



**Canadian  
Blood  
Services**

BLOOD  
PLASMA  
STEM CELLS  
ORGANS  
& TISSUES

COVID-19 Seroprevalence Report

2020-08-20

# COVID-19 Seroprevalence Report

## August 19, 2020

### Samples collected from May 9 to June 18, 2020

## Introduction

SARS-Cov-2 is a novel coronavirus first identified in Wuhan, Hubei province China in late 2019. It is responsible for a respiratory illness, coronavirus infection disease (COVID-19). Some people become extremely ill and can die from complications, while others experience mild symptoms or may not be aware of their infection at all. As of August 18<sup>th</sup>, 2020 122,872 cases of COVID-19 have been reported in Canada, and 9,032 deaths. These statistics do not convey the true infection rate because some infections will not cause illness, others may not be severe enough for people to seek testing. Testing for SARS-Cov-2 antibodies is important to understand what proportion of the population have already been infected (the seroprevalence) and to monitor infection over the course of the pandemic. This information will improve mathematical models to predict the course of infection and inform public health policy.

Blood donors are reasonably representative of healthy Canadians between the ages of 17 and about 60. There are people over 60 who donate blood, although there are fewer as age increases. There are blood collection sites in all large cities and many smaller urban centres in all provinces except Quebec but people in rural areas may have less opportunity to donate. Blood donations are not collected in the northern territories.

In partnership with the Canadian Immunity Task Force, Canadian Blood Services is testing samples left over from donations for SARS-Cov-2 antibodies. The objective is to inform public health policy and evaluate the impact on the blood supply. In this first report to the Canadian Immunity Task Force results from testing of blood donor samples collected between May 9 to June 18, 2020 are presented.

## Methods

### Blood donor eligibility

Before each donation blood donors must answer screening questions to ensure that they are in good health and do not have risk factors for infections that may be transmitted to blood recipients. There is no evidence that SARS-Cov-2 can be transmitted through blood transfusion, but it is important to ensure other donors and staff are safe while in the blood clinic. Donors are asked if they have had COVID-19 or been in contact with someone who has. They are deferred from donation for 2 weeks if they have been in contact with someone who was infected, and if they have had the infection deferral is for two weeks after symptoms disappear. Donors also have their temperature checked before they enter the clinic, and their hemoglobin level is checked before they can donate.

### 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, starting on May 9, 2020.

### SARS-Cov-2 antibody testing

All plasma samples were tested using the Abbott Architect SARS-Cov-2 IgG assay (chemiluminescent microparticle immunoassay (CMIA)). This assay was assumed to have 92.7% (90.2-94.8%) sensitivity and 99.9% (99.4 – 100%) specificity (1). Testing was conducted at Canadian Blood Services in Ottawa.

### Data management and analysis

All participant data were de-identified by the information technology team at Canadian Blood Services by providing a random identification number. Demographic variables were extracted from the Canadian Blood Services donor database (e.g. donation date, birth year, sex, Forward Sortation Area of residential postal code) and linked to the test data.. Information about the study was made available on the web-site in late June, prior to commencing testing. Donors were not informed of their results because confirmatory/supplemental testing was not carried out. This study was approved by the Canadian Blood Services Research Ethics committee.

### Data management and analysis

De-identified data were analysed by the Canadian Blood Services Epidemiology & Surveillance Department. 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. In order to make inference to the general population, weighting factors were applied based on the donor's residential Forward Sortation Area (FSA), age group and sex. Data were weighted based on Statistic Canada data (catalogue # 98-400-X2016008). For FSAs with few donors, several FSAs were combined, generally to include at least 500 donors. For data with no FSA recorded or if not in a province where blood is collected (0.21% of samples) weighting was based on FSA of the blood centre.

The seroprevalence was calculated as the number of positive samples divided by all samples tested. Ninety-five percent confidence intervals were calculated based on the binomial distribution (Exact method). The adjusted seroprevalence and confidence intervals present the weighted data adjusted for sensitivity and specificity of the assay using the Rogan-Gladen equation (2). Breakdowns of seroprevalence by province, sex and age groups were prepared, as well as for a selection of cities. Statistical comparisons between groups were carried out using logistic regression.

## Results

As shown in Table 1, of 37,737 samples tested slightly over half were from male donors and are from all age groups although there tend to be more from older age groups. Just over half of donations were from Ontario, the next highest numbers of donations were Alberta and British Columbia. There were somewhat more donations tested from eastern Canada than Canadian Blood Services' usual collections because for logistic reasons samples from eastern Canada were stored starting about two weeks earlier than from the western provinces.

Table 2 shows the seroprevalence rates for all 9 provinces and for all of Canada (except Quebec and territories). The overall adjusted seroprevalence is 0.70%. The weighted percent positive was greater in females ( $p < 0.05$ ) but there were no significant differences between age groups (Figure 1).

Table 3 compares seroprevalence by province (See also Figure 2). The highest adjusted rate was in Ontario at 0.96% and the lowest in Newfoundland and Prince Edward Island. However, the numbers of samples in some provinces are small, hence wide confidence intervals. Using a logistic model with Ontario as the reference Ontario was higher than British Columbia and Alberta ( $p < 0.01$ ).

Table 4 shows the seroprevalence by cities which had sufficient numbers of samples to permit meaningful interpretation. The highest seroprevalence was observed in Ontario cities (Ottawa 1.29%, Toronto 1.07%).

## Conclusion

The seroprevalence of SARS-Cov-2 was low in Canadian blood donors during May 9 to June 18, 2020 (less than 1%). It was slightly higher in Ontario compared with other provinces. There was slightly higher seroprevalence in females compared with males, but no difference between age groups. While the donation selection criteria ensure blood donors are healthy, caution should be exercised in extrapolating findings to all healthy adult Canadians because blood donors self-select to be blood donors, because in some areas access to a donation clinic may be limited and because there are fewer elderly donors.

## Points for Interpretation

1. Blood donors are a healthy sub-set of the adult Canadian population. Important points to keep in mind with regard 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 be more closely reflect the Canadian population. However, weighting of the data had only a modest impact on the seroprevalence estimate. For example, the unweighted seroprevalence for the full sample was 0.73%, and after weighting factors applied it was 0.75%, then after the weighted seroprevalence was adjusted for sensitivity and specificity, 0.70%.
3. The sensitivity and specificity of the Abbott assay were obtained from a report from the United Kingdom. The manufacturer indicates higher sensitivity and a second more recently released report from Denmark indicates it 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. In some rare cases, 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. The adjusted percent positive was statistically higher in females compared with males, but a spurious finding cannot be ruled out with a single sample.
6. In total, 38,638 samples were tested. Of these 901 (2.3 %) were a donation from donors who had been tested more than once during the sampling period. Most of these (98%) were apheresis donations which permit frequent donation. Three of these donations were positive on their first donation; there were no donations negative on their first donation and later positive, and none negative after a positive test. Repeat tested samples were excluded from the present analysis. Analysis is presented for the 37,737 first time tested samples of which most (95.6%) were from whole blood donations.
7. There were 0.21% of donations with an FSA in Quebec, the territories or missing. When compared with these donations excluded, there was no difference.

## References

1. The National SARS-Cov-2 Serologic Assay Evaluation Group. Head-to-head benchmark evaluation of the sensitivity and specificity of five immunoassays for SARS-Cov-2 serology on >1500 samples. Available at: <https://doi.org/10.6084/m9.figshare.12593288.v1>.
2. Lang Z, Reiczigel J. Confidence limits for prevalence of disease adjusted for estimated sensitivity and specificity. Preventive Veterinary Medicine. 2014:113;13-22.

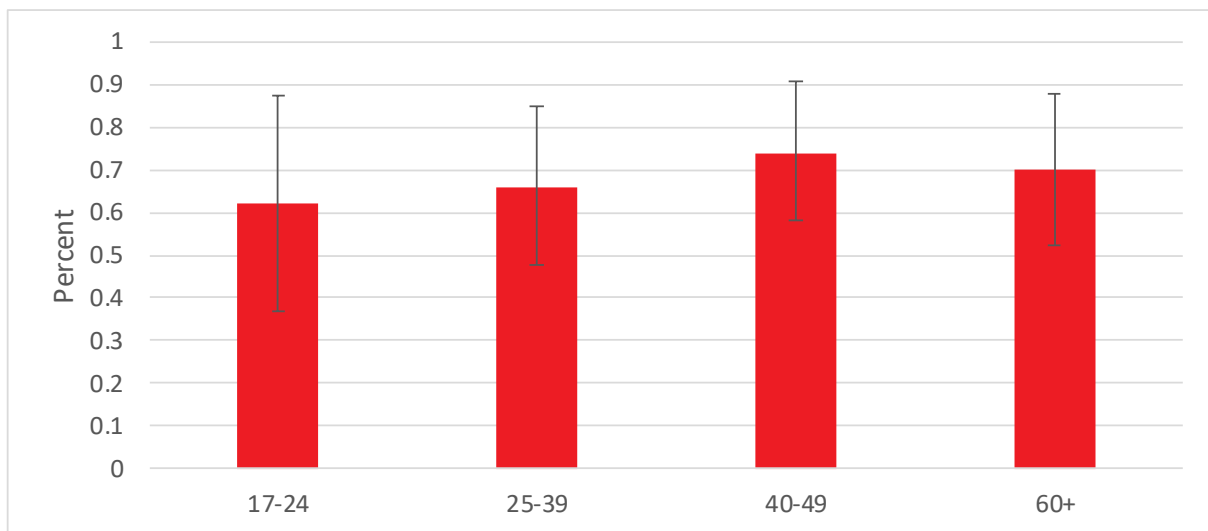
**Table 1.** Number and percentage Canadian Blood Services donor samples tested

	Number Tested	Percentage
<b>Sex</b>		
Female	17,694	46.89
Male	20,043	53.11
<b>Age</b>		
17-24	3,581	9.49
25-39	10,781	28.57
40-59	14,147	37.49
60+	9,228	24.45
<b>Province</b>		
British Columbia	4,962	13.15
Alberta	5,644	14.96
Saskatchewan	1,387	3.68
Manitoba	1,753	4.65
Ontario	19,839	52.57
New Brunswick	1,477	3.91
Nova Scotia	1,610	4.27
Prince Edward Island	448	1.19
Newfoundland	617	1.64
<b>Total</b>	<b>37,737</b>	

**Table 2.** SARS-Cov-2 Seroprevalence by Sex and Age

	Unweighted				Adjusted	
	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	Percent Positive	95% Confidence Interval
<b>Sex</b>						
Female	17,694	144	0.81	0.687, 0.957	0.81	0.667, 0.946
Male	20,043	131	0.65	0.547, 0.775	0.58	0.456, 0.705
<b>Age</b>						
17-24	3,581	30	0.84	0.566, 1.194	0.62	0.367, 0.873
25-39	10,781	76	0.70	0.556, 0.882	0.66	0.479, 0.849
40-59	14,147	103	0.73	0.595, 0.882	0.74	0.580, 0.906
60+	9,228	66	0.72	0.554, 0.909	0.70	0.524, 0.878
<b>Total</b>	<b>37,737</b>	<b>275</b>	<b>0.73</b>	<b>0.645, 0.820</b>	<b>0.70</b>	<b>0.603, 0.790</b>

**Figure 1.** SARS-Cov-2 seroprevalence by age groups



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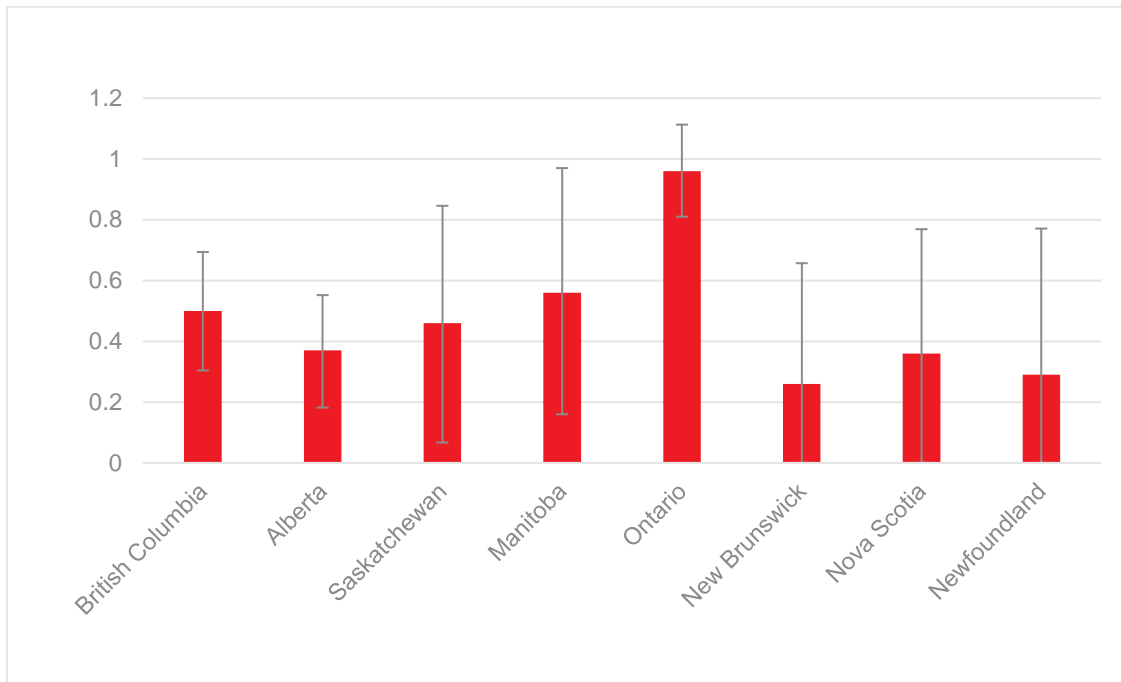


**Table 3.** SARS-Cov-2 seroprevalence by province

	Unweighted				Adjusted	
	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	Percent Positive	95% Confidence Interval
British Columbia	4,962	29	0.58	0.392, 0.838	0.50	0.304, 0.694
Alberta	5,644	24	0.43	0.273, 0.632	0.37	0.182, 0.552
Saskatchewan	1,387	10	0.72	0.346, 1.322	0.46	0.067, 0.846
Manitoba	1,753	9	0.51	0.235, 0.972	0.56	0.160, 0.970
Ontario	19,839	189	0.95	0.822, 1.098	0.96	0.810, 1.113
New Brunswick	1,477	6	0.41	0.149, 0.882	0.26	0.000, 0.657
Nova Scotia	1,610	7	0.43	0.175, 0.894	0.36	0.000, 0.769
Prince Edward Island	448	0				
Newfoundland and Labrador	617	1	0.16	0.004, 0.900	0.29	0.000, 0.771
<b>Total</b>	<b>37,737</b>	<b>275</b>	<b>0.73</b>	<b>0.645, 0.820</b>	<b>0.70</b>	<b>0.603, 0.790</b>

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**Figure 2.** Prevalence by provinces



**Table 4.** SARS-Cov-2 seroprevalence in selected cities

	Unweighted				Adjusted	
	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	Percent Positive	95% Confidence Interval
Vancouver	2,873	20	0.70	0.426, 1.073	0.60	0.328, 0.865
Calgary	2,069	10	0.48	0.232, 0.887	0.43	0.089, 0.772
Edmonton	2,043	8	0.39	0.169, 0.770	0.38	0.057, 0.704
Ottawa	1,975	18	0.91	0.541, 1.437	1.29	0.735, 1.836
Toronto	6,597	71	1.08	0.841, 1.356	1.07	0.827, 1.304

## Appendix - Regional SARS-Cov-2 seroprevalence by sex and age

**Table 1.1.** British Columbia

	Unweighted				Adjusted	
	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	Percent Positive	95% Confidence Interval
<b>Sex</b>						
Female	2,383	12	0.50	0.260, 0.878	0.42	0.166, 0.670
Male	2,579	17	0.66	0.384, 1.053	0.59	0.287, 0.884
<b>Age</b>						
17-24	390	0	-		-	
25-39	1,478	8	0.54	0.234, 1.064	0.53	0.122, 0.945
40-59	1,772	15	0.85	0.475, 1.392	0.83	0.415, 1.238
60+	1,322	6	0.45	0.167, 0.985	0.33	0.033, 0.636
<b>Total</b>	<b>4,962</b>	<b>29</b>	<b>0.58</b>	<b>0.392, 0.838</b>	<b>0.50</b>	<b>0.304, 0.694</b>

**Table 1.2.** Alberta

	Unweighted				Adjusted	
	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	Percent Positive	95% Confidence Interval
<b>Sex</b>						
Female	2,802	14	0.50	0.273, 0.837	0.41	0.140, 0.687
Male	2,842	10	0.35	0.169, 0.646	0.32	0.071, 0.568
<b>Age</b>						
17-24	564	4	0.71	0.194, 1.806	0.48	0.000, 1.054
25-39	1,725	6	0.35	0.128, 0.756	0.33	0.006, 0.658
40-59	2,095	9	0.43	0.197, 0.814	0.41	0.081, 0.734
60+	1,260	5	0.40	0.129, 0.924	0.29	0.000, 0.643
<b>Total</b>	<b>5,644</b>	<b>24</b>	<b>0.43</b>	<b>0.273, 0.632</b>	<b>0.37</b>	<b>0.182, 0.552</b>

**Table 1.3.** Saskatchewan and Manitoba

	Unweighted				Adjusted	
	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	Percent Positive	95% Confidence Interval
<b>Sex</b>						
Female	1,479	9	0.61	0.279, 1.152	0.61	0.183, 1.028
Male	1,661	10	0.60	0.289, 1.104	0.42	0.047, 0.787
<b>Age</b>						
7-24	319	0	-		-	
25-39	878	3	0.34	0.071, 0.995	0.16	0.000, 0.530
40-59	1,163	5	0.43	0.140, 1.000	0.25	0.000, 0.627
60+	780	11	1.41	0.706, 2.509	1.44	0.599, 2.271
<b>Total</b>	<b>3,140</b>	<b>19</b>	<b>0.61</b>	<b>0.365, 0.943</b>	<b>0.51</b>	<b>0.232, 0.795</b>

**Table 1.4.** Ontario

	Unweighted				Adjusted	
	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	Percent Positive	95% Confidence Interval
<b>Sex</b>						
Female	9,119	105	1.15	0.943, 1.392	1.17	0.944, 1.405
Male	10,720	84	0.78	0.626, 0.969	0.73	0.538, 0.925
<b>Age</b>						
17-24	1,956	25	1.28	0.829, 1.881	1.09	0.643, 1.541
25-39	5,604	55	0.98	0.740, 1.276	0.98	0.662, 1.289
40-59	7,511	69	0.92	0.715, 1.161	0.99	0.734, 1.252
60+	4,768	40	0.84	0.600, 1.141	0.85	0.580, 1.120
<b>Total</b>	<b>19,839</b>	<b>189</b>	<b>0.95</b>	<b>0.822, 1.098</b>	<b>0.96</b>	<b>0.810, 1.113</b>

**Table 1.5.** Atlantic Provinces

	Unweighted				Adjusted	
	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	Percent Positive	95% Confidence Interval
<b>Sex</b>						
Female	1,911	4	0.21	0.057, 0.535	0.26	0.000, 0.568
Male	2,241	10	0.45	0.214, 0.819	0.30	0.000, 0.643
<b>Age</b>						
17-24	352	1	0.28	0.007, 1.573	0.08	0.000, 0.558
25-39	1,096	4	0.36	0.100, 0.932	0.31	0.000, 0.835
40-59	1,606	5	0.31	0.101, 0.725	0.12	0.000, 0.412
60+	1,098	4	0.36	0.099, 0.930	0.51	0.000, 1.012
<b>Total</b>	<b>4,152</b>	<b>14</b>	<b>0.34</b>	<b>0.184, 0.565</b>	<b>0.28</b>	<b>0.050, 0.509</b>