Public Health Ontario | Santé publique Ontario

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Canadian Blood Services

Leveraging capacity for public health surveillance

SARS-CoV-2 and beyond

Public Health Ontario Rounds
August 8, 2023

Sheila O'Brien
Associate Director, Epidemiology & Surveillance

Canadian Blood Services
BLOOD PLASMA STEM CELLS ORGANS & TISSUES

I have no conflicts of interest

Funding

The SARS CoV-2 seroprevalence study was funded by the **Government of Canada** through the COVID-19 Immunity Task Force

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

Objectives

1. Explain the similarities and differences between blood donors and the general population
2. Describe key findings from the Canadian Blood Services SARS-CoV-2 seroprevalence study
3. Discuss the role that blood donors can play in public health surveillance post-pandemic

Where are you currently working (main job)?

- Public Health Ontario
- Public health (other province)
- A university
- The pharmaceutical industry
- A blood service
- Other not for profit organization
- Other
- Retired

Which answer best describes Canadian Blood Services?

- A public health organization
- A biologics manufacturer (collect blood, make and distribute blood products)
- Both
- Neither

Blood donors for public health surveillance

Blood donors for public health surveillance

They are demographically different – mostly high income white city dwellers

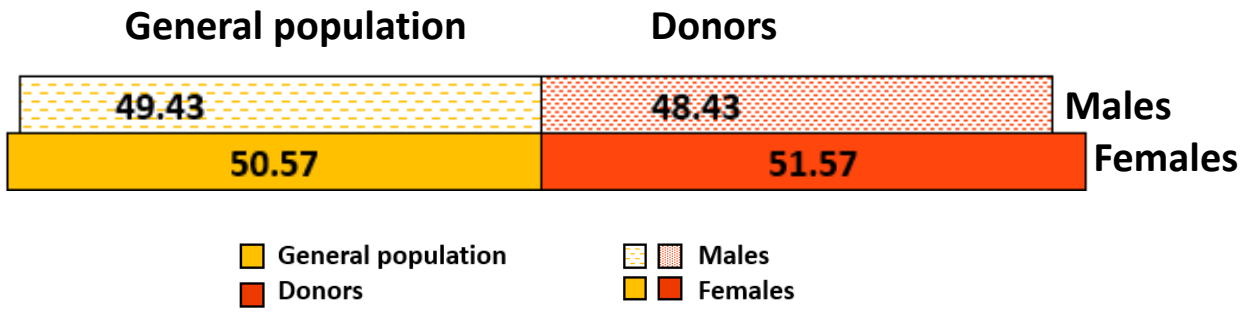
They're at really low risk of infections (screening questions plus they're all super cautious)

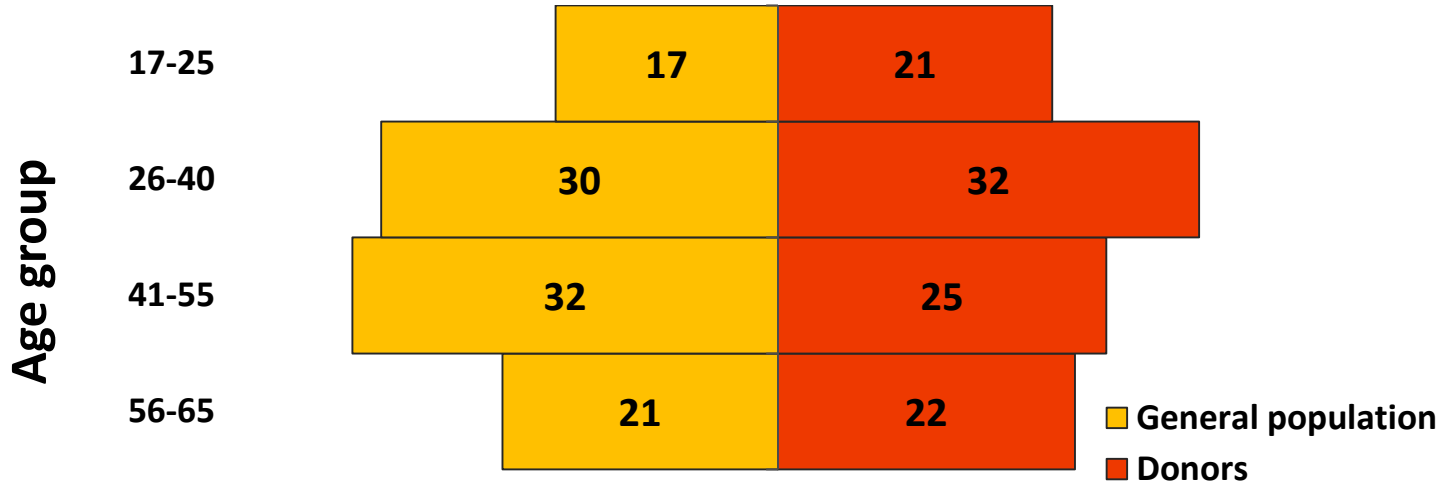
They're ultra healthy, totally not like ordinary people

Demographics

- Donor criteria vary by country
- In Canada we regularly revise the deferral criteria and have reduced deferral for many of the health criteria
- Need to be careful interpreting donor results from different countries and from different times

Demographic comparison

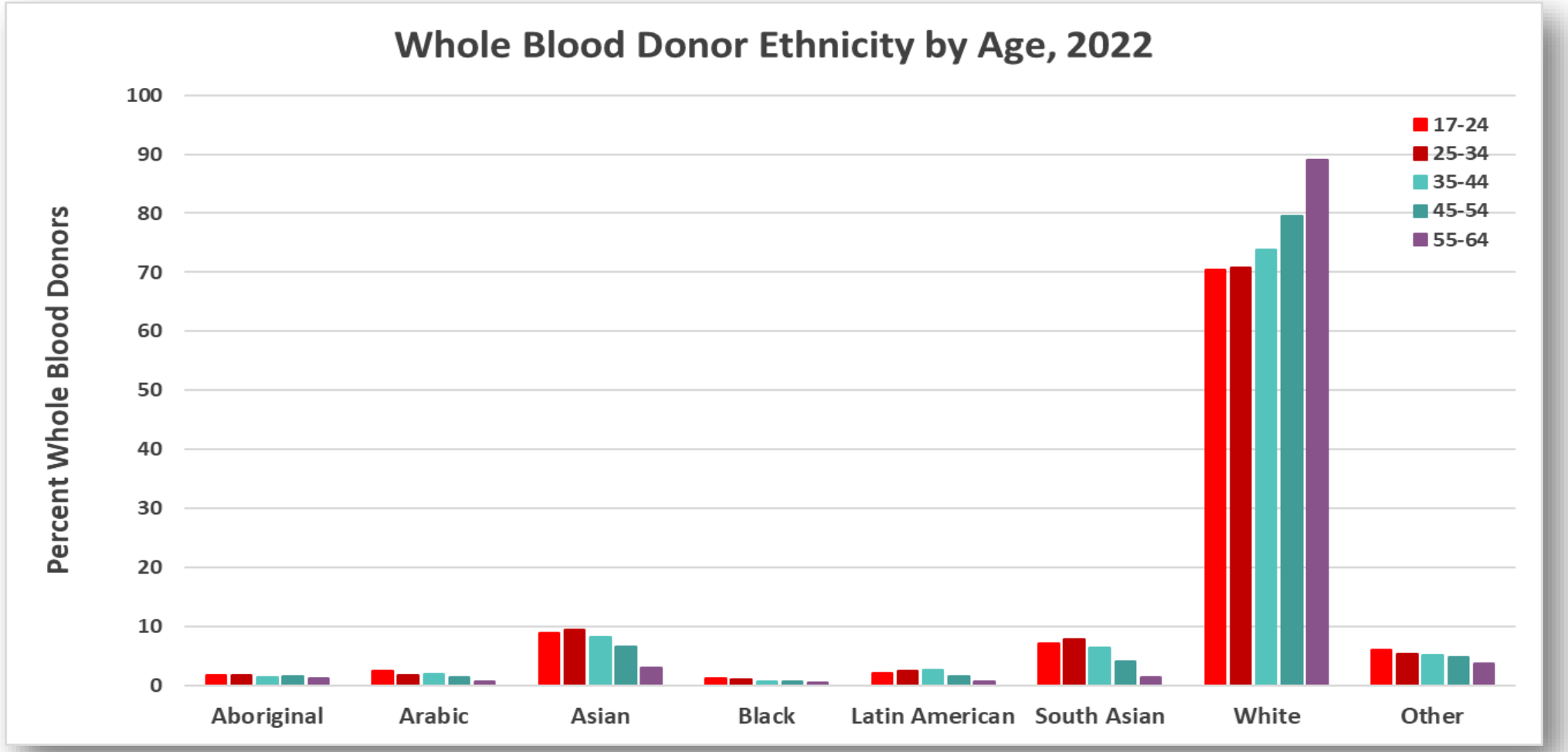




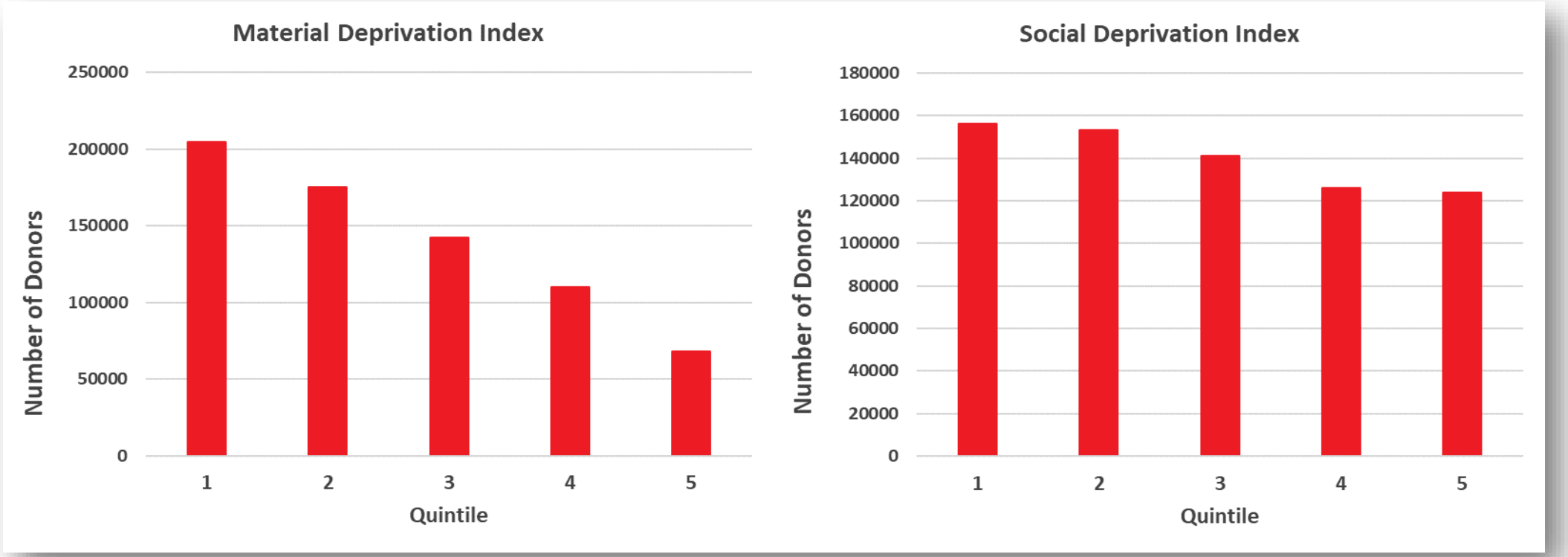
Note: the upper age limit for donation was removed in 2015.

Canadian Blood services Epidemiology Donor Database, Statistics Canada

Ethnic Group



Pampalon social and material deprivation indices
Whole blood donors – 2022



Geographic Distribution

- Approximately 850,000 donations per year from about 400,000 donors
- From all provinces except Quebec
- From all major cities and most smaller cities and surrounding areas
- About half of collections from mobile sites, half from permanent sites

Health Criteria

REASONS FOR DEFERRAL

Recipient Safety / Product Quality	Donor Safety
Infectious Risk	Low hemoglobin
Teratogenic Medications	Recovering from procedure or medical condition
Medications that affect blood cells or plasma	Pregnancy
Medical conditions that affect blood cells or plasma	Medical condition where donation is inadvisable
	Risk of adverse events

Donor Health Criteria (Temporary deferrals)

- There are many temporary deferral criteria which will defer:

People who are currently unwell

or

Are taking medications that may cause health problems to the recipient (includes some vaccines)

- **Note:** diabetics, controlled hypertension, many people with heart conditions and most recovered cancers are eligible if well.
- Pregnancy and anemia are temporary deferrals.

Donor Health Criteria (Permanent deferrals)

- Cancer - hematologic and melanoma
- Crohn’s Disease
- Congestive Heart Failure
- Cirrhosis
- Stroke (from non-reversable conditions)
- Renal impairment
- Immune deficiency disorder

Danish Blood Donor Study

- National donor study for health research
- Donors are invited to participate at registration (95% consent)
- Complete a health and lifestyle questionnaire
- Includes a biobank
- Linkage to health and pharmaceutical databases in Denmark

Canadian Blood Services
BLOOD PLASMA STEM CELLS ORGANS & TISSUES

Body Mass Index and smoking status The Danish Blood Donor Study

	Females N = 18,120	Males N = 19,688
Age		
>= 30	31.2%	24.2%
31-40	23.2%	25.3%
41-50	23.7%	24.7%
51-60	16.0%	18.0%
>60	5.8%	7.9%
Current smoker		
	17.0%	16.0%
BMI		
25-30	25.0%	41.0%
>30	10.0%	10.0%

Kaspersen KA, Pedersen OB, Petersen MS et al. Epidemiology 2015:26;580-589

VoxSanguinis
The International Journal of Transfusion Medicine
ISBT International Society of Blood Transfusion
Vox Sanguinis (2021) **116**, 288–295

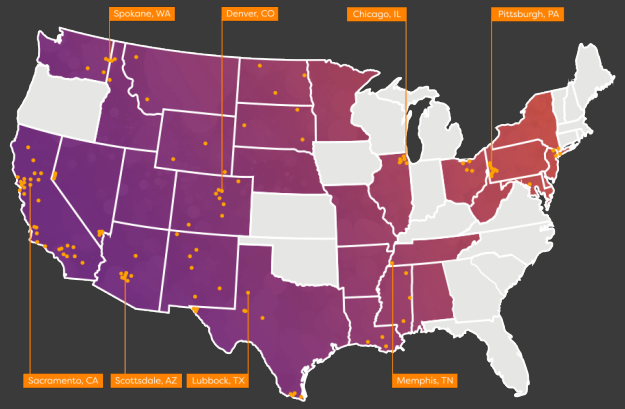
DOI: 10.1111/vox.13022

ORIGINAL PAPER

Characterization of health issues in young first-time blood donors

Jonathan A. Hughes, Marjorie D. Bravo, Mary Townsend & Hany Kamel
Vitalant Medical Affairs, Scottsdale, AZ, USA

- Analyzed 1.6 million first time blood donors
- From 26 centers in 19 states across the USA
- Hypertension SBP >130, DBP >80 mmHG
- Overweight BMI 25-29, Obese BMI > 30
- Cholesterol borderline/high >200 mcg/dL



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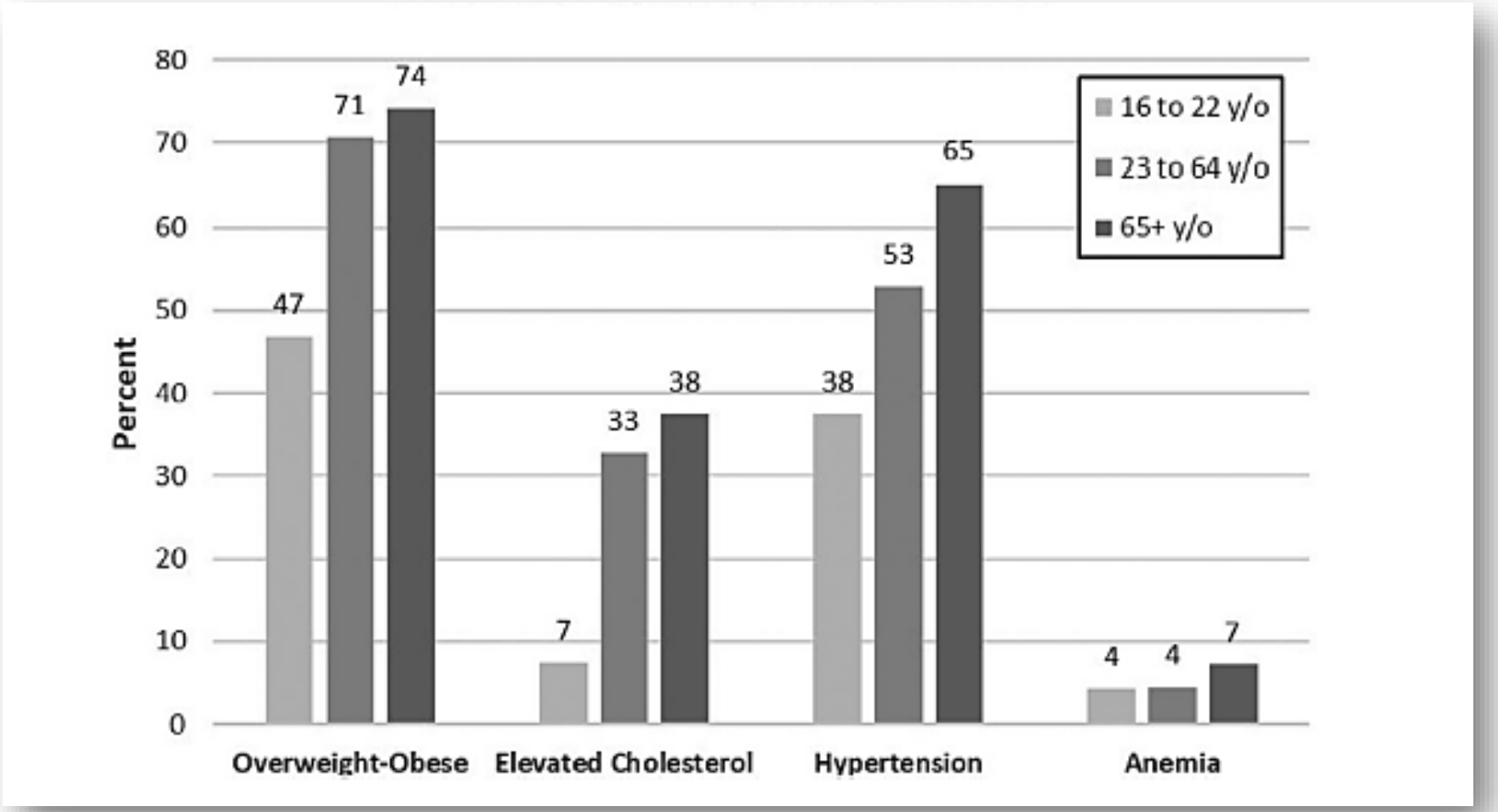
STEM CELLS
ORGANS
& TISSUES

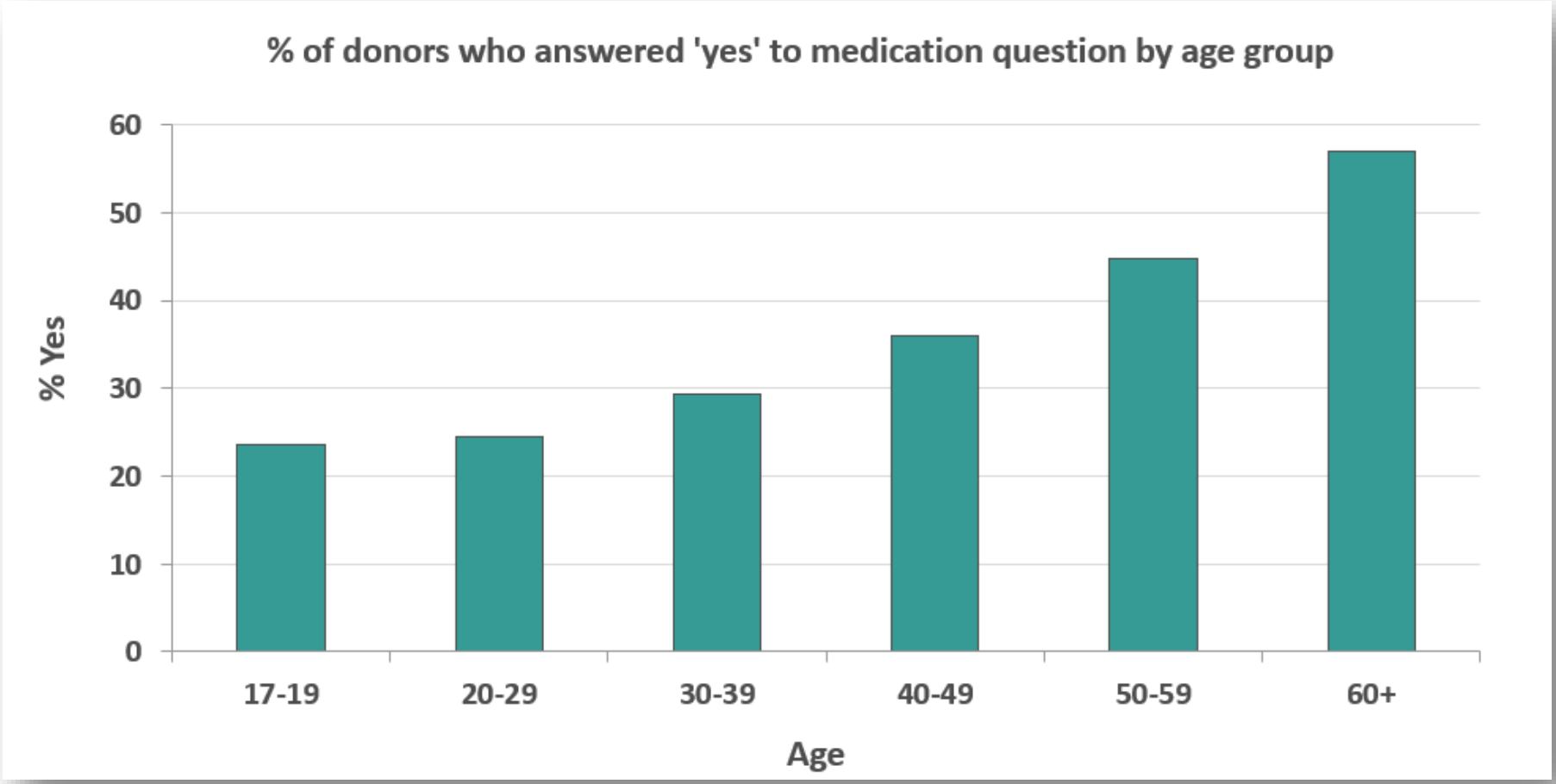
Health attributes in first-time donors



Of young donors who continued to donate these health indicators generally became worse (monitored over 9 years)

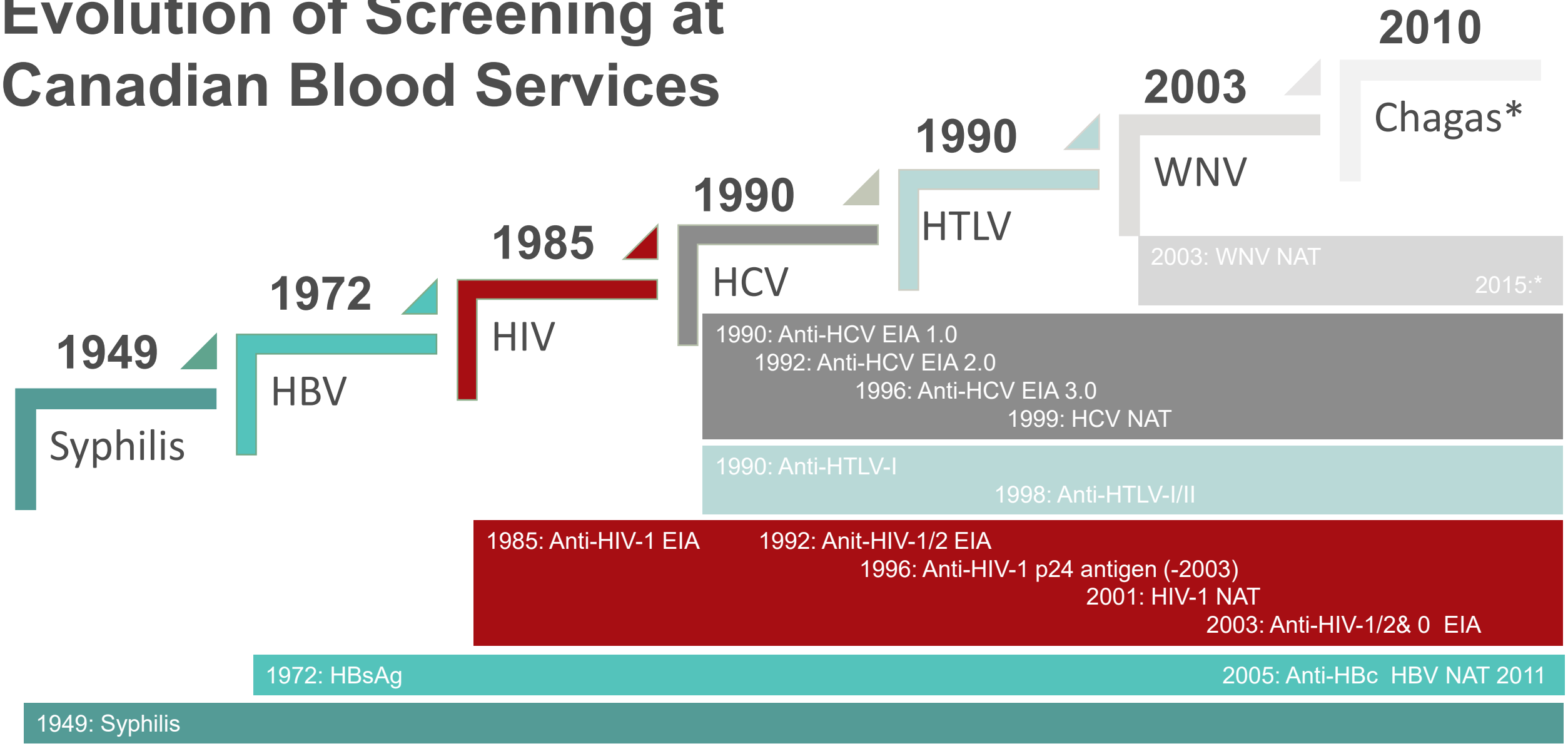
Donor History Questionnaire

Medications in the last 3 days (excludes birth control and vitamins)



Infectious Risk Criteria

Evolution of Screening at Canadian Blood Services



*** Selective testing (not all donors), based on prespecified risk factors**

Canadian Blood Services — BLOOD PLASMA STEM CELLS ORGANS & TISSUES

Most infectious risks are addressed with temporary deferral

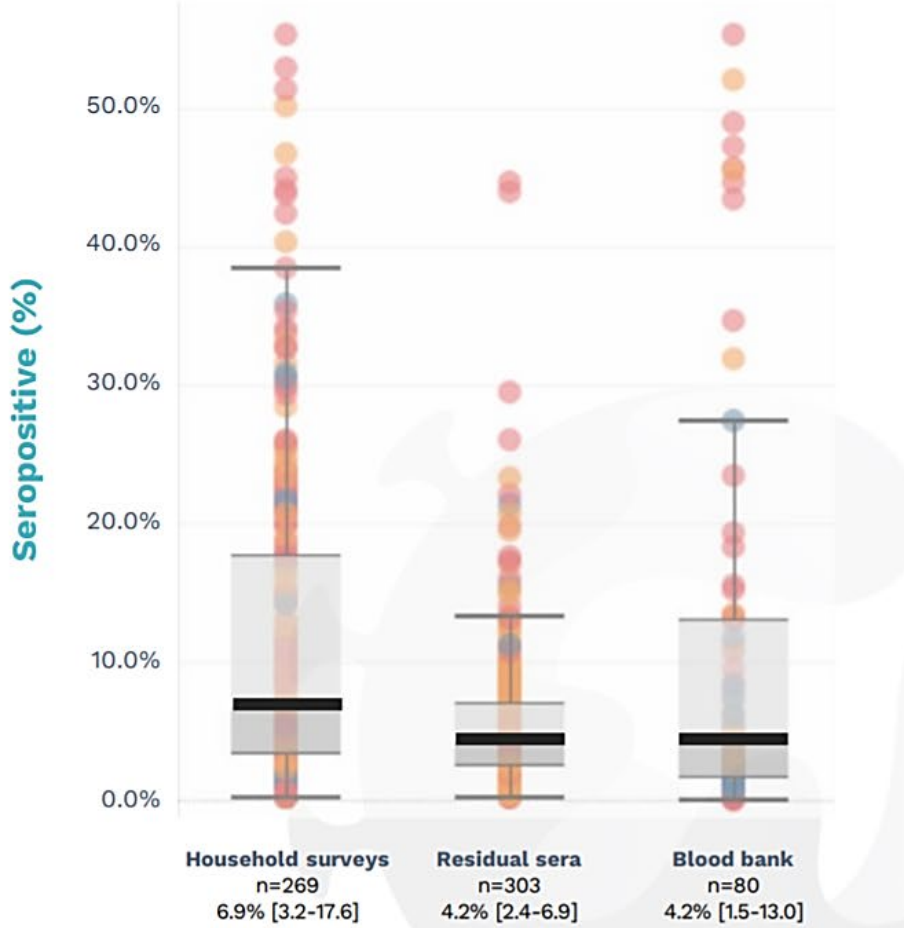
- Feeling unwell
- Had a shot for exposure to HBV
- Recent hepatitis or exposure
- Tattoo, skin or ear piercing
- Acupuncture or electrolysis (not deferred if sterile, single use needles)
- Needlestick injury
- Transactional sex
- Anal sex with a new partner or more than one partner
- History of malaria, Chagas, Babesiosis, Leishmaniasis (indefinite deferral)
- Travel to risk areas (malaria, Chikungunya, Zika, vCJD)

COVID-19 Immunity Task Force

Blood donor studies are representative of the general population

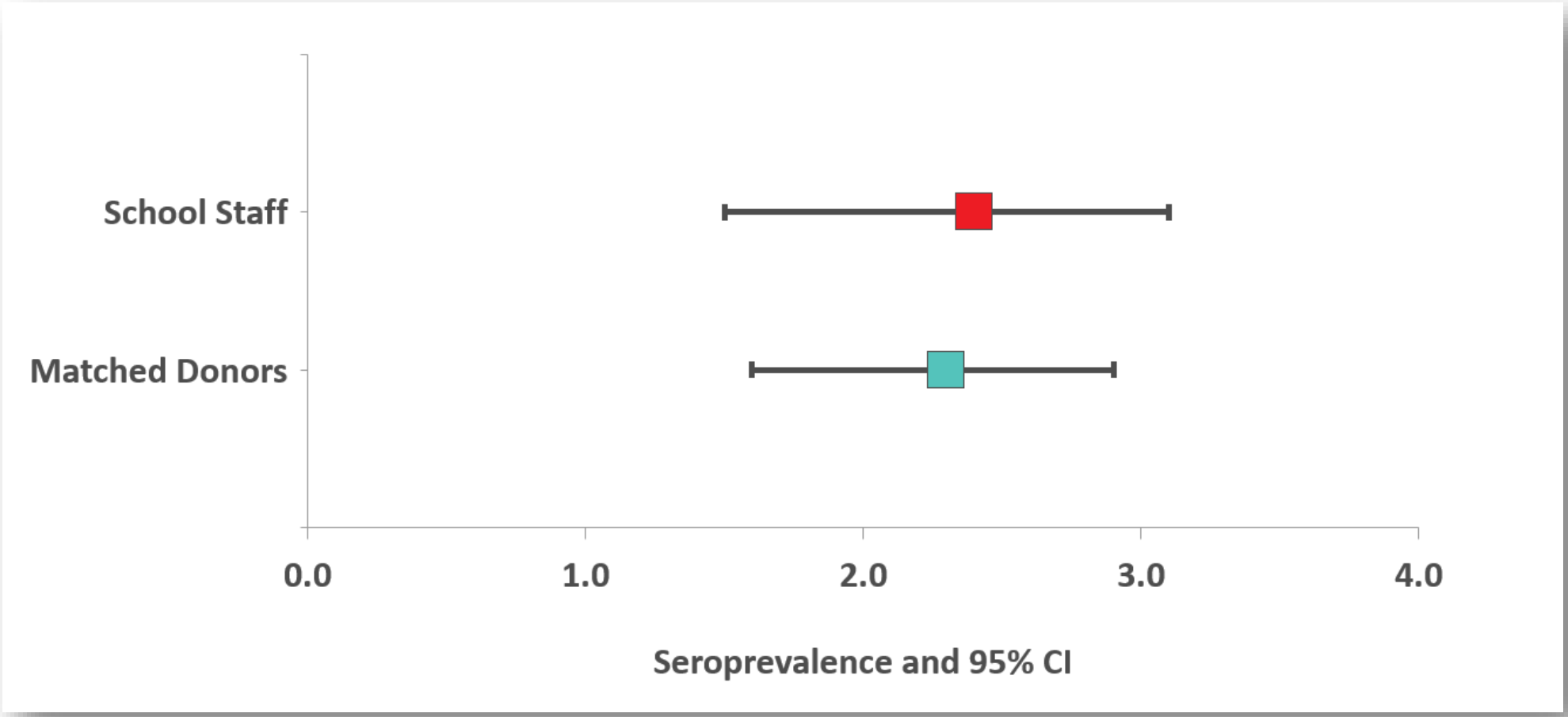
Do studies of blood donors produce comparable results?

- 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



https://www.covid19immunitytaskforce.ca/wp-content/uploads/2021/05/CITF_CBS-HQ_Presentation_05-26-2021_ENG.pdf

Sars-CoV-2 Seroprevalence and 95% Confidence Intervals Comparing BC School Staff with Matched Donors



About 1500 school staff matched 1:2 blood donors for sample date, age, sex and FSA

Canadian Blood Services BLOOD PLASMA STEM CELLS ORGANS & TISSUES

David M. Goldfarb, MD[1,2,3], Louise C. Mâsse, PhD[4], Allison W. Watts, PhD[5], Sarah M. Hutchison, PhD[1,5], Lauren Muttucomaroe, BSc[5], Else S. Bosman, PhD[5], Vilte E. Barakauskas, PhD[1,2,3], Alexandra Choi, MD[6], Michael A. Irvine, PhD[7], Frederic Reicherz, MD[5], Daniel Coombs, PhD[8], Collette O'Reilly, MSc[9], Sadaf Sediqi, BSc[1], Hamid R. Razzaghian, PhD[1], Manish Sadarangani, BM BCh Dphil[1,3,5,10], Sheila F. O'Brien, PhD[11,12], **Pascal M. Lavoie**, MDCM, PhD[1,3,5,*]

Blood donors for public health surveillance

They are demographically different – mostly high income white city dwellers

Tending to be more affluent, lower ethnic representation but representative of adult age groups, except the elderly

They're at really low risk of infections (screening questions plus they're all super cautious)

Main limitations are symptomatic infections and infections we defer for

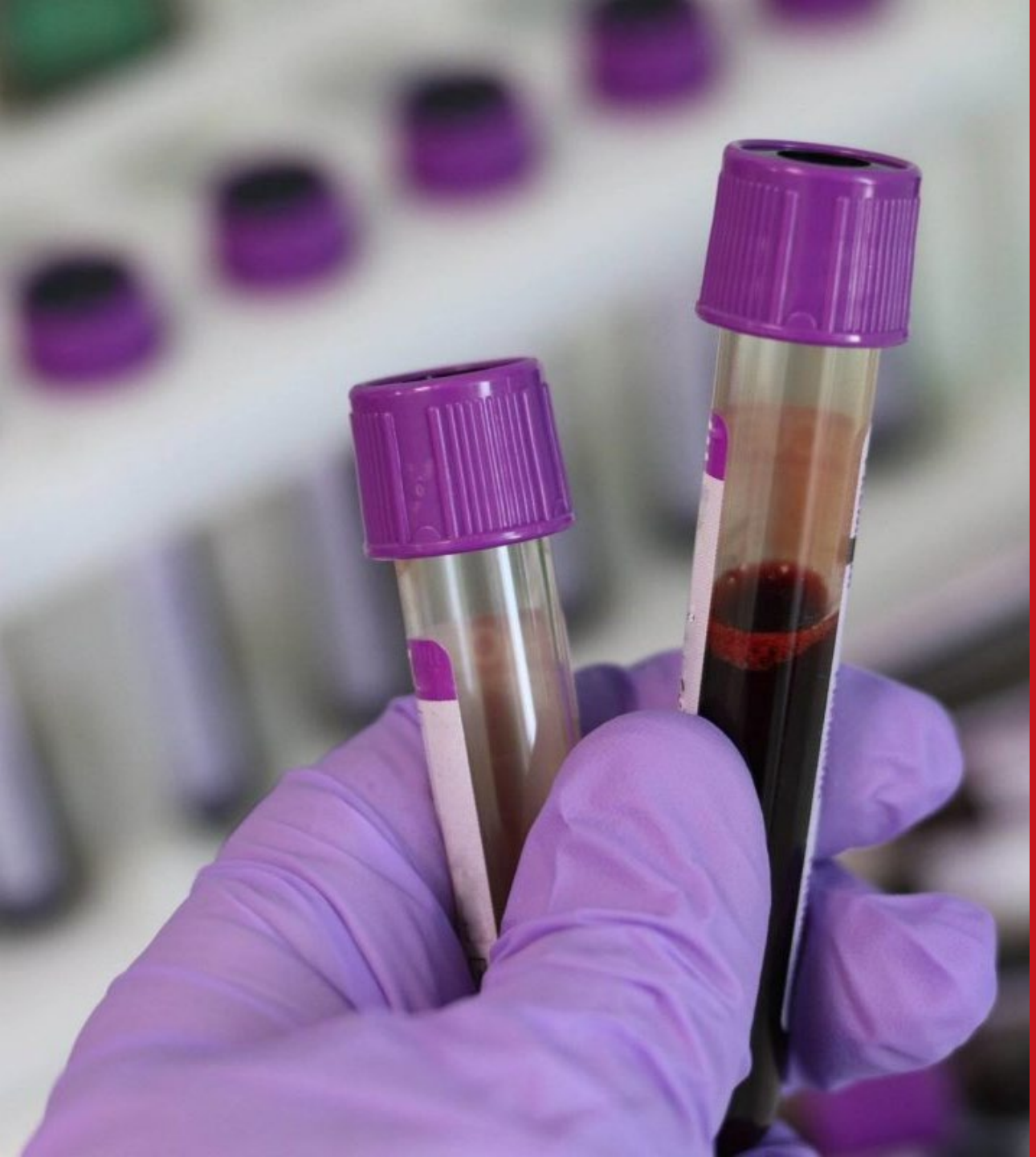
They're ultra healthy, totally not like ordinary people

Very few permanent health deferrals, need to be well on the day


SARS-CoV-2 Seroprevalence

How would you rate the value of the Canadian Blood Services SARS-CoV-2 seroprevalence data to public health response of the pandemic?

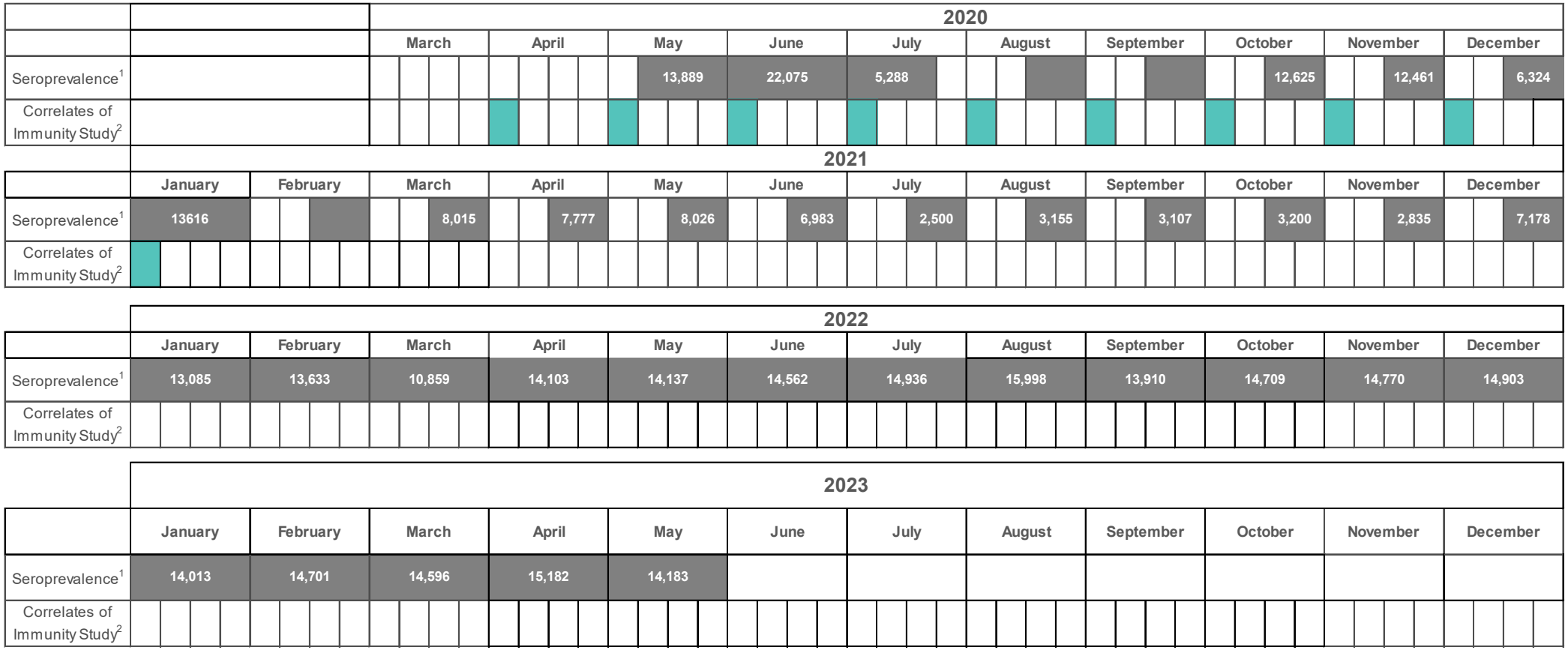
- Very valuable
- Valuable at certain times
- Informative but not for decision making
- It had limited impact



822,223
samples tested

(381,334 in Ontario)

Sampling Figure



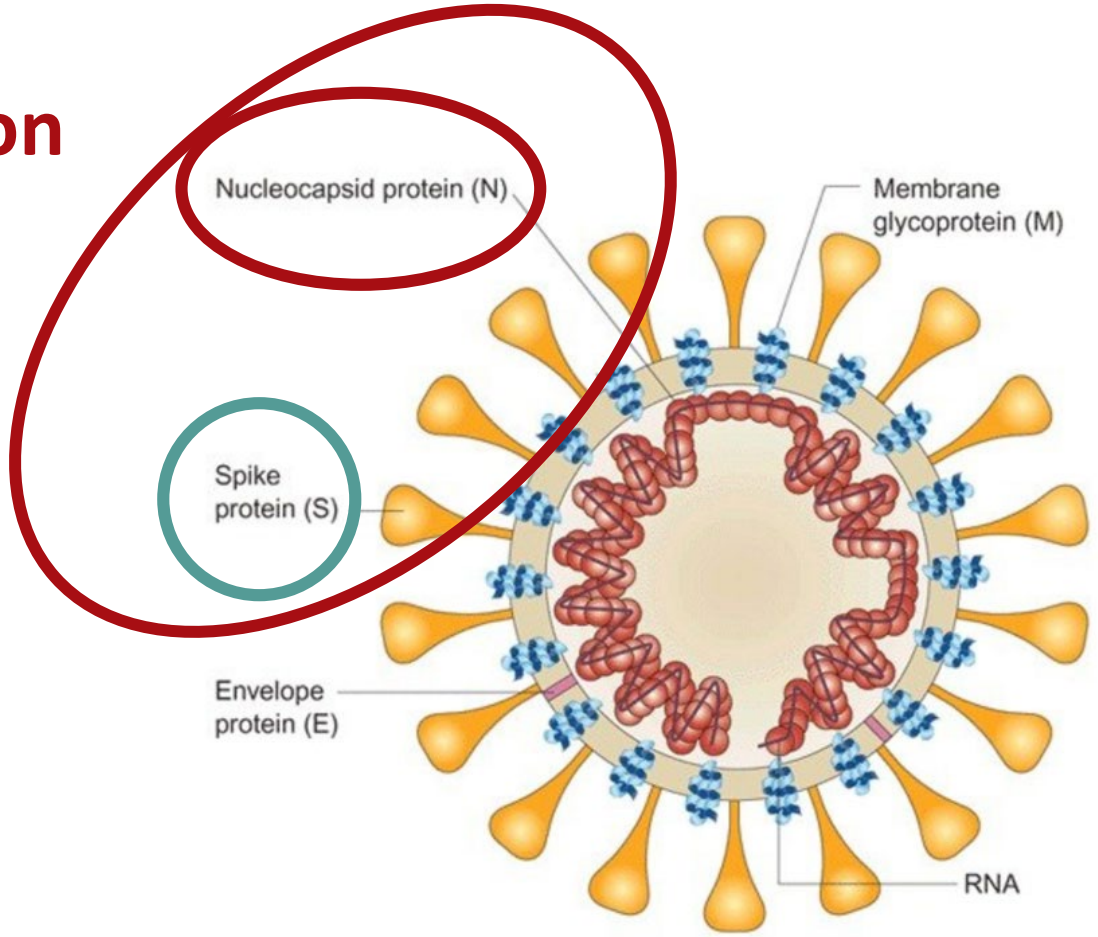
[1] Samples will be tested against the **IgG Abbott Assay until January 2021;** note as of August 2020, sampling will be reduced to include all samples from the second half of the month (~17,000 per month)

[2] Immunity sub-study (PI: S. Drew (CIHR 2020) sampling 1500 samples per month until March 2021; this study will allow for orthogonal testing as each sample will be tested **against multiple assays**

Testing for SARS-CoV-2 Antibodies

Natural Infection

Vaccination



Roche Elecsys ® Anti-SARS-CoV-2 S immunoassay

Roche Elecsys® Anti-SARS-CoV-2 immunoassay

Laboratory Methods

April to December 2020

- Abbott Architect SARS-CoV-2 IgG assay (Nucleocapsid)
  - Sensitivity 92.7% and specificity 99.9%

January 2021 to December 2022

- Roche Elecsys ® Anti-SARS-CoV-2 S immunoassay (total Ig, Spike)
  - Sensitivity 98.8% and specificity 99.6% (semi-quantitative)
- Roche Elecsys® Anti-SARS-CoV-2 immunoassay (total Ig, Nucleocapsid)
  - Sensitivity 99.5% and specificity 99.8%

All positivity percentages were adjusted

- For age and gender of general population by raking
- For assay characteristics using the Rogan-Gladen equation

Data Variables

Age and Gender

Collected at registration to donate

Race/ethnicity

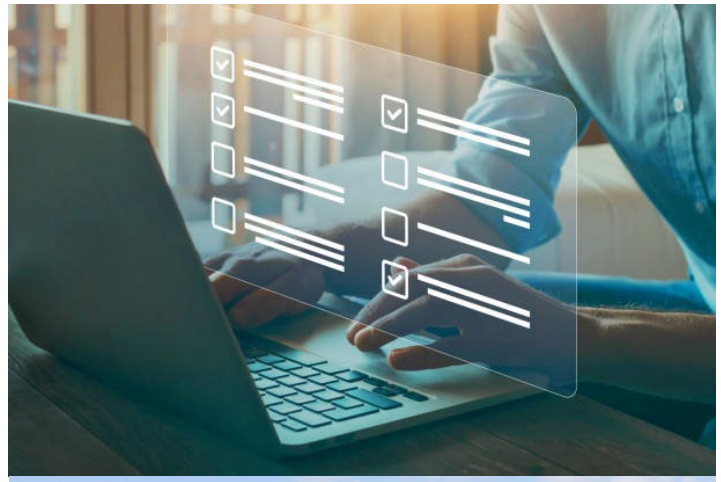
Blood donation screening question

Pampalon material and social deprivation scales

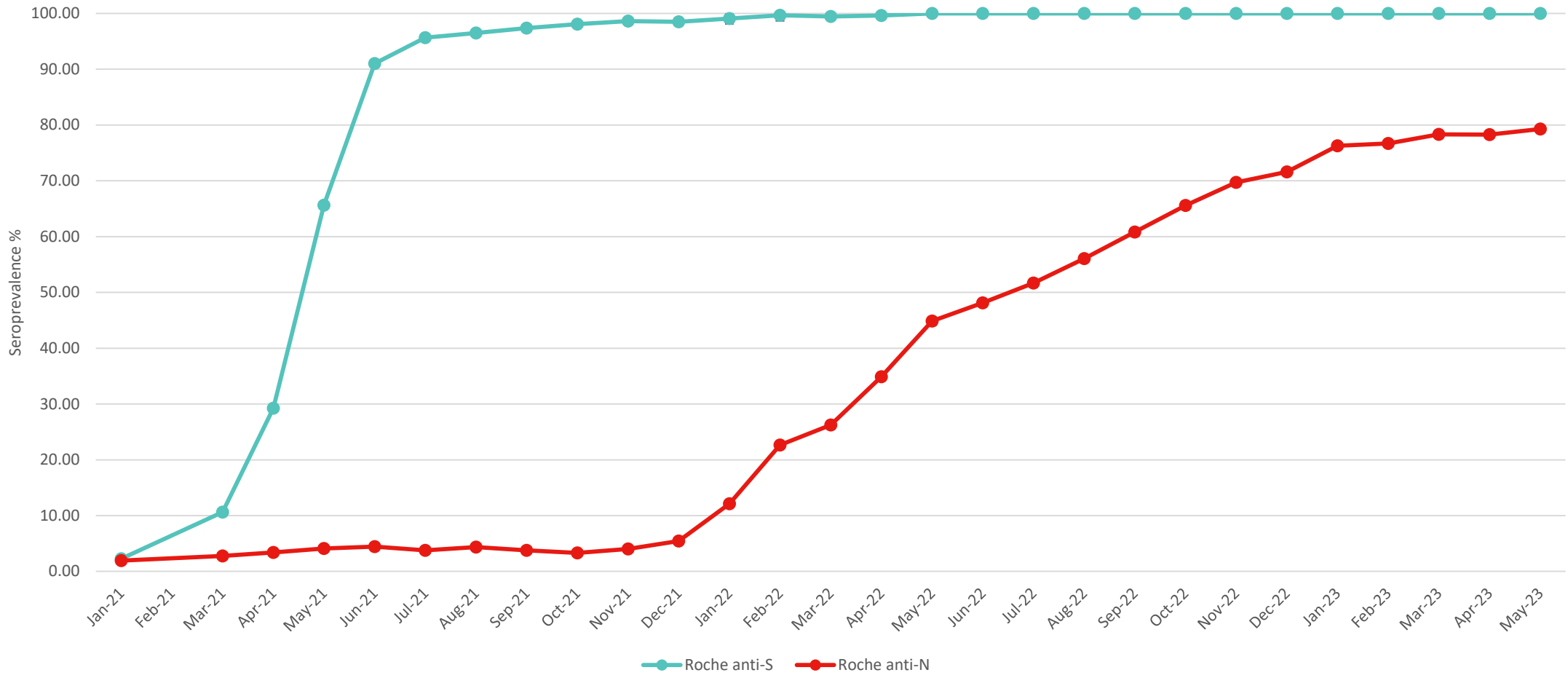
Residential neighbourhood variables

Material deprivation- income, job security, education

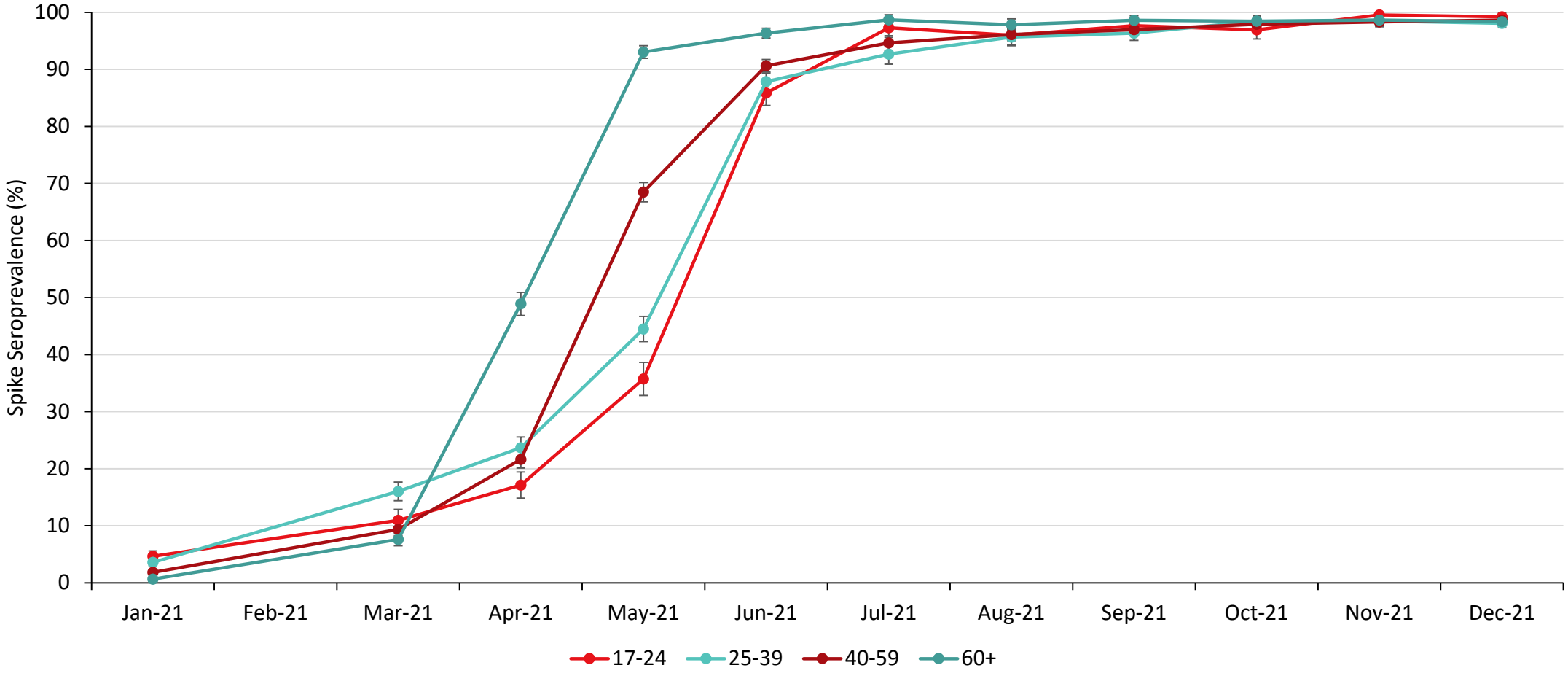
Social deprivation- living alone, single parent, separated/divorced/widowed



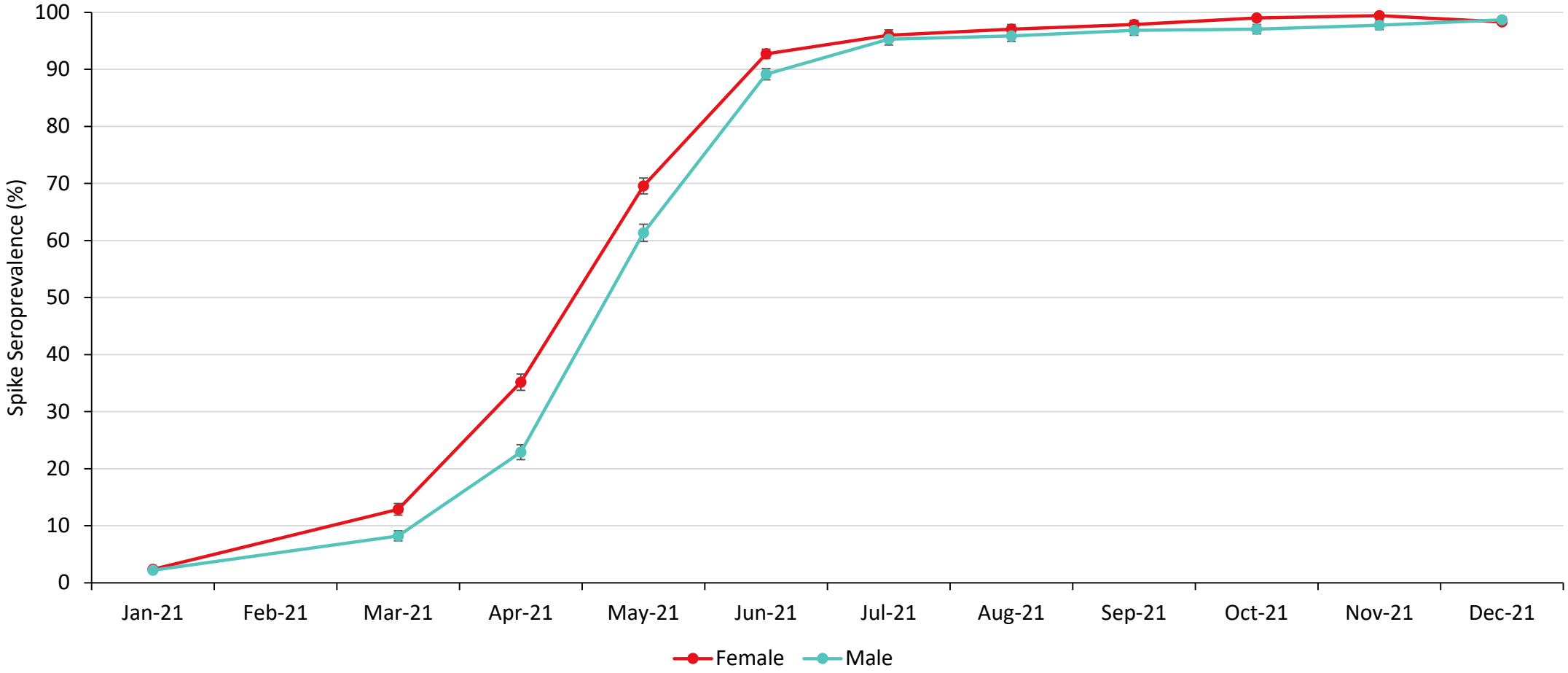
The percentage of Ontario donors with vaccine and infection antibodies increased January 2021 – May 2023



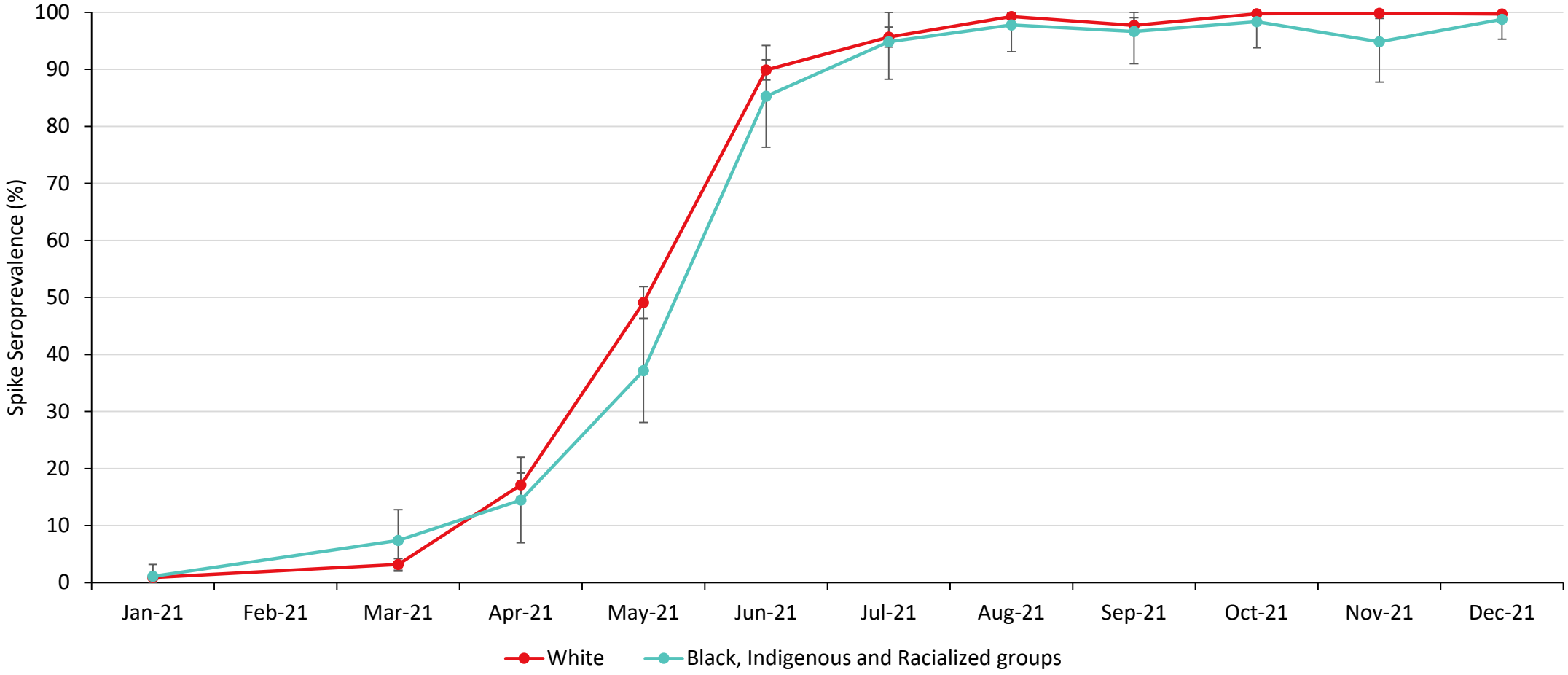
The percentage of Ontario donors with vaccine antibodies increased in older donors first (2021)



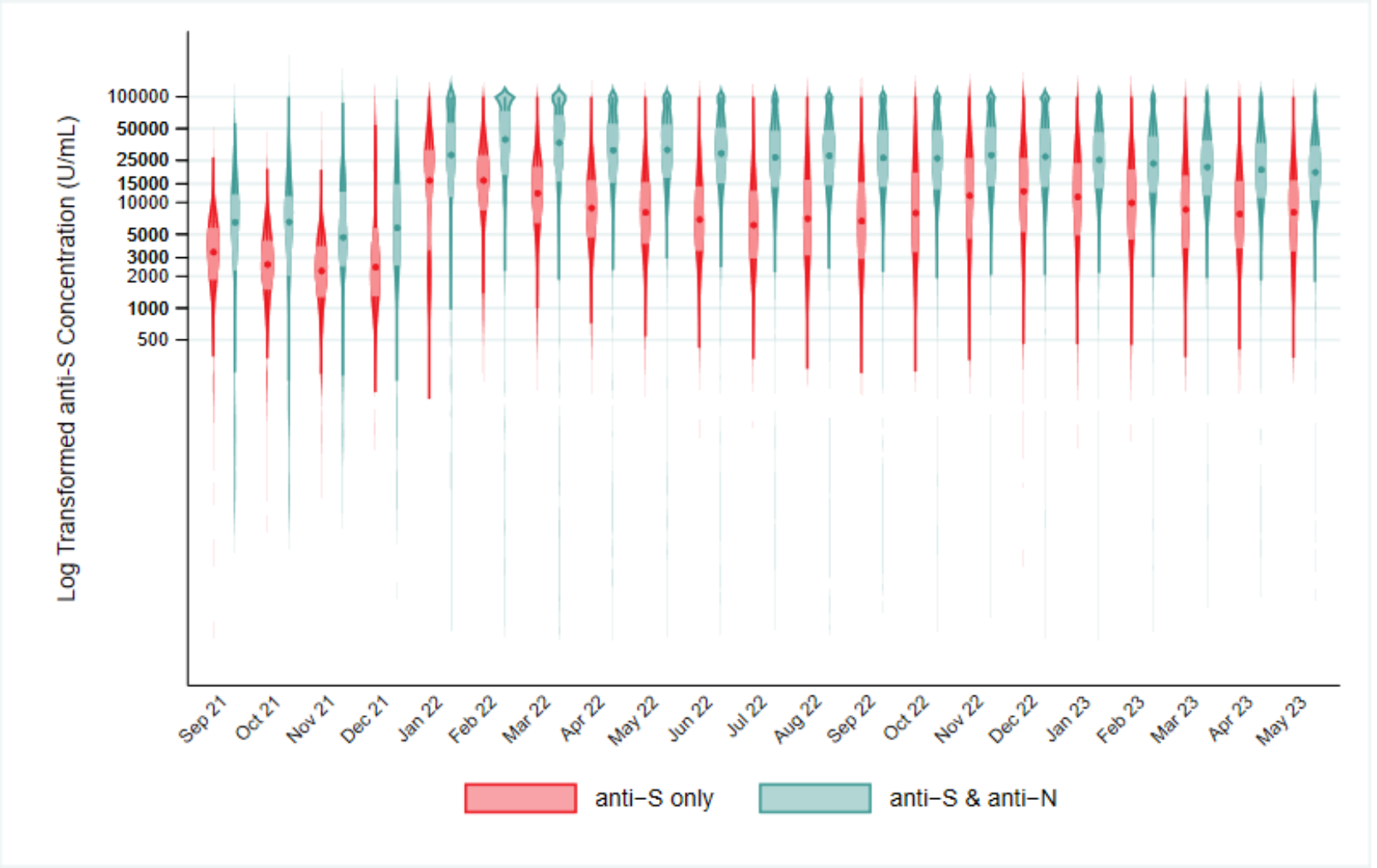
The percentage of Ontario donors with vaccine antibodies increased in female donors first (2021)



The percentage of Ontario donors with vaccine antibodies in White and Black, Indigenous and Racialized donors (2021)

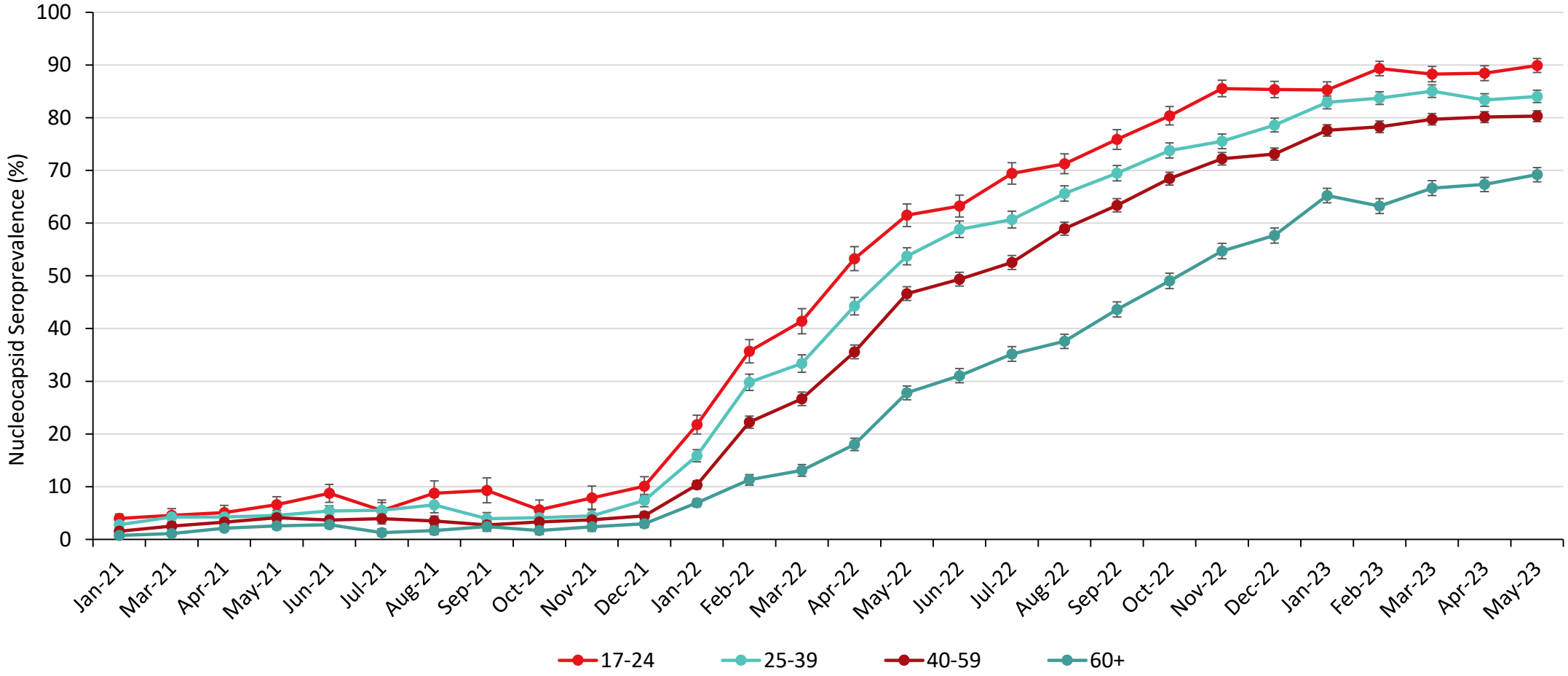


Spike antibody concentration tends to be higher in donors with infection antibodies vs vaccination-only antibodies

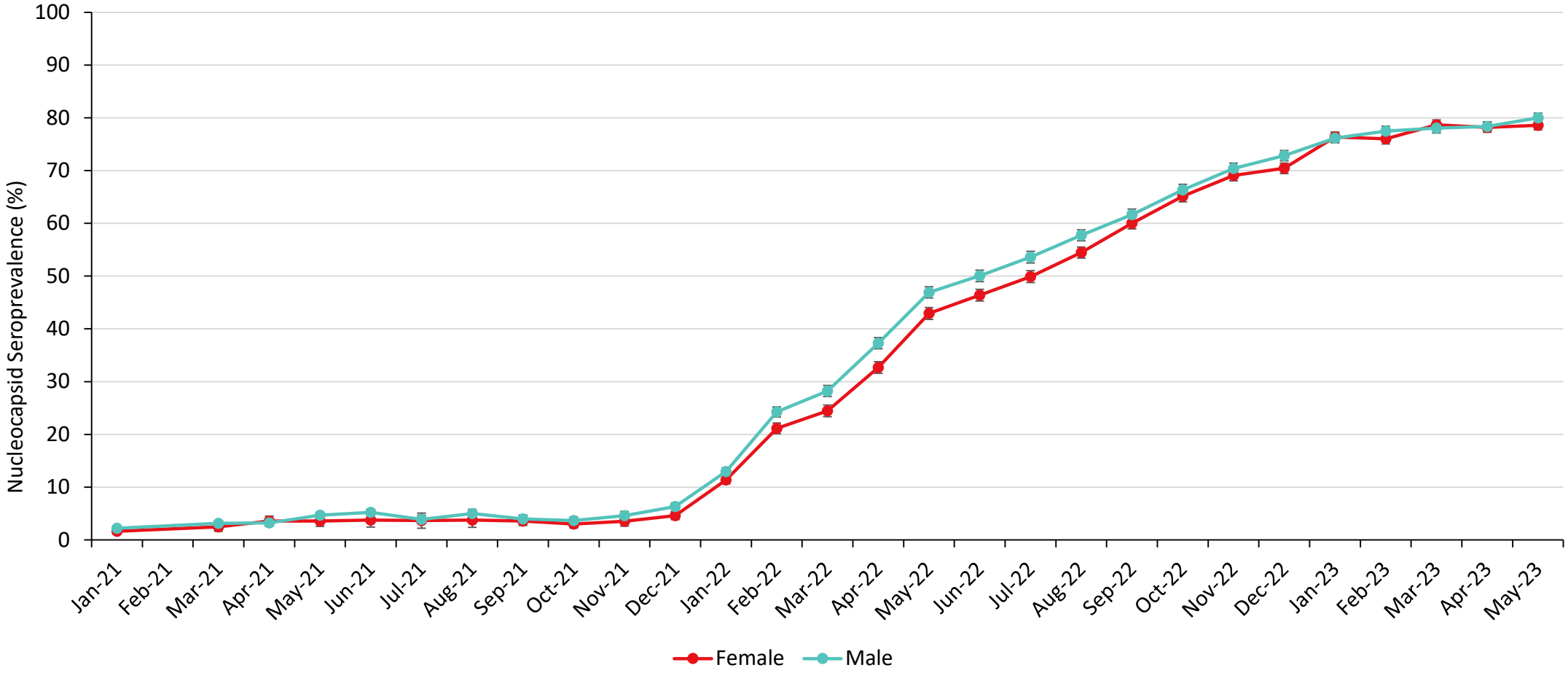


The circle represents the median and the lighter shaded area represents the IQR

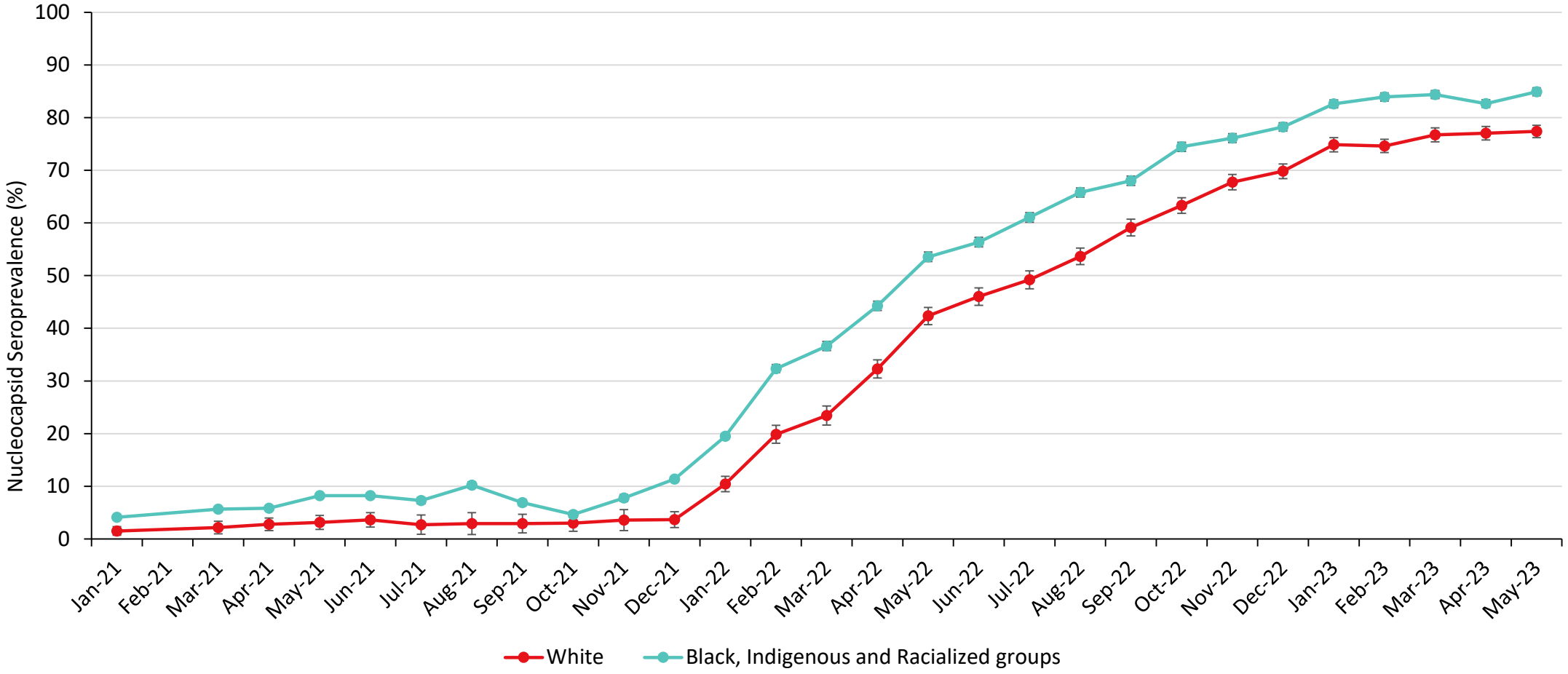
The percentage of Ontario donors with infection antibodies increased most in younger donors
January 2021 – May 2023



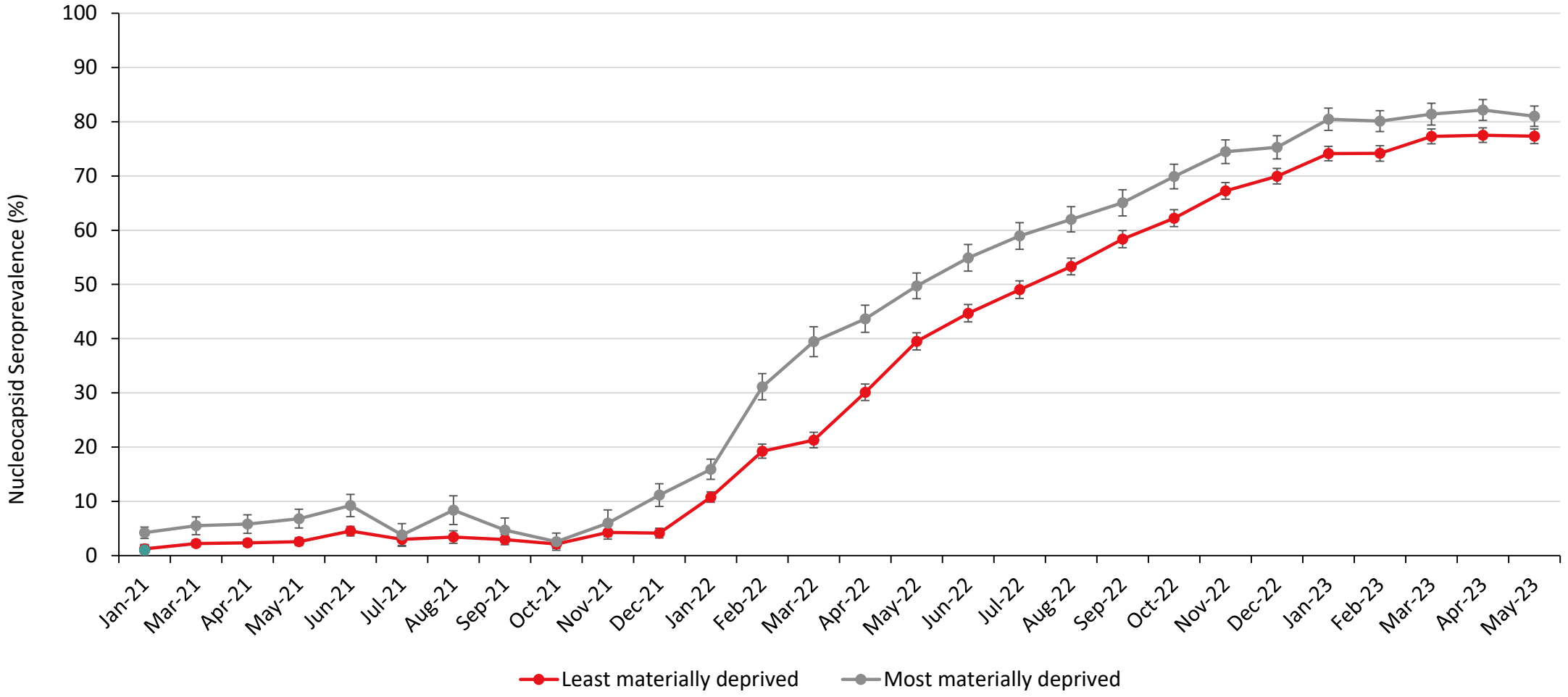
The percentage of Ontario donors with infection antibodies, male and female donors January 2021 – May 2023



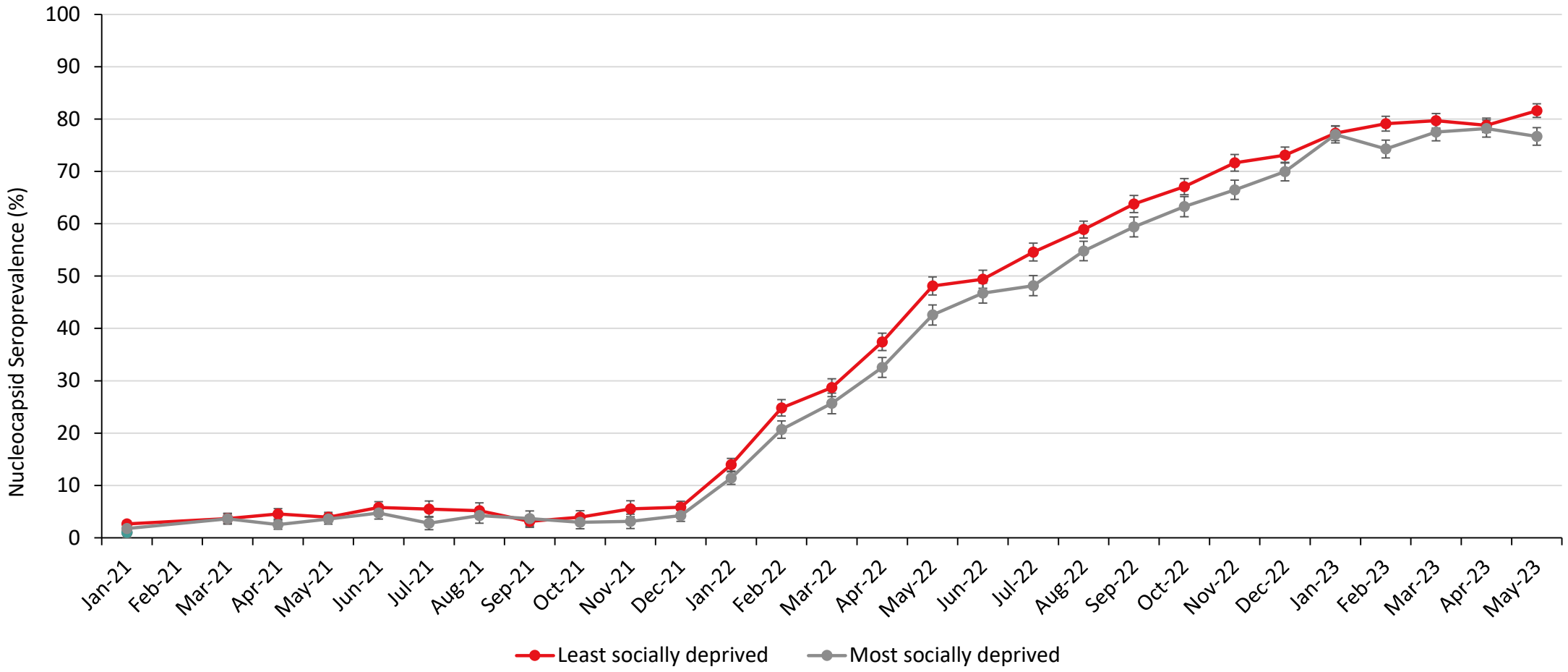
The percentage of Ontario donors with infection antibodies increased most in Black, Indigenous and Racialized donors
January 2021 – May 2023



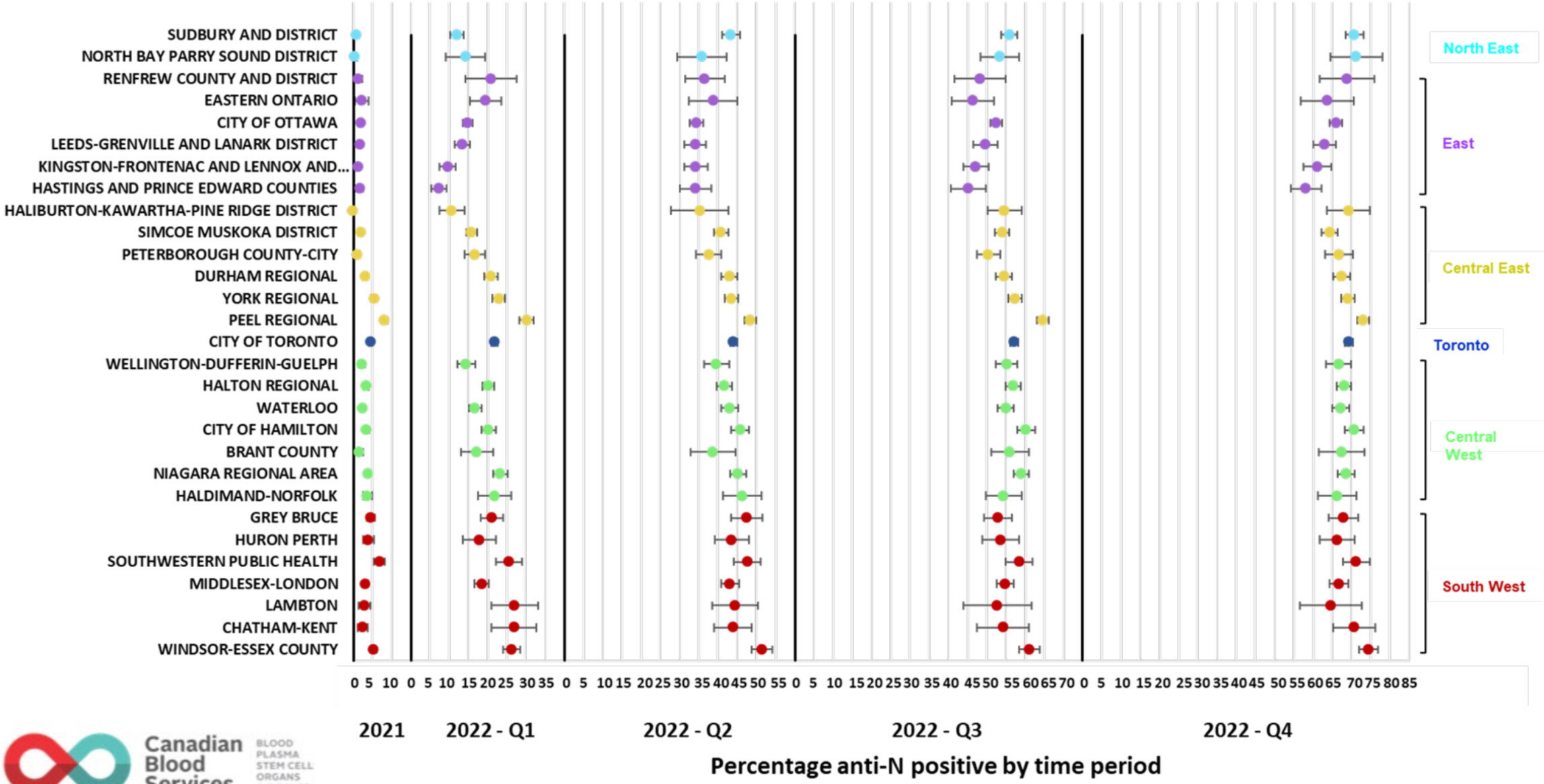
Ontario donors living in more materially deprived neighbourhoods had higher percentages of infection antibodies, January 2021 – May 2023



Ontario donors living in less socially deprived neighbourhoods had higher percentages of infection antibodies, January 2021 – May 2023



Infection seroprevalence varies by Ontario public health unit over 2021 and 2022



Canadian Blood Services
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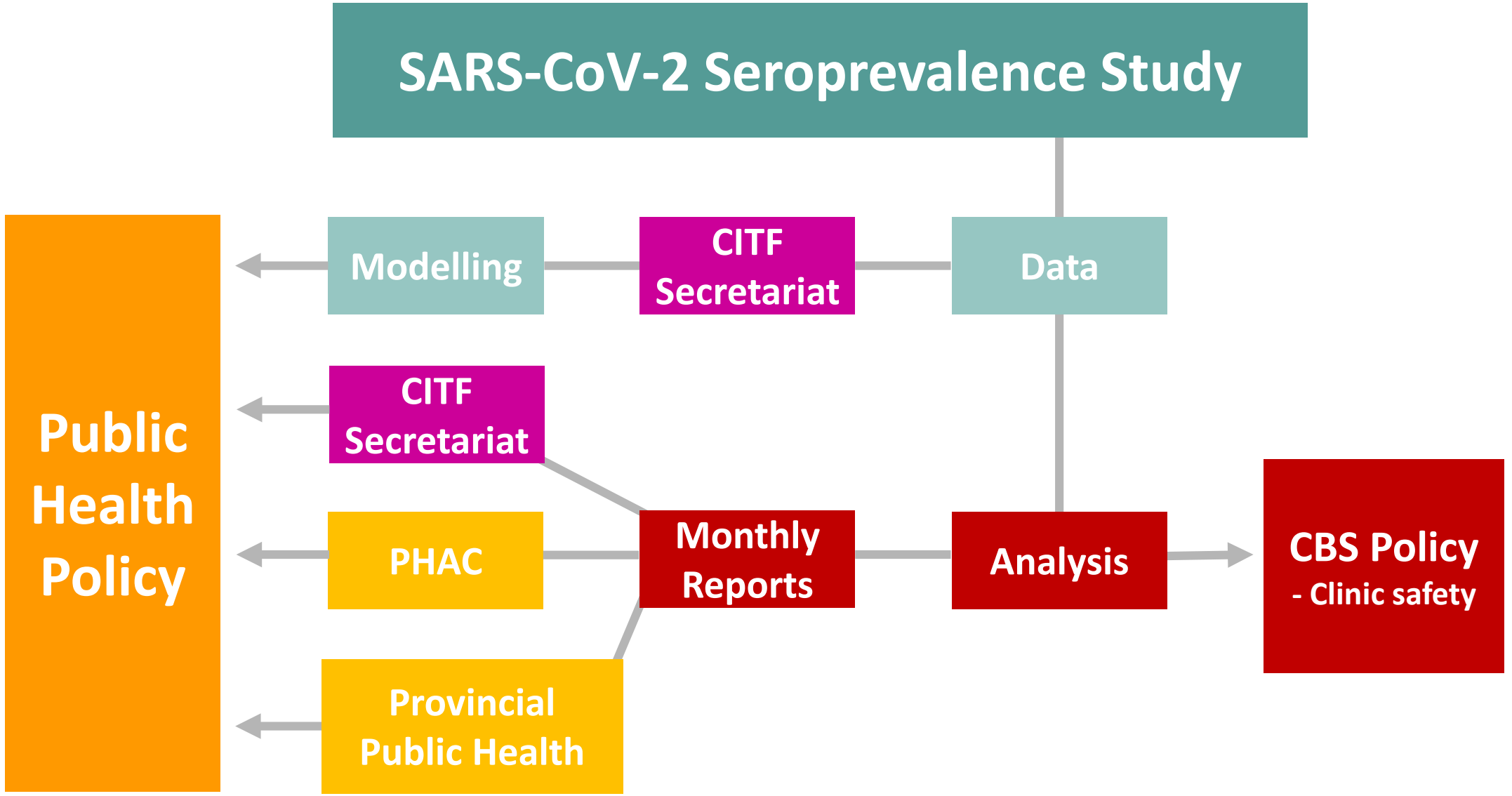
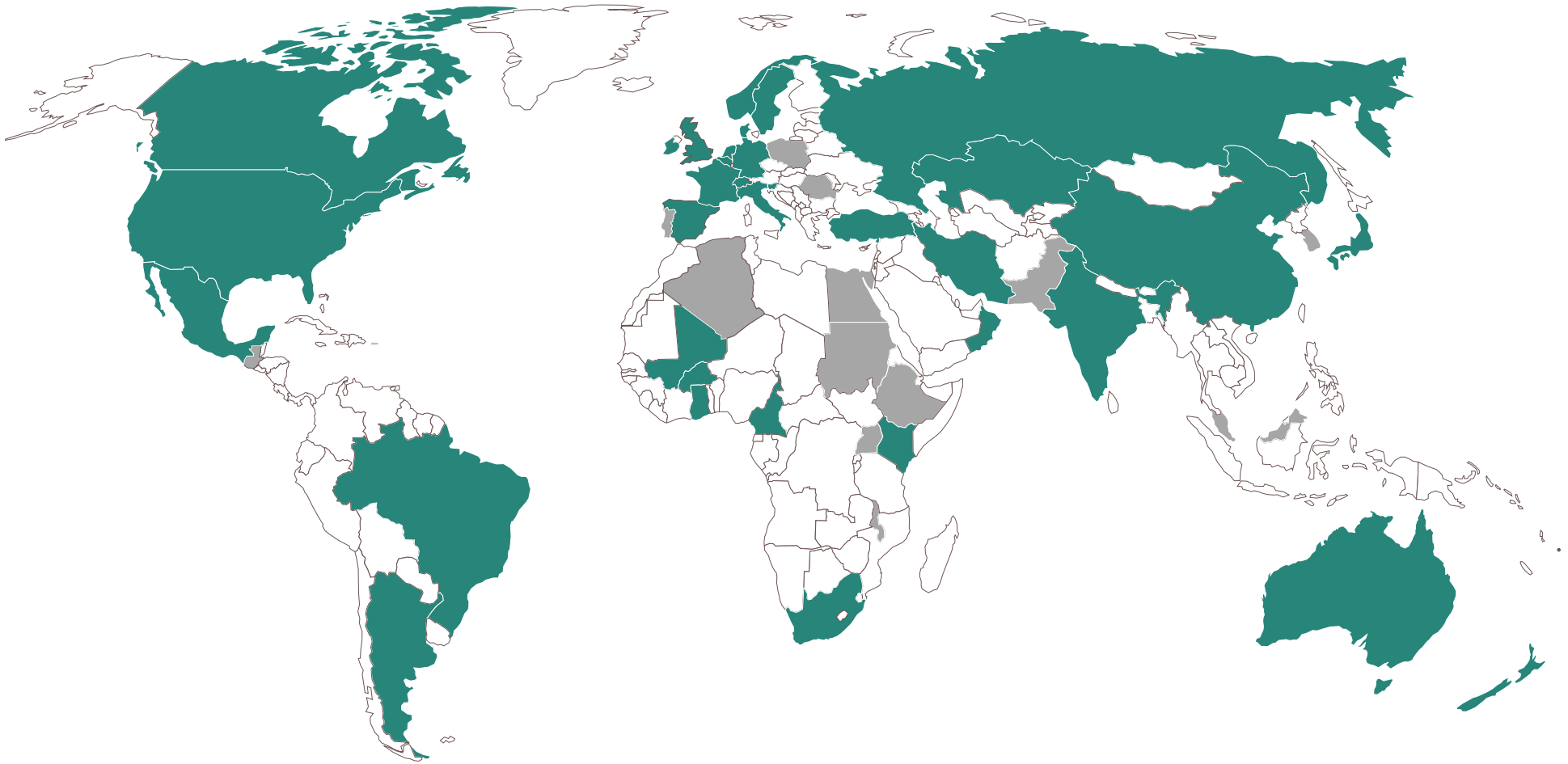

SARS-CoV-2 Seroprevalence Study
Public Health Policy
Modelling
CITF Secretariat
Data
CITF Secretariat
PHAC
Monthly Reports
Analysis
CBS Policy
- Clinic safety
Provincial Public Health

What is our Future Role in Public Health Research/Surveillance?

In your opinion, what future public health role could Canadian Blood Services fulfill?

- Providing data and research on the CBS website
- As an interactive partner with public health to inform interventions
- Providing blood samples for surveillance
- No future role – stick to providing blood products
- I have no opinion

32 of 48 countries (73%) surveyed blood operators were conducting seroprevalence study to inform public health

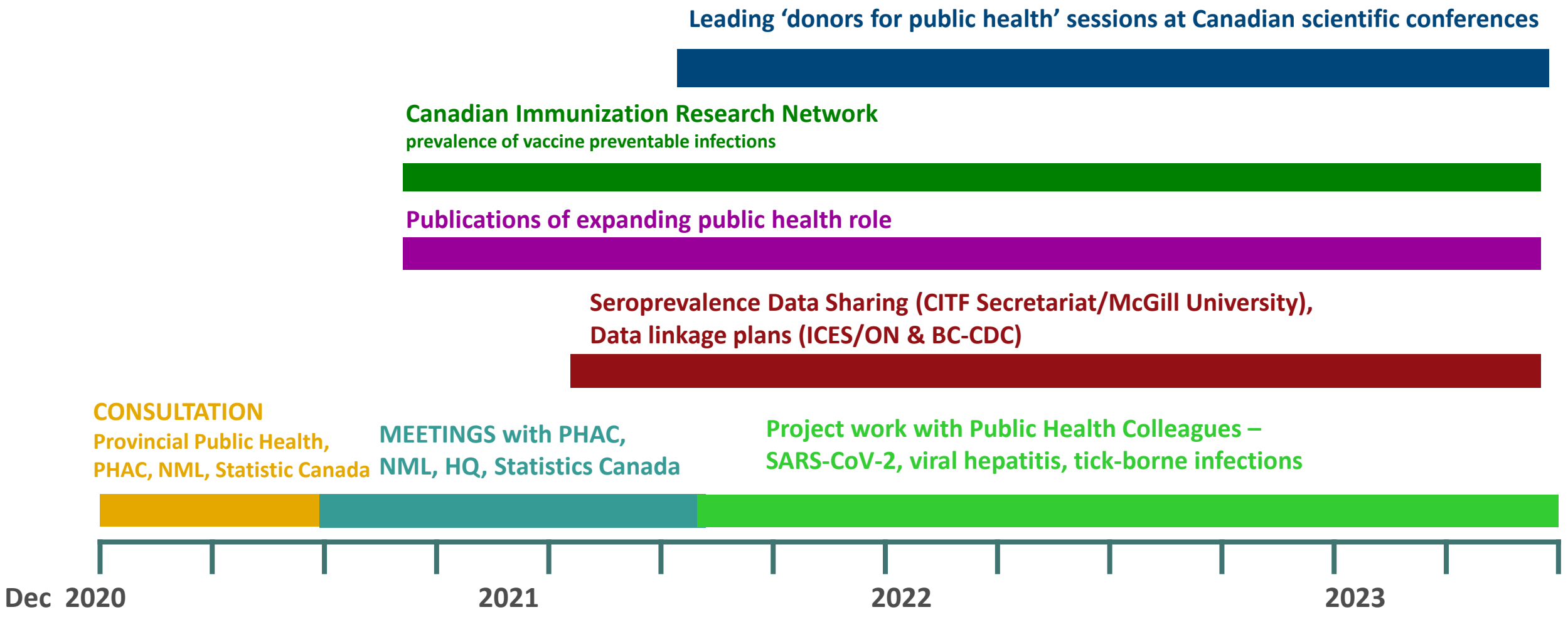


Seroprevalence studies No seroprevalence studies

Canadian Blood Services BLOOD PLASMA STEM CELLS ORGANS & TISSUES

O'Brien, S et al, Vox Sanguinis (2020)

Our journey to understand enhanced public health potential: Timeline summary of selected events



viruses

MDPI

Article

Hepatitis B Blood Donor Screening Data: An Under-Recognized Resource for Canadian Public Health Surveillance

Sheila F. O'Brien [1,2,*], Cassandra N. Reedman [1,3], Carla Osiowy [4,5,6], Shelly Bolotin [7,8,9,10], Qi-Long Yi [1,2], Lillian Lourenço [3], Antoine Lewin [11,12], Mawuena Binka [13,14], Niamh Caffrey [1] and Steven J. Drews [15,16]

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

BC Centre for Disease Control
Provincial Health Services Authority

Public Health Ontario

HÉMA-QUÉBEC

Since raising awareness of our interest in public health participation, the Public Health Agency of Canada are using our hepatitis C and hepatitis B data for national estimates

National Hepatitis C estimates: Incidence, prevalence, undiagnosed proportion and treatment, Canada, 2019

Nashira Popovic[1]*, Anson Williams[1], Simone Périnet[1], Laurence Campeau[1], Qiuying Yang[1], Fan Zhang[1], Ping Yan[1], Jordan Feld[2], Naveed Janjua[3], Marina Klein[4], Mel Krajden[3], William Wong[5], Joseph Cox[1]

isbtweb.org/isbt-working-parties/transfusion-transmitted-infectious-diseases/public-health-research-toolkit.html

Aims to assist blood centers and researchers interested in expanding their services in public health programs

Donor Public Health References

O'Brien SF 2023 Viruses Hepatitis B blood donor screening data: An under-recognized resource for public health surveillance doi: 10.3390/v15020409
O'Brien SF 2023 CMAJ An expanded role for blood donor emerging pathogen surveillance doi:10.1503/cmaj.147635-1
O'Brien SF 2022 Transfusion How do we decide how representative our donors are for public health surveillance? doi: 10.1111/trf.17140
Lewin A 2022 Vox Sanguinis Research partnerships between blood services and public health doi:10.1111/vox.13374
O'Brien SF 2022 CCDR Canadian blood suppliers: An expanding role in public health surveillance? doi: 10.14745/ccdr.v48i04a02
Pedersen OB 2012 Vox Sanguinis The Danish Blood Donor Study: A large prospective cohort and biobank for medical research. doi: 10.1111/j.1423-0410.2011.01553.x

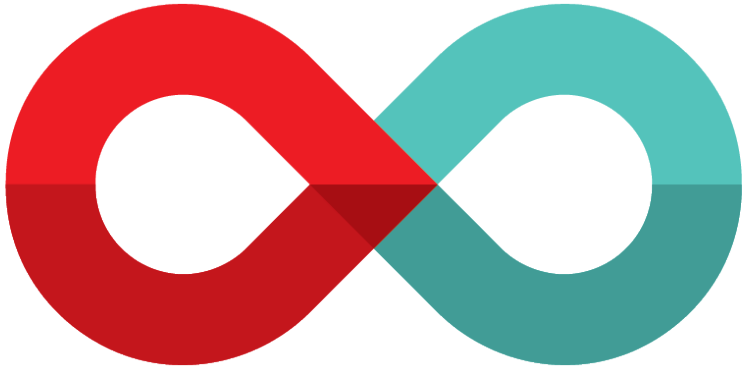
ISBT International Society of Blood Transfusion

Canadian Blood Services BLOOD PLASMA STEM CELLS ORGANS & TISSUES

Summary

- Blood donors are a healthy subset of the adult population
- Most Ontario donors (about 80%) have hybrid immunity
- Ongoing collection of seroprevalence data will facilitate comprehensive modelling of immunity
- Blood donor sero-surveillance over three years of the pandemic demonstrates the value that donors can bring to public health surveillance
- Canadian Blood Services is developing a post-pandemic role in public health research and surveillance

- Steven Drews (Assoc Director, Microbiology) and Chantale Pambrun (Sr. Medical Director, Innovation and Portfolio Management) and the SARS-CoV-2 Project Team
- Our SARS-CoV-2 laboratory staff led by Valerie Conrod and Craig Jenkins
- Our blood donors



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