Canadian Blood Services
BLOOD
PLASMA
STEM CELLS
ORGANS
& TISSUES

COVID-19 Public Seroprevalence Report

April 2020 to January 2021

May 10, 2021

COVID-19 Seroprevalence Report | Data from April 2020 to January 2021.

Background

Severe acute respiratory syndrome coronavirus (SARS-CoV-2), the virus that causes coronavirus disease 2019 (COVID-19) causes a wide spectrum of disease outcomes. While some people become extremely ill and can die from complications, others experience mild symptoms or may not be aware of their infection at all.

Since the start of the pandemic, more than 1.2 million Canadians have been diagnosed with COVID-19. Yet, this statistic does not convey the true infection rate because diagnosis depends on testing and testing may be disproportionately directed to outbreaks. In contrast to diagnostic testing, which detects cases at the time of infection; serological tests identify SARS-CoV-2 specific antibodies after natural infections or vaccination.

Tracking SARS-CoV-2 antibodies in a population is important to understand what proportion has already been exposed (the seroprevalence) and to monitor infection over the course of the pandemic. These studies can play a pivotal role in helping public health authorities assess policies to contain and mitigate outbreaks, determine healthcare capacity, and coordinate vaccine distribution.

Blood donors are reasonably representative of healthy Canadians between the ages of 17 and about 60. At the Canadian Blood Service, collection sites are in all large cities and many smaller urban centers in all provinces except Quebec. Therefore, people in rural areas and from the northern territories may have less opportunity to donate. This report also does not include results from blood donations collected in Quebec; Hema-Quebec is conducting separate studies to determine the seroprevalence in donors in Quebec.

In partnership with the Canadian COVID-19 Immunity Task Force, Canadian Blood Services is testing samples left over from donations for SARS-CoV-2 antibodies. **This report summarizes seroprevalence estimates from residual blood from April 2020 until January 2021.**

What did we do?

Blood samples

Just before a donor gives their blood donation, several small tubes of blood are collected for infectious disease and other testing. An extra sample is taken, called the retention sample, in case extra testing is required. Only about 20% of these retention samples are needed. For seroprevalence testing, plasma from the 80% of retention samples not needed for operational testing was aliquoted and frozen at -20°C or colder. Sampling has varied through time (See **Appendix Table 1** for the number of retention samples that were tested from April 2020 until January 2021).

SARS-CoV-2 antibody testing

All plasma samples were tested using the Abbott Architect SARS-CoV-2 IgG assay (chemiluminescent microparticle immunoassay (CMIA)) which targets the nucleocapsid antigen. This assay was assumed to have 92.7% (90.2-94.8%) sensitivity and 99.9% (99.4 – 100%) specificity (1).

Data analysis

The seroprevalence was calculated as the number of positive samples divided by all samples tested. Cross-sectional estimates were reported by monthly. Seroprevalence estimates were then summarized by geography (regions and selected cities), sex, age groups, self-reported ethnicity and socioeconomic status. Socioeconomic status was estimated by five levels (quantiles) of the Pampalon Material and Social Deprivation Indices (MSDI). MSDI was derived from 2016 Statistics Canada census, aggregated from postal codes to the dissemination area. Trends over two-week intervals were evaluated by geographical region by linear regression. Statistical comparisons between groups were carried out using logistic regression.

Adjustments: Because blood donors tend to live in areas close to a blood clinic there will be higher concentrations of donors in certain areas compared with the general population, and lower concentrations in other areas. To make inference to the general population, weighting factors were applied based on the donor's residential Forward Sortation Area (FSA) of their postal code, age group and sex. The weighted seroprevalence was also adjusted for sensitivity and specificity of the assay.

What did we find?

A total of 179,473 samples were tested from April 2020 until January 2021.

Overall seroprevalence increased from 0.70% (95% CI 0.63, 0.77) during Wave 1 to 0.88% (95% CI 0.73, 1.04%) in October, 1.51% (95% CI 1.31, 1.71) in November, 1.37% (95%CI 1.18, 1.56) and 1.99% (95% CI 1.84, 2.15) in January 2021 (**Appendix Table 1**).

Figure 1 illustrates adjusted SARS-CoV-2 by approximately two-week intervals[1]. The greatest single increase was in the last week of November. This increase was largely driven by a spike in seroprevalence in the Prairies (**Figure 2**). In January, we found the highest adjusted rate was in Manitoba (3.92% (95% CI 2.92, 4.93%)) and the lowest in Newfoundland and Prince Edward Island.

Figure 3A-F illustrates the adjusted SARS-CoV-2 seroprevalence rates by sociodemographic variables for all Canadian provinces (except Quebec and territories) over time (Appendix Table 1).

Sex (Figure 3A)/Age (Figure 3B): We found no statistically significant differences by sex over time. While there was no significant difference by age groups from April 2020 until October

[1] Additional data from a research study "Correlates of Immunity" that samples 1500 donors per month from April to September 2020 were included to create these graphs (PI S Drews, CIHR funded)

2020, as of November 2020, rates differed by age groups. Rates among donors aged 17-24 years old increased significantly from 0.76% (95%CI 0.57, 0.96%) during Wave 1 to 2.97% (95% CI 2.2, 3.73%) in November and to 3.45% (95% CI 2.87, 4.02) in January 2021.

Ethnicity (Figure 3C): Consistently, from the beginning of the pandemic seroprevalence rates were higher among racialized groups compared to donors who self-identified as white. Disparities widened 23% from Wave 1 to January 2021.

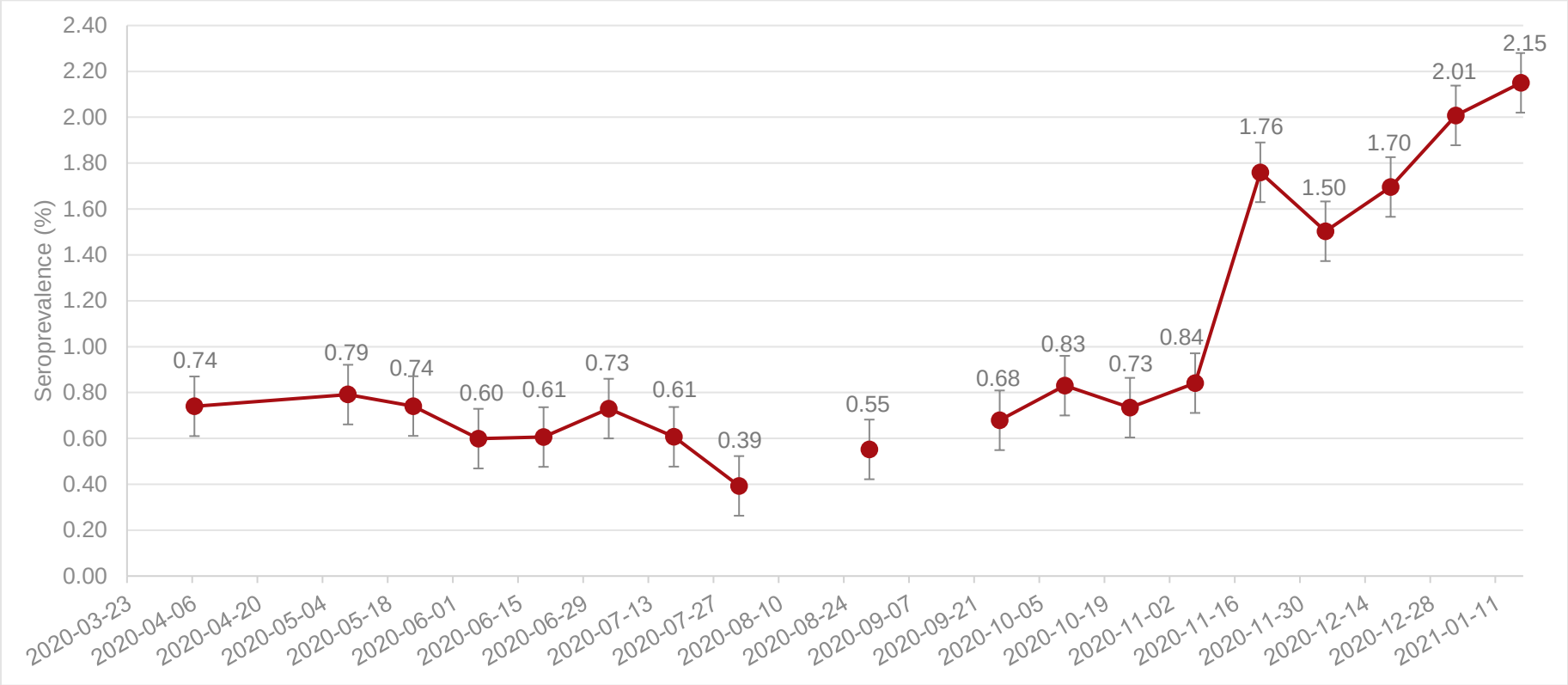
Social Deprivation (Figure 3D) and Material Deprivation (Figure 3E): There was no difference in seroprevalence by levels of social deprivation index in Wave 1, however over time donors living in the most socially deprived neighborhoods (scored=5) had the lowest seroprevalence in January 2021. Disparities between levels of material deprivation widened over the course of the pandemic. In January, seroprevalence rates between donors living in the most affluent neighborhood was 1.17% while those living in the most materially deprived area was 4.04%.

Cities (Figure 3F): Seroprevalence increased significantly in most metropolitan cites over time, except for Ottawa. By January the city with the highest rate was Edmonton 3.74%. (Appendix Table 1).

Conclusion

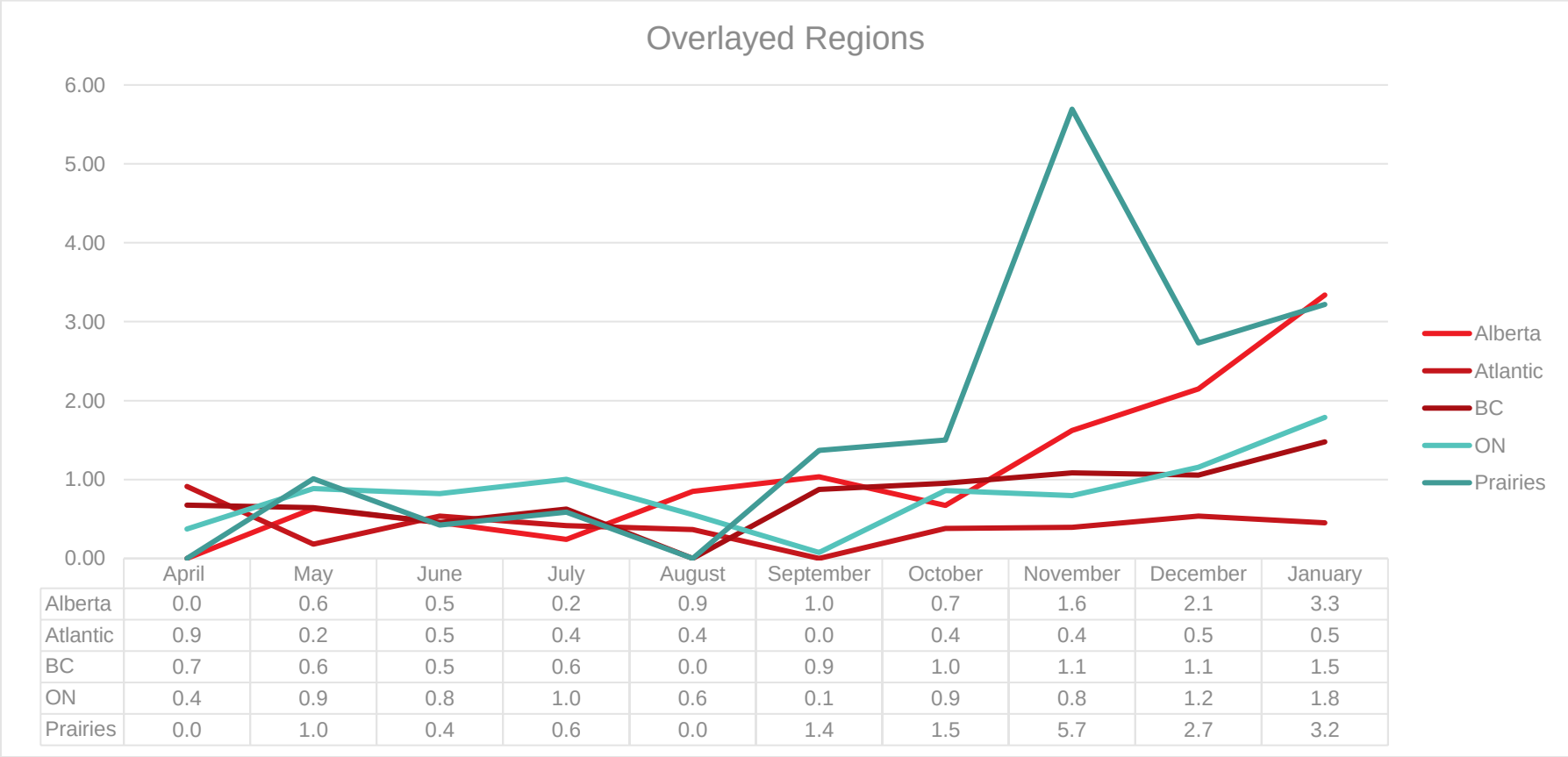
Overall seroprevalence of SARS-CoV-2 remains low in Canadian blood donors but there was significant variation by geographic areas and neighbourhood. Donors living in lower income neighbourhoods were more likely to have antibodies than those in more affluent neighbourhoods. Likewise, racialized groups remained more likely to have antibodies compared to white donors and the gap had widen since Wave 1. While the donor selection criteria ensure blood donors are healthy, caution should be exercised in extending findings to all healthy Canadians adults because donors self-select to be blood donors, in some areas access to a donation clinic may be limited and because there are fewer elderly donors.

Figure 1. Overall trends of SARS-CoV-2 seroprevalence by approximately two-week intervals from April 2020 until January 2021.



Notes: SARS-CoV-2 seroprevalence rates (red dots) bars represent (95% confidence intervals). All estimates were weighted and adjusted for test characteristics. **Limited data from the CIHR funded study (Correlates of Immunity) was available to estimate seroprevalence estimates from July 21, 2021 until October 1, 2020.**

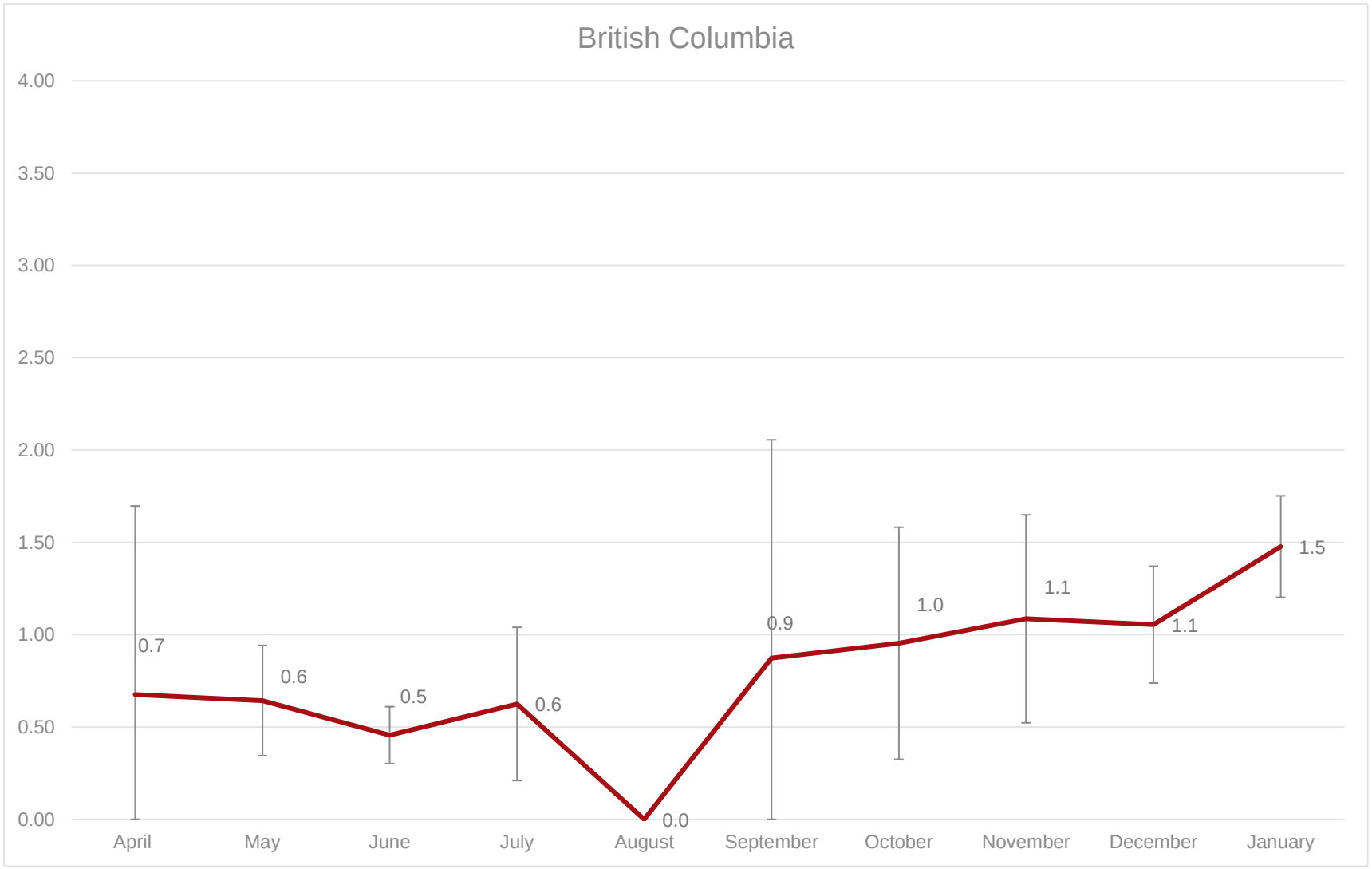
Figure 2A. Overall trends of SARS-CoV-2 seroprevalence monthly from April 2020 until January 2021.

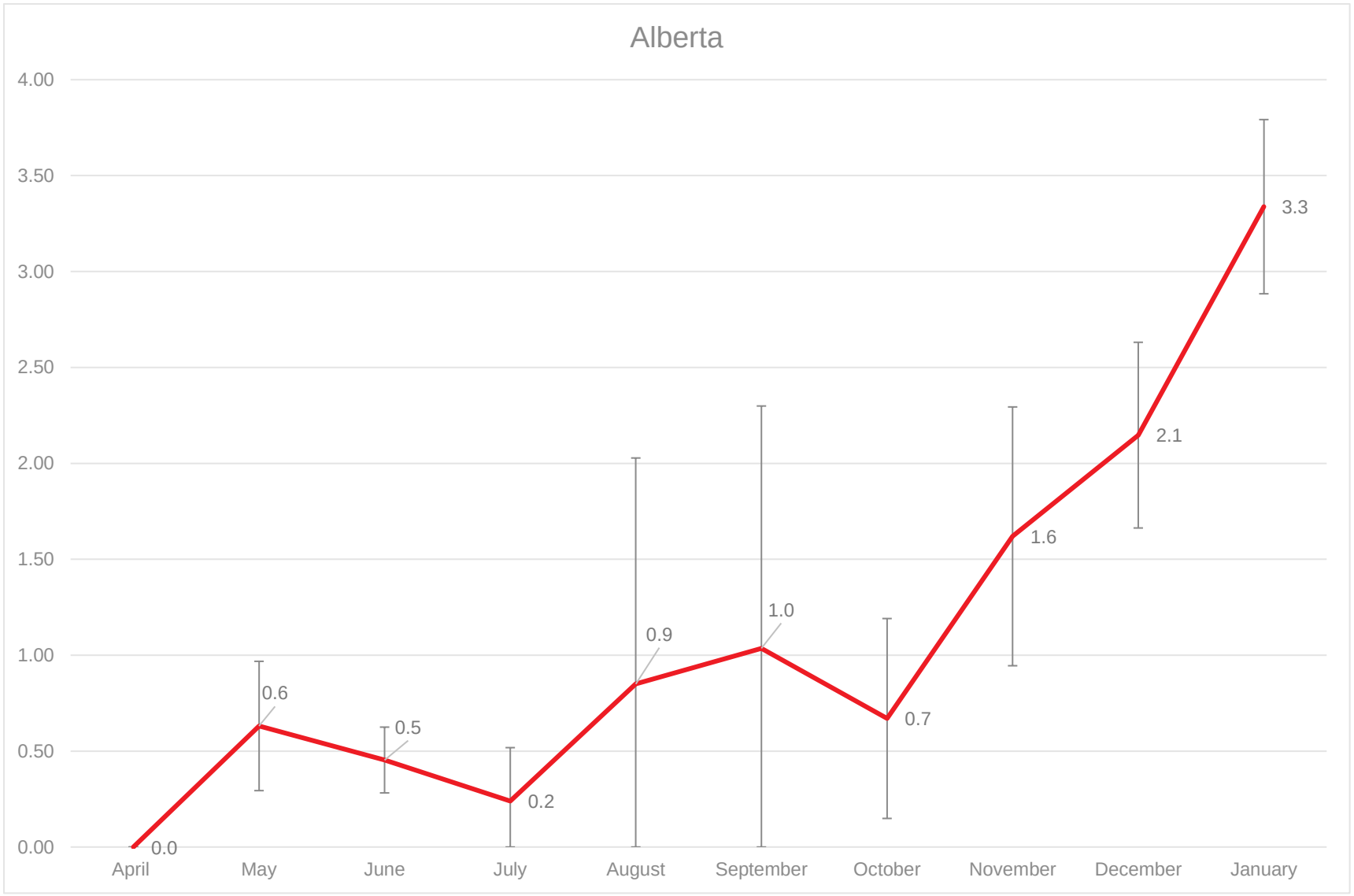


	April	May	June	July	August	September	October	November	December	January
Alberta	0.0	0.6	0.5	0.2	0.9	1.0	0.7	1.6	2.1	3.3
Atlantic	0.9	0.2	0.5	0.4	0.4	0.0	0.4	0.4	0.5	0.5
BC	0.7	0.6	0.5	0.6	0.0	0.9	1.0	1.1	1.1	1.5
ON	0.4	0.9	0.8	1.0	0.6	0.1	0.9	0.8	1.2	1.8
Prairies	0.0	1.0	0.4	0.6	0.0	1.4	1.5	5.7	2.7	3.2

Notes: SARS-CoV-2 seroprevalence rates (red dots) bars represent (95% confidence intervals). All estimates were weighted and adjusted for test characteristics. **Limited data from the CIHR funded study (Correlates of Immunity) was available to estimate seroprevalence estimates from July 21, 2021 until October 1, 2020.**

Figure 2B. Trends of SARS-CoV-2 seroprevalence by region from April 2020-January 2021 (Monthly).

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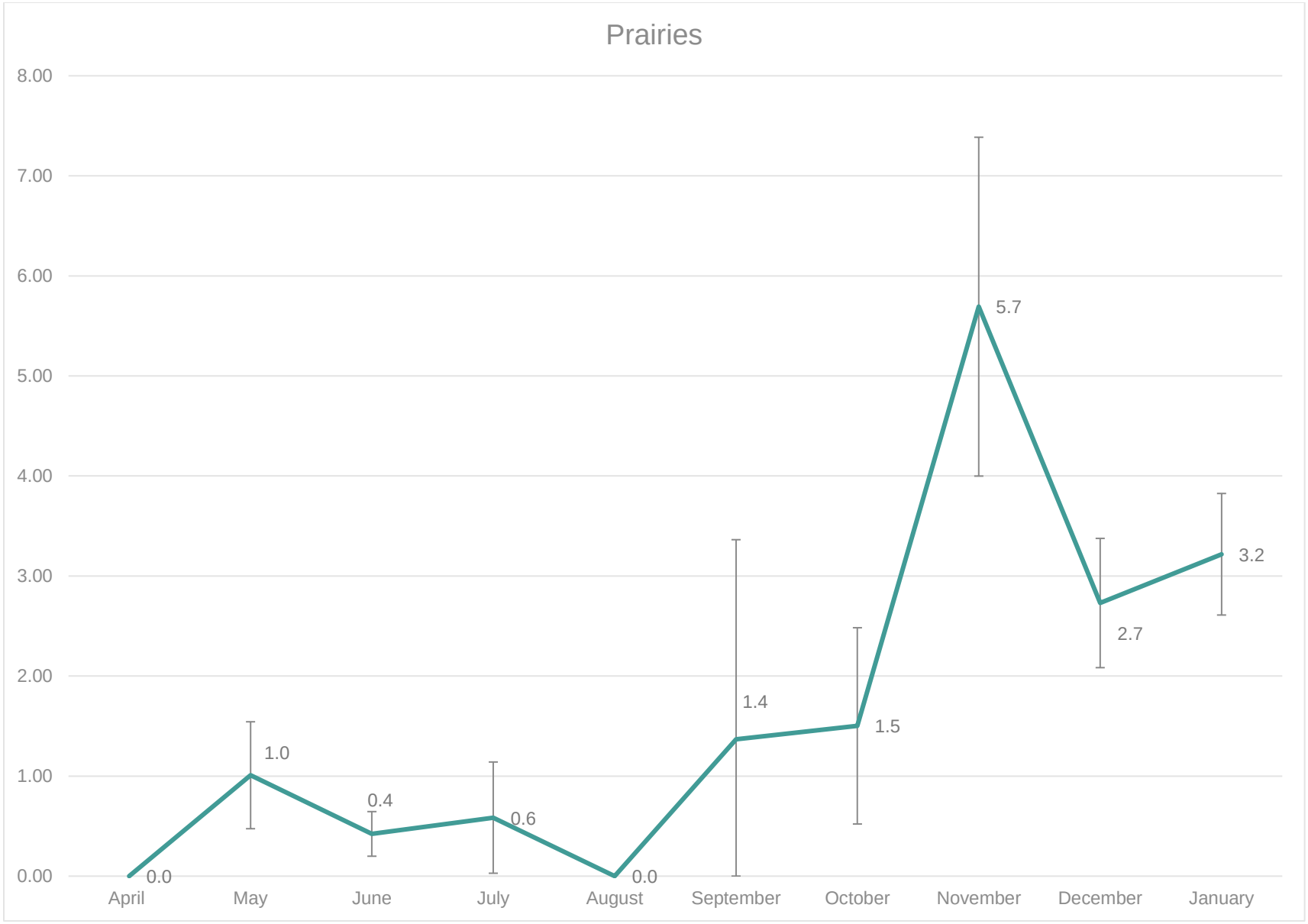
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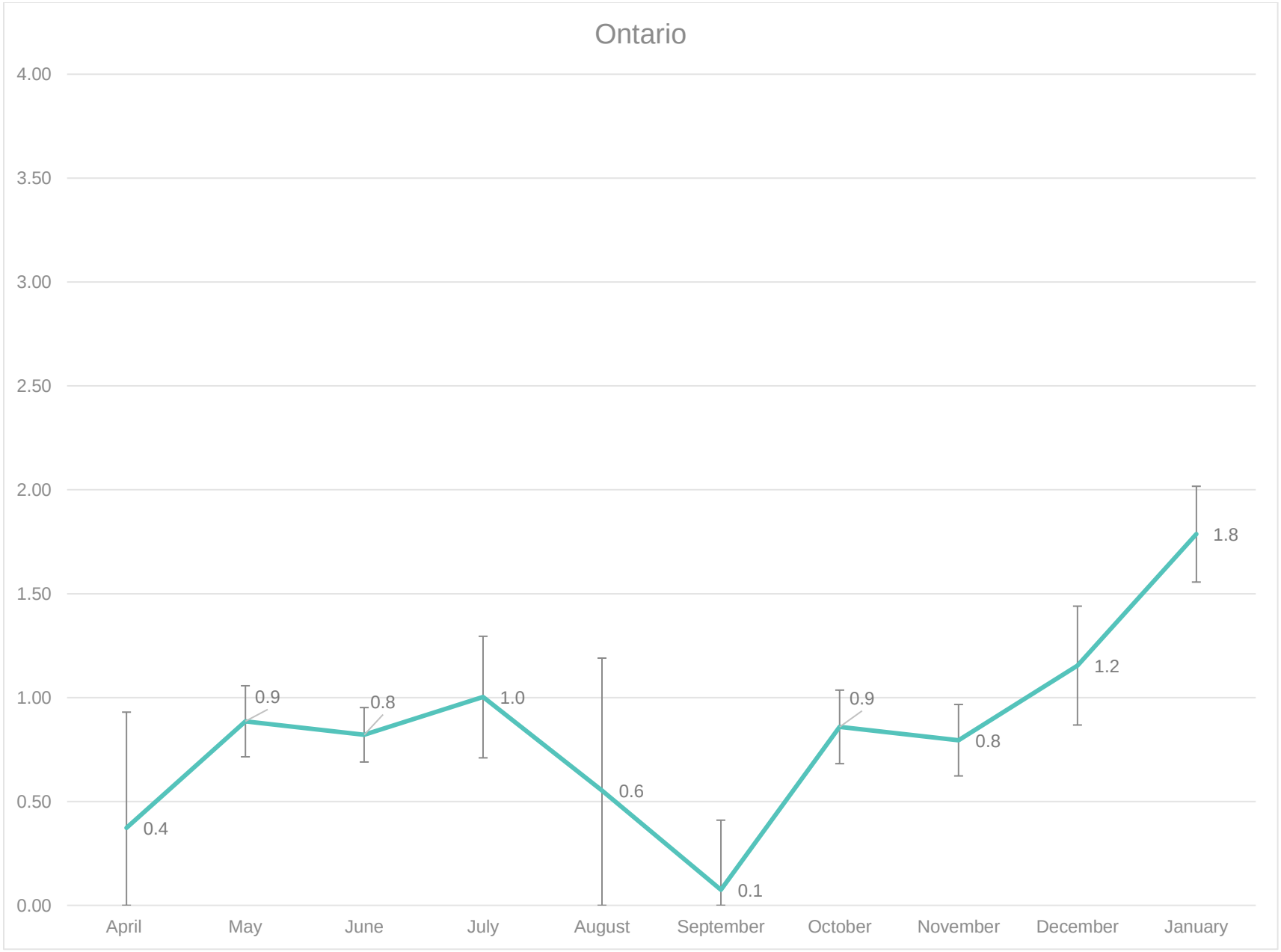
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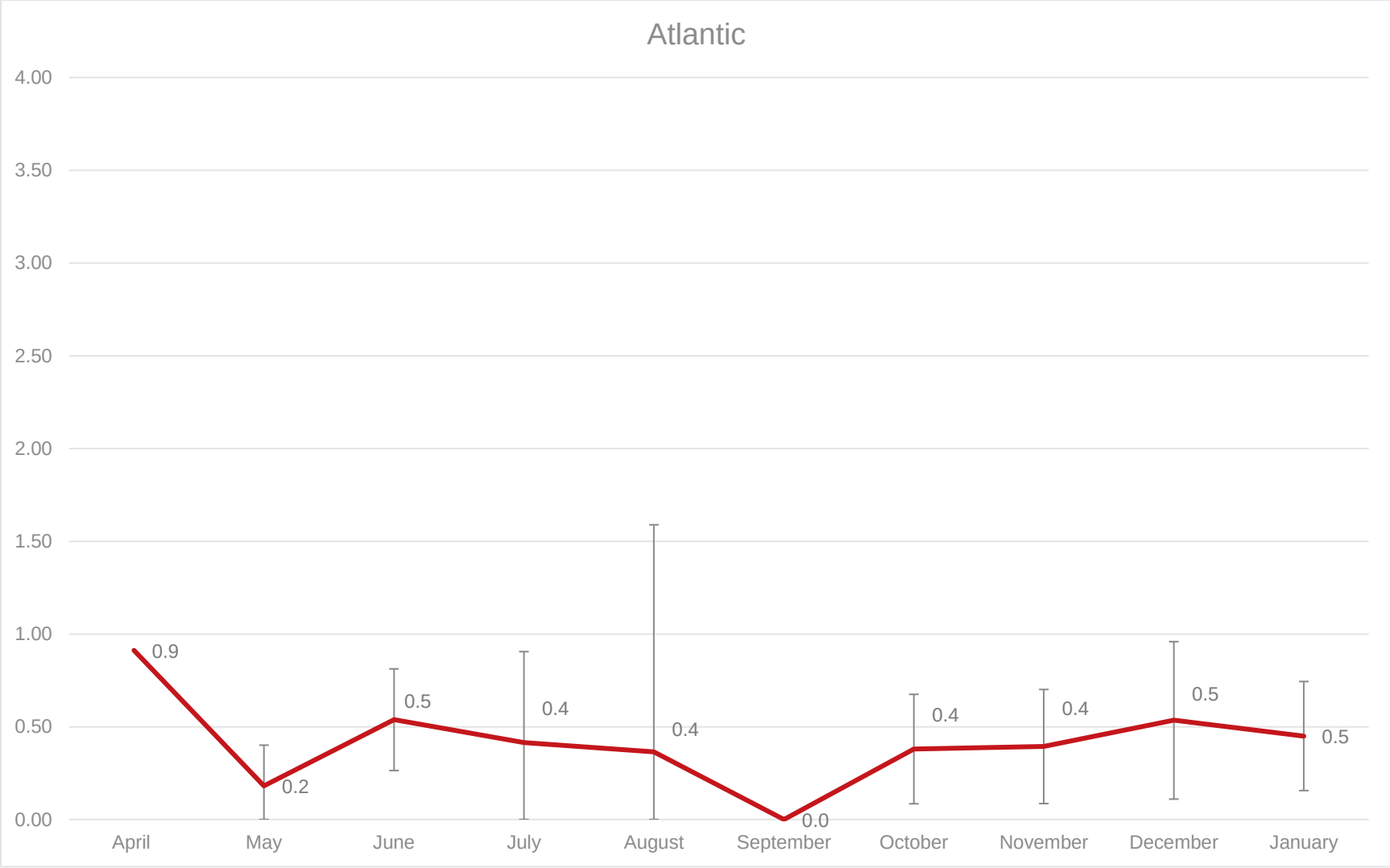
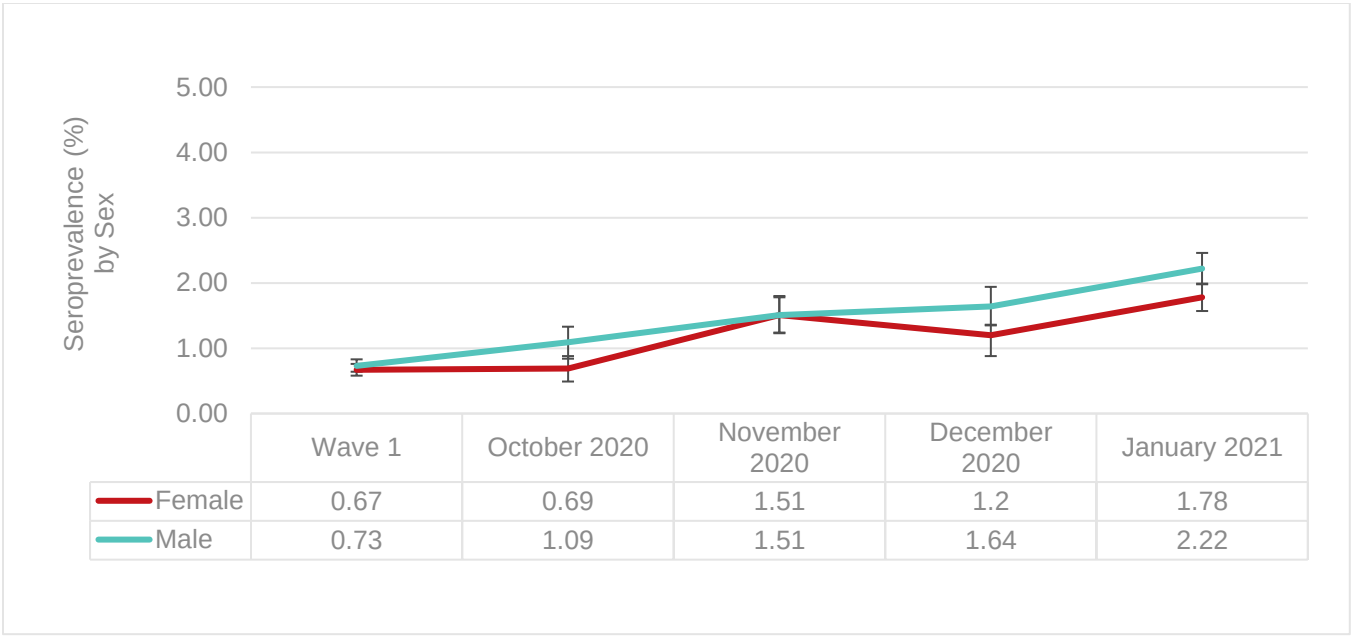


Notes: SARS-CoV-2 seroprevalence rates (red dots) bars represent (95% confidence intervals). All estimates were weighted and adjusted for test characteristics. **Limited data from the CIHR funded study (Correlates of Immunity) was available to estimate seroprevalence estimates from July 21, 2021 until October 1, 2020.**

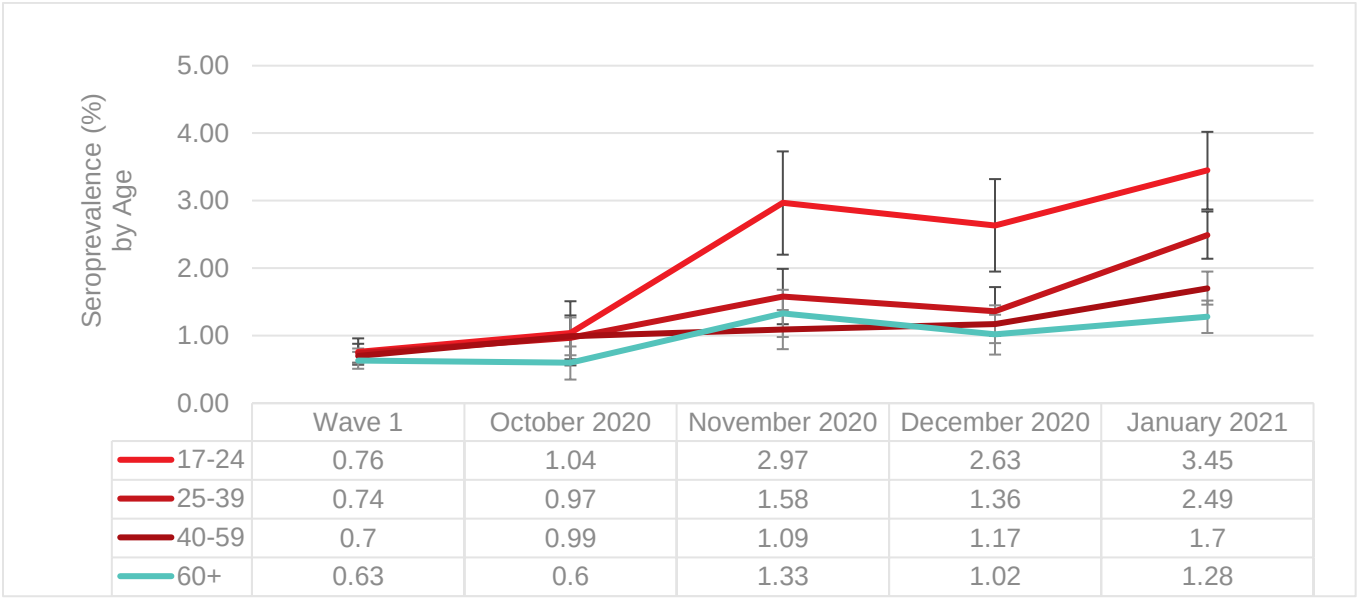
Figure 3. Adjusted SARS-CoV-2 seroprevalence rates by (A) Sex (B) Age groups (C) Ethnicity (D) Social Deprivation (E) Material Deprivation (F) Metropolitan Cities. Bars represent (95% CI) all results are weighted and adjusted for test characteristics (Appendix Table 1 and 2)

3A.



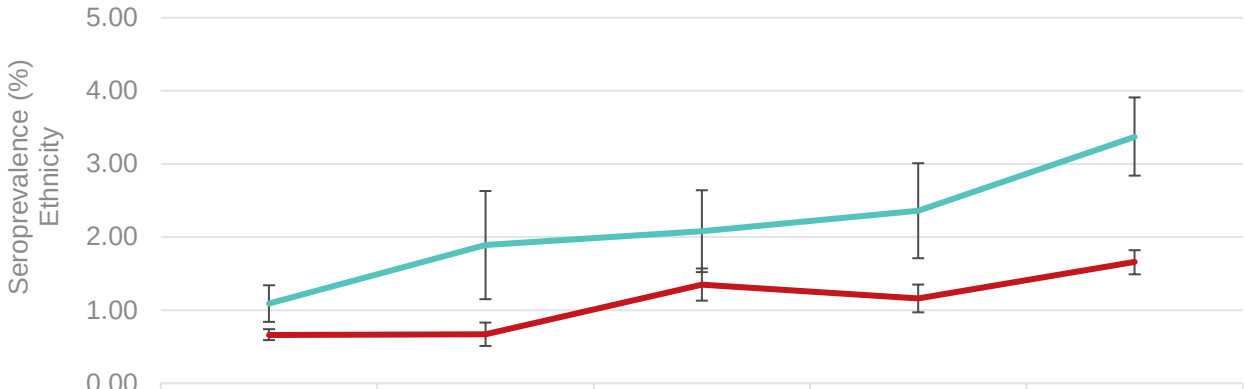
	Wave 1	October 2020	November 2020	December 2020	January 2021
Female	0.67	0.69	1.51	1.2	1.78
Male	0.73	1.09	1.51	1.64	2.22

3B.



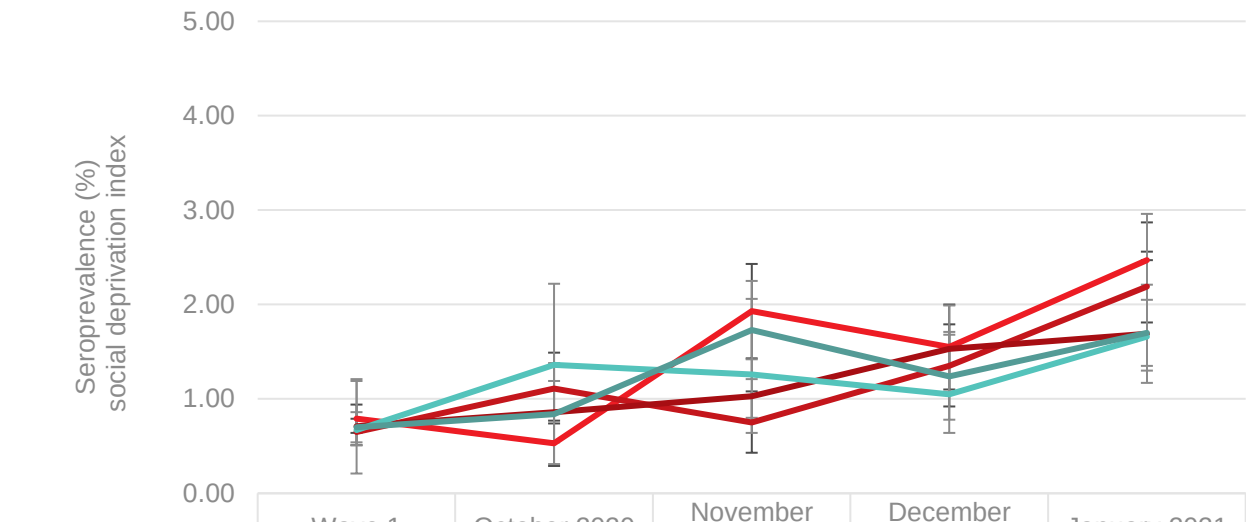
	Wave 1	October 2020	November 2020	December 2020	January 2021
17-24	0.76	1.04	2.97	2.63	3.45
25-39	0.74	0.97	1.58	1.36	2.49
40-59	0.7	0.99	1.09	1.17	1.7
60+	0.63	0.6	1.33	1.02	1.28

3C.



	Wave 1	October 2020	November 2020	December 2020	January 2021
White	0.66	0.67	1.35	1.16	1.66
Other Racialized Groups	1.09	1.89	2.08	2.36	3.37

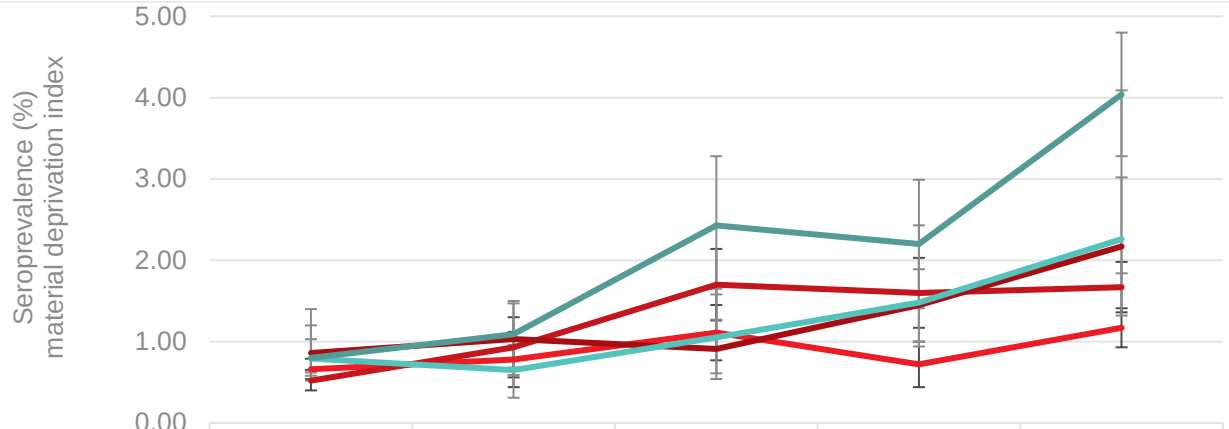
3D.



	Wave 1	October 2020	November 2020	December 2020	January 2021
1 (least deprived)	0.79	0.53	1.93	1.55	2.47
2	0.65	1.11	0.75	1.35	2.19
3	0.71	0.86	1.03	1.53	1.69
4	0.67	1.36	1.26	1.05	1.66
5 (most deprived)	0.7	0.84	1.73	1.24	1.7

Social deprivation- refers to a fragile social network, characterized by individuals living alone, being a lone parent and being separated, divorced or widowed.

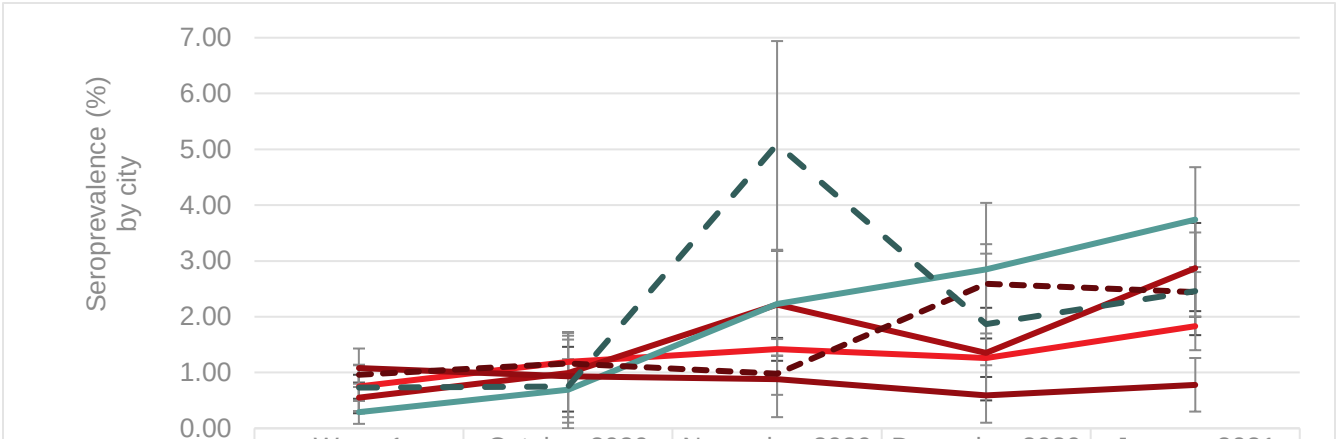
3E.



	Wave 1	October 2020	November 2020	December 2020	January 2021
1 (least deprived)	0.66	0.78	1.11	0.72	1.17
2	0.52	0.93	1.7	1.6	1.67
3	0.86	1.03	0.91	1.45	2.17
4	0.79	0.65	1.05	1.48	2.26
5 (most deprived)	0.8	1.09	2.43	2.2	4.04

Material deprivation- is associated with low education, insecure job situation and insufficient income.

3F.



	Wave 1	October 2020	November 2020	December 2020	January 2021
Vancouver	0.75	1.19	1.42	1.26	1.83
Calgary	0.55	0.99	2.22	1.35	2.87
Edmonton	0.29	0.69	2.23	2.85	3.74
Ottawa	1.08	0.93	0.88	0.59	0.78
Toronto	0.96	1.16	0.98	2.59	2.44
Winnipeg	0.73	0.75	5.09	1.87	2.46

Appendix Table 1. Comparison of SARS-CoV-2 seroprevalence by socio-demographic variables (Wave 1 (April-July 2020), October, November, December and January 2021) %+ (Percent Positive)

	Wave 1 April-July 2020			October 2020			November 2020			December 2020			January 2021		
	Number Tested	%+	95% CI	Number Tested	%+	95% CI	Number Tested	%+	95% CI	Number Tested	%+	95% CI	Number Tested	%+	95% CI
Sex															
Female	35,547	**0.67**	0.58, 0.76	7,258	**0.69**	0.49, 0.88	7,451	**1.51**	1.24, 1.78	8,240	**1.12**	0.88, 1.36	15,102	**1.78**	1.57, 1.98
Male	39,095	**0.73**	0.64, 0.83	9,553	**1.09**	0.84, 1.33	9,598	**1.51**	1.23, 1.80	10,769	**1.64**	1.35, 1.94	19,819	**2.22**	1.99, 2.46
Age															
17-24	7,165	**0.76**	0.57, 0.96	1,491	**1.04**	0.56, 1.51	1,631	**2.97**	2.20, 3.73	1,737	**2.75**	2.01, 3.49	2,758	**3.45**	2.87, 4.02
25-39	21,733	**0.74**	0.60, 0.88	4,535	**0.97**	0.65, 1.30	4,644	**1.58**	1.17, 1.99	5,211	**1.33**	0.95, 1.71	9,863	**2.49**	2.14, 2.84
40-59	27,777	**0.70**	0.59, 0.81	6,446	**0.99**	0.71, 1.27	6,382	**1.09**	0.80, 1.38	7,319	**1.24**	0.93, 1.54	12,810	**1.70**	1.46, 1.95
60+	17,967	**0.63**	0.51, 0.76	4,339	**0.60**	0.35, 0.84	4,392	**1.33**	0.98, 1.68	4,742	**0.96**	0.66, 1.27	9,490	**1.28**	1.04, 1.52
Ethnicity															
White	52,852	**0.66**	0.59, 0.74	12,893	**0.67**	0.51, 0.83	12,806	**1.35**	1.13, 1.57	14,289	**1.14**	0.94, 1.34	25,983	**1.66**	1.49, 1.82
Indigenous	778	**0.93**	0.21, 1.65	157	**0**	0.00, 0.00	174	**3.59**	0.88, 6.30	233	**3.51**	0.68, 6.35	415	**1.05**	0.00, 2.14

Asian	3,098	**0.93**	0.60, 1.27	598	**1.59**	0.55, 2.62	527	**2.43**	1.11, 3.75	776	**1.17**	0.28, 2.06	1,387	**2.74**	1.82, 3.65
Other racialized groups	6,819	**1.09**	0.84, 1.34	1,536	**1.89**	1.15, 2.63	1,800	**1.82**	1.20, 2.44	1,698	**2.74**	1.87, 3.61	3,172	**3.95**	3.23, 4.66
Social Deprivation (1=least deprived 5=Most deprived)[1]															
1	14,004	**0.79**	0.64, 0.94	3,240	**0.53**	0.29, 0.77	3,105	**1.93**	1.43, 2.43*	3,603	**1.55**	1.10, 2.00	6,450	**2.47**	2.07, 2.87
2	13,865	**0.65**	0.51, 0.79	3,242	**1.11**	0.74, 1.49	3,517	**0.75**	0.43, 1.08	3,485	**1.35**	0.92, 1.77	6,544	**2.19**	1.81, 2.56
3	13,151	**0.71**	0.55, 0.86	3,257	**0.86**	0.50, 1.22	3,139	**1.03**	0.64, 1.42	3,496	**1.53**	1.07, 1.99	6,348	**1.69**	1.35, 2.02
4	12,341	**0.67**	0.52, 0.83	2,682	**1.36**	0.86, 1.86	2,705	**1.26**	0.80, 1.72	3,151	**1.05**	0.63, 1.46	5,651	**1.66**	1.30, 2.02
5	13,170	**0.70**	0.54, 0.86	2,768	**0.84**	0.31, 1.38	2,757	**1.73**	1.21, 2.25	3,019	**1.24**	0.78, 1.71	6,098	**1.70**	1.35, 2.05
Material Deprivation (1=least deprived 5=Most deprived)[2]															
1	19,633	**0.66**	0.54, 0.79	4,043	**0.78**	0.44, 1.12	3,900	**1.11**	0.77, 1.45	5,246	**0.72**	0.44, 1.00	9,278	**1.17**	0.93, 1.41
2	16,457	**0.52**	0.40, 0.65	3,761	**0.93**	0.56, 1.30	3,911	**1.7**	1.26, 2.14	4,171	**1.6**	1.17, 2.03	7,382	**1.67**	1.36, 1.98
3	13,872	**0.86**	0.70, 1.02	3,263	**1.03**	0.65, 1.41	3,248	**0.91**	0.54, 1.27	3,374	**1.45**	1.01, 1.87	6,573	**2.17**	1.80, 2.54
4	10,460	**0.79**	0.61, 0.96	2,602	**0.65**	0.31, 0.99	2,589	**1.05**	0.60, 1.49	2,437	**1.48**	0.95, 2.02	5,128	**2.26**	1.83, 2.68

5	6,109	**0.80**	0.58, 1.03	1,520	**1.09**	0.68, 1.50	1,575	**2.43**	1.58, 3.28	1,526	**2.2**	1.41, 2.99	2,730	**4.04**	3.28, 4.80
Metropolitan Cities															
Vancouver	5,819	**0.75**	0.53, 0.96	207	**1.19**	0.50, 1.92	677	**1.42**	0.9, 1.96	2,020	**1.26**	0.70, 1.85	3,649	**1.83**	1.35, 2.30
Calgary	4,192	**0.55**	0.27, 0.82	371	**0.99**	0.30, 1.72	527	**2.22**	1.30, 3.18	1,561	**1.35**	0.50, 2.16	2,596	**2.87**	2.07, 3.68
Edmonton	4,404	**0.29**	0.08, 0.49	445	**0.69**	0.10, 1.24	529	**2.23**	1.30, 3.18	1,460	**2.85**	1.70, 4.04	2,417	**3.74**	2.81, 4.68
Ottawa	3,680	**1.08**	0.74, 1.43	1,154	**0.93**	0.20, 1.66	1,101	**0.88**	0.20, 1.60	728	**0.56**	0.01, 1.13	1,340	**0.78**	0.30, 1.26
Toronto	13,203	**0.96**	0.80, 1.13	3,940	**1.16**	0.70, 1.59	3,425	**0.98**	0.60, 1.41	1,773	**2.59**	1.90, 3.30	4,364	**2.44**	2.00, 2.89
Winnipeg	2,242	**0.73**	0.31, 1.14	131	**0.75**	0.0, 1.71	288	**5.09**	3.20, 6.94	852	**1.87**	0.60, 3.13	1,131	**2.46**	1.42, 3.51
TOTAL	**74,642**	**0.70**	**0.63, 0.77**	**16,811**	**0.88**	**0.73, 1.04**	**17,049**	**1.51**	**1.31, 1.71**	**16,961**	**1.37**	**1.18, 1.56**	**34,921**	**1.99**	**1.84, 2.15**

[1]Social deprivation- refers to a fragile social network, characterized by individuals living alone, being a lone parent and being separated, divorced or widowed (1=least deprived and 5=most deprived)
[2]Material deprivation- is associated with low education, insecure job situation and insufficient income (1=least deprived and 5=most deprived)

Points for Interpretation

1. Blood donors are a healthy sub-set of the adult Canadian population. Important points to keep in mind with regards to representativeness of the sample are:
    - blood donors self-select to donate blood therefore those who choose not to donate blood for whatever reason are not included in the sample.
    - Blood donations are collected from people aged 17 years and older, however there are relatively few donations from elderly donors.
    - Blood donations are collected in larger cities and many smaller urban areas, but people in rural areas may be under-represented. Canadian Blood Services does not collect blood in the northern territories or the province of Quebec.
2. Data were weighted for age, sex and location to more closely reflect the Canadian population. For example, the unweighted SARS-CoV-2 seroprevalence for the full sample in January 2021 was 2% (95% CI 1.86, 2.16)), and after weighting factors applied it was 2.06% (95% CI 1.90, 2.22), then after the weighted seroprevalence was adjusted for sensitivity and specificity, 1.99% (95% CI 1.84, 2.15).
3. The sensitivity and specificity of the Abbott assay were obtained from a report from the United Kingdom. The manufacturer indicates higher sensitivity. A study from Denmark indicates sensitivity may be slightly lower.
4. The sensitivity and specificity of the assay are very good, but it is still possible that some true positives may be missed, and some positive results may be false. Confirmatory testing has not been performed. The seroprevalence was adjusted for sensitivity and specificity using a well-established mathematical formula. The Abbott assay used by Canadian Blood Services detects IgG antibodies to the SARS-CoV-2 nucleocapsid protein. IgG develops during infection but may not be present early in the course of infection. Donors are deferred if they have recent COVID-19 infection, but asymptomatic early stage infections may not be detected. Due to a variety of biological factors, donors may have variable antibody responses to different binding sites on the SARS-CoV-2 virus (e.g. Spike, receptor binding domain of Spike, nucleocapsid protein).
5. Disclaimer: Canadian Blood Services is providing this report of the study results on an "as is" basis and makes no representations or warranties, express or implied, including with regards to the accuracy, reliability or validity of the information or its fitness for a particular purpose. The use of this report and/or any study results is the responsibility of the user. Canadian Blood Services assumes no liability resulting from any such use. This report may not be reproduced without permission from Canadian Blood Services.

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