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

Seminar Series | Research Results & Implications

How social determinants of health affected the COVID-19 pandemic in Canada

January 25, 2023 | 12:30 p.m. to 2:00 p.m. EST

Moderator

Catherine Hankins, MD, PhD, FRCPC, CM

Former Co-Chair, COVID-19 Immunity Task Force

Professor and Interim Chair, Department of Global and Public Health at McGill's School of Population and Global Health

Land Acknowledgement

I am speaking to you from my place of work at McGill University, which is located in Montréal/Tiohtià:ke in the area of Turtle Island now known as Canada on land which has long served as a site of meeting and exchange amongst Indigenous Peoples, including the Haudenosaunee and Anishinabeg Nations. The Kanien'kehá:ka Nation (Haudenosaunee) is the traditional custodian of the lands and waters on which Montréal/Tiohtià:ke sits. We acknowledge the colonial origins of Montreal and McGill University and encourage everyone to engage in decolonising efforts, beyond land acknowledgment. We thank the diverse Indigenous Peoples whose presence marks this territory on which peoples of the world now gather.

Social determinants of health

Social and economic inequities have contributed to how certain communities in Canada have been more at risk of:

▶ Getting infected with SARS-CoV-2
▶ Being hospitalized for COVID-19
▶ Dying of COVID-19

Factors include:

▶ Income and material deprivation
▶ Employment
▶ Household and bedroom density
▶ Race/ethnicity
▶ Education

COVID-19 Immunity Task Force mandate

Established by the Government of Canada in April 2020

Mandate:

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

CITF supports studies active across Canada
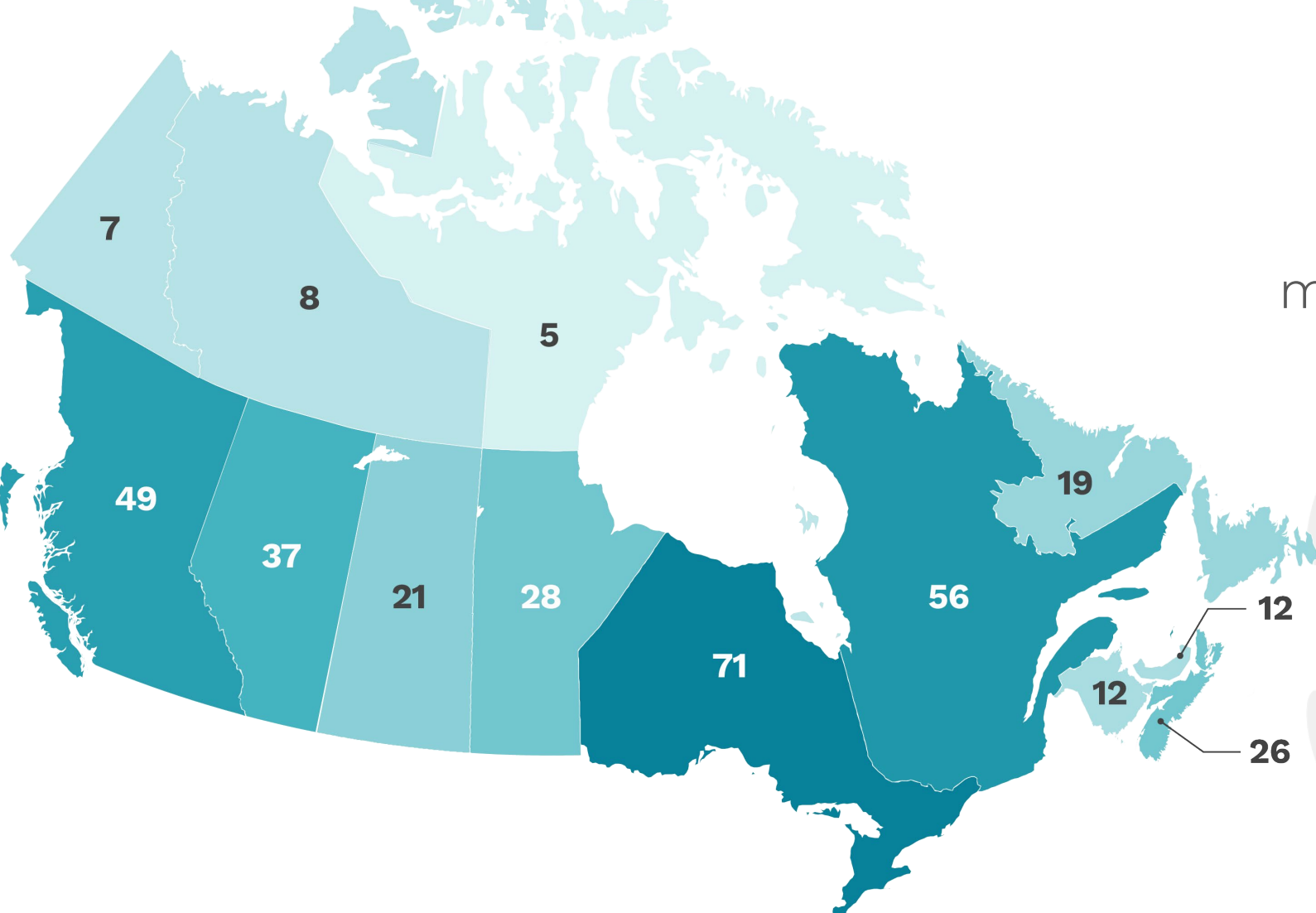
119 studies
many including at-risk communities due to social determinants of health

7

8

5

49

37

21

28

56

19

71

12

12

26

Panelists

Sheila O'Brien PhD, Associate Director, Epidemiology & Surveillance, Canadian Blood Services; Adjunct Professor, School of Epidemiology & Public Health, University of Ottawa

Upton Allen O.Ont., MBBS, MSc, FAAP, FRCPC, Hon FRCP (UK), FIDSA, Professor, Department of Paediatrics and Institute of Health Policy Management and Evaluation, University of Toronto; Chief, Division of Infectious Diseases, The Hospital for Sick Children (SickKids); Senior Associate Scientist, The Hospital for Sick Children (SickKids)

Jack Jedwab PhD, President and CEO Metropolis Institute and the Association for Canadian Studies

Simona Bignami PhD, Professor, Department of Demography, Université de Montréal

Sonia Anand MD, PhD, FRCPc, FRSC, Professor of Medicine and Epidemiology and Associate Chair Equity, Diversity, Department of Medicine, McMaster University; Vascular Medicine Specialist, Hamilton Health Sciences; Senior Scientist, Population Health Research Institute

Land acknowledgement

I would like to acknowledge that since I am in Ottawa, I am on the traditional unceded territory of the Anishnaabeg nation.

Disclaimer

I have no COIs to declare related to this study.

Who are blood donors?

17	**At least 17 years old** **Weigh at least 50kg***
☺	**Feeling well on the day** (no recent COVID-19 or risk of COVID-19)
🧰	**Meet donor eligibility criteria**
📉	**At low risk of blood transmissible infection**
💊	**Not taking certain medications**

Live in any major city, most smaller cities and many towns in any province except Quebec (nor the territories)
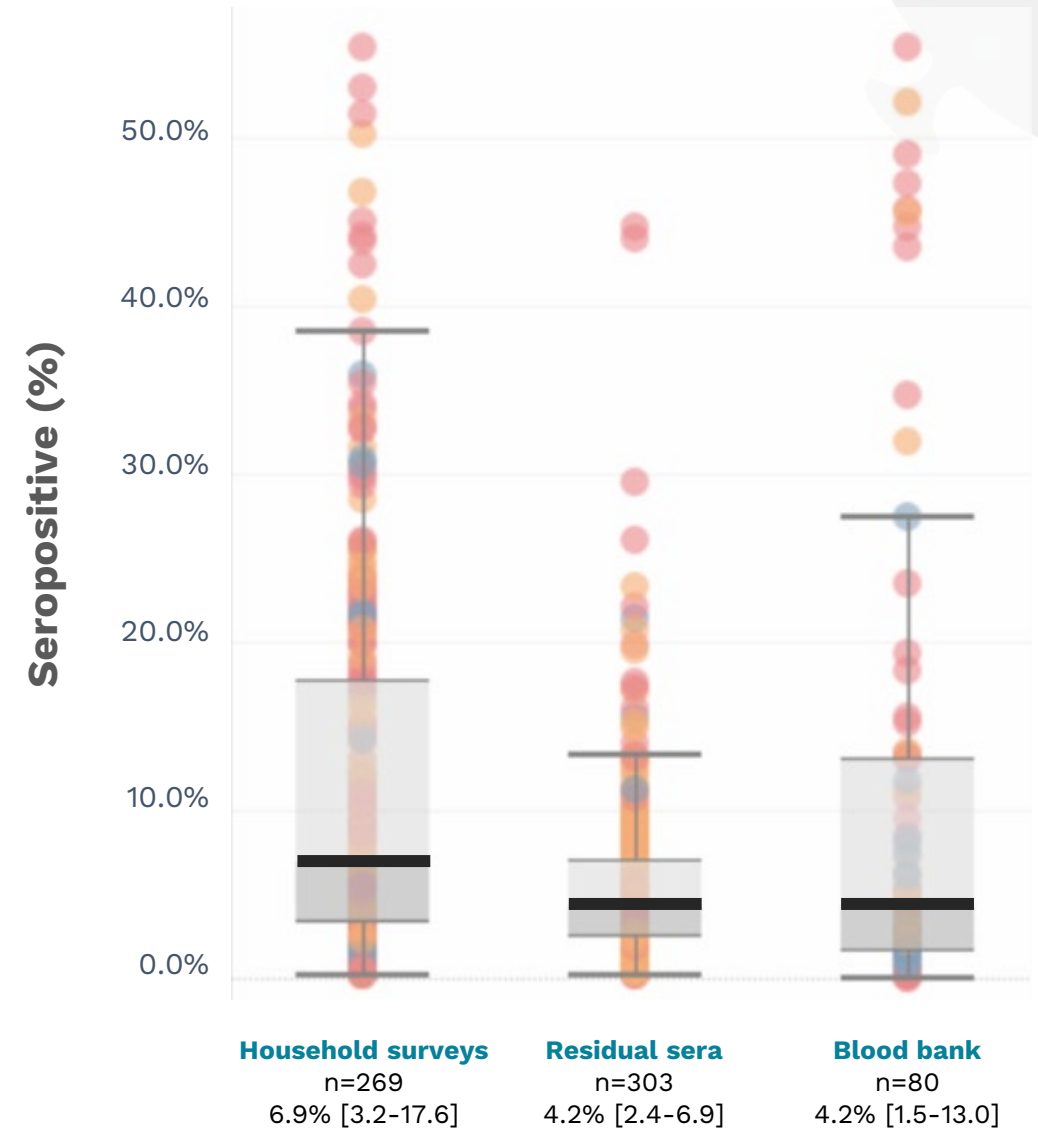
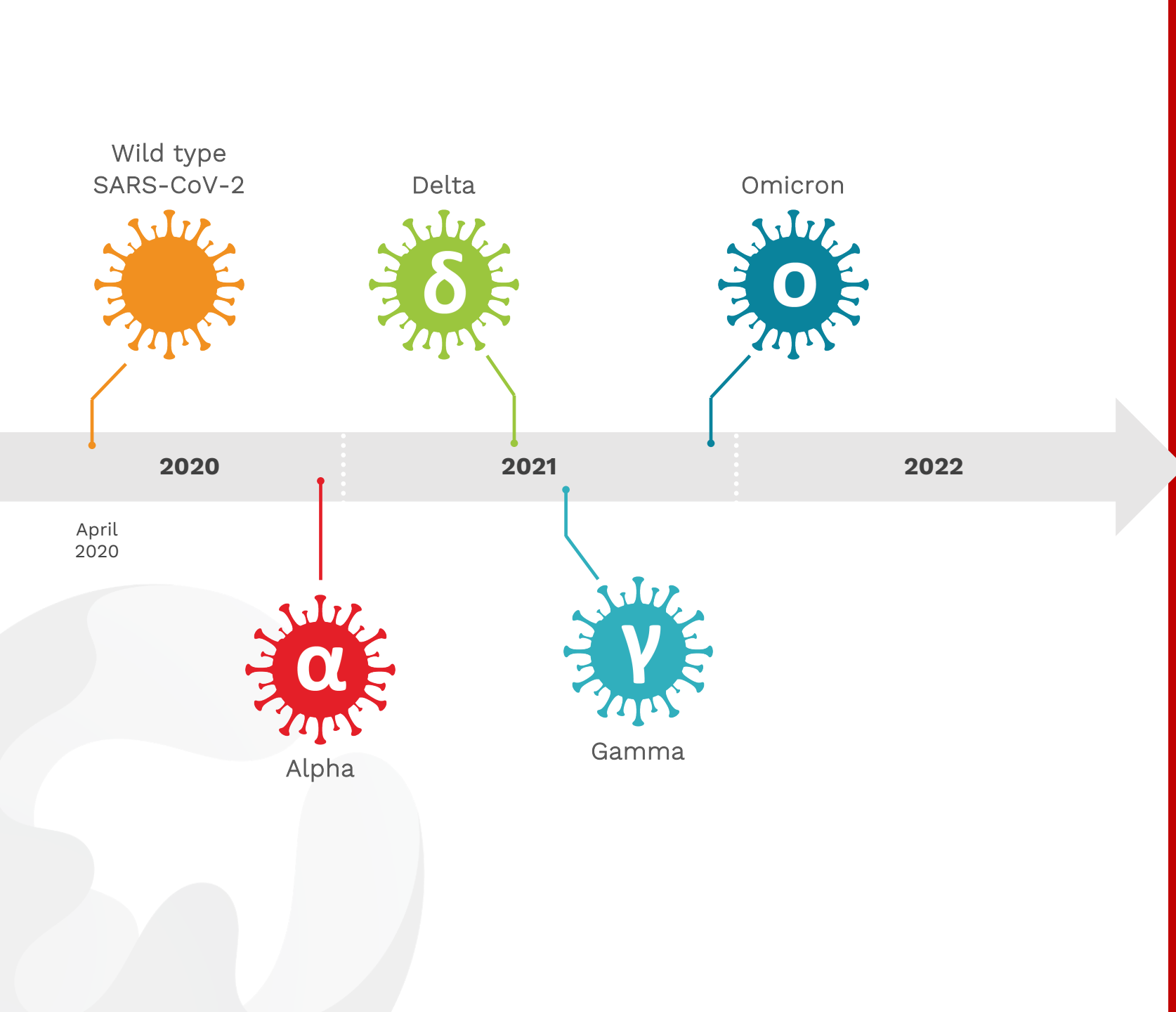*Some additional height/weight criteria for young donors

Canadian Blood Services
BLOOD PLASMA STEM CELLS ORGANS & TISSUES

Blood donor studies are representative of the general population

Do studies of blood donors produce comparable results?

- SeroTracker meta-regression: **No difference** in seroprevalence from blood banks and household surveys

- Analysis corrects for risk of bias, study region, scope of study, and reported case burden

Household surveys
n=269
6.9% [3.2-17.6]

Residual sera
n=303
4.2% [2.4-6.9]

Blood bank
n=80
4.2% [1.5-13.0]

Canadian Blood Services
BLOOD PLASMA STEM CELLS ORGANS & TISSUES

Wild type SARS-CoV-2 · April 2020 · 2020 · Alpha · Delta · 2021 · Gamma · Omicron · 2022
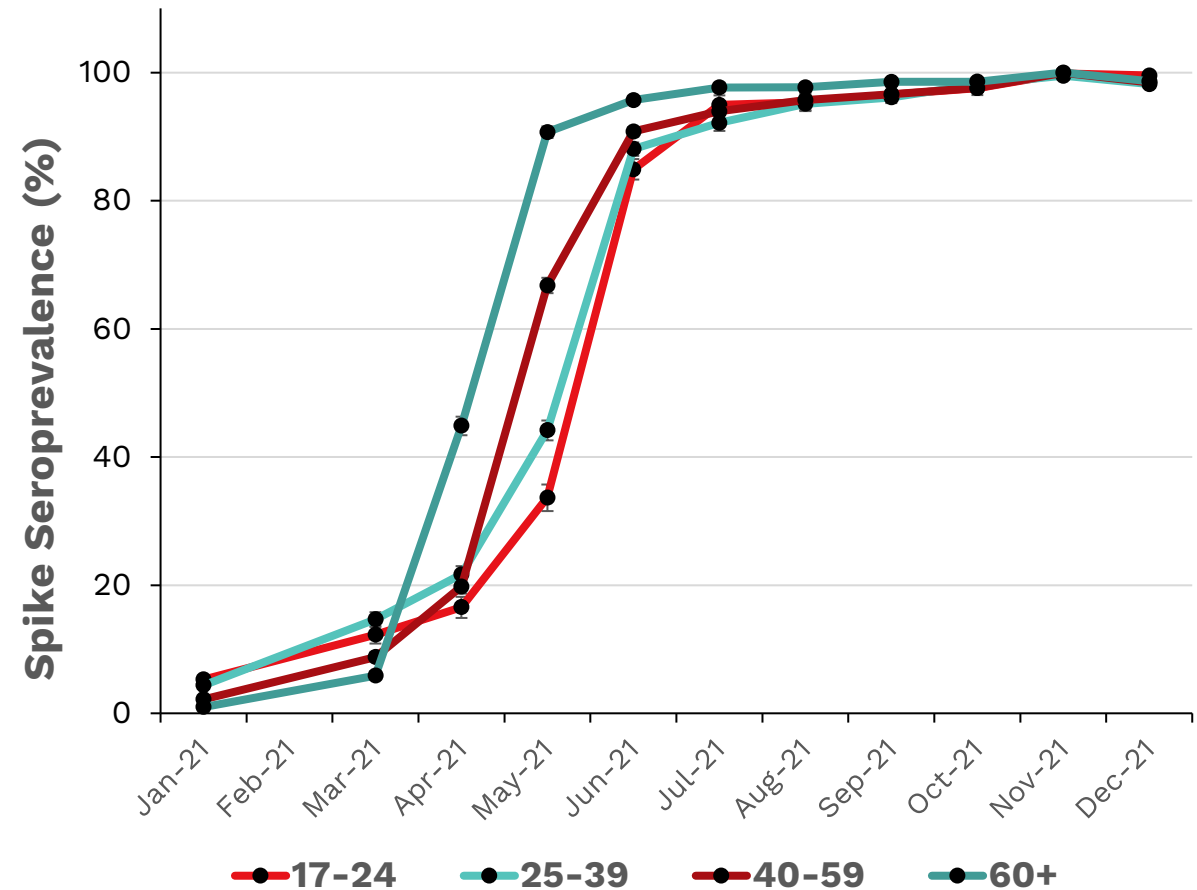
516,107 samples tested

April 2020 to November 2022

Nearly all donors were vaccinated in 2021

Vaccine-related seroprevalence in oldest to youngest age groups, 2021

Canadian Blood Services

BLOOD
PLASMA
STEM CELLS
ORGANS
& TISSUES

Measuring social determinants of health

Race / ethnicity

- Blood donation screening question
- Asked to find donors with rare blood groups to better match blood products to patients

Pampalon material deprivation scale

- Data about neighbourhoods where blood donors live
- Based on income, job security, education

Canadian Blood Services

BLOOD
PLASMA
STEM CELLS
ORGANS
& TISSUES
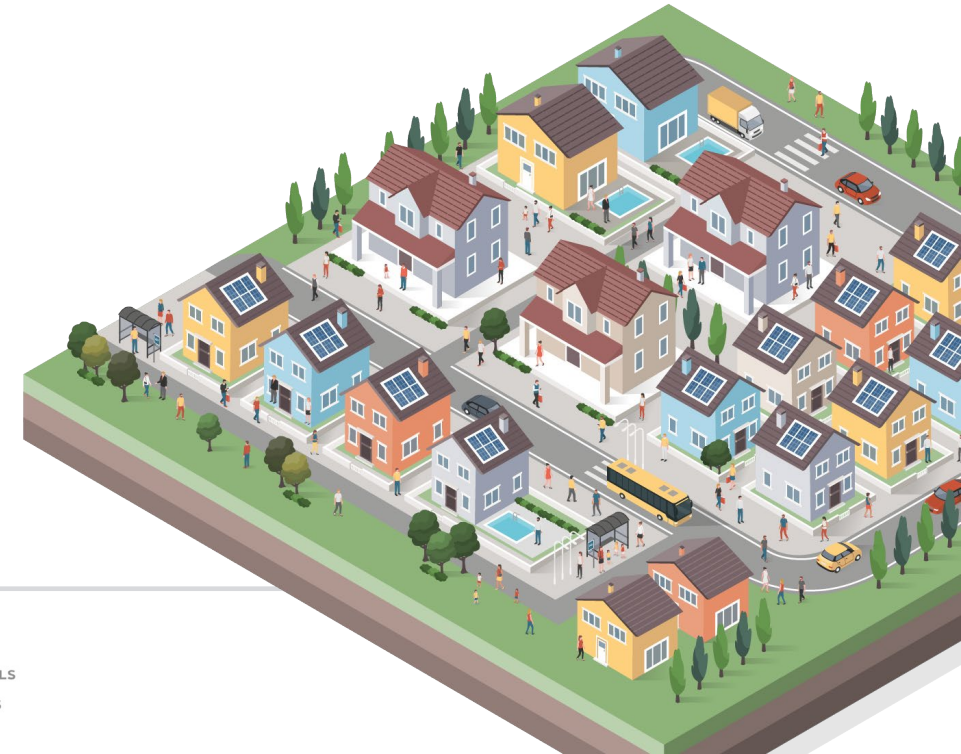
Infection-acquired seroprevalence has consistently been higher in racialized groups
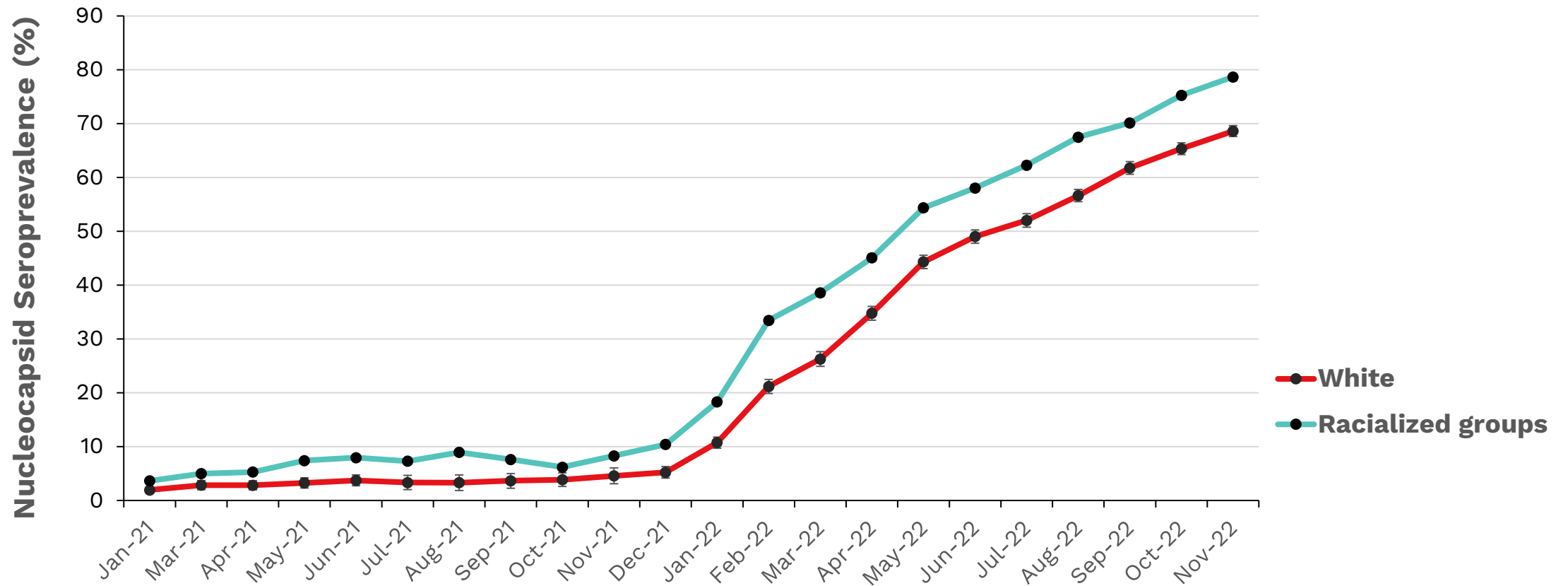
Infection-acquired seroprevalence was higher in racialized groups across regions, 2021
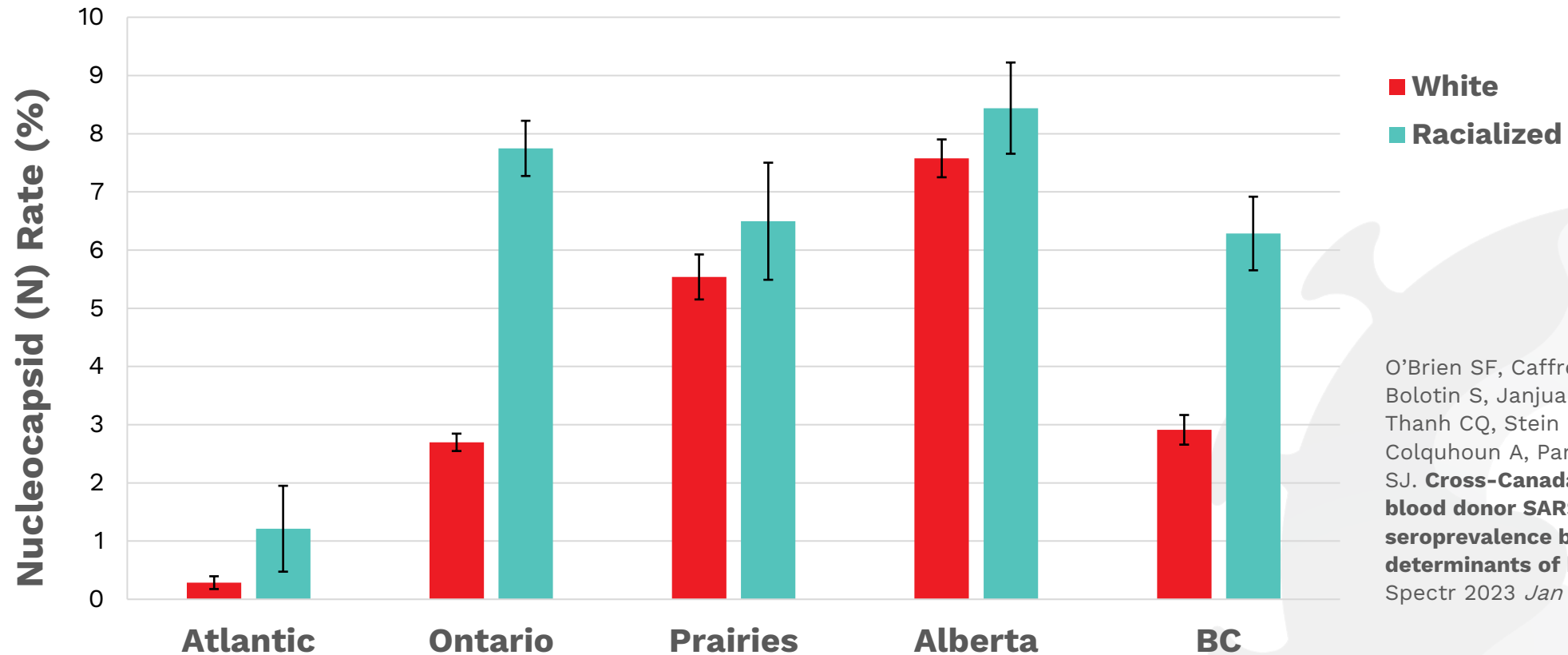
O'Brien SF, Caffrey N, Yi QL, Bolotin S, Janjua NZ, Binka M, Thanh CQ, Stein DR, Lang A, Colquhoun A, Pambrun C, Drews SJ. **Cross-Canada variability in blood donor SARS-CoV-2 seroprevalence by social determinants of health.** Microbiol Spectr 2023 *Jan 10:e0335622*

Infection-acquired seroprevalence has been higher in donors living in materially deprived neighbourhoods
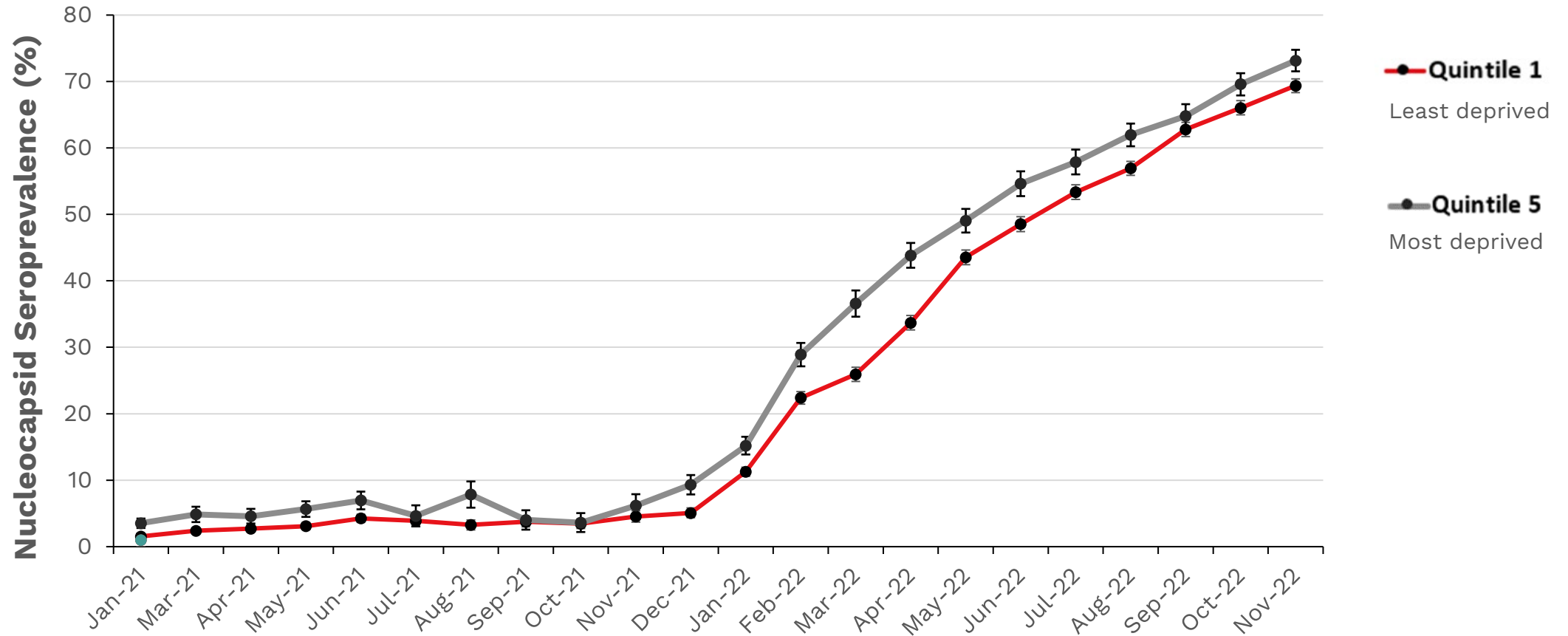
Infection-acquired seroprevalence varied regionally among neighbourhood material deprivation, 2021
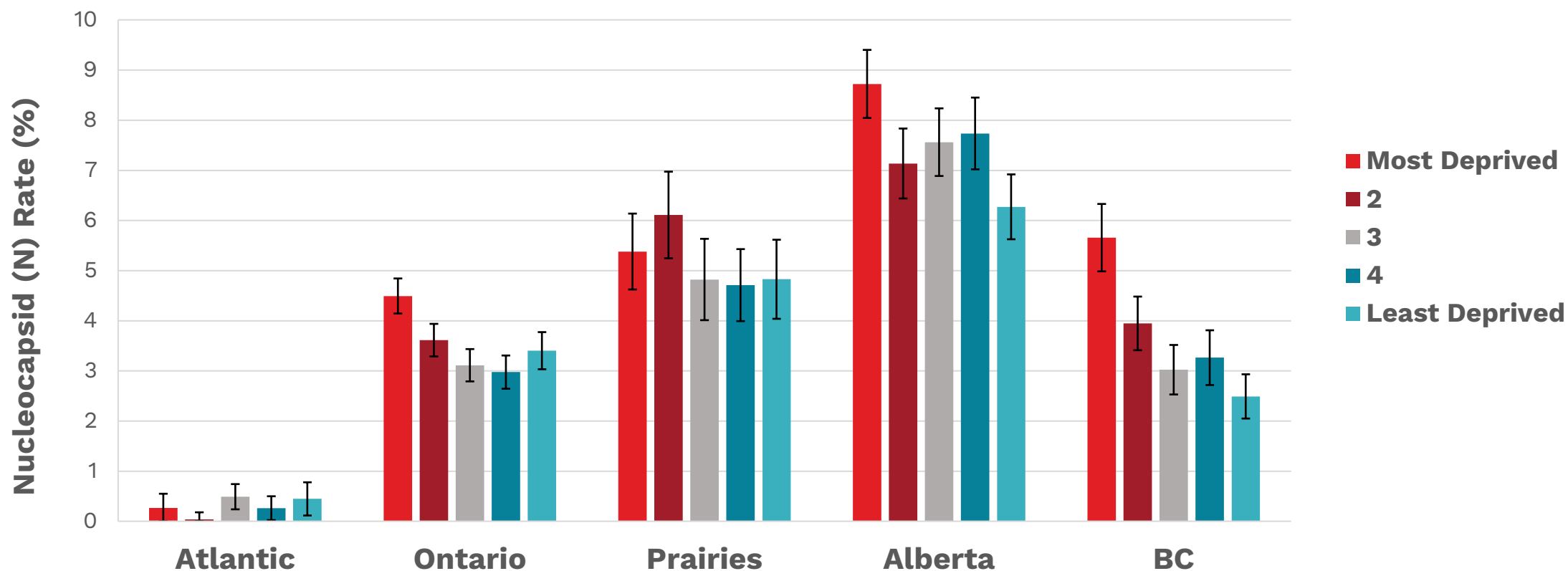
Key learnings

- Seroprevalence due to infection **higher in racialized donors**

- Seroprevalence due to infection **higher** in donors from more **materially deprived neighbourhoods**

- Seeing as most blood donors are reasonably health-conscious, these findings underscore the **pervasiveness of the socioeconomic gradient** in Canada

Canadian Blood Services

BLOOD
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& TISSUES
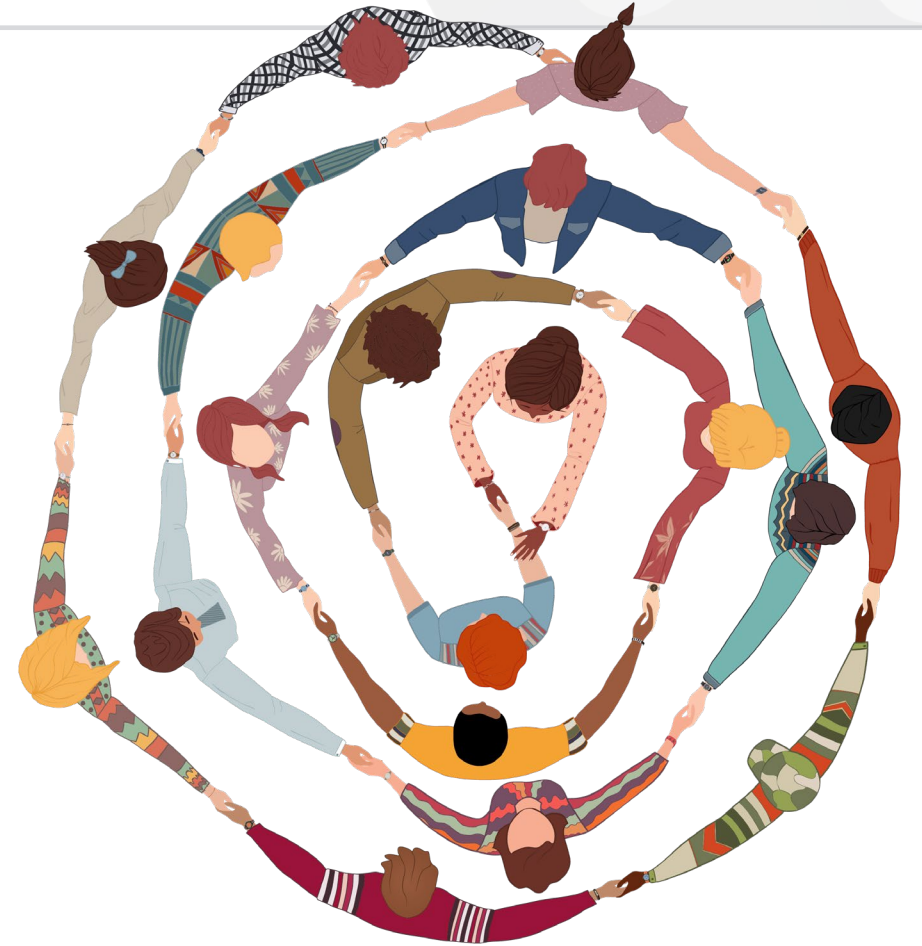
Study Team

PROJECT LEADERSHIP

Isra Levy (VP Medical Affairs and Innovation)

Chantale Pambrun (Sr. Medical Director)

Sheila O'Brien (Epidemiology)

Steven Drews (Microbiology)

Craig Jenkins (Innovation Management)

Michael Pluscauskas (Sr. Project Manager)

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Dhuha Hassan (MLA)

Doug Ems (MLT)

Qi-Long Yi (Biostatistician)

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Lori Osmond (Research Associate)

CBS SUPPORT STAFF

Adrian Craciun (Strategic Financial Management)

David Mckee (Procurement)

Julia Orr (Payroll/Accounting)

Tony Lynn (Donor Testing)

Glenda Marroquin (Logistics)

The seroMARK project

COVID-19 seroprevalence and vaccine responses among Black Canadians

Upton D. Allen

Professor, Department of Paediatrics and Institute of Health Policy Management and Evaluation, University of Toronto

Chief, Division of Infectious Diseases,
The Hospital for Sick Children (SickKids)

Senior Associate Scientist,
The Hospital for Sick Children

Land acknowledgement

I would like to begin by acknowledging the land on which my institution (SickKids) operates. For thousands of years, it has been the traditional land of the Huron-Wendat and Petun First Nations the Seneca and most recently the Mississaugas of the Credit River.

Today, Toronto is home to Indigenous peoples from across Turtle Island. We are committed to working towards new relationships that include First Nations, Inuit, and Métis peoples and we are grateful for the opportunity to share this land in caring for children and their families.

Disclaimer

I have no COIs to declare related to this study.

Ontarians in COVID-19 "hot zones" over 3X more likely to have infection-acquired antibodies in Year 1

Students / teachers
13%

Black persons
14.4%

< 19 years
20%

0   5   10   20

3.6%
London / Oakville

12.6%
Toronto North West

13.4%
Frontline workers

* Relative Risk
3.31 (1.01-10.89)

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YORK U UNIVERSITÉ UNIVERSITY
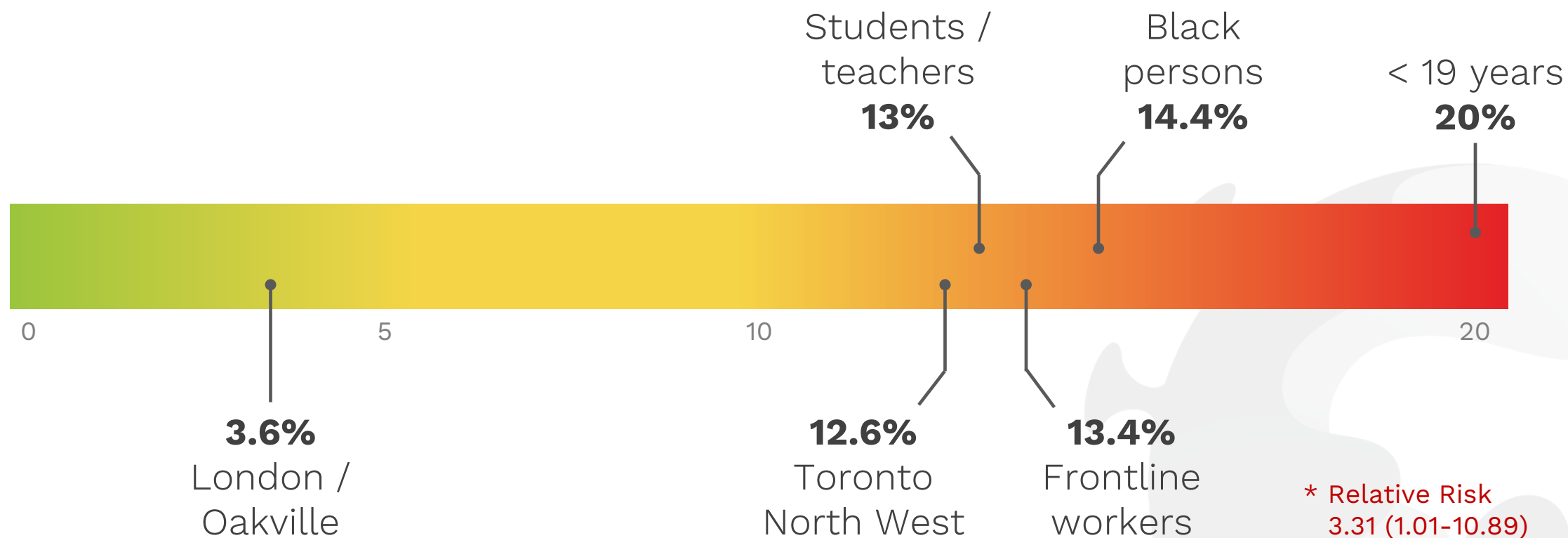
Most study participants now have infection-acquired antibodies to SARS-CoV-2

Seropositivity rates among selected groups

	Period #1 (%) N	Period #2 (%) N	Period #3 (%) N	Period #4 (%) N
Dates	Aug. to Dec. 2020	July to Dec. 2021	Jan. to June 2022	July to Dec. 2022
Overall positivity	9.6 (37/387)	14.0 (66/473)	39.2 (230/587)	55.9 (186/333)
GTA North West	12.6 (26/206)	68.6 (48/70)	80.9 (72/89)	66.7 (40/60)
Frontline workers	13.4 (11/82)	40.5 (30/74)	81.4 (57/70)	67.5 (27/40)
Students/teachers	13.0 (25/192)	40.9 (29/71)	65.2 (45/69)	72.7 (24/33)
Age under 19 yrs	20 (10/50)	34.8 (8/23)	61.5 (24/39)	73.3 (11/15)

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Following vaccination, antibody levels are higher among people who previously had COVID-19

Low end	Intermediate levels	High end

| 0 | 500 BAU/mL | 1500 BAU/mL |
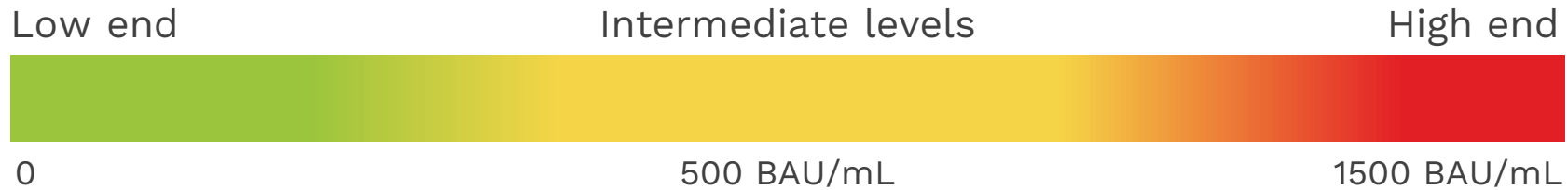
	High Response	**No High Response**	
NP Positive	97 (66.9%)	48 (33.1%)	145
NP Negative	179 (36.5%)	312 (63.5)	491
			636

RR 1.84 (1.56 - 2.16). OR 3.52 (2.38 – 5.21)   P < .0001

The seroMARK project: COVID-19 seroprevalence
and vaccine uptake among Black Canadians

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Sickle Cell Disease: COVID-19 vaccine uptake

- Persons with Sickle Cell Disease are known to be at risk of having severe outcomes from COVID-19

- Sickle Cell Disease is an illness that affects Black persons predominantly

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- More than half of the children (57%) with Sickle Cell Disease had evidence of having had COVID-19

- Approximately 63% of eligible children received 2 doses of vaccine

- Less than 10% of eligible children received 3 doses of vaccine

Very low vaccine uptake among children and adolescents in Ontario (ref data)

COVID-19 vaccine coverage estimates by pediatric age groups: Ontario, December 14, 2020 to January 2, 2023

Age (years)	Coverage (%): Completed primary series and any booster dose 6+ months ago	Coverage (%): Completed primary series and any booster dose < 6 months ago
5–11	0	6.3
12–17	12.5	8.7

Source: Public Health Ontario

Sickle Cell Disease: COVID-19 vaccines are generally safe

- Side effects generally mild (e.g., pain/discomfort at injection site)

- 1 episode of sickle cell crisis occurred after vaccination (< 6 weeks) among 175 vaccinated children

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Community Advisory Groups facilitate research in Black communities

- Our experience suggests that **community advisory groups** can be beneficial in enhancing representation of Black communities in COVID-19-related research.

- The most suitable model of community engagement: one that does not rely on a single point in time consultation but more **sustained interaction** between researchers and members of the Black community.

Study Team & Collaborators

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Mariana Abdulnoor

Jean-Philippe Julien

Niranjan Kissoon

Alice Litosh

Peter Wong

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seroMARK Community Advisory Group (Dr. Pamela Appelt, Chair)

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Hugues Loemba

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Funded by

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Simona Bignami, PhD

Professor, Department of Demography, Université de Montréal

The impacts of the social determinants of health on the COVID-19 pandemic:

Preliminary evidence from RISC-Montréal

Land acknowledgement

Université de Montréal is situated on land where, long before the arrival of the French, people of many Indigenous nations came together and interacted. We wish to acknowledge these nations, their descendants and the spirit of fraternity that presided over the signing in 1701 of the Great Peace of Montreal, a treaty that fostered peaceful relationships between France, its Indigenous allies and the Haudenosaunee federation. The spirit of fraternity that inspired this treaty serves as a model for our own university community.

Disclaimer

We have no COIs to declare related to this study.

Objectives

- Collect quantitative and qualitative evidence on COVID-19 risk factors and immunity (infection-acquired and vaccine induced) among residents of Montreal North and residents of other Montreal neighbourhoods

- Compare COVID-19 risk profiles, according to:
  - Beliefs   ⎤
  - Attitudes   ⎬ About the disease
  - Behaviours ⎦
  - Sociodemographic characteristics (age, gender, occupational status, minority/immigration status, and household characteristics)

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Analytical sample

1318 participants age 18 years and older

Online survey questions between August 9, 2021 and December 31, 2022

Dried Blood Spot samples

Sample composition highlights the difficulties of reaching lower educated and immigrant respondents

Of **1318 interviewed respondents** with available serological results:

70% were **women**

85% identified as **white**

60% reported to hold a **graduate degree or higher**

74% reported to have been **born in Canada**; among the 21% born abroad, only 9% to reported to be recent immigrants

The impacts of the social determinants of health on the COVID-19 pandemic: Preliminary evidence from RISC-Montréal

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Sample composition highlights the difficulties of reaching lower educated and immigrant respondents... even in Montreal North

Of **131 interviewed respondents** in Montreal North with available serological results:

77% were women

39% reported to hold a graduate degree or higher

81% identified as white

89% reported to have been born in Canada

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Seroprevalence was highest for males, those age 35-54, less educated, born in Canada and teachers

		% Positive	Number
	All respondents 18+	19%	1318
Age	18-34 [29%]	17%	375
	35-54 [46%]	**21%**	604
	55+ [23%]	20%	303
Gender	Male [28%]	**20%**	370
	Female [70%]	19%	924
Education Level	Secondary or less [16%]	**21%**	114
	Certificate/CEGEP [24%]	5%	258
	University degree or higher [60%]	7%	938
Immigration Status	Born in Canada [74%]	**20%**	1015
	Born abroad [21%]	16%	286
Occupation	Health care worker [22%]	18%	287
	Preschool, primary, secondary teacher [3%]	**20%**	45
	Other [75%]	19%	986
Neighbourhood	Montreal North [10%]	15%	131
	Other neighbourhoods [90%]	**20%**	1187
	Average household size [2.4]	2.5	

The sample proportions for each category are indicated in the square parentheses. Differences according to the sample characteristics are not statistically significant. Percentages may not add to 100 due to missing values.

Those 35-54, less educated, born in Canada and teachers had highest prevalence of SARS-CoV-2

	All respondents 18+	Omicron	Post-Omicron	Fall 2022
Age	18-34	9%	23%	12%
	35-54	7%	**25%**	**20%**
	55+	**14%**	23%	19%
Gender	Male	9%	**26%**	**18%**
	Female	10%	23%	**18%**
Education Level	Secondary or less	11%	20%	14%
	Certificate/CEGEP	8%	**24%**	17%
	University degree or higher	10%	**24%**	**18%**
Immigration Status	Born in Canada	**11%**	**24%**	**19%**
	Born abroad	4%	22%	15%
Occupation	Health care worker	**20%**	**29%**	11%
	Preschool, primary, secondary teacher	14%	18%	**25%**
	Other	8%	23%	20%
Neighbourhood	Montreal North	5%	**36%**	**20%**
	Other neighbourhoods	**11%**	24%	17%
	Average household size	2.4	2.4	2.3

Seroprevalence not higher in Montreal North than in the rest of the city in all study periods

			% Positive	Number
		All respondents 18+	19%	1318
Omicron wave	*Serological samples collected between December 2021 and March 2022*	All of Montreal	10%	218
		Montreal North	5%	57
Post-Omicron	*Serological samples collected between April and June 2022*	All of Montreal	24%	606
		Montreal North	36%	14
Fall 2022	*Serological samples collected between July and December 2022*	All of Montreal	17%	494
		Montreal North	18%	60

Differences are statistically significant (p<.000).

Challenges

▶ Evolution in the spread of COVID-19 over time and across population subgroups

▶ Access to testing (particularly with the availability of home tests)

▶ Attitudes towards testing, which affect the analysis and interpretation of data collected

▶ Selected socio-demographic groups appeared to be more reticent to take the dried blood spot test, but that reticence waned considerably over the course of the pandemic

To illustrate reticence of certain groups to take COVID-19 rapid tests: Results from CIHR-5

In the past six months, have you taken an at-home COVID-19 rapid test? (N=347)

	Montreal total	Man	Woman	18-35	35-54	55 plus
Yes	61.5%	60.4%	62.5%	62%	63%	52%
No	38.5%	39.5%	37.5%	38%	37%	48%

	White	Visible minority	Born in Canada	Born outside Canada
Yes	68%	56%	66.5%	53.5%
No	32%	44%	33.5%	46.5%

Montrealers identifying as visible minorities or persons born outside of Canada were less likely to have taken an at-home COVID-19 rapid test.

	Vaccinated	Not vaccinated
Yes	63%	26.5%
No	37%	73.5%

Montrealers that were not vaccinated were much less likely to report having taken an at-home COVID-19 rapid test.

Conclusions

▶ Community of residence, age and occupation status are strongly associated with COVID-19 seroprevalence

▶ Although the sample size is small, respondents who are male, age 35-54, or residents in Montreal North have the highest seroprevalence after the Omicron wave

▶ Health care workers, followed by teachers, have the highest seroprevalence in all study periods

The impacts of the social determinants of health on the COVID-19 pandemic: Preliminary evidence from RISC-Montréal

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Next steps

▶ We need to understand how the changing sample composition over time has affected our descriptive results

▶ More in general, we need to understand the interplay between the different sample characteristics and seroprevalence over time

Acknowledgements

We would like to thank:

▶ The **COVID-19 Immunology Task Force** for providing funding for RISC-Montréal

▶ Our **study team**: Fatmata Kamara (ACS-Metropolis), Paul Holley (ACS-Metropolis), Jeanne Latour (Université de Montréal) and Shawn Goldsmann (Université de Montréal)

Land acknowledgement

McMaster University recognizes and acknowledges that it is located on the traditional territories of the Mississauga and Haudenosaunee nations, and within the lands protected by the "Dish with One Spoon" wampum agreement.

Disclaimer

I have no COIs to declare related to this study.

Rationale and objectives

RATIONALE

- **South Asians:** largest non-white ethnic group in Canada

- **Peel was a hotspot:** 22% of provincial cases (wave 2) but 10% of population [1]

- **Risk factors:** exposure and barriers to accessing testing and reliable health information
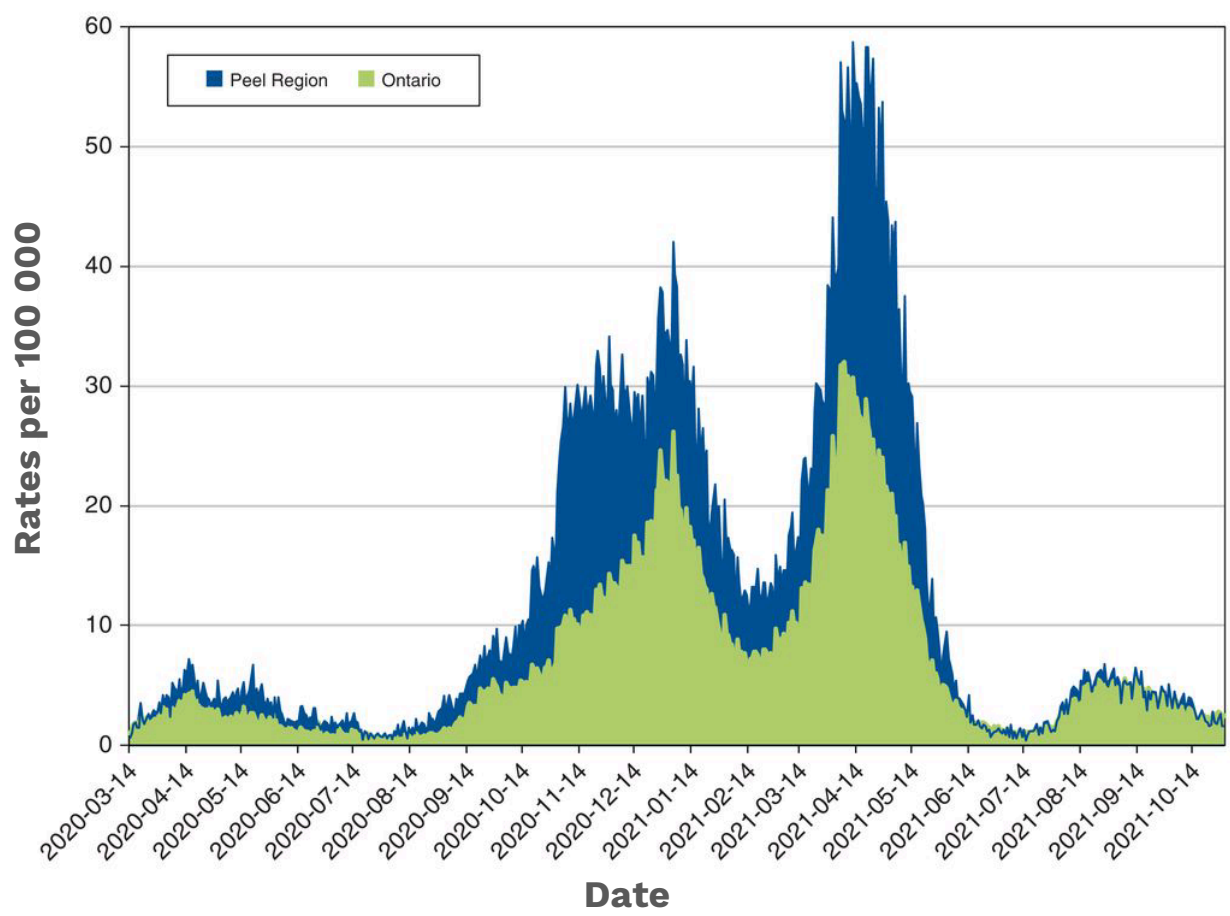
OBJECTIVES

- Investigate the burden of SARS-CoV-2 infection among South Asians in the GTA

- Determine which demographic and informational characteristics were most closely aligned with seropositivity

[1] Public Health Ontario

COVID CommUNITY South Asian

McMaster University

Population Health Research Institute
HEALTH THROUGH KNOWLEDGE

Hamilton Health Sciences

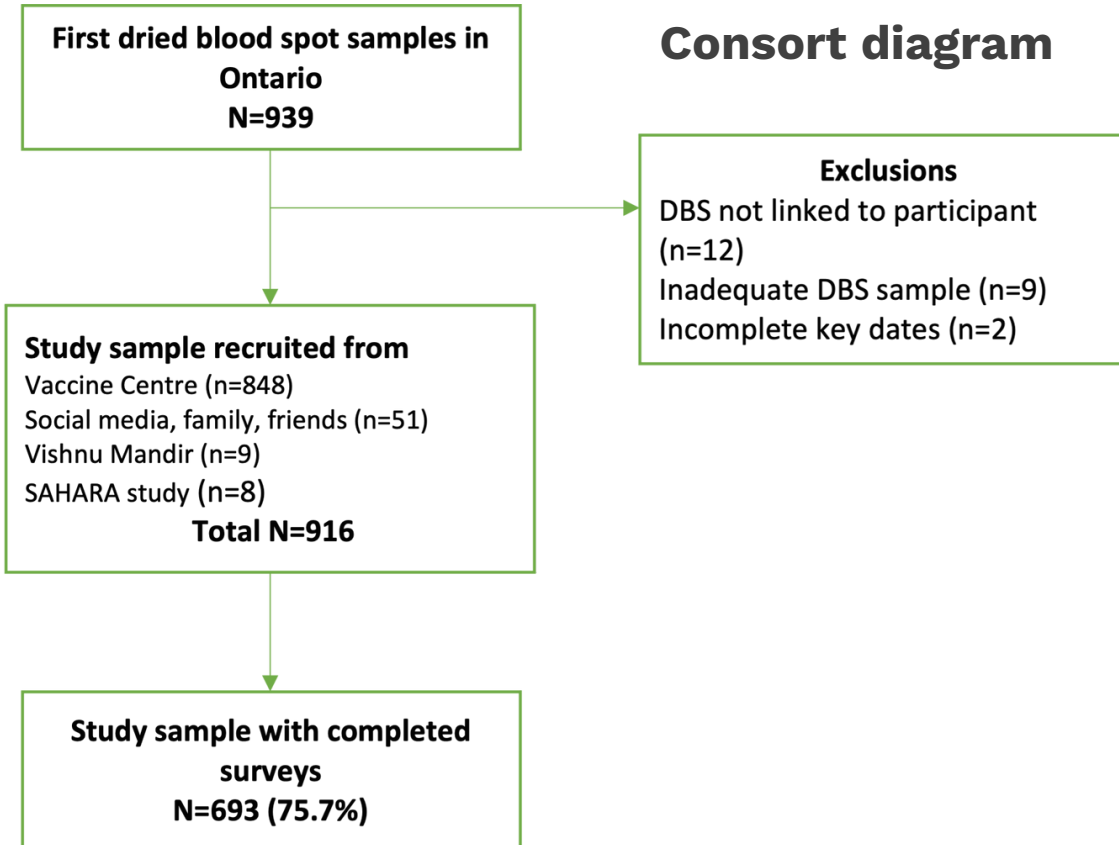# COVID-19 pandemic comparing Peel region to Ontario

COVID-19 daily case rates in Ontario and Peel Region from March 14, 2020, to October 31, 2021

Data from Public Health Ontario

Demographic characteristics

First dried blood spot samples in Ontario
N=939

Consort diagram

Exclusions
DBS not linked to participant (n=12)
Inadequate DBS sample (n=9)
Incomplete key dates (n=2)

Study sample recruited from
Vaccine Centre (n=848)
Social media, family, friends (n=51)
Vishnu Mandir (n=9)
SAHARA study (n=8)
Total N=916

Study sample with completed surveys
N=693 (75.7%)

- Mean age: **41.5 years old**

- **49.2%** women

- **32.9%** essential workers*

- **19.1%** live in a multigenerational household

- **65.4%** were born in Canada or had lived in Canada for more than 10 years

* Defined using criteria of the Government of Ontario (e.g., food manufacturing and transportation workers)

Seropositivity

Dried Blood Spot (DBS)

Age- and sex-standardized seropositivity for previous infection:
23.6%
(95% CI 20.8%–26.4%)

Adjusted seropositivity for multiple respondents per household:
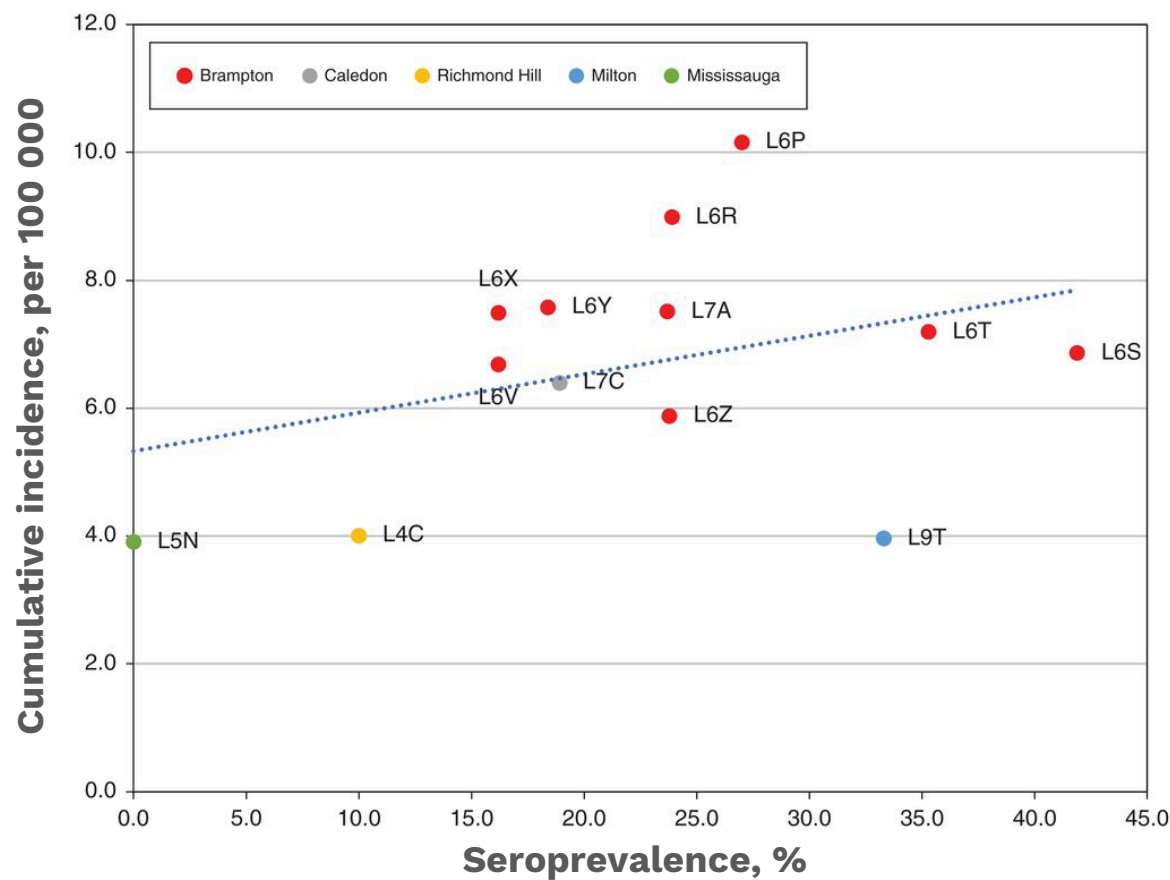**22.9%**
(95% CI 20.1%–26.1%)

Seropositivity

Adjusted seropositivity was higher in participants who were:

- ▶ Male
- ▶ Older
- ▶ Less educated
- ▶ Living in multigenerational households
- ▶ Lower FSA income per household size
- ▶ From the City of Brampton

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COVID-19 cumulative incidence by seroprevalence

Cumulative incidence of COVID-19 cases (per 100) as of Oct 3, 2021 by age-sex standardized seroprevalence by FSA

Cumulative incidence data from Institute of Clinical Evaluative Sciences

Top-ranked sources of COVID-19 health information (n = 585)
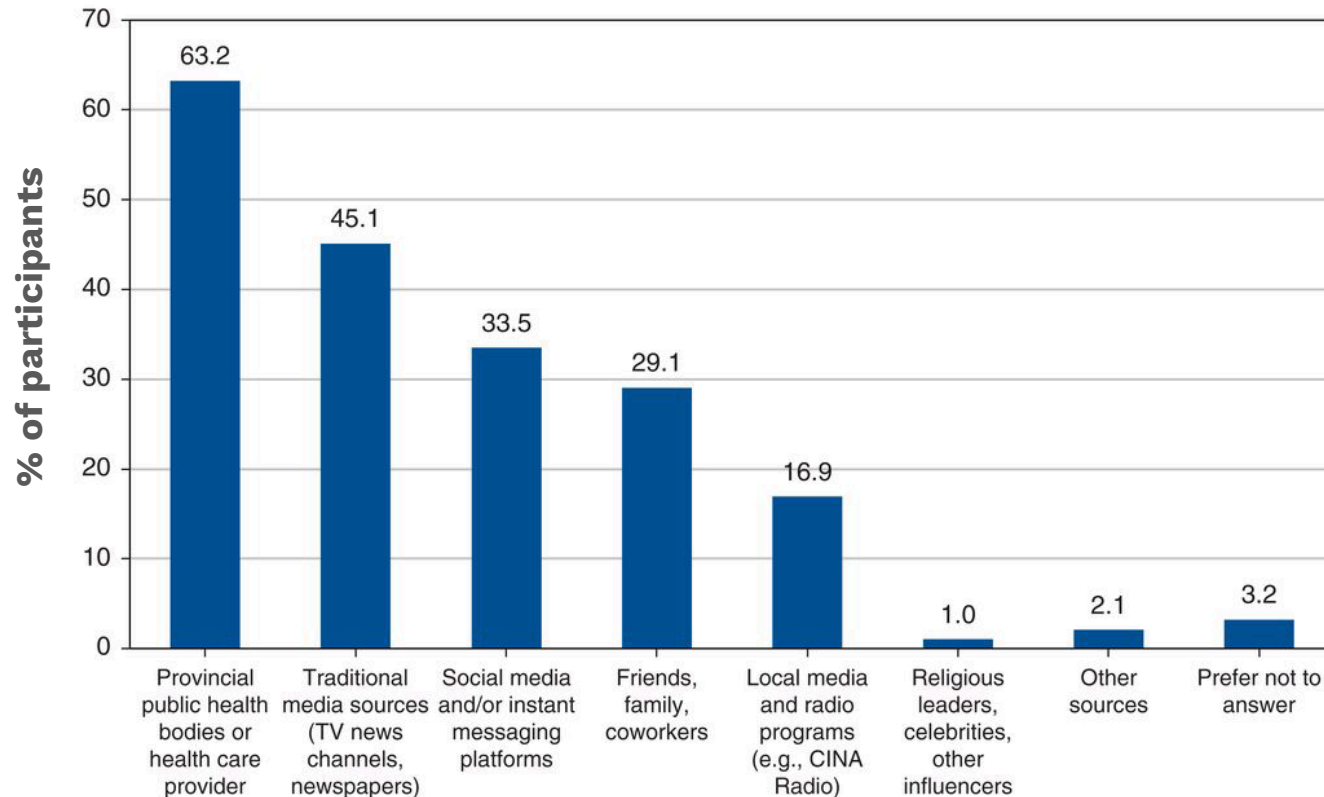
Top 3 most trusted sources of information:

▶ Health care providers or provincial public health bodies (n = 370)

▶ Traditional media sources (n = 264)

▶ Social media (n = 196)

Data from Public Health Ontario

Vaccine Attitudes Examination (VAX) Scale

- Assess attitudes towards general vaccines

- 12-item scale consisting of 4 sub-scales
  - ▶ Mistrust of vaccine benefit
  - ▶ Worries about unforeseen future side effects
  - ▶ Concerns about commercial profiteering
  - ▶ Preference for natural immunity

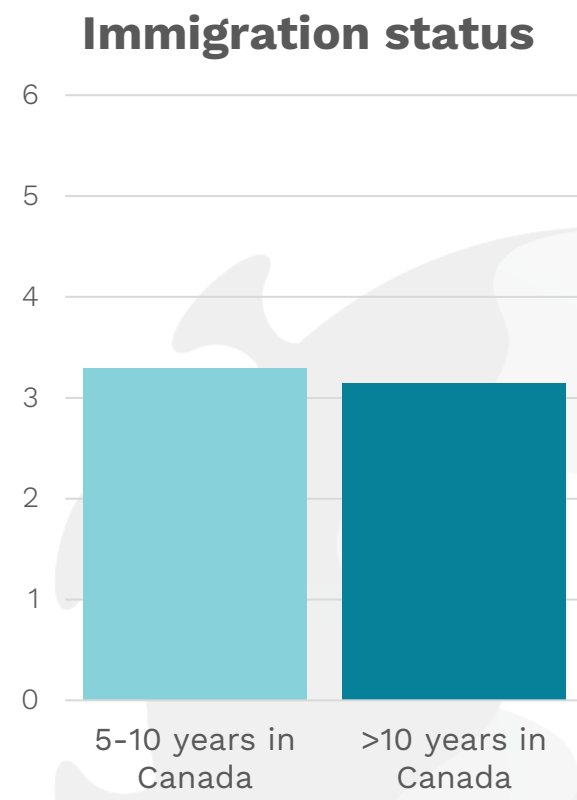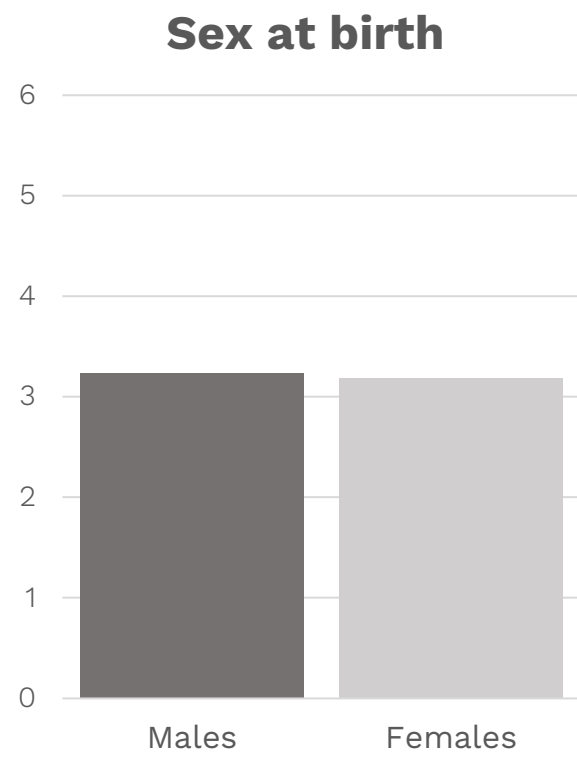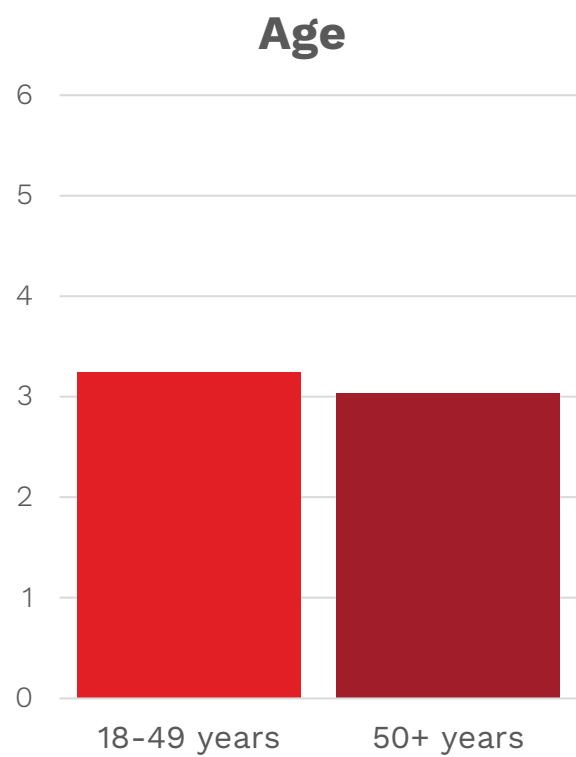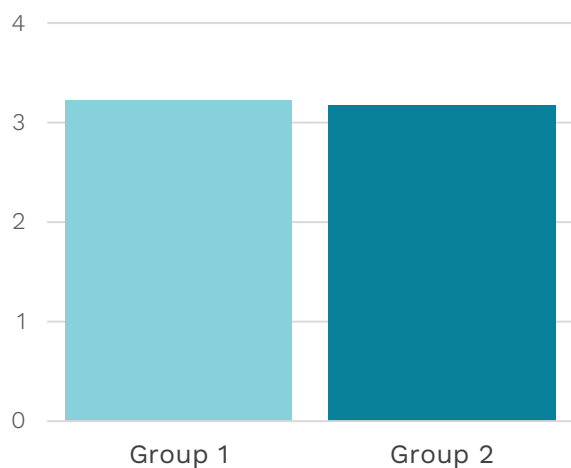| Items |
| --- |
| I feel safe after being vaccinated (–) |
| I can rely on vaccines to stop serious infectious diseases (–) |
| I feel protected after getting vaccinated (–) |
| Although most vaccines appear to be safe, there may be problems that we have not yet discovered. |
| Vaccines can cause unforeseen problems in children. |
| I worry about the unknown effects of vaccines in the future. |
| Vaccines make a lot of money for pharmaceutical companies, but do not do much for regular people. |
| Authorities promote vaccination for financial gain, not for people's health. |
| Vaccination programs are a big con. |
| Natural immunity lasts longer than a vaccination. |
| Natural exposure to viruses and germs gives the safest protection. |
| Being exposed to diseases naturally is safer for the immune system than being exposed through vaccination. |

Overall mean VAX score comparisons

Age — 18-49 years; 50+ years

Sex at birth — Males; Females

Immigration status — 5-10 years in Canada; >10 years in Canada

Overall mean VAX score comparisons

Highest level of education completed

Group 1 | Group 2

Group 1 | Less than high school graduation, high school graduation, trade certificate, vocational school, or apprenticeship training

Group 2 | Non-university certificate/diploma, university bachelor's degree, graduate degree)
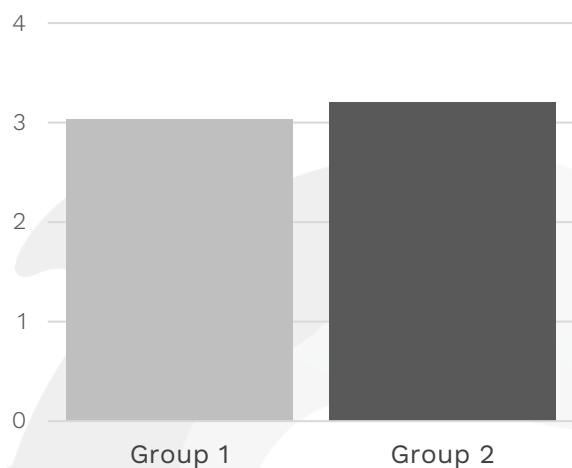
Marital status
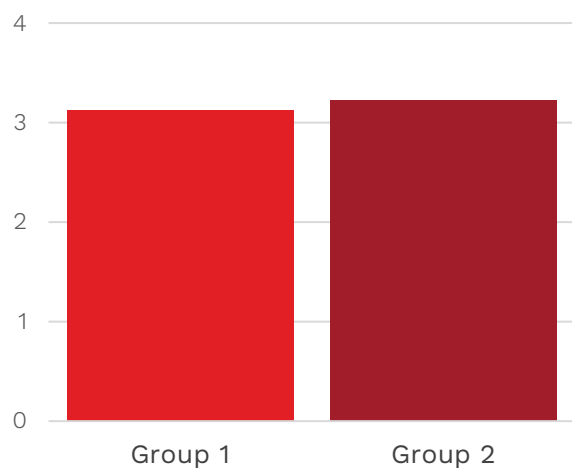
Group 1 | Group 2

Group 1 | Never married, divorced/separated, widowed

Group 2 | Common law, currently married

Employment status

Group 1 | Group 2

Group 1 | Retired, unemployed, temporarily, permanently laid off due to COVID-19

Group 2 | Employed

Predictors of vaccine hesitancy

Predictor	Sig.
Highest level of education completed	.005
Employment status	.002
Immigration status	<.001

Adjusted for multiple respondents for household. Higher scores are interpreted as more hesitant.

Linear Mixed Model for social determinants predictors of vaccine hesitancy measured by VAX Score			
Parameter	**VAX Score Estimate**	**Sig.**	**95% Confidence Interval**
Intercept	34.344	<.001	(30.091, 38.596)
HIGHEST LEVEL OF EDUCATION COMPLETED			
Less than high school graduation	0	.	.
High school graduate	.181	.933	(–4.026, 4.388)
Trade certificate, vocational school, or apprenticeship training	1.425	.612	(–4.090, 6.941)
Non-university certificate or diploma from a community college, CEGEP	1.649	.463	(–2.758, 6.056)
University bachelor's degree	-1.154	.587	(–5.321, 3.014)
University graduate degree (e.g. masters or doctorate)	-2.228	.302	(–6.466, 2.010)
EMPLOYMENT STATUS			
Unemployed	0	.	.
Temporarily/permanently laid off due to COVID-19	2.608	.177	(–1.181, 6.397)
Retired	-2.667	.069	(–5.541, 0.207)
Employed	1.696	.062	(–.089, 3.480)
IMMIGRATION STATUS			
Born in Canada	0	.	.
0-5 years in Canada	4.367	**<.001**	(2.337, 6.397)
5-10 years in Canada	3.544	**.005**	(1.082, 6.006)
>10 years in Canada	2.506	**.007**	(.684, 4.329)

Predictors of vaccine hesitancy

Adjusted overall VAX scores were higher in participants who were:

- ▶ Newer immigrants
- ▶ Employed
- ▶ Lower levels of education completed

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Reducing excess risk of infection and disease within at-risk communities

▶ **Partnering with communities** to tailor programs to their socio-cultural and economic realities

▶ **Co-creating custom materials and guidance** that address concerns about tests and increase study participation

▶ Fostering **sustained relationships and interaction** between researchers and community members

▶ **Addressing upstream determinants and mitigating barriers** to healthcare, housing, education and employment opportunities

Improving vaccine coverage and uptake within at-risk communities depends on:

▶ Collaborating with **community leaders** and **key opinion leaders** to **co-develop strategies** to identify issues and address concerns

▶ Partnering with **community advocacy groups** to disseminate tailored information effectively

▶ Providing information about vaccines in **people's own language** and in **accessible formats**

Questions?

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