2%), fever (24.3%), joint pain (20.2%), injection site swelling (9.2%), and injection site redness (8.6%)
  - Most reactions were mild or moderate in severity. Severe solicited adverse reactions were reported in ≤1.5% for local ARs and in ≤3.5% for systemic ARs.
- Observed unsolicited AEs did not suggest any serious safety concerns for adolescents 12-15y
- Adverse events of special interest (AESI): lymphadenopathy (0.8% vaccines, 0.2% in the placebo); no cases of Bell's palsy, thrombocytopenia, DVT, anaphylaxis

Perez JL. (2021). COVID-19 Vaccine BNT162b2. Safety, Immunogenicity and Efficacy in Subjects 12-15 years old. Pfizer.

NACI recommendation on the use of Pfizer and Moderna mRNA vaccines in adolescents 12-17y

- mRNA vaccines are very effective and **have a favourable benefit versus risk profile in adolescents 12+**
- A complete series with an mRNA vaccine should be offered to adolescents 12-17y without contraindications
- People who experienced myopericarditis after their first dose of an mRNA vaccine should wait to get their second dose until more information is available
- Individuals with a history of myocarditis unrelated to mRNA vaccination should consult their clinical team
- People previously diagnosed with myocarditis who are no longer being followed by a medical professional for heart issues should receive the vaccine

National Advisory Committee on Immunization (NACI) rapid response: Additional dose of COVID-19 vaccine in immunocompromised individuals following 1- or 2- dose primary series. September 10, 2021

Pfizer and Moderna mRNA vaccines in adolescents 12-17y

- Higher rates of cases of myocarditis/pericarditis have been reported after vaccination with Moderna compared to the Pfizer vaccine - verification of the difference is ongoing

- On Sept 29 2021, Ontario issued preferential recommendation on the use of Pfizer-BioNTech vaccine for individuals aged 18-24 years out of an abundance of caution

National Advisory Committee on Immunization (NACI) rapid response: Additional dose of COVID-19 vaccine in immunocompromised individuals following 1- or 2- dose primary series. September 10, 2021

Recommendation for the 12-29y population

To minimize the rare risk of myocarditis and/or pericarditis after receiving a COVID-19 mRNA vaccine, NACI now recommends:

- Pfizer-BioNTech Comirnaty mRNA vaccine (30 mcg) is preferred in adolescents and young adults 12 to 29 years of age over Moderna' Spikevax (100mcg)
- The second dose of a primary series should be provided 8 weeks after the first dose
- As a precaution, a booster dose of Pfizer-BioNTech Comirnaty may be preferred over a booster dose of Moderna Spikevax (i.e. 50 mcg dose) for adults 18 to 29 years of age who are recommended to receive a booster dose.

NACI: Updated recommendation on the use of authorized COVID-19 vaccines in individuals aged 12 years and older in the context of myocarditis and pericarditis reported following mRNA COVID-19 vaccination. Dec 3,2021
Amirthalingham et al. medRxIV. https://doi.org/10.1101/2021.07.26.21261140

Consent & Vaccination for Mature Minors

- In Canada, we respect the rights of teenagers (mature minors) to make decisions including those to protect their own health

- If a teen has the capacity to consent to COVID-19 vaccination, parental consent is not necessary and parents do not have standing to be the decision makers in place of their teen

COVID-19 vaccination in children aged 5-11

The **Pfizer BioNTech COVID-19 vaccine has been authorized by Health Canada for kids 5-11y** as a two-dose regimen of 10µg administered 3 weeks apart (November 19th, 2021)

Health Canada Statement. Health Canada authorizes use of Comirnaty (the Pfizer-BioNTech COVID-19 vaccine) in children 5 to 11 years of age. (November 19th, 2021)

Pfizer vaccine in children 5-11 years of age

Study Characteristics

- Randomized, placebo, controlled Phase 2/3 study in 5 to <12 yrs; Mar - Oct 2021
- Sample size 4518 (3018 vaccine recipients; 1500 placebo)
- 2 doses 10µg each, 3 wks apart

Efficacy and Immunology

- Two-dose 10µg for 5 to <12y similar efficacy as two-dose 30µg in 16-25y based on 50% neutralizing titers at 1 mth post-dose 2
- Delta variant neutralizing titer at 1 mth post-dose 2 comparable to titer against wild-type (n = 38)
- Jul-Sep 2021 when Delta was the predominant strain, **vaccine effectiveness was 90.7%** (against confirmed symptomatic COVID-19 7 days after dose 2)

Vaccines and Related Biological Products Advisory Committee Meeting Document. (2021 Oct 26) FDA.
Walter E. B. et al. Evaluation of the BNT162b2 Covid-19 Vaccine in Children 5 to 11 Years of Age. NEJM. November 9, 2021

Pfizer vaccine in children 5-11 years of age

Side Effects

- Overall consistent with general pediatric population and known reactogenicity
- Mild to moderate side effects mostly occurring 1-2 days after dose with short resolution
- Low incidence AEs
- Most common local reaction: injection site pain
- Most common systemic reaction: fatigue, headache, muscle pain, chills

Vaccines and Related Biological Products Advisory Committee Meeting Document. (2021 Oct 26) FDA.
Walter E. B. et al. Evaluation of the BNT162b2 Covid-19 Vaccine in Children 5 to 11 Years of Age. NEJM. November 9, 2021

Pfizer vaccine in children 5-11 years of age

Myocarditis Risk

- No cases of myocarditis/pericarditis observed at 3 mths post-dose 2 (small sample size)
- Myocarditis rate is 21 per million for 2nd dose based on adolescent 12-15 years data
- Lower expected post-vaccine myocarditis rate in 5 to <12 yrs compared to older vaccines due to lower dose (10µg vs 30µg)
- 5 long-term safety studies with 5 yr follow-up planned

Vaccines and Related Biological Products Advisory Committee Meeting Document. (2021 Oct 26) FDA.
Walter E. B. et al. Evaluation of the BNT162b2 Covid-19 Vaccine in Children 5 to 11 Years of Age. NEJM. November 9, 2021

NACI recommendation on the use of the Pfizer vaccine in children 5-11y

- NACI recommends two 10mcg doses of the Pfizer vaccine may be offered to children 5-11y
- ≥ 8 weeks between doses is recommended as:
  - longer intervals result in higher effectiveness that may last longer
  - may be associated with lower risk of myocarditis
- Children 11 years old who receive the 10mcg dose but turn 12 before their 2nd dose may receive a 30mcg dose
- Two doses of vaccine may be offered to children who have had COVID-19
- Children who had MIS-C should postpone vaccination until recovery or after 90 days since diagnosis
- The Pfizer vaccine should be given at least 14 days before or after another vaccine when feasible

National Advisory Committee on Immunization (NACI) rapid response: Recommendation on the use of the Pfizer-BioNTech COVID-19 vaccine (10 mcg) in children 5-11 years of age. November 19, 2021

NACI recommendation on the use of the Pfizer vaccine in children 5-11y

Risk of Myocarditis

- Myocarditis/pericarditis follow mRNA vaccination occur:
  - most commonly in 12-30y males
  - more often after the second dose
  - more often after Moderna than Pfizer vaccine
  - within a week of vaccination

- Canadian safety surveillance data suggest an extended interval between doses may reduce the risk of myocarditis

- Data from the US suggest risk of myocarditis may be higher in 16-17y compared to younger adolescents 12-15y

- Myocarditis following vaccination has similar epidemiologic profile to classic myocarditis. Classic myocarditis (unrelated to COVID-19) occurs more commonly in adolescents and is less common in younger children 5-11y

National Advisory Committee on Immunization (NACI) rapid response: Recommendation on the use of the Pfizer-BioNTech COVID-19 vaccine (10 mcg) in children 5-11 years of age. November 19, 2021

ACIP: benefits outweigh risks for vaccination and recommends the vaccine to children 5-11y

COVID-19 in children is a major public health problem

- 1.9 million COVID-19 cases & 8,300 hospitalizations among U.S. children 5–11y as of Oct 10, 2021
- 5,217 total cases of MIS-C (44% in 5-11y)
- Children 5–11y represent a growing proportion of new COVID-19 cases - 10.6% of infections week of Oct 10
- COVID-19 ranks as the 8th leading cause of death in 5-11y age group
- Delta-wave surges of pediatric COVID-19 hospitalizations occurred even with a significant proportion of children previously infected

Woodworth KR et al. The Advisory Committee on Immunization Practices' Interim Recommendation for Use of Pfizer-BioNTech COVID-19 Vaccine in Children Aged 5–11 Years — United States, November 2021. MMWR

ACIP: benefits outweigh risks for vaccination and recommends the vaccine to children 5-11y

Risk of Myocarditis

- The observed myocarditis risk is highest in males aged 12–29y. No cases of myocarditis were reported in the Pfizer trial in 5-11y.
- The baseline risk for myocarditis is much higher in 12–17y than in 5–11y. Myocarditis in adolescents might not predict risk for myocarditis in younger children.

Vaccination is important to protect children against COVID-19, even in those previously infected, and to reduce community transmission.

Woodworth KR et al. The Advisory Committee on Immunization Practices' Interim Recommendation for Use of Pfizer-BioNTech COVID-19 Vaccine in Children Aged 5–11 Years — United States, November 2021. MMWR

Safety of the Pfizer vaccine in children 5-11y in the US

- Approx. **8 million doses** have been administered to children 5-11 years of age
- Side effects were **mild and brief**, most commonly after dose 2. The most common reported events were:
  - Pain at injection site
  - Fatigue
  - Headache
- Few myocarditis cases have been reported (11 out of approx. 8 million doses administered)
  - 7 children recovered and 4 were recovering at the time of the report

Hause, A. M. et al. MMWR COVID-19 Vaccine Safety in hildrenAged 5-11 Years - United States, November 3-December 19, 2021
https://www.cdc.gov/mmwr/volumes/70/wr/mm705152a1.htm?s_cid=mm705152a1_w

Vaccine dose timing in children

Shorter intervals between vaccine doses may be in children's best interest because of high risk of exposure to Omicron

- Canada's National Advisory Committee on Immunization (NACI) recommended 8-week interval for children aged 5-11
  - Recommendation is based on evidence from adults that longer gaps may improve immune response, reduce side-effects e.g. myocarditis

- US follows 3-week dose intervals for children, based on Pfizer's clinical programs evidence
  - Britain follows 12-week interval
- 3-week interval is approved by Health Canada

Advisory Committee Statement. National Advisory Committee on Immunization (NACI). Nov 19, 2021.
Interim Clinical Considerations for Use of COVID-19 Vaccines Currently Approved or Authorized in the United States. CDC. Dec 21, 2021

Omicron and children: Increased hospitalizations in the US

- From Dec 25-Jan 1, a sharp increase was observed in children 0-4 years who are not eligible for vaccination

- Data include those admitted to hospitals for non-COVID reasons who then test positive - many "hospitalized with COVID, as opposed to because of COVID"

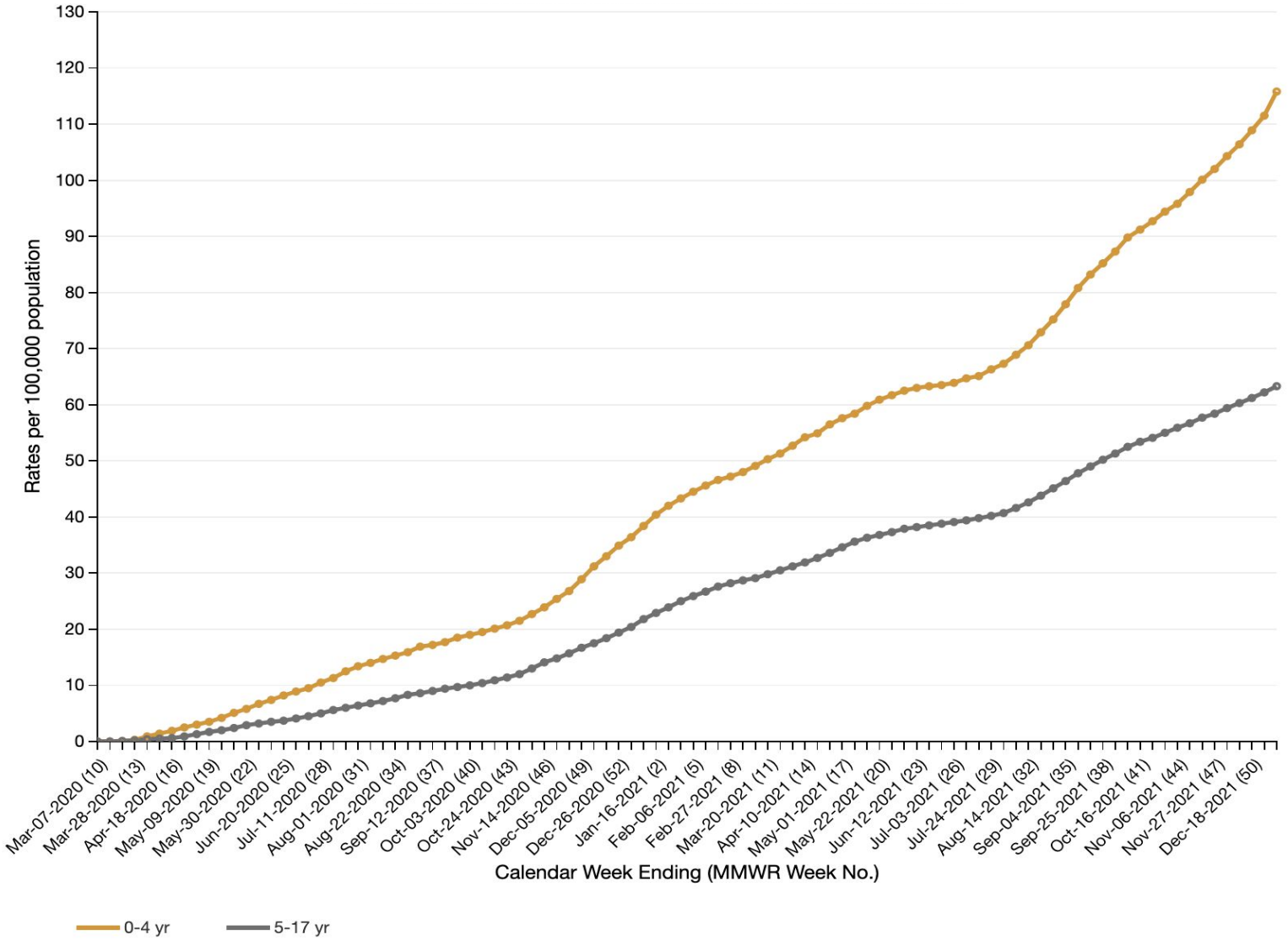
- Rate of hospitalized children aged 0-4 aged 5-11 years who were infected was 0.6 per 100,000, similar to past months

- CDC data show:
  - 0-4 years: +4.3 cases/100,000, compared to +2.6/100,000 the week before (Dec 25-Jan 1 vs. Dec 18-Dec 25) = **65% increase** in cases in one week, **double** the rate one month ago
  - 5-17 years: 1.1/100,000 vs 0.9/100,000 = **22% increase** in one week

CDC COVID Data Tracker. Accessed Jan 8, 2022

Rates of COVID-19 Associated Hospitalization in the US 0-17y population

Preliminary weekly rates as of Jan 1, 2022



CDC COVID-NET Hospitalization Network Rates of COVID-19 Associated Hospitalizations. Preliminary weekly rates as of Jan 1, 2022
https://covid.cdc.gov/covid-data-tracker/#covidnet-hospitalization-network Accessed Jan 8, 2022

Press release: Moderna vaccine in children 6-12 years of age

- Moderna announced the vaccine is safe and highly effective in children aged 6-12y using a two dose regime of 50 µg, given 28 days apart. (Phase 2/3 KidCOVE)
- The vaccine elicited a strong immune response evidenced by robust neutralizing antibody levels comparable to young adults.
- The vaccine was well-tolerated. AE were mild to moderate.
- Most common AE were fatigue, headache, fever and injection site pain.
- Moderna plans to submit results to the US FDA and other regulatory agencies in the near term.

Moderna Announces Positive Top Line Data from Phase 2/3 Study of COVID-19 Vaccine in Children 6 to 11 Years of Age. October 25, 2021

Vaccine Trials in Younger Kids

Vaccine Clinical Trial	Trial Details	Results Timeline
Pfizer NCT04816643	• Recruiting; 6 mos - 11 y/o in 3 age groups (5-11y; 2-4y; 6-23m, in sequence); n=4644 • Phase 1 is dose finding (10/20/30 mcg mRNA) • Phase 2/3 is safety, immunogenicity, clinical efficacy - bridging trial	Results for 6m-5y expected in the fourth quarter
Moderna NCT04796896	• Recruiting; 6 mos - 11 y/o in 3 age groups (6-11y; 2-5y; 6-23m, in sequence); n=13275 • Phase 1 is dose finding (25/50/100 mcg mRNA) • Phase 2/3 is safety immunogenicity, clinical efficacy - bridging trial	Results for 6-11y released Oct 2021 (press release)

Myocarditis in kids post second dose of vaccine?

- Case series of 7 patients published, teens 14-19
- All male
- All developed symptoms 2-4 days after second dose
- Primary symptom: chest pain (all) with 5/7 reporting fever
- All of the teens had elevated troponin levels and abnormal electrocardiogram and cardiac MRI results
- None fit criteria for MIS-C, 6/7 no evidence of previous COVID infection
- Treatment: 6/8 had NSAIDS, 4/7 IVIG and steroids

All recovered

Marshall et al. 2021. Symptomatic Acute Myocarditis in 7 Adolescents After Pfizer-BioNTech COVID-19 Vaccination

Myocarditis following mRNA COVID-19 vaccination in the US

- CDC: observed reports > expected cases after dose 2 for individuals 12-39 years old (excess cases per million second doses = 14.4 for Pfizer and 19.7 for Moderna)
- Most cases occurred within 7 days following vaccination and were most commonly observed after dose 2
- Myopericarditis reports after dose 2 are predominantly young males
- **Most patients have had full recovery of symptoms**

CDC. COVID-19 Vaccine Safety Technical (VaST) Work Group. August 30, 2021

More on myocarditis

Israel: 2.13 cases per 100,000 persons; the highest incidence was among male patients between the ages of 16 and 29 years.

Israel: myocarditis occurred in approximately 1 of 26,000 men and 1 of 218,000 women after the second vaccine dose.

Canada: by November 19 2021, there were 1,329 cases of myocarditis and/or pericarditis with reports submitted to the Public Health Agency of Canada (PHAC) and Health Canada from over 59 million administered doses of COVID-19 vaccines Rate of 22.2 in 1 M

Mevorach et al. DOI: 10.1056/NEJMoa2109730. Oct 6, 2021
Witberg et al. DOI: 10.1056/NEJMoa2110737. Oct 6, 2021

Risk of Myocarditis: COVID-19 vs vaccines

- MMWR report (CDC). Hospital records from COVID-19 patients (1.5 million) vs non COVID-19 patients (35 million) Mar2020-Jan2021
- The risk for myocarditis among patients with COVID-19 was nearly **16 times higher** (0.146% for COVID-19 patients vs 0.009% in non-COVID-19 patients)
- The risk among COVID-19 patients was most pronounced in those **<16 years old who had a 37-fold increased risk of myocarditis**
- The risk of myocarditis is far higher after COVID-19 compared to vaccination
    - Compared to a recent Israeli study. **Risk ratio 3.2** after vaccination **vs. 18.3** after SARS-CoV-2 infection
    - In line with current recommendations stating **the benefits of COVID-19 vaccinations outweigh the risks of vaccine-caused myocarditis** especially when community transmission is high

Boehmer TK et al. Association Between COVID-19 and Myocarditis Using Hospital-Based Administrative Data - United States, March 2020-January 2021. MMWR Morb Mortal Wkly Rep. 2021; 10.15585/mmwr.mm7035e5.

Barda N, Dagan N, Ben-Shlomo Y, et al. Safety of the BNT162b2 mRNA Covid-19 Vaccine in a Nationwide Setting. *N Engl J Med*. 2021;10.1056/NEJMoa2110475.

VAERS Reporting Rate for Myocarditis among males after mRNA COVID-19 vaccine (n=797)

169,740,953 doses of mRNA vaccine administered to males as of Oct 6, 2021

Highest rates of myocarditis are among male adolescents 16-17y

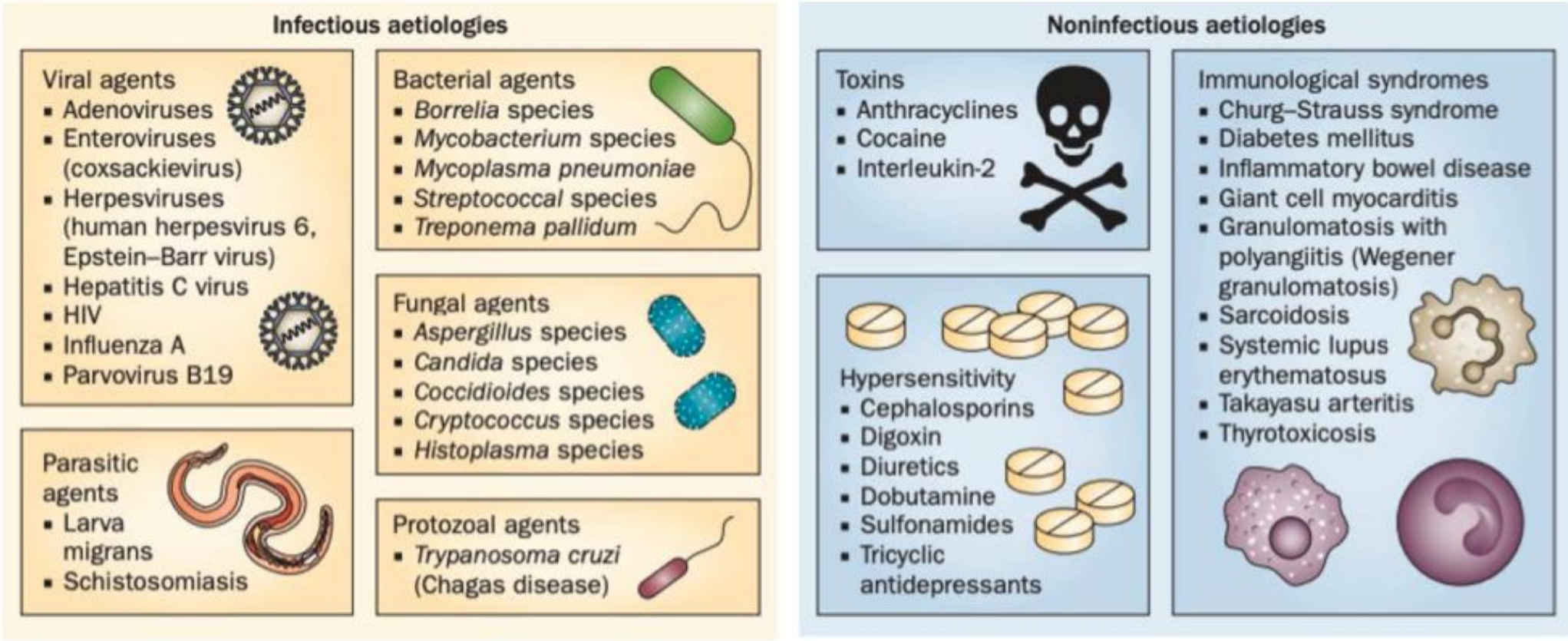
Myocarditis Rate per 1 million doses (n=797)

	Pfizer		Moderna	
	(Males)		(Males)	
Ages	**Dose 1**	**Dose 2**	**Dose 1**	**Dose 2**
12-15	**4.2**	**39.9**		
16-17	**5.7**	**69.1**		
18-24	**2.3**	**36.8**	**6.1**	**38.5**
25-29	1.3	**10.8**	**3.4**	**17.2**
30-39	0.5	**5.2**	**2.3**	**6.7**
40-49	0.3	**2.0**	0.2	**2.9**
50-64	0.2	0.3	0.5	0.6
65+	0.2	0.1	0.1	0.3

Reporting rates exceed background incidence

Vaccines and Related Biological Products Advisory Committee Meeting. mRNA COVID-19 Vaccine-Associated Myocarditis (2021 Oct 26) FDA.

Causes of myocarditis include viral infection as the most common aetiology

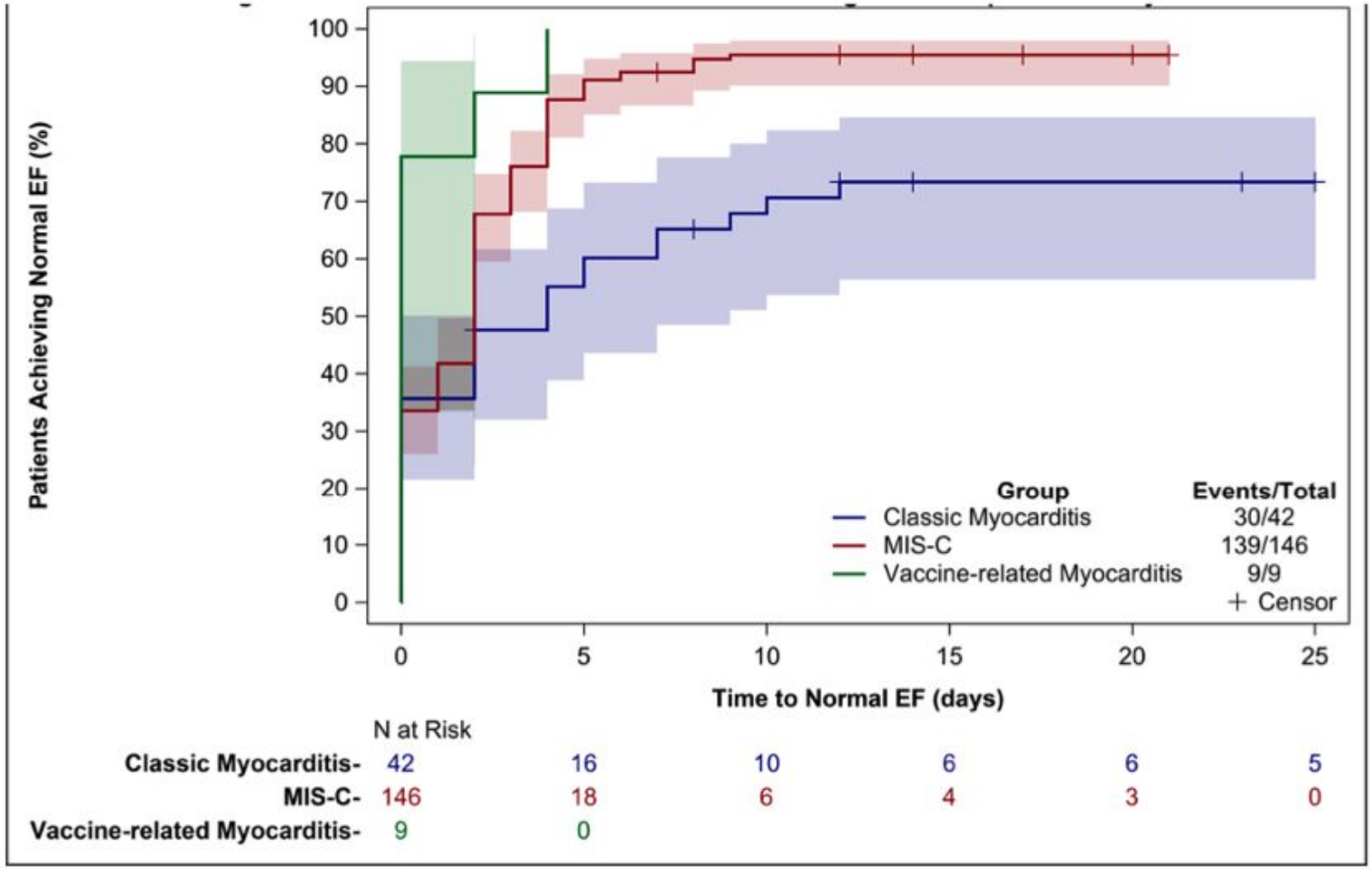


Vaccines and Related Biological Products Advisory Committee Meeting. mRNA COVID-19 Vaccine-Associated Myocarditis (2021 Oct 26) FDA.
Pollack, A. et al. Viral myocarditis—diagnosis, treatment options, and current controversies. Nat Rev Cardiol (2015).

Not all myocarditis is the same

- A retrospective cohort study (preprint) compared patients <21y with classic pre-pandemic viral myocarditis (n=43), MIS-C myocarditis (n=149) and COVID-19 vaccine-related myocarditis (n=9)

- Patients with vaccine-related myocarditis had **prompt resolution of symptoms and improvement in cardiac function** evidenced by time to normal ejection fraction (EF) by echocardiogram



Vaccines and Related Biological Products Advisory Committee Meeting. mRNA COVID-19 Vaccine-Associated Myocarditis (2021 Oct 26) FDA.
Patel, T. et al. Comparison of MIS-C Related Myocarditis, Classic Viral Myocarditis, and COVID-19 Vaccine related Myocarditis in Children. medRxiv 2021

How to communicate the safety

- Brisk immune response
- 9/10 kids had sore arm, 5-7/10 had headache or fatigue, 3/10 had chills, 1 in 5 had fever
- No bell's palsy, DVT, thrombocytopenia or anaphylaxis

Vaccines and Related Biological Products Advisory Committee Meeting Document. (2021 Oct 26) FDA.

Long-term effects of vaccine

- Vaccine side effects occur within 6 weeks.
- Protection seems to last a minimum of 6 months
- It is understandable to worry about long term effects, but so far and from previous vaccines we do not have any evidence that effects would be noted longer than 6 weeks post vaccine

Long-term effects of COVID-19

- We are starting to understand more about COVID-19 (the disease) long term effects:
  - Long covid or post covid syndrome, has been described in as many as 1 in 4 adults who had COVID (including those who had mild disease)
  - Most of these people are previously very healthy and fit
  - We are seeing PCS being described more and more in children! Long term effects are: organ damage, shortness of breath, decreased exercise tolerance, extreme fatigue, debilitating headaches, brain fog
  - More than 50% of adults with PCS, IMPROVE after they have their vaccine (this is a correlation, not causation, but reason to hope!)

https://www.theguardian.com/society/2021/may/18/long-covid-symptoms-ease-after-vaccination-survey-finds

What about allergies?

- Anaphylaxis Pfizer: 4.7 cases/million doses; Moderna: 2.5 cases/million doses
- 82% after 1st dose, 79% history of allergies, 32% previous anaphylaxis
- History of anaphylaxis to other allergens is NOT a contraindication to the mRNA vaccine but it is recommended that such people wait 30 mins post vaccine administration (vs 15 mins).
- 90% of anaphylaxis happened within 30 mins of the vaccine administration.
- Other vaccines – rate of anaphylaxis ~1-10/million doses
- Polyethylene glycols (PEGs) may be main allergen of concern (in Pfizer & Moderna vaccines)

Mitigating Pain at Administration

Pain is an important factor in vaccine uptake.

- Meta-analysis, 35 studies included in the final analysis.
- Avoidance of influenza vaccines related to needle fear in influenza vaccine occurred in:
- 16% of adult patients.
- 27% of hospital employees.
- 18% of workers at long term care facilities.
    - Important factor in COVID-19 vaccines as they are reported to have more pain and injection site reactions than influenza vaccines.

5 Commitments to Comfort Principles

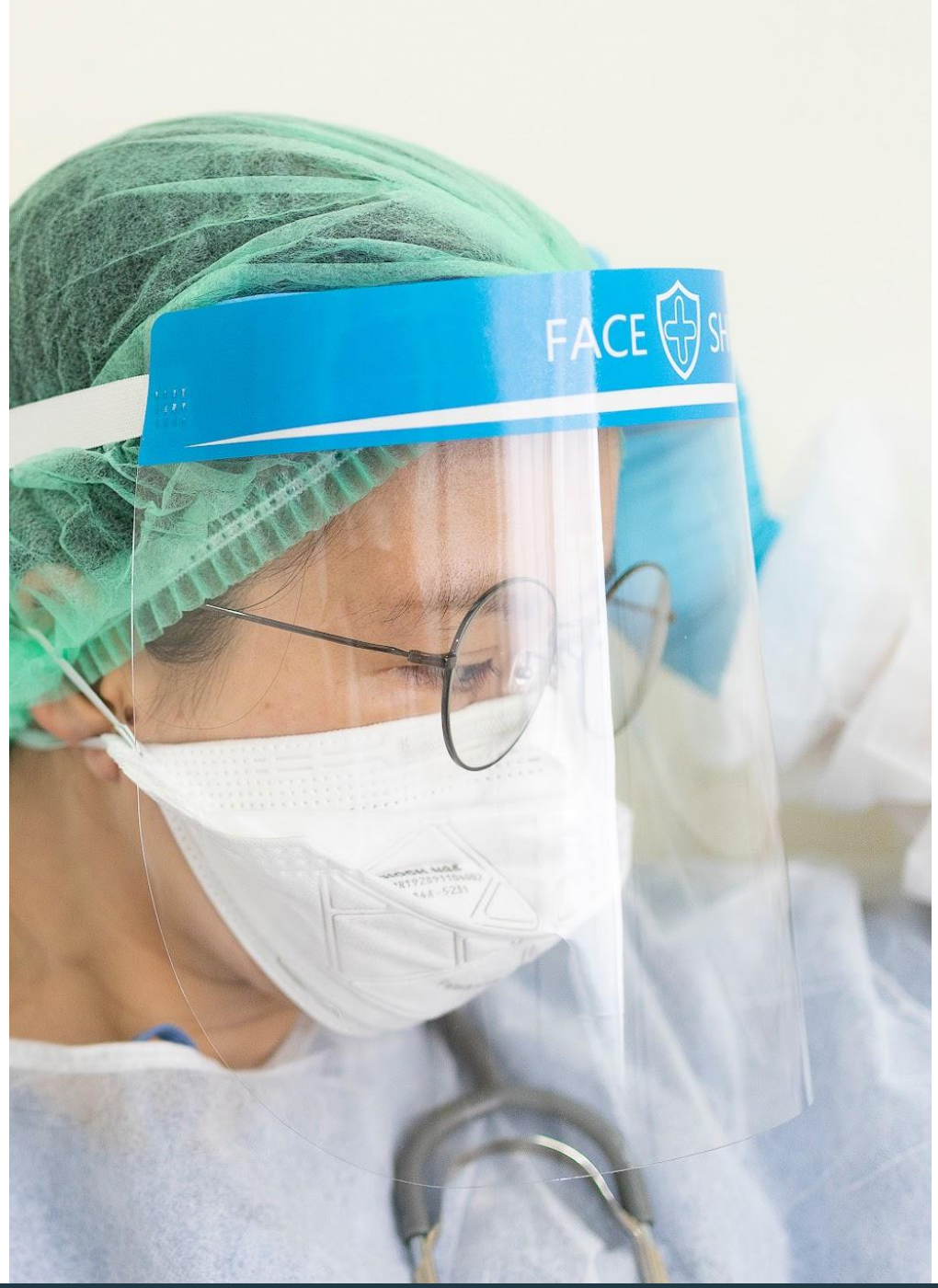
1. **Create a Comfort Plan**
    a. Ask if the person being vaccinated has preferences or concerns with their comfort management and offer choice when able (e.g., preferred pain management strategies, comfort positions).

2. **Use Numbing Cream**

3. **Use Simple, Positive Language**
    a. This makes it more likely a person will return for vaccinations in the future.
    b. Communicate in a way that reduces fear and distress prior, during, and after the immunization.
        i. Avoid saying “it will be over soon” or “it will be OK” or words that amplify fear or pain, for example “this is a really painful shot”.
        ii. Talk about what is going well/went well, for example “you did a great job relaxing your arm”
        iii. After the immunization is over tell the individual “they did well”, or “by doing this today you are saving lives/keeping yourself and others safe.

4. **Use Comfort Positions: Upright comfortable position**
    a. If they feel faint or has a history of fainting with needles:
        i. encourage alternating muscle tension and relaxation (for 15 seconds increments), or have them lie down.

5. **Shift Attention**
    a. Examples: using electronics (music/games), slow deep breathing, asking ‘small talk’ friendly questions, or focusing on a picture or poster on the wall.



Vaccine Acceptance & Hesitancy

Concerns and hesitancy are natural.

Hesitancy doesn’t stem from ignorance.

Key Factors

Demographic

Geographic

Psychographic

Vaccine hesitant in Canada tend to be:

- Racialized/ Historically marginalized
- Dependent on less reliable sources of information
  - Have children
  - Have a household income <$40k/yr
  - 18-34 years old

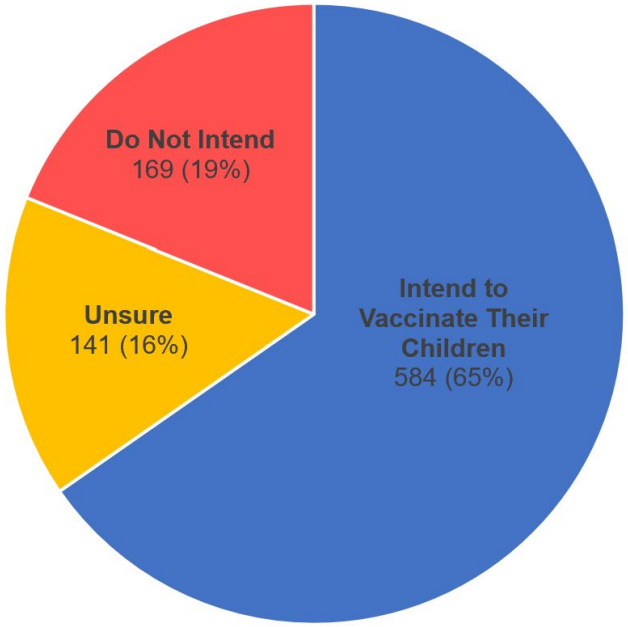
Alfieri et al. Parental COVID-19 vaccine hesitancy for children. BMC Public Health. Sept 13, 2021
Leger 2021 and Garretson 2020

Vaccine Hesitant Parents

- Are more concerned about vaccine safety
- Feel their children are not at high risk of COVID-19 complications
- May feel their kids have already had COVID-19 and have natural immunity
- Don’t trust governments and health agencies
- Have had a negative interaction with healthcare providers in the past
- Have had a negative experience with vaccines in the past

Most Canadian parents intend to vaccinate their children once a COVID-19 vaccine becomes available:

"Suppose one or more of the COVID-19 vaccines available for individuals 12 and older becomes available to children under 12. Would you have your child vaccinated?" n=594



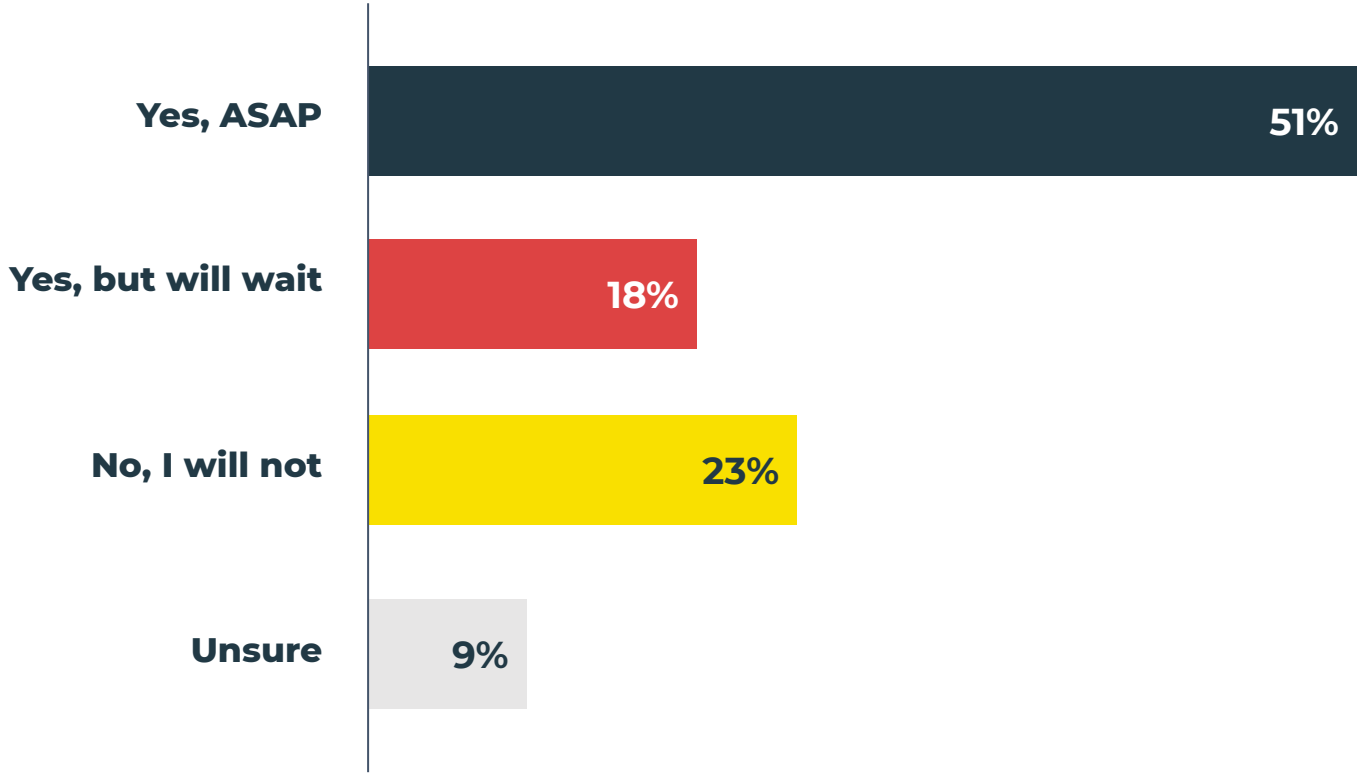
Of those unwilling to vaccinate their children, the following reasons were selected:	Number of Respondents (%)
Children do not need vaccines as they are low risk of severe consequences due to COVID-19	55 (32.7%)
Other safety risks	47 (28.0%)
Natural immunity from previous COVID-19 infection is sufficient protection for my child	20 (11.9%)
Myocarditis risks	16 (9.5%)
Fertility risks	13 (7.7%)
Other reasons	17 (10.1%)

Source: Angus Reid Kids and COVID, Published online October 2021

Willingness to vaccinate children in Canada

If a COVID-19 vaccine become available to your child(ren) aged five to 11, will you get them vaccinated?

Among Canadian parents with children in this age range (n = 812)



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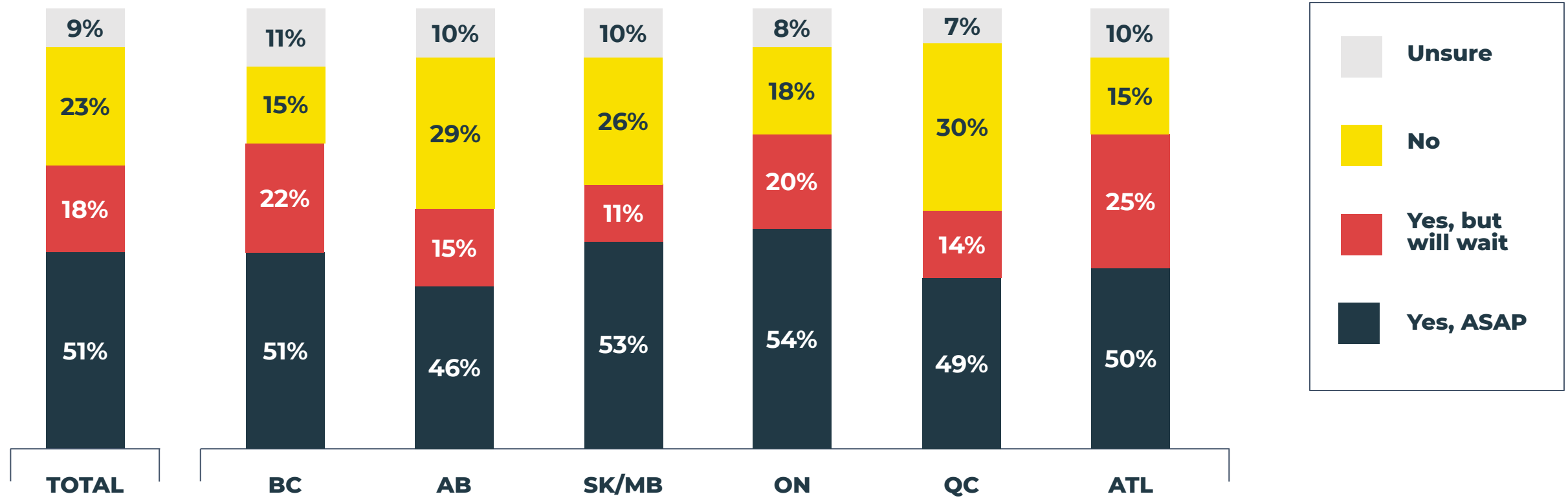

Source: Angus Reid Kids and COVID, Published online October 2021

Willingness to vaccinate children in Canada

If a COVID-19 vaccine become available to your child(ren) aged five to 11, will you get them vaccinated?

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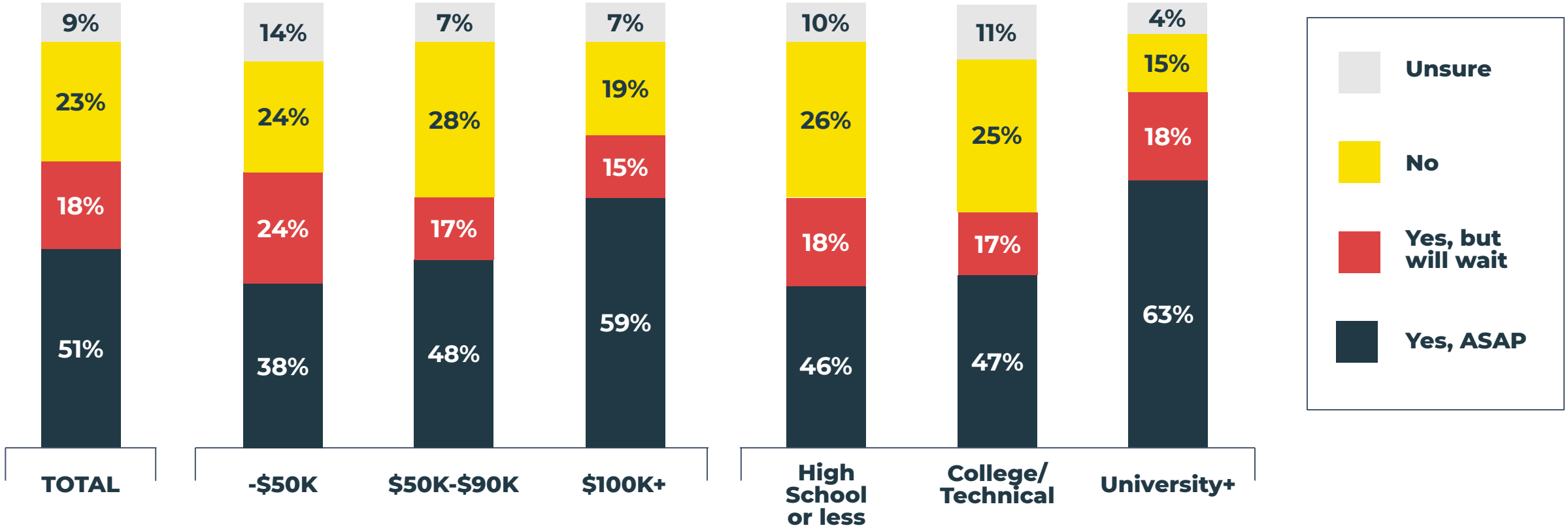


Source: Angus Reid Kids and COVID, Published online October 2021

Vaccine Hesitancy in Ethnic Communities

Community	Vaccine Hesitancy
Black	47%
Indiginous	38%
Middle Eastern	35%
Latinx	32%
South Asian	30%
East Asian	28%
White	25%

Racialized Canadians have suffered disproportionately during the pandemic and have higher distrust of vaccines.

Histories of trauma related to medical experimentation and discrimination has earned the government and biomedical institutions distrust from minority communities

Key Factors

Demographic

Geographic

Psychographic

Health Care Workers (HCW) Can Be Vaccine Hesitant Themselves

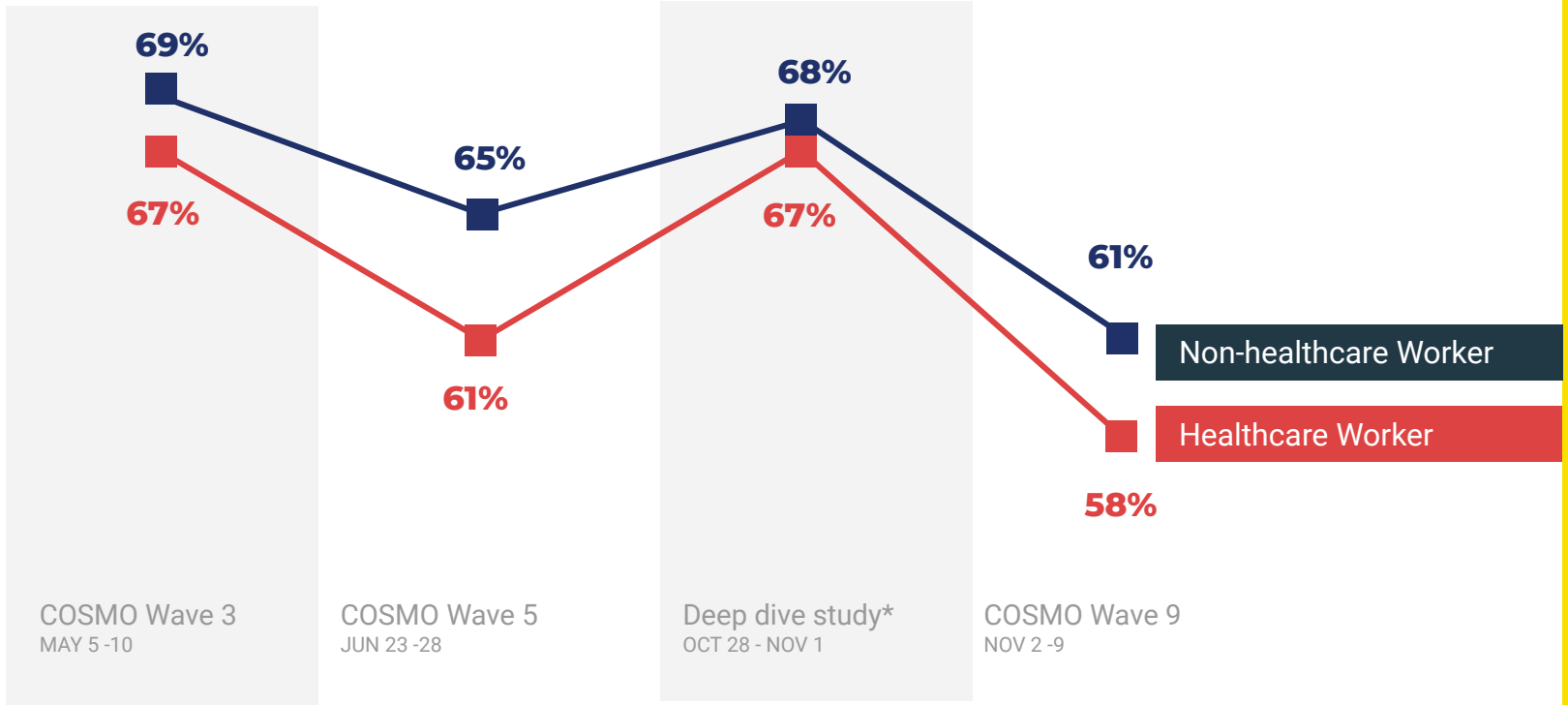
Rates of vaccine hesitancy in healthcare workers mirrors that of the rest of the population

- 76% are strong supporters, 17% are ambivalent, and 7% oppose the vaccine
- 49% of personal support workers were hesitant about the COVID-19 vaccine
- Healthcare workers who are lower wage, racialized, female and part time workers were more likely to be vaccine hesitant.

Healthcare Workers' Vaccine Hesitancy

Declining confidence over time

If a safe COVID-19 vaccine becomes available and is recommended, would you get it?



*Note that two studies use different wording and scales for this question:

- COSMO: "If a safe COVID-19 vaccine becomes available and is recommended, would you get it?" (7-pt scale)
- Deep dive study: "If a COVID-19 vaccine became available and is recommended for me, I would get it." (5-pt scale)
- Data points based on small sub-sample size. Statistically significant but not generalizable beyond sample (see Annex)

Insights from COSMO

- The number of respondents reporting that they agree that they will get a safe COVID-19 vaccine has declined gradually since the beginning of the pandemic. 67% of healthcare workers agreed in Wave 3 but this percentage has declined to 58% by Wave 9.
- Healthcare workers have also been slightly less likely to agree that they would get an effective COVID-19 vaccine since Wave 3 compared to non-healthcare workers. 63% agreed in Wave 3, while only 51% agree in Wave 9.

impact canada

HCW and Hesitancy Crawshaw et al. The Ottawa Hospital Research Institute. March 2021

32 cross sectional survey-based studies
5/32 Canadian
Studied vaccine acceptance

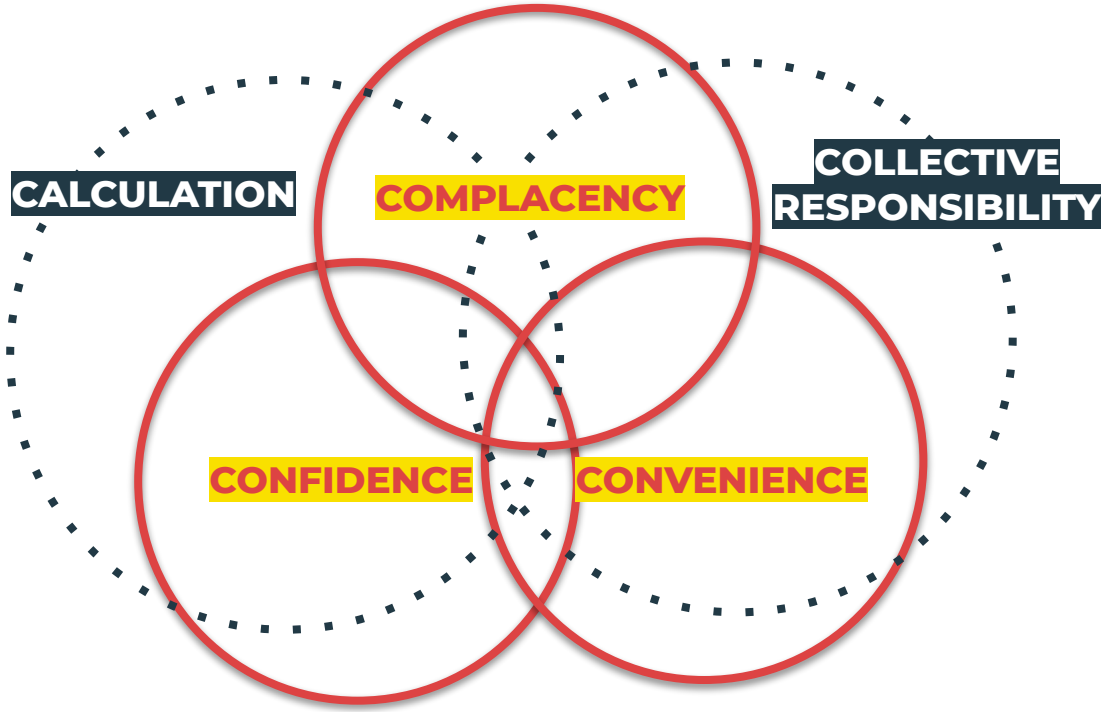
- Acceptance rates ranged from 57% - 80%
- Negative beliefs about COVID-19 vaccine safety, efficacy, and necessity were associated with lower vaccination acceptance
- Lower vaccination acceptance rates were found among non-physician HCWs (e.g., nurses, PSW)
- History of accepting influenza vaccination were more accepting of COVID-19 vaccines.

Key Factors

Demographic

Geographic

Psychographic


CALCULATION
COMPLACENCY
COLLECTIVE RESPONSIBILITY
CONFIDENCE
CONVENIENCE

Facets of the Problem

TRUST

PAIN POINTS
- Misinformation
- Changing messages
- Media and social media distortion
- Distrust of government
- Uncertainty of decisions

OPPORTUNITIES
- Frame vaccination as essential BECAUSE OF mistrust of institutions (i.e. “take matters into your own hands, protect yourself”)

CONCERN

PAIN POINTS
- Pandemic fatigue
- Low or no perceived risk
- Hopelessness
- Brand concerns: side effects outweigh risk of COVID

OPPORTUNITIES
- Encouraging individual agency
- Increasing concern with COVID

CONVENIENCE

PAIN POINTS
- Supply vs. demand
- Lack of clarity around availability and priority
- Hassle of waiting lists, phone numbers, scheduling
- “Healthcare apathy” (i.e. dislike of doctors, paperwork)

OPPORTUNITIES
- Streamline process and incentivize early registration
- Hyper-target message/audience based on clinics and availability


YOU DESERVE PROTECTION
Roll up your sleeves, get vaccinated
VISIT WWW.PROTECTCANADA.ORG AND BOOK YOUR APPOINTMENT

What do we know about VH and vaccine communication?

Is the Messenger More Important Than the Message?

Most Trusted Messenger

83% - My doctor, nurse or pharmacist

13% **Celebrities**

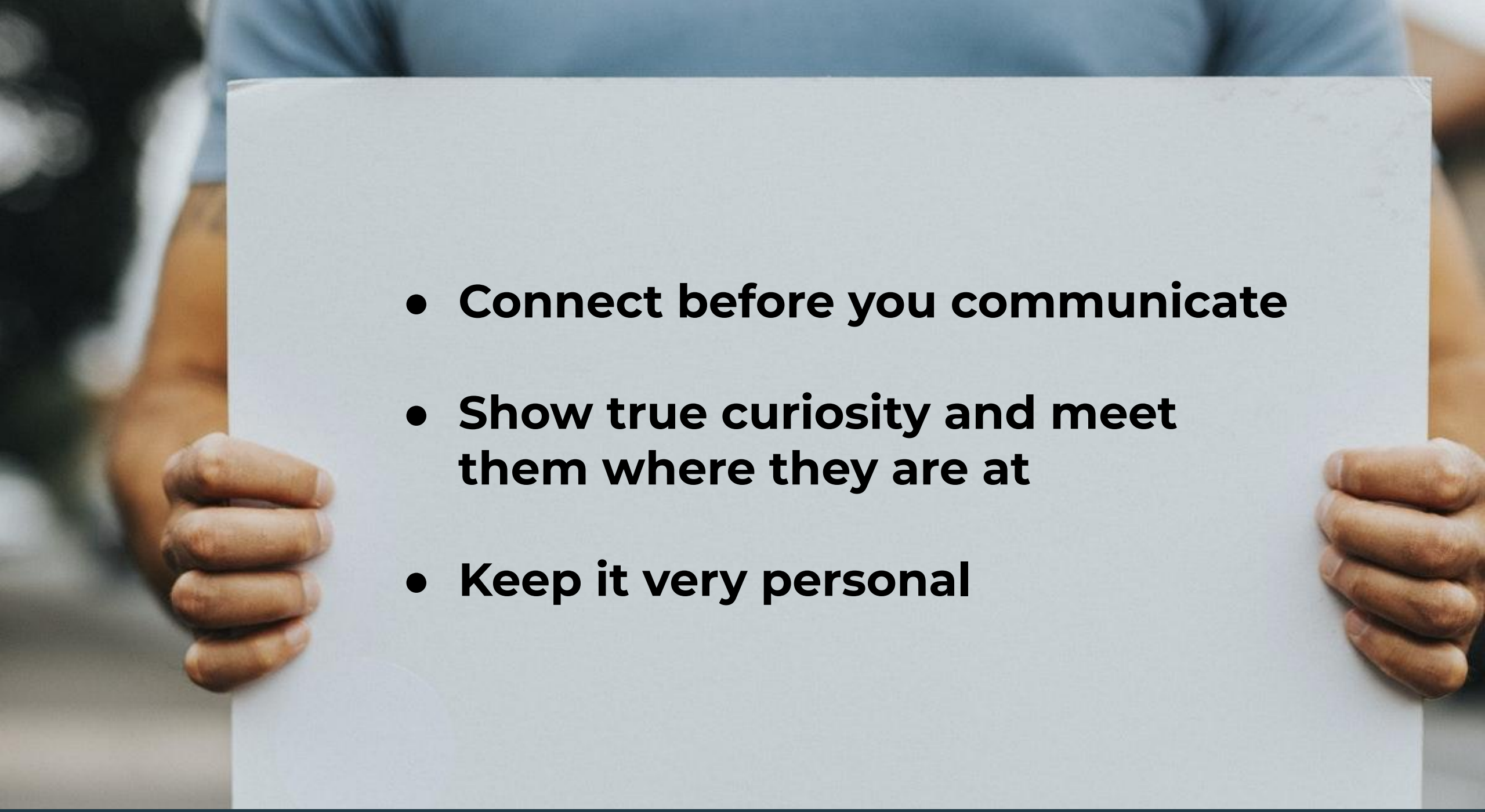
Most Convincing Message

72% - Protecting yourself and your loved ones

64% - Return to normal

Nationally, there is much more variation (70%) between trust in messengers than there is between trust in messages (8%)

Source: Reagan-Udall Foundation for the FDA


• Connect before you communicate
• Show true curiosity and meet them where they are at
• Keep it very personal

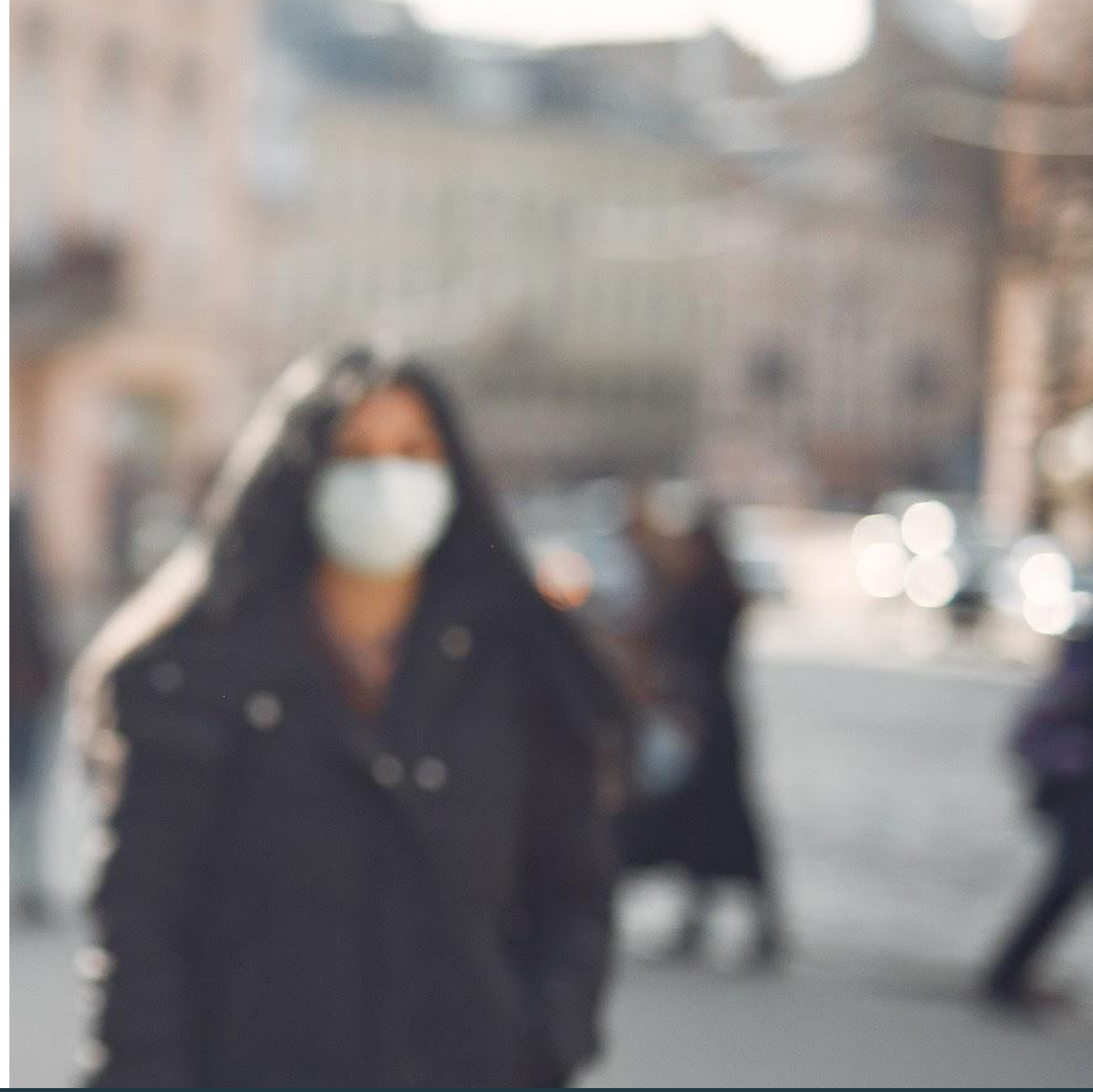
How to Build the Connection and Show Curiosity

Clinical setting:

- Get to know the patient and their social history
- Validate their emotions behind their story
- Listen to their previous experiences
- Bring in anecdotes

Non-Clinical Setting

- Share your story
- Validate the emotion (and identify with it)



How to craft the message

- Keep the conversation around their identity
- Focus on the personal benefit
  - Vs collective benefit
- Directly address safety concerns
  - Stay away from platitudes

Freedman et al. Lancet. May 12, 2021.https://doi.org/10.1016/S2468-2667(21)00096-7

A few pointers on the message:

- Remember the gist of what you're trying to communicate
  - People make decisions on gist!
- **Keep Messaging simple: use simple numbers**

Behavioural Science Principles for Supporting COVID-19 Vaccine Confidence and Uptake Among Ontario Health Care Workers - Ontario COVID-19 Science Advisory Table (covid19-sciencetable.ca)

The Gist of Vaccine Information

COVID-19 Vaccine Communication Framework

Pr — **Pr**oactively starting the conversation with a **Pr**esumptive statement.

O — **Offer** to share your knowledge about the facts and your experience with having had the vaccine.

T — **Tailor** the recommendations to their specific health concerns.

C — Address specific **concerns** (should not be the bulk of the conversation).

T — **Talk** through a specific plan for where and when to get the vaccine.

Pr	**Pr**oactively starting the conversation with a **Pr**esumptive statement.	**I am here to support you as you make the decision to take the vaccine. I had the chance to take the vaccine myself and am happy to help you get protected too.**
O	**Offer** to share your knowledge about the facts and your experience with having had the vaccine.	**I have been thinking a lot about this vaccine for my patients and educating myself on the science around it. Can I share some of what I know with you?**
T	**Tailor** the recommendations to their specific health concerns.	**Here is why you are the right person for this vaccine: you have high blood pressure and diabetes but good quality of life. Because of your conditions, you at high risk of being hospitalized with COVID, so we need to maintain the good quality of life you have right now.**
C	Address specific **concerns** (should not be the bulk of the conversation).	**I had the chance to take the vaccine myself and am happy to help you make the decision too, so you can be protected.**
T	**Talk** through a specific plan for where and when to get the vaccine.	**You can do the following the get the vaccine. Provide schedule (2 doses).**

Messages for parents at public health level

An indication from barriers and facilitators to COVID-19 vaccine uptake, that:

- That not all kids are at low risk of COVID
- As a vaccine preventable disease, COVID-19 has had a significant toll in children
- As our understanding in children of this disease progresses, more long term effects of COVID-19 in kids are identified
- Cannot predict with high accuracy which children will have mild vs severe COVID-19
- Even in people who have complied as much as possible with public health measures have been infected (even very careful isolation is not immune to infection)
- Other groups (by age, region) who have been successfully vaccinated already

Messages for parents in one on one interactions

Explore past history with regards to:

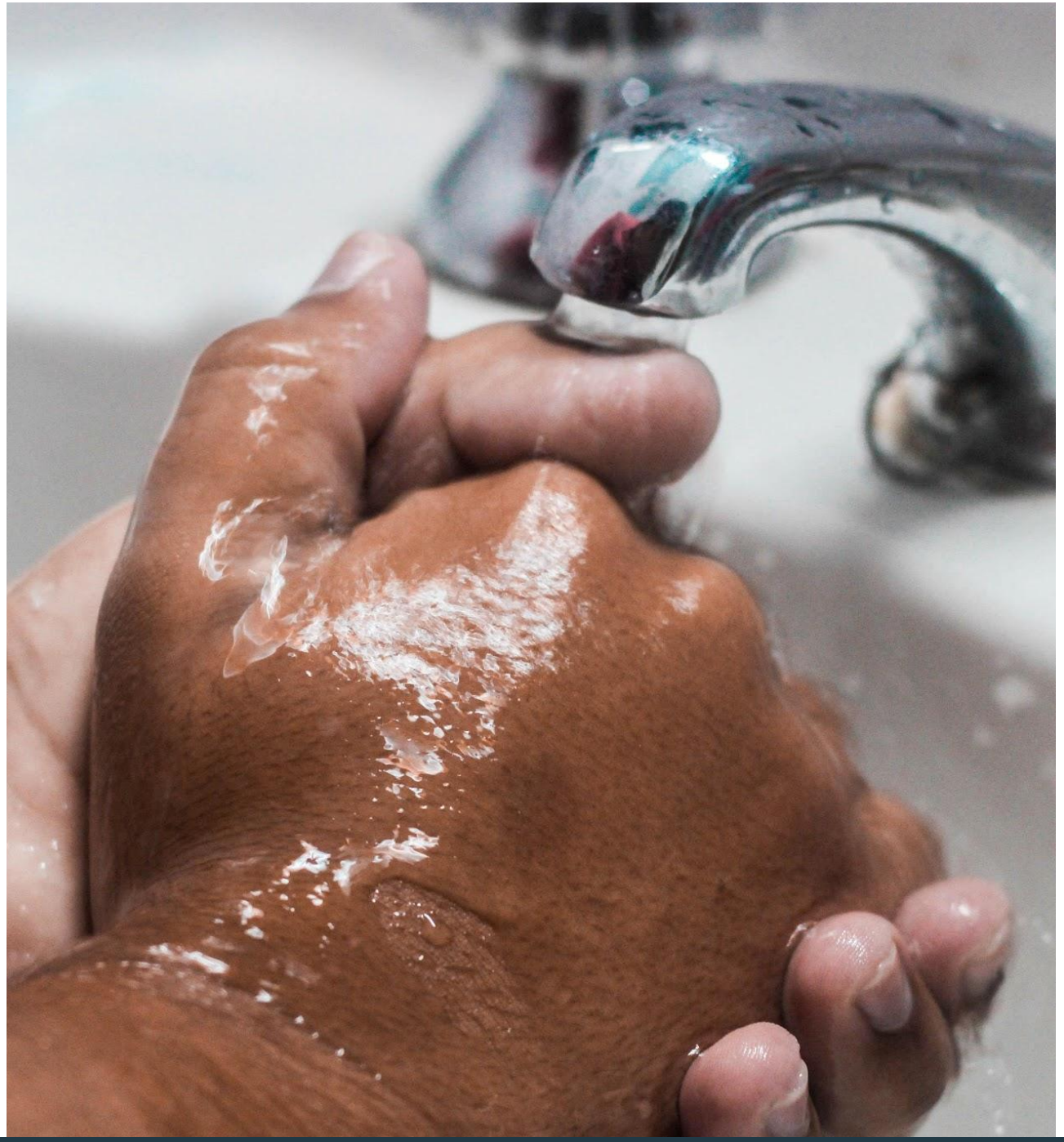
- Cultural trauma and how that impacts the vaccination decision
- Negative or positive interactions with healthcare workers
- Perceived personal contraindications to immunization

Focus messaging on:

- Personal health benefits of vaccine
- Children's mental health & socialization are impacted by the pandemic
- Outline how you as health care provider have vaccinated your children, how other parents in your social circle have (Peer pressure to vaccinate)
- If available/applicable, offer parents choice between vaccines

BUILDING VACCINE CONFIDENCE ONLINE

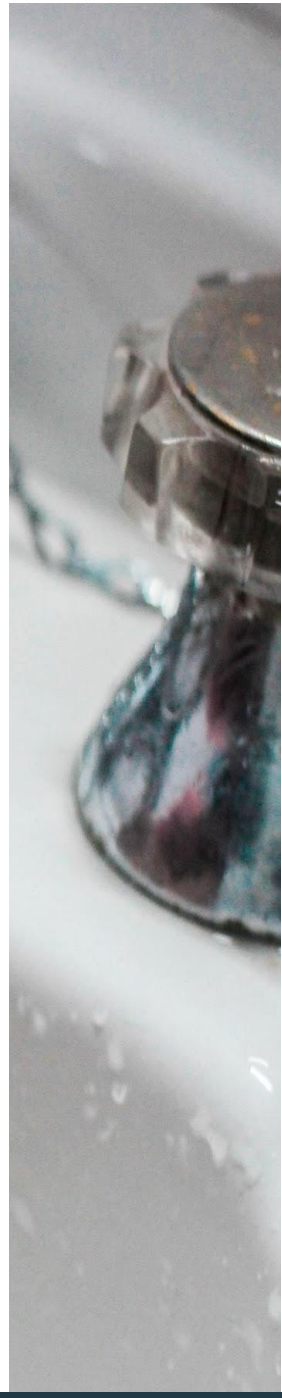
A PRIMER FOR HEALTHCARE PROFESSIONALS



Objectives

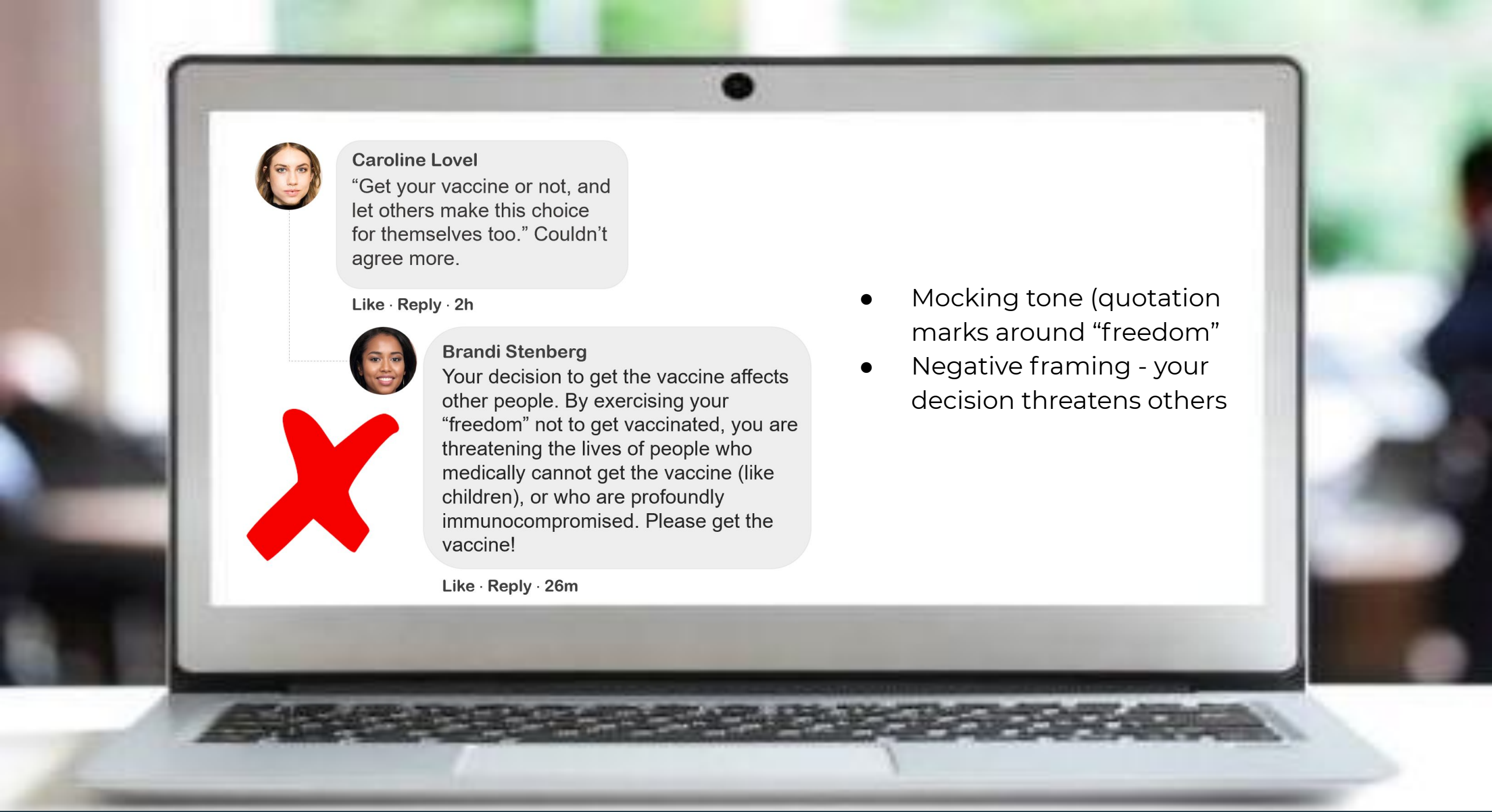
These slides outline practical, evidence-based principles that can guide your engagement with vaccine-hesitant individuals online.

They will show examples of how to respond (and how not to respond) to vaccine-hesitant posts, using real comments from social media.



Principle #1: Engage, don’t attack

- Mimic “active listening”: acknowledge what the individual has said, and provide validation where you can.
- Avoid judgement and labels.
- Use positive emotions to motivate, rather than negative emotions to shame or create fear.



- Mocking tone (quotation marks around “freedom”
- Negative framing - your decision threatens others

- Acknowledges the poster’s perspective
- Uses positive framing (“the vaccine keeps you safe”
- Invites further discussion

Principle #2: Humanize yourself

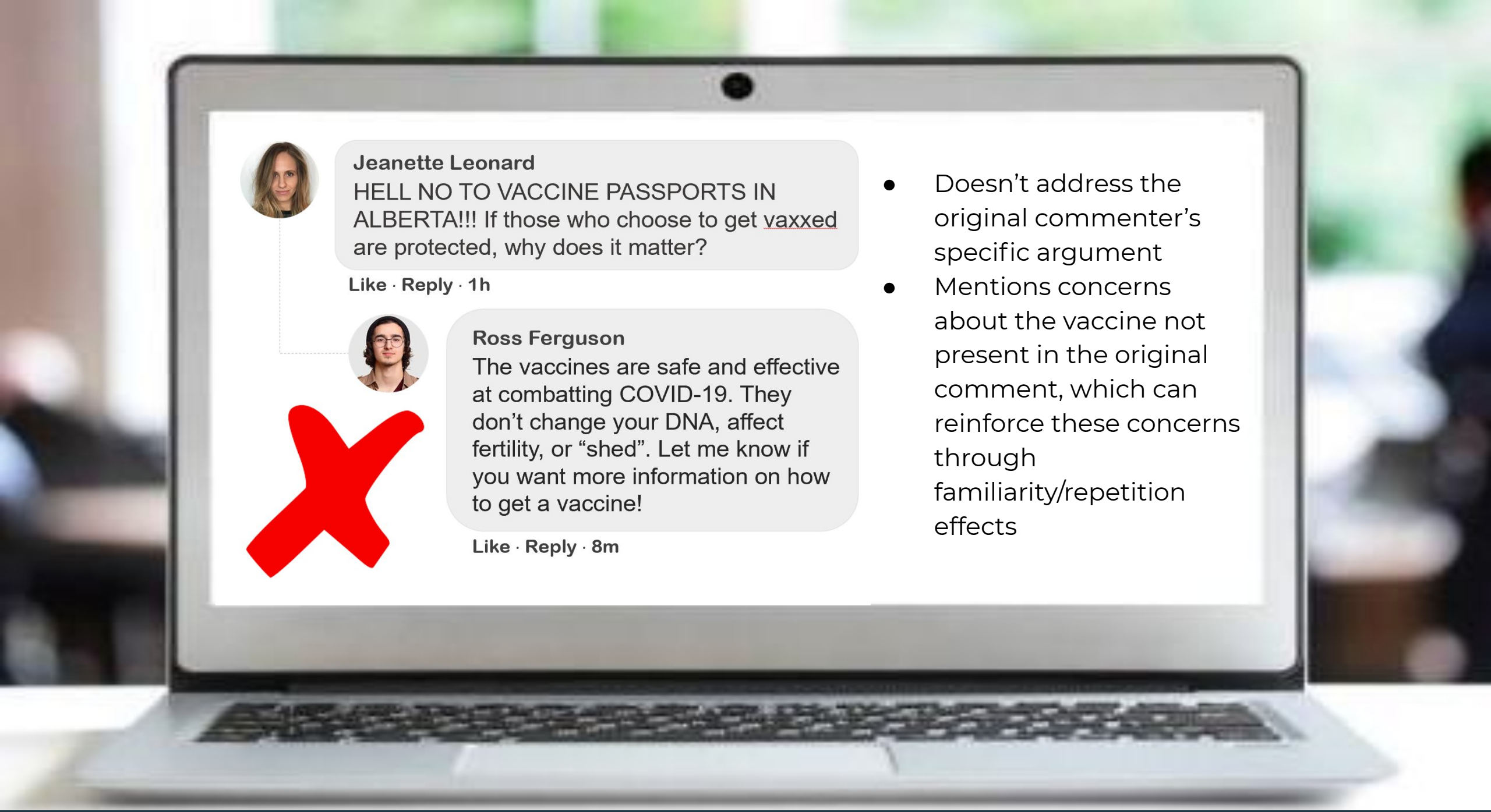
- Provide some information about yourself (“I am a registered nurse and a mom of 3”)
- Adopt a friendly tone
- Use personal anecdotes to make your point

- Gives no information about who is responding to the comment
- Dry/scientific tone

- Greets the other user in a friendly way, and introduces himself
- Uses a personal anecdote to make his point

Principle #3: Tailor your response

- Address the specific concern that was brought up. Don't expand the scope of the conversation to include other potential concerns about the vaccine.
- When possible, use facts and figures that are specific to the individual's age, gender, city, or other life circumstances.
- If you suspect that cultural background may play a role in the individual's vaccine hesitancy, find a team member who shares that background to respond.



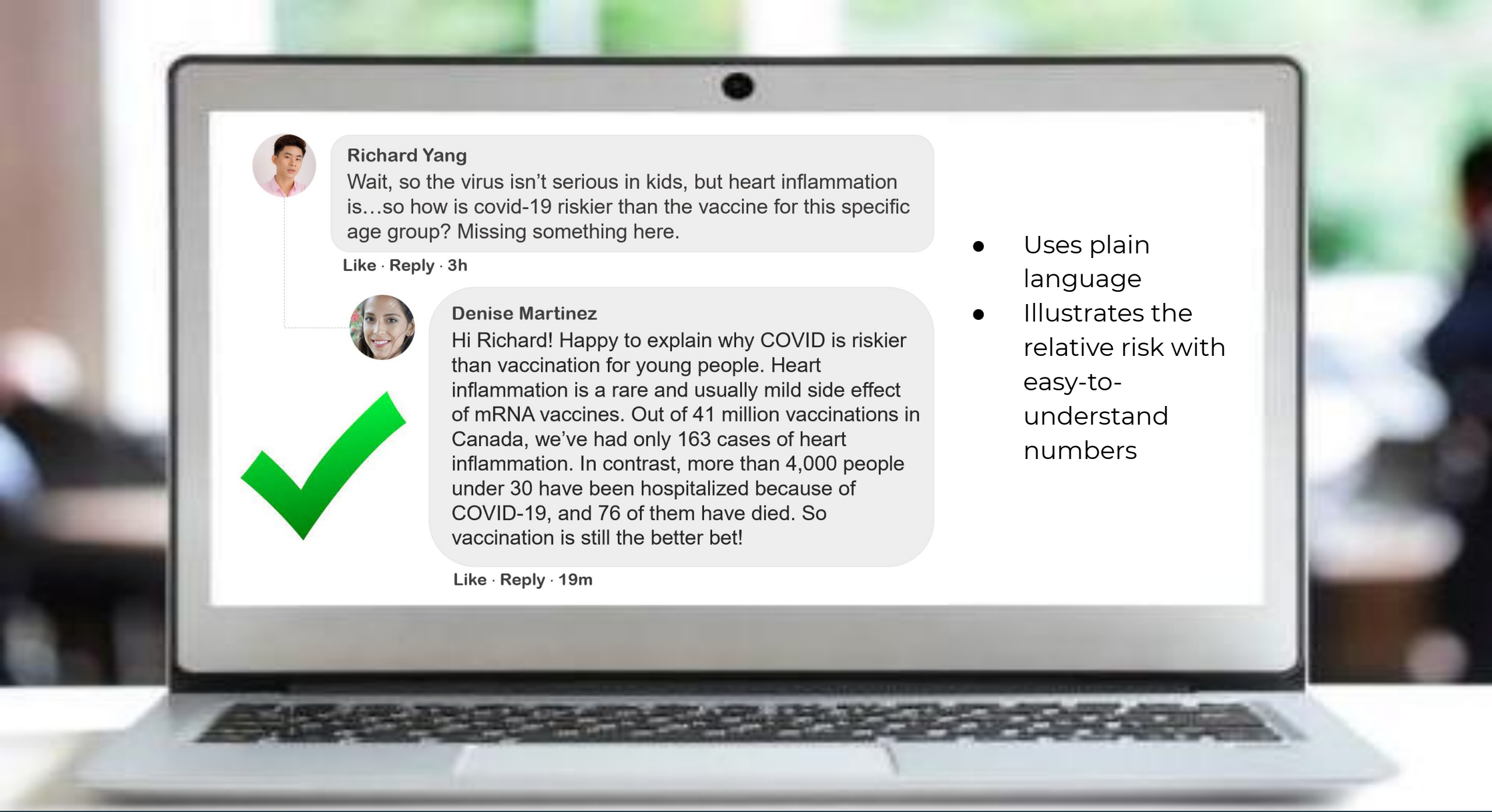
- Doesn't address the original commenter's specific argument
- Mentions concerns about the vaccine not present in the original comment, which can reinforce these concerns through familiarity/repetition effects

- Answers original commenter's question/concern
- Uses information in the comment or user profile (Alberta/Flames connection) to connect with the individual

Principle #4: Be clear and concrete

- Use plain language; avoid technical terms or jargon.
- When expressing odds, use concrete framing (e.g., “If 100,000 people got the vaccine, just 2 would have any adverse reaction”, not “There is a 0.002% chance of adverse reactions.”
- Analogies are a great way to make abstract concepts clearer.

- Dry language
- Uses technical terms where simpler words are available (e.g. “symptomatic therapy”, “myocarditis”
- Vague: states that risk of COVID-19 outweighs the risk of myocarditis, but doesn’t show this with facts



- Uses plain language
- Illustrates the relative risk with easy-to-understand numbers

Principle #5: Be accurate and transparent

- Make sure any factual claims you make are accurate, and support them with links to relevant sources.
- Don’t make claims that go beyond the science. If there is genuine uncertainty around a subject, acknowledge this; but also explain why you think getting a COVID vaccine is still a good idea.

- Dismissive
- Goes beyond the science: randomized trials on pregnant women have not yet been completed
- Does not address the concern about long term effects

- Acknowledges gaps in our understanding of the vaccine's effects
- Gives a good reason to get the vaccine, despite some uncertainty


Common
Misconceptions
& Questions

mRNA cannot go back into the nucleus where the DNA is - humans just don't have these enzymes.

Our bodies use mRNA all the time to make proteins.

The vaccine mRNA and the protein it makes are dissolved within minutes to hours.

We also consume mRNA in our diet (such as meat!)

COMMON MISCONCEPTIONS AND QUESTIONS

How does mRNA relate to DNA?

Vaccine Ingredients:

- Medicinal ingredient: BNT162b2 (mRNA)
- Non-medicinal ingredients:
    - ALC-0315 = ((4-hydroxybutyl)azanediyl)bis(hexane-6,1-diyl) bis(2-hexyldecanoate)
    - ALC-0159 = 2-[(polyethylene glycol)-2000]-N,N-ditetradecylacetamide
    - 1,2-Distearoyl-sn-glycero-3-phosphocholine
    - cholesterol
    - dibasic sodium phosphate dihydrate
    - monobasic potassium phosphate
    - potassium chloride
    - sodium chloride
    - sucrose
    - water for injection

COMMON MISCONCEPTIONS AND QUESTIONS

It does not contain mercury, formaldehyde, aluminum.

COMMON MISCONCEPTIONS AND QUESTIONS

Can the vaccine affect the menstrual cycle

- There have been some reports of this phenomenon whereby women have heavier or irregular periods
- This has not been studied in the trials but should be reported if noted
- Many theories as to why that can happen:
  - Could be that a “stress” response can affect the regularity of the periods
  - Could be that there is an immunological phenomenon at level of endometrium causing shedding
- Many OBGYN experts have weighed in on this and they recommend that this is NOT a contraindication to a vaccine, it is short lived if happens at all .

TELL US WHAT YOU THINK

Complete our survey:

http://bit.ly/19tozero-outreach

19tozero.ca

This survey has ethical clearance from the University of Calgary, a partner of 19 To Zero.

UNIVERSITY OF CALGARY

19 TO ZERO
UNITED AGAINST COVID-19