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COVID-19 Seroprevalence Report

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March 12th, 2022

Report #17: December 2021 Survey

The advance of Omicron

Summary

December 2021

December 14 - December 30 2021 (n=16,816)

•Humoral Immunity (Based on results from the Spike antibody assay):

- Spike antibody results indicate a SARS-CoV-2 humoral response to vaccination or natural infection. Because people are advised to be vaccinated irrespective of past infection, those with Nucleocapsid and Spike antibody positive results together likely have been infected and may or may not have been vaccinated.
- The (adjusted) proportion of blood donors with humoral immunity for SARS-CoV-2 was 98.58% (95% CI 98.34, 98.82%) (based on results from the Spike antibody assay). This was predominantly driven by vaccination.
- Spike antibody concentrations were high by September, but gradually decreased. A peak in values followed by decline is expected after vaccination. By December, concentrations increased in older age groups likely due to administration of third doses consistent with policies to vaccinate older age groups earlier.

•Natural Infections (Based on results from the Nucleocapsid antibody assay):

- Seroprevalence (natural infection) in December was 6.39% (95% CI 6.01, 6.76), higher than November at 5.08% (95% CI 4.58, 5.50) ($P < 0.001$). There was a gradual increase over the 17 day reporting period from 5.60% (5.03, 6.18) to 6.55% (5.95, 7.15) to 7.51% (6.63, 8.39) consistent with emergence of the Omicron variant.
- Consistent with previous surveys, donors aged 17-24 years old had the highest seroprevalence rate (11.37% (95% CI 9.99, 12.75%)) compared to other age groups.
- Seroprevalence rates remained similar to November in most provinces, however, rates increased in December in Alberta (12.94% (95% CI 11.62, 14.27%), $P < 0.001$) and Ontario (5.43% (95% CI 4.94, 5.92%), $P < 0.001$) compared to November.
- Racialized groups have a higher seroprevalence rate (10.40% (95% CI 9.32, 11.48%)) compared to white donors (5.21% (95% CI 4.81, 5.61%)).
- Among repeat tested donors, new infections in unvaccinated donors have increased since June 1.53% (1.14, 2.00) to 3.93% (3.13, 4.86%) in December but vaccine breakthrough infections are low, 0.71% (0.45, 1.06%).

November 2021

November 13 - November 24 2021 (n=9,018)

•**Humoral Immunity (Based on results from the Spike antibody assay):**

- Spike antibody results indicate a SARS-CoV-2 humoral response to vaccination or natural infection. Because people are advised to be vaccinated irrespective of past infection, those with Nucleocapsid and Spike antibody positive results together likely have been infected and may or may not have been vaccinated.
- The (adjusted) proportion of blood donors with humoral immunity for SARS-CoV-2 was 98.52% (95% CI 98.18, 98.86%), slightly higher than October (based on results from the Spike antibody assay) ($P = 0.039$). This was predominantly driven by vaccination.
- Spike antibody concentrations were very high (>2500 U/mL) by July, but gradually decreasing in almost all age groups as the months progress with the greatest decrease in older age groups. A peak in values followed by decline is expected after vaccination. These results are consistent with policies to vaccinate older age groups earlier.

•**Natural Infections (Based on results from the Nucleocapsid antibody assay):**

- Seroprevalence (natural infection) in November was 5.08% (95% CI 4.58, 5.50), higher than October at 4.26% (95% CI 3.85, 4.68%) ($P = 0.014$).
 - Consistent with previous surveys, donors aged 17-24 years old had the highest seroprevalence rate (9.35% (95% CI 7.62, 11.07%)) compared to other age groups.
 - Racialized groups have a higher seroprevalence rate (8.28% (95% CI 6.82, 9.74%)) compared to white donors (4.56% (95% CI 4.05, 5.07%)).
- Among repeat tested donors, new infections in unvaccinated donors have increased since June 1.53% (1.14, 2.00) to 3.19% (2.42, 4.13) in November but vaccine breakthrough infections are low, 0.6% (0.37, 0.93).

October 2021

October 14 - October 23 2021 (n=9,627)

•Humoral Immunity (Based on results from the Spike antibody assay):

- Spike antibody results indicate a SARS-CoV-2 humoral response to vaccination or natural infection. Because people are advised to be vaccinated irrespective of past infection, those with Nucleocapsid and Spike antibody positive results together likely have been infected and may or may not have been vaccinated.
- The proportion of blood donors with humoral immunity for SARS-CoV-2 was 98.01% (95% CI 97.65, 98.36%), slightly higher than September (based on results from the Spike antibody assay). This was predominantly driven by vaccination.
- Spike antibody concentrations were very high (>2500 AU/mL) by July, but began to decrease in older individuals by September. In October values are still very high but gradually decreasing in all age groups. A peak in values followed by decline is expected after vaccination. These results are consistent with policies to vaccinate older age groups earlier.
- Similar to past reports, donors living in affluent neighbourhoods had higher seroprevalence rates, 99.25% (95% CI 98.72, 99.79%) compared to those living in the most materially deprived neighbourhoods, 97.13% (95% CI 95.64, 98.61%).
- Of 25,100 donors tested on 2 or more occasions since January 2021, the most common (55.2%) test profile was presumed unvaccinated to vaccinated (N negative S negative on their first tested donation and N negative S positive on their last tested donation). There were 15 presumed breakthrough infections (donors who were N negative S positive on their first tested donation and N positive S positive on their last tested donation).

•Natural Infections (Based on results from the Nucleocapsid antibody assay):

- Seroprevalence (natural infection) in October was 4.26% (95% CI 3.85, 4.68%) similar to September, 2021 at 4.38% (95% CI 3.96, 4.81%).
- Consistent with previous surveys, donors aged 17-24 years old had the highest seroprevalence rate (7.50% (95% CI 5.98, 9.01%) compared to other age groups.
- Racialized groups have a higher seroprevalence rate (6.18% (95% CI 4.92, 7.45%)) compared to white donors (3.85% (95% CI 3.40, 4.31%)).

September 2021

September 14 - September 24 2021 (n=9,363)

• **Humoral Immunity (Based on results from the Spike antibody assay):**

- Spike antibody results indicate a SARS-CoV-2 humoral response to vaccination or natural infection. Because people are advised to be vaccinated irrespective of past infection, those with Nucleocapsid and Spike antibody positive results together likely have been infected and may or may not have been vaccinated.
- The proportion of blood donors with humoral immunity for SARS-CoV-2 was 97.03% (95% CI 96.62, 97.44%), slightly higher than August (based on results from the Spike antibody assay). This was predominantly driven by vaccination.
- Spike antibody concentrations were very high (>2500 AU/mL) by July, but are beginning to decrease in older individuals by September. A peak in values followed by decline is expected after vaccination. These results are consistent with policies to vaccinate older age groups earlier.
- Similar to past reports, donors living in affluent neighbourhoods had higher seroprevalence rates, 97.56% (95% CI 96.83, 98.28%) compared to those living in the most materially deprived neighbourhoods, 94.72% (95% CI 92.93, 96.51%).
- Of 21,727 donors tested on 2 or more occasions since January 2021, the most common (54.0%) test profile was presumed unvaccinated to vaccinated (N negative S negative on their first tested donation and N negative S positive on their last tested donation). There were 12 presumed breakthrough infections (donors who were N negative S positive on their first tested donation and N positive S positive on their last tested donation).

• **Natural Infections (Based on results from the Nucleocapsid antibody assay):**

- Seroprevalence (natural infection) in September was 4.38% (95% CI 3.96, 4.81%) similar to August, 2021 at 4.43% (95% CI 3.99, 4.86%).
- Consistent with previous surveys, donors aged 17-24 years old had the highest seroprevalence rate (8.70% (95% CI 7.06, 10.34%)) compared to other age groups. Rates in the 60+ age group increased significantly in September (2.78% (95% CI 2.13, 3.43%)) compared to August (1.61% (95% CI 1.09, 2.12%)) while other age groups did not change.
- Racialized groups have a higher seroprevalence rate (7.61% (95% CI 6.24, 8.97%)) compared to white donors (3.65% (95% CI 3.20, 4.10%)).

August 2021

August 15 - August 26 2021 (n=9,109)

•Humoral Immunity (Based on results from the Spike antibody assay):

- Spike antibody results indicate a SARS-CoV-2 humoral response to vaccination or natural infection. Because people are advised to be vaccinated irrespective of past infection, those with Nucleocapsid and Spike antibody positive results together likely have been infected and may or may not have been vaccinated.
- The proportion of blood donors with humoral immunity for SARS-CoV-2 was 96.09% (95% CI 95.63, 96.54) slightly up from July (based on results from the Spike antibody assay). This was predominantly driven by vaccination.
- Median spike antibody concentrations increased in July compared to previous months ($P < 0.001$) but increased even further in August ($P < 0.001$).
- Similar to past reports, donors living in affluent neighbourhoods had higher seroprevalence rates, 98.25% (95% CI 97.56, 98.95%) compared to those living in the most materially deprived neighbourhoods, 93.41% (95% CI 91.45, 95.37%).
- Of 17,762 donors tested on 2 or more occasions since January 2021, the most common (52.9%) test profile was presumed unvaccinated to vaccinated (N negative S negative on their first tested donation and N negative S positive on their last tested donation). There were 11 presumed breakthrough infections (donors who were N negative S positive on their first tested donation and N positive S positive on their last tested donation).

•Natural Infections (Based on results from the Nucleocapsid antibody assay):

- Seroprevalence (natural infection) in August was 4.43% (95% CI 3.99, 4.86%) similar to July, 2021 at 4.08% (95% CI 3.65, 4.51%).
- Consistent with previous surveys, donors aged 17-24 years old had the highest seroprevalence rate (8.44% (95% CI 6.80, 10.09%)) compared to other age groups. Rates in this age group were highest in Manitoba at 24.95% (95% CI 13.53, 36.37%).
- Racialized groups have a higher seroprevalence rate (11.14% (95% CI 9.14, 13.15%)) compared to white donors (3.30% (95% CI 2.86, 3.74%)). Natural infection rates in racialized donors also increased significantly compared to July. Compared to previous reports, the gap between those in materially deprived vs. affluent neighbourhoods has begun to widen likely due to the 4th wave, 7.85% (95% CI 5.87, 9.83%) vs 3.27% (95% CI 2.52, 4.02%).

July 2021

July 14 - July 23 2021 (n=8,457)

•**Humoral Immunity (Based on results from the Spike antibody assay):**

- Spike antibody results indicate a SARS-CoV-2 humoral response to vaccination or natural infection. Because people are advised to be vaccinated irrespective of past infection, those with Nucleocapsid and Spike antibody positive results together likely have been infected and may or may not have been vaccinated.
- The proportion of blood donors with humoral immunity for SARS-CoV-2 was 94.69% (95% CI 94.16, 95.22) a significant increase from June (based on results from the Spike antibody assay). This was predominantly driven by vaccination.
- Median Spike antibody concentrations increased in June compared to previous months ($P < 0.001$) but increased more in July ($P < 0.001$).
- The seroprevalence of white donors (95.04% (95% CI 94.44, 95.64%)) was not different from racialized groups (93.82% (95% CI 92.48, 95.15%)), this gap has closed compared to earlier surveys. Similar to past reports, donors living in affluent neighbourhoods had higher seroprevalence rates, 96.72% (95% CI 95.82, 97.61%) compared to those living in the most materially deprived neighbourhoods, 92.94% (95% CI 90.89, 95.00%).
- Of 14, 201 donors tested on 2 or more occasions since January 2021 the most common (51.2%) test profile was N negative S negative on their first tested donation and N negative S positive on their last tested donation, most likely due to vaccination. There were 5 donors who were N negative S positive on their first tested donation and N positive S positive on their last tested donation, potentially breakthrough infections.

•**Natural Infections (Based on results from the Nucleocapsid antibody assay):**

- Seroprevalence (natural infection) in July was 4.08% (95% CI 3.65, 4.51%), decreased from June, 2021.
- Natural seroprevalence in most provinces except Alberta plateaued, likely due to widescale vaccination and social restrictions.
- Consistent with previous surveys, donors aged 17-24 years old had the highest seroprevalence rate (6.71% (95% CI 5.17, 8.25%)) compared to other age groups, however, this number has decreased since June, 2021.
 - Rates in this age group were highest in Alberta at 11.88% (95% CI 6.80, 16.97%) and British Columbia at 9.91% (95% CI 5.44, 14.37%). Since June, 2021 these rates have decreased or stayed very similar in almost every province with the exception of British Columbia where they have increased.
- Racialized groups had a higher seroprevalence rate (7.29% (95% CI 5.95, 8.63%)) compared to white donors (3.33% (95% CI 2.87, 3.78%)). Compared to previous reports, the gap between those in materially deprived vs. affluent neighbourhoods is closing, 4.62% (95% CI 3.03, 6.22%) vs 3.87% (95% CI 3.02, 4.71%). However, those living in more socially deprived settings (had lower social contact) had lower seroprevalence rates compared to those that were least deprived, 3.35% (95% CI 2.39, 4.30%) vs. 5.63% (95% CI 4.47, 6.80%).

June 2021

June 14 - June 29 2021 (n=16,884)

•**Humoral Immunity (Based on results from the Roche S assay):**

- Roche S results indicate a SARS-CoV-2 humoral response to vaccination or natural infection. Because people are advised to be vaccinated irrespective of past infection, those with Roche N and S positive results together likely have been infected and may or may not have been vaccinated.
- The proportion of blood donors with humoral immunity for SARS-CoV-2 was 90.78% (95% CI 90.32, 91.25) a significant increase from May (based on results from the Roche S assay). This was predominantly driven by vaccination.
- The proportion of blood donors with presumed vaccine-induced humoral immunity to SARS-CoV-2 was 86.05% (95% CI 85.50, 86.59%), a significant increase from May (based on results from the Roche S-only assay).
- White donors did not have different seroprevalence rates (Roche S, primarily vaccine-induced) (90.81% (95% CI 90.25, 91.35%)) compared to other racialized groups (91.37% (95% CI 90.27, 92.47%)), this gap has closed compared to previous surveys. However, white donors had higher seroprevalence rates (Roche S-only, presumed vaccine induced) (86.87% (95% CI 86.26, 87.49%)), compared to other racialized groups (83.14% (95% CI 81.72, 84.56%)) with a decreased difference between these two groups compared to May. Similarly, donors living in affluent neighbourhoods had higher seroprevalence rates (Roche S, primarily vaccine-induced), 93.68% (95% CI 92.90, 94.46%) compared to those living in the most materially deprived neighbourhoods, 88.33% (95% CI 86.60, 90.06%).

•**Natural Infections (Based on results from the Roche N assay):**

- Seroprevalence (natural infection) in June was 4.5% (95% CI 4.19, 4.83%), increased from May, 2021.
- Natural infections in most provinces except Alberta plateaued, likely due to widescale vaccination.
- Consistent with previous surveys, donors aged 17-24 years old had the highest seroprevalence rate (9.3% (95% CI 8.04, 10.57%)) compared to other age groups.
 - Rates in this age group were highest in Alberta at 17.53% (95% CI 13.23, 21.82%), Saskatchewan at 14.26% (95% CI 6.66, 21.87%), and Manitoba at 15.56% (95% CI 8.46, 22.65%).
- Racialized groups had a higher seroprevalence rate (7.95% (95% CI 6.95, 8.95%)) compared to white donors (3.72% (95% CI 3.38, 4.06%)). Those living in materially deprived vs. affluent neighbourhoods had a higher rate of natural infections, 6.95% (95% CI 5.62, 8.27%) vs 4.26% (95% CI 3.66, 4.87%).

May 2021

May 22 -June 4 2021 (n=17,001)

- The proportion of blood donors with humoral immunity for SARS-CoV-2 was 63.9% (95% CI 63.2, 64.6) a significant increase from April (based on results from the Roche S assay). This was predominantly driven by vaccination.

- **Vaccine-Induced Humoral Immunity (Reactive to Roche S-only):**

- The proportion of blood donors with vaccine-induced humoral immunity to SARS-CoV-2 was 59.8% (95% 59.1, 60.6), a significant increase from April.
- White donors had higher seroprevalence rates (vaccine-induced) (61.8% (95% CI 60.9, 62.7) compared to other racialized groups (48.9% (95% CI 47.1, 50.7%). Similarly, donors living in affluent neighbourhoods also had higher seroprevalence rates 64.8% (95% CI 63.4, 66.2%) compared to those living in the most materially deprived neighbourhoods, 56.6% (95% CI 54.0, 59.1%).

- **Natural Infections (Based on results from the Roche N assay):**

- Seroprevalence (natural infection) in May was 4.0% (95% CI 3.7, 4.3), increased from April, 2021.
- Natural infections in most provinces except Ontario and Alberta plateaued, likely due to widescale vaccination.
- Consistent with previous surveys donors aged 17-24 years old had the highest seroprevalence rate (7.0% (95% CI 5.9, 8.1)) compared to other age groups.
 - Rates in this age group were highest in Alberta 12.7% (95% CI 9.0, 16.4) and Manitoba 11.3% (95% CI 5.2, 17.4).
- Racialized groups had a higher seroprevalence rate (7.4% (95% CI 6.5, 8.3)) compared to white donors (3.3% (95% CI 2.9, 3.6)). Those living in materially deprived vs. affluent neighbourhoods had a higher rate of natural infections 5.7% (95% CI 4.5, 6.8) vs 3.1% (95% CI 2.6, 3.6).

April 2021

April 13-April 30 2021 (n=16,931)

- The proportion of blood donors with humoral immunity to SARS-CoV-2 was 26.9% (95% CI 26.2, 27.6) a significant increase from March (based on results from the Roche S assay). This was predominantly driven by vaccination.

- **Vaccine-Induced Humoral Immunity (Reactive to Roche S-only):**

- The proportion of blood donors with vaccine-induced humoral immunity to SARS-CoV-2 was 23.6% (95% 23.0, 24.3), a significant increase from March.
- Vaccine inequity emerged in April 2021.
- White donors had higher seroprevalence rates (vaccine-induced) (25.0% (95% CI 24.3, 25.8) compared to other racialized groups (17.9% (95% CI 16.5, 19.3%). Similarly, donors living in affluent neighbourhoods also had higher seroprevalence rates 26.9% (95% CI 25.6, 28.2%) compared to those living in the most materially deprived neighbourhoods, 20.9% (95% CI 18.8, 23.0%).

- **Natural Infections (Based on results from the Roche N assay):**

- Seroprevalence (natural infection) in April was 3.2% (95% CI 3.0, 3.5), similar to March 2021.
- Natural infections in most provinces except Ontario decreased or plateaued, likely due to widescale vaccination.
- Consistent with previous surveys donors aged 17-24 years old had the highest seroprevalence rate (5.4% (95% CI 4.4, 6.3)) compared to other age groups.
- Rates in this age group were significantly higher in Alberta 8.9% (95% CI 5.7, 12.0) and Manitoba 15.0% (95% CI 7.9, 22.0) compared to the full sample.
- Racialized groups had a higher seroprevalence rate (5.3% (95% CI 4.4, 6.1)) compared to white donors (2.8 (95% CI 2.5, 3.1)). Those living in materially deprived vs. affluent neighbourhoods had a higher rate of natural infections 4.6% (95% CI 3.5, 5.7) vs 2.7% (95% CI 2.2, 3.2).

March 2021

February 27-March 13, 2021 (n=16,873)

- Serological testing using the Roche nucleocapsid (N) and the Roche spike (S) total antibody assays allows us to monitor trends in natural infection transmission and vaccine-induced seropositivity.
- Overall, as of March 2021 adjusted seroprevalence by the Roche S assay (proxy for humoral immunity, vaccine or natural infection immunity) was 9.9% (95% CI 9.4, 10.3). The fraction of the population naturally exposed as opposed to developing immunity post-vaccination varied across Canada.
- Adjusted seroprevalence by the Roche S assay alone (N negative, proxy for vaccine-induced immunity) was 6.8% (95% 6.4, 7.16) a significant increase from January.
- Using self-reported vaccine history the Roche S assay alone had a sensitivity of 96.1% to identify vaccination (after 2 weeks)
- Despite broader access to COVID-19 vaccines, seroprevalence by the Roche N assay (proxy for natural infections) continued to increase from January (2.2% (95% 2.1, 2.4) to March (3.3% (95% CI 3.0, 3.5))
- Consistent with previous surveys, donors aged 17-24 years old demonstrated the highest seroprevalence rate (natural infection immunity) 6.37% (5.31, 7.44) compared to other age groups. Rates in this age group were significantly higher in Alberta 14.7% (95% CI 10.8, 18.6) and Manitoba 20.8% (95% CI 12.3, 28.0) than for the full sample.
- The disparities in natural infection immunity seroprevalence rates between racialized groups and white donors and those living in materially deprived vs. affluent neighbourhoods narrowed for the first time since November 2020 when disparities began to widen.

January 2021 (Roche)

January 1-27, 2021 (n=33,400 Roche)

- In order to evaluate seroprevalence in the vaccine era, residual blood is now tested using the Roche Elecsys® Anti-SARS-CoV-2 Spike (S) (semi-quantitative) and N (qualitative) assays. All vaccines will produce antibodies to S but not N, and natural infection will usually produce antibodies to S and N.
- In January 2021, seroprevalence estimates were higher by the Roche S assay (2.78% (95% CI 2.58, 2.97%) compared to either nucleocapsid assays. Seroprevalence by the Roche N assay was 2.24% (95% CI 2.08, 2.41) comparable to the Abbott N (1.99% (95% CI 1.84, 2.15)).
- **New:** 511 (1.5%) of donors self-reported vaccination against COVID-19 in the last 3 months in January 2021.

January 2021

January 1-27, 2021 (n=34,921)

- Seroprevalence in January was 1.99% (95% CI 1.84, 2.15)
- Across Canada seroprevalence remained the highest in Manitoba (3.92% (95% CI 2.92, 4.93)) and lowest in PEI (0%)
- Seroprevalence increased significantly in Ontario (1.16% vs 1.82%) and in Alberta (2.12% to 3.41%) from December 2020 until January 2021
- Consistent with previous surveys, donors aged 17-24 years old the highest seroprevalence rate (3.45% (95% CI 2.87, 4.02)).
- Disparities by socioeconomic status and racialized groups widened. Donors living in the most materially deprived neighbourhoods were nearly 4-times more likely to be positive than those living in affluent neighbourhoods (4.04% compared with 1.17%) . Racialized groups of donors were two time more likely to be positive than self identified white donors (3.37% compared to 1.66%)
- Detailed comparison with the previous survey (December 2020) is included.

December 2020

December 10-23, 2020 (n=16,961)

- Seroprevalence in December was 1.37% (95% CI 1.18, 1.56)
- Regional variation: Across Canada seroprevalence remained the highest in Manitoba (3.02% (95% CI 1.75, 4.29)) however this was a significant decrease from the last report.
- Donors aged 17-24 years old remained the age group with the highest seroprevalence (2.75% (95% CI 2.01, 3.49))
- Disparities by socioeconomic status widened, donors living in the most materially deprived neighbourhoods were 3-times more likely to be positive than those living in affluent neighbourhoods (2.2% compared with 0.72%)
- **New:** Longitudinal data on repeat donors illustrating waning S/co ratios over time

November 2020

November 7-25, 2020 (n=17,049)

- Seroprevalence in November was 1.51% (95% CI 1.31, 1.71)
- Regional variation: Seroprevalence increased mostly in Western Canada. Highest rates were observed in the Prairies; Manitoba's rate increased to 8.56% (95% CI 6.51, 10.62) and Saskatchewan's rate increased to 4.2% (95% CI 2.3, 5.8). There was a slight decrease in Ontario to 0.77% (95% CI 0.56, 0.97%) and PEI remained at 0.
- Donors aged 17-24 years old had the highest seroprevalence rates 2.97% (95% CI 2.20, 3.37%) while donors 40-59 years old 1.09% (95% CI 0.80, 1.38%) had the lowest rates.
- New: Revised time series (Additional data from the correlates of immunity study from April until Aug 31, 2020 are included in this report)
- Comparison of Wave 1 (May-July) to November 2020

October 2020

October 12-31, 2020 (n=16,811)

- Seroprevalence increased significantly in October to 0.88% (95% CI 0.73, 1.04) (p=0.04).
- Regional variation: Manitoba's seroprevalence rate increased to 2.96% (95% CI 1.70, 4.23), the highest in Canada. Ontario remained stable at 0.87% (0.65, 1.08)
- New: Heat maps to illustrate inter-provincial variation (by economic regions)
- Disparities widen: Donors that self-identified as white (0.75%; 95% CI 0.61, 0.92) had significantly lower seroprevalence compared to other racialized groups (1.82%; 95% CI 1.21, 2.62)

Wave 1

May 9, 2020- July 21, 2020 (n=74,642)

- Seroprevalence was estimated at 0.70% (95% CI 0.63, 0.77)
- Regional variation: Ontario, 0.88% (95% CI 0.78, 0.99) had the highest seroprevalence, very low seroprevalence in Atlantic provinces.
- Disparities: Donors that self-identified as white (0.66%; 95% CI 0.59, 0.74) had lower seroprevalence compared to racialized groups (1.09%; 95% CI 0.84, 1.34)

Introduction

SARS-CoV-2 is responsible for the respiratory illness, coronavirus infection disease 2019 (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. Early in the pandemic (by late March 2020) strict physical distancing measures were implemented. As a result, the first wave of the epidemic in Canada peaked by the end of April 2020 and plateaued during the summer. A resurgence of cases began in late September 2020, peaking in January 2021 (the second wave). This was followed by a third wave that emerged in many regions across Canada in March 2021, which then subsided in late April. A fourth wave of this epidemic began in early August 2021 and subsided by the end of October. Finally, in mid-December 2021, a fifth wave began. As of December 30, 2021, 2,188,409 cases of COVID-19 had been reported in Canada.

Beginning in January 2021, the dominant variant of concern (VOC) in Canada was Alpha (B.1.1.7). Alpha remained the dominant VOC in the Canadian population until late June 2021 when Delta (B.1.617.2) became dominant. Beginning in mid-December 2021, a new more contagious VOC named Omicron (B.1.1.529) has become the most dominant VOC in the Canadian population. By late December 2021 public health testing facilities were overwhelmed and restrictions on testing were implemented in many jurisdictions. Because many people with symptoms were not being tested, as well as those infected but without symptoms, the reported cases underestimate the infection rate. Surveillance studies that monitor SARS-CoV-2 antibodies are important to understand what proportion of the population have detectable antibodies (the seroprevalence) and to monitor trajectories over the course of the pandemic. This information improves mathematical models to predict the course of infection and can inform public health policies.

Antibody concentrations typically peak within a month of vaccination and then gradually decrease. Antibody concentrations can be much higher after a second or third dose of vaccine, or when an infection occurs pre- or post-vaccination. More than 86% of the eligible population had received two doses as of November 20, 2021. Starting in November 2021, some Canadians became eligible for a third dose. Monitoring spike (vaccine) antibody concentrations and the proportion of people with omicron variant infection provides data for mathematical models to estimate the status of humoral immunity.

In partnership with the COVID-19 Immunity Task Force, Canadian Blood Services is testing residual blood for SARS-CoV-2 antibodies from blood donors. This report tracks SARS-CoV-2 seroprevalence distinguishing natural and likely vaccine induced humoral immunity. We present seroprevalence rates based on two Roche total Ig- assays that detect Spike (S) and Nucleocapsid (N) antibodies and monitor the concentration of S antibodies. We assess temporal changes and evaluate differences by geographical regions, age groups, racialized groups, and socioeconomic status.

Methods

Population

Canadian Blood Services has blood collection sites in all large cities and many smaller urban centres in all provinces except Quebec. People in rural areas may have less opportunity to donate and donations are not collected in the northern territories. Blood donors are reasonably representative of healthy Canadians between the ages of 17 and about 60.

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. Donors are deferred if they have been in contact with someone who was infected or if they have had the infection for 2 weeks after symptoms disappear (3 weeks if hospitalized). 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 screening. An extra sample is taken, known as the retention sample, in case extra testing is required (80% of these retention samples are not needed for operational testing). For this study retention samples were aliquoted and frozen at -20°C or colder, starting on May 9, 2020.

Periodicity

All retention samples were tested for SARS-CoV-2 antibodies until July 21, 2020 (Wave 1). From August 2020 until December 2020, only samples from approximately the last two weeks of each month were tested (except samples from August and September which were stored but not tested). In January 2021 a larger sample was tested, in February samples were stored but not tested. As of March, testing of approximately 2 weeks per month resumed. Beginning in July 2021 the sample size was reduced to include about 300 samples per age/region grouping plus extra repeat tested donors. In December samples from 2 weeks were tested without sorting in order to be able to report more quickly. Seroprevalence estimates also include an additional 1,500 residual blood tests from the correlates of immunity study from April 2020 to January 2021. These were tested on a battery of assays (orthogonal testing) including the Abbott IgG Assay which is reported until January 2021.

		2020											
		March	April	May	June	July	August	September	October	November	December		
Seroprevalence ¹				14,541	51,963	21,594	17,000	17,000	16,811	17,049	16,961		
Correlates of Immunity Study ²													
		2021											
		January	February	March	April	May	June	July	August	September	October	November	December
Seroprevalence ¹		34,921	16,873	16,931	17,001	16,884	8,457	9,109	9,363	9,627	9,018	16,816	
Correlates of Immunity Study ²													

¹ Samples tested with the **Abbott SARS-CoV-2 IgG Assay until January 2021** (residual blood from August 2020, September 2020 and February 2021 are aliquoted but have not been tested). As of January 2021, all samples were tested using the Roche Elecsys® Anti-SARS-CoV-2 assays (S and N).

² Orthogonal Testing (PI: S. Drews (CIHR 2020) sampling 1,500 samples per month until and including January 2021 (Abbott tested); this study is known as the “Correlates of Immunity Study”

SARS-CoV-2 antibody testing

Two assays were used. The Roche Elecsys® Anti-SARS-CoV-2 spike semi-quantitative immunoassay detects total antibodies (including IgA, IgM and IgG) to the SARS-CoV-2 spike (S) protein (**Spike antibody**). The Elecsys® Anti-SARS-CoV-2 qualitative immunoassay detects total antibodies (including IgA, IgM and IgG) to SARS-CoV-2 using a recombinant protein, nucleocapsid (N) antigen (**Nucleocapsid antibody**). At a concentration of ≥ 0.8 U/mL, the Spike antibody assay was assumed to have sensitivity of 98.8% and specificity of 99.6%. At a concentration of ≥ 1.0 U/mL, the Nucleocapsid antibody assay was assumed to have sensitivity of 99.5% and specificity of 99.8%¹. All testing was conducted at Canadian Blood Services laboratories in Ottawa.

Samples from January to August were tested neat and at a 1:10 dilution for Spike antibody, however, by June many samples were above the maximum detection level when diluted. From September onwards samples were tested up to a 1:400 dilution.

Serological testing using the Nucleocapsid, and Spike antibody assay allows trends in natural infection transmission and vaccine-induced seropositivity to be monitored². In this report the dual terms Spike antibody/ humoral immunity (by vaccine or natural infection) and Nucleocapsid antibody/ proxy for natural infection will be used interchangeably. This is to ease interpretation for readers, with the caveat that these interpretations do not reflect the complexity of adaptive immunity.

Ethical issues

All data were de-identified by the information technology team at Canadian Blood Services by providing a random identification number. Demographic variables and vaccination history were extracted from the Canadian Blood Services donor database (e.g., donation date, birth year, sex, racialized groups, Forward Sortation Area of residential postal code) and linked to the test data. In the donor pamphlet “What you must know to donate blood” which donors must read before each donation, and in the pamphlet entitled “What happens to your blood donation?”

donors were informed that their blood will be tested for routine infectious disease markers and other tests as required. Information about the study was made available on the website in late June 2020 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 Board.

Data management and analysis

De-identified demographic data were analysed by the Canadian Blood Services Epidemiology & Surveillance Department. Socioeconomic status was estimated by quintiles 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 (DA) level (the smallest geographic unit available in the Canadian census, consisting of 400–700 persons). 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), age group and sex. Data were weighted based on Statistics 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 (0.2% 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 Exact method. The adjusted seroprevalence and confidence intervals present the weighted data adjusted for sensitivity and specificity of the assay using the Rogan-Gladen equation³. SARS-CoV-2 seroprevalence was stratified by geography (regions, province and selected metropolitan cities), sex, age groups, self-reported ethnicity, and social and material deprivation indices.

Temporal trends by monthly intervals were evaluated by demographic variables. Statistical comparisons between groups were carried out using logistic regression.

Beginning in November some donors would be receiving their third dose of vaccine. Concentration of spike antibody relative to time since most recent vaccination beginning in November 2021 was evaluated using the donor history questionnaire asking about vaccination in last 3 months for which the date of last vaccination is sometimes recorded.

Donors who donated more than once since testing began with the Roche assay in January 2021 and whose samples were selected for seroprevalence testing (at least two samples tested per donor) were included in a separate dataset for analysis and are referred to as “repeat donors”. At monthly intervals, beginning with June 2021, donations from repeat donors were evaluated for potential incident infections. If a donor was S positive and N negative on their previous donation (presumed vaccinated) before the month being observed and then was S positive N positive on their following donation in the corresponding month (eg. June), this was considered a potential incident breakthrough infection. Percent incidence for each month was calculated by dividing the number of new incident infections (S positive N positive) in that month by the total

number of donors who tested S positive N negative on their previous donation prior to the corresponding month. This same approach was used to evaluate incident cases among donors who were S negative and N negative (presumed unvaccinated) on their previous donation who then were S positive N positive on their following donation in the corresponding month.

Results

Between December 14 and December 30, 2021, a total of 16,816 unique donors were tested for SARS-CoV-2 antibodies.

Table 1 compares adjusted seroprevalence rates by different assays (**Nucleocapsid and Spike antibody**) by sociodemographic variables for all Canadian provinces (except Quebec and territories). Overall adjusted seroprevalence by Spike antibody (a proxy of humoral immunity) was 98.58% (95% CI 98.34, 98.82%). The adjusted seroprevalence by Nucleocapsid antibody (proxy for natural infection) was 6.39% (95% CI 6.01, 6.76%) (please refer to points of interpretation). There was a gradual increase over the 17-day reporting period from 5.60% (5.03, 6.18) to 6.55% (5.95, 7.15) to 7.51% (6.63, 8.39) consistent with the emergence of the Omicron variant.

Figure 1 illustrates temporal trends of SARS-CoV-2 seroprevalence from April 4, 2020, until November 24, 2021, by monthly intervals. The discontinuation of the line in January 2021 represents the transition from the Abbott assay to the Roche assay. The largest increase in seroprevalence was seen in the Roche S assay, from early-March onwards, mirroring wider vaccine roll out. Figure 2 (A-E) stratifies seroprevalence by regions. Most of the humoral immunity was induced by vaccines (compared to natural infections) across the country. Appendix Tables A1.1-A1.6 compare seroprevalence rates by sex, age groups and material deprivation in different regions.

Table 2A compares temporal changes in seroprevalence rates by natural infection (**Nucleocapsid antibody** between November and December 2021). Overall, the seroprevalence rate for natural infections was higher in December 6.39% (95% CI 6.01, 6.76%) compared to November 5.04% (95% CI 4.58, 5.50%) ($P < 0.001$), and natural infections remained similar to the previous month across most provinces with increases in Alberta (12.94% (95% CI 11.62, 14.27%) and Ontario (5.43% (95% CI 4.94, 5.92%)) compared to November. Donors aged 17-24 years old continued to have the highest seroprevalence rate at 11.37% (95% CI 9.99, 12.75%) compared to other age groups.

Table 2B illustrates increases in seroprevalence by **Spike antibody** (proxy for humoral immunity), in many sociodemographic variables between November and December. In December, nearly all sociodemographic groups had at least 98% seroprevalence.

After vaccination an increase in antibody concentration followed by gradual decline is expected. From September to December dilution of high concentration spike antibody samples permitted measurement of antibody concentrations as high as 100,000 U/mL. Figure 3 illustrates distributions of log transformed S antibody concentrations by age group from September to December. There were 3,616 donors who reported vaccination in either November or December

2021. Note that there may be others for whom vaccination date was not recorded. Figure 4 shows S concentration increasing by time since vaccination for those who reported that they received a vaccine dose in November 2021 or later.

From June to October 2021 the percentage of incident breakthrough infections varied by month with no clear trend (See Table 3). Breakthrough infections were rare. By December 2021 there were 0.71% (0.45, 1.06) of donors who were S and N positive but S positive N negative on their previous donation. Table 4 shows the percentage of incident cases by month in likely unvaccinated donors. Since June the percentage has slowly increased to 3.93% (3.13, 4.86) in December.

Figures 5A-H illustrate temporal trends of seroprevalence by Nucleocapsid and Spike antibody results by sociodemographic variables (ethnicity, age, material deprivation, and social deprivation) from January to December 2021. Differences in natural infections between white and racialized groups were seen from January to December 2021 with racialized groups having higher natural infection rates. Other sociodemographic variables had significant differences at various months corresponding to the vaccine roll out across Canada with evident trends in certain groups having increased Spike and/or Nucleocapsid antibodies compared to others.

Conclusion

Widescale COVID-19 vaccine rollouts are evident by high seroprevalence rates across Canada. Overall, as of December 2021, adjusted seroprevalence by the Spike antibody assay (proxy for humoral immunity) was 98.58% (95% CI 98.34, 98.82%). While humoral immunity was largely driven by vaccination, the fraction of the population naturally exposed varied across Canada. Among repeat tested donors, new infections in unvaccinated donors have increased since June but vaccine breakthrough infections are low.

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 more closely reflect the Canadian population. For example, the Nucleocapsid antibody assay unweighted SARS-CoV-2 seroprevalence for the full sample was 7.09% (95% CI 6.71, 7.49), and after weighting

factors applied it was 6.54% (95% CI 6.17, 6.93), then after the weighted seroprevalence was adjusted for sensitivity and specificity, 6.39% (95% CI 6.01, 6.76). Using the Spike antibody assay, the unweighted SARS-CoV-2 seroprevalence for the full sample was 97.30% (95% CI 97.04, 97.54), and after weighting factors applied it was 97.41% (95% CI 97.16, 97.65%), then after the weighted seroprevalence was adjusted for sensitivity and specificity, 98.58% (95% CI 98.34, 98.82%).

3. The sensitivity and specificity of the Roche assays 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.
4. Different seroprevalence rates by the assays reflect different isotypes being measured. The Roche assay identifies IgA, IgG and IgM antibodies. The Abbott assay measured IgG. Detection of Nucleocapsid antibodies is likely a marker of natural infection while Spike antibodies can be induced by either natural infection or by vaccines.
5. Seroprevalence results reflect measurement of humoral immunity. The exact mechanisms of protective immunity against SARS-CoV-2 remains unknown. The protection at particular levels of Spike antibody is unknown. Quantitative results from the Spike antibody assay will be valuable to inform policy regarding booster shots as the science evolves.
6. As of September 2021, the dilution for higher concentration (>250 U/mL) was increased from 1:10 to 1:400. This allows antibody concentration to be measured as high as 100,000 U/mL rather than 2,500 U/mL. It is possible that values between 250 and 320 U/mL may be less accurate because they are at the lower end of sensitivity of the assay.
7. SARS-CoV-2 antibody signals wane over time.
8. Spike antibodies reflect SARS-CoV-2 humoral response. Most Spike antibody positive results are related to vaccination. However, some Spike antibody positives may be due to natural infection (with or without N antibodies). Donors with both Spike and Nucleocapsid antibodies are assumed to have had a natural infection; however, they may have also been vaccinated before or after the infection.

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). In December the most common positive antibody profile was positive on Spike antibody and negative on Nucleocapsid antibody (see below).

Diagnostic phenotypes in December 2021 (unadjusted)

	Nucleocapsid Antibody	Spike Antibody	Total N (%)
	Negative	Negative	454 (2.7%)
	Negative	Positive	15,170 (90.2%)
	Positive	Negative	0 (0.0%)
	Positive	Positive	1,192 (7.1%)
Total			16,816

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Table 1. Comparing SARS-CoV-2 seroprevalence by sociodemographic variables by Nucleocapsid and Spike antibody results in December 2021

	Nucleocapsid Antibody Results (proxy for natural infection)				Spike Antibody Results (proxy for humoral immunity by either natural infection or vaccination)			
	Crude		Adjusted		Crude		Adjusted	
	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	Number Tested	Number Positive	Percent Positive	95% Confidence Interval
Sex								
Female	6,997	484	5.91	5.41, 6.42	6,997	6,812	98.58	98.24, 98.92
Male	9,819	708	6.89	6.33, 7.45	9,819	9,550	98.58	98.23, 98.93
Age								
17-24	1,576	204	11.37	9.99, 12.75	1,576	1,551	99.54	98.99, 100.00
25-39	4,418	383	8.04	7.20, 8.88	4,418	4,289	98.21	97.68, 98.74
40-59	6,520	425	5.72	5.11, 6.33	6,520	6,333	98.44	98.01, 98.86
60+	4,302	180	3.58	3.04, 4.13	4,302	4,189	98.66	98.20, 99.11
Province								
British Columbia	3,390	208	5.83	4.98, 6.69	3,390	3,314	98.99	98.46, 99.52
Alberta	3,455	450	12.94	11.62, 14.27	3,455	3,334	97.79	97.07, 98.50
Saskatchewan	882	64	7.00	5.03, 8.98	882	860	99.05	97.94, 100.00
Manitoba	807	61	8.18	6.21, 10.14	807	780	97.77	96.47, 99.06
Ontario	7,178	402	5.43	4.94, 5.92	7,178	6,988	98.49	98.14, 98.84
New Brunswick	185	2	0.45	0.00, 1.22	185	181	99.49	98.25, 100.00
Nova Scotia	649	3	0.25	0.00, 0.79	649	638	99.69	98.69, 100.00
Prince Edward Island	134	0	.	.	134	132	99.91	97.55, 100.00
Newfoundland	136	2	0.96	0.00, 2.12	136	135	100.00	98.95, 100.00
Metro area								
Vancouver	1,821	133	7.20	5.90, 8.50	1,821	1,794	99.70	99.09, 100.00
Calgary	1,203	112	9.12	7.17, 11.06	1,203	1,171	98.70	97.65, 99.75
Edmonton	984	74	7.59	5.60, 9.58	984	960	98.98	97.88, 100.00

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Ottawa	521	11	2.27	1.08, 3.46	521	512	99.20	98.12, 100.00
Toronto	2,891	234	7.78	6.90, 8.67	2,891	2,830	98.87	98.37, 99.37
Winnipeg	535	32	6.34	4.19, 8.50	535	526	99.68	98.60, 100.00
Ethnicity^{1,2}								
White	12432	751	5.21	4.81, 5.61	12,432	12,102	98.65	98.37, 98.93
Indigenous	196	12	4.84	1.79, 7.89	196	184	94.95	91.55, 98.35
Asian	931	59	6.81	5.15, 8.47	931	920	99.86	99.11, 100.00
Other racialized groups	2022	263	12.58	11.12, 14.05	2,022	1,962	98.12	97.36, 98.88
Social Deprivation³								
1 (least deprived)	3224	248	7.15	6.24, 8.06	3,224	3,127	98.24	97.64, 98.83
2	3250	221	6.19	5.35, 7.03	3,250	3,165	98.83	98.31, 99.36
3	2924	181	5.44	4.60, 6.28	2,924	2,848	98.72	98.15, 99.29
4	2773	217	6.95	5.99, 7.91	2,773	2,703	98.65	98.05, 99.24
5 (most deprived)	2692	152	4.91	4.08, 5.74	2,692	2,623	98.51	97.90, 99.13
Material Deprivation³								
1 (least deprived)	4,403	236	5.06	4.39, 5.74	4403	4314	99.20	98.78, 99.62
2	3,588	208	5.13	4.39, 5.86	3588	3486	98.56	98.02, 99.09
3	3,113	208	5.69	4.86, 6.51	3113	3031	98.62	98.06, 99.18
4	2,326	216	8.20	7.08, 9.33	2326	2248	97.92	97.19, 98.65
5 (most deprived)	1,433	151	9.32	7.87, 10.77	1433	1387	97.96	97.08, 98.84
Total	16,816	1192	6.39	6.01, 6.76	16,816	16,362	98.58	98.34, 98.82

¹ Self reported ethnicity was missing for 1,235 (7.3%) donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 8.20% (95% CI 6.61, 9.78); and Spike antibody was 98.07% (95% CI 97.07, 99.08).

² Combining all racialized groups together resulted in adjusted SARS-CoV-2 seroprevalence of 10.40% (95% CI 9.32, 11.48) by the Nucleocapsid antibody assay, and 98.49% (95% CI 97.92, 99.07) by Spike antibody.

³ Postal Codes were missing for 1,953 (11.6%) of donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 8.23% (95% CI 6.97, 9.50) and Spike antibody was 98.50% (95% CI 97.76, 99.24).

Table 2a. Changes in SARS-CoV-2 seroprevalence by **Nucleocapsid Antibody assay (proxy for natural infection)** by sociodemographic variables between November and December 2021

	November 2021 (crude)		November 2021 (adjusted)		December 2021 (crude)		December 2021 (adjusted)		P-Value*
	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	
Sex									
Female	3,489	201	4.48	3.87, 5.09	6,997	484	5.91	5.41, 6.42	0.0007
Male	5,529	322	5.63	4.93, 6.32	9,819	708	6.89	6.33, 7.45	0.0070
Age									
17-24	1,121	128	9.35	7.62, 11.07	1,576	204	11.37	9.99, 12.75	0.0801
25-39	2,238	139	5.81	4.81, 6.80	4,418	383	8.04	7.20, 8.88	0.0013
40-59	2,922	159	4.73	3.97, 5.49	6,520	425	5.72	5.11, 6.33	0.0515
60+	2,737	97	2.86	2.19, 3.53	4,302	180	3.58	3.04, 4.13	0.1115
Province									
British Columbia	1,421	75	4.63	3.59, 5.68	3,390	208	5.83	4.98, 6.69	0.0921
Alberta	2,048	195	9.25	7.67, 10.82	3,455	450	12.94	11.62, 14.27	0.0008
Saskatchewan	661	53	8.30	5.39, 11.20	882	64	7.00	5.03, 8.98	0.4605
Manitoba	790	70	8.83	6.04, 11.61	807	61	8.18	6.21, 10.14	0.7056
Ontario	2,835	116	4.04	3.45, 4.63	7,178	402	5.43	4.94, 5.92	0.0007
New Brunswick	374	5	1.70	0.01, 3.40	185	2	0.45	0.00, 1.22	0.1339
Nova Scotia	537	5	0.57	0.00, 1.53	649	3	0.25	0.00, 0.79	0.5364
Prince Edward Island	120	2	1.63	0.00, 5.41	134	0	.	.	0.1978
Newfoundland	232	2	0.63	0.00, 1.97	136	2	0.96	0.00, 2.12	0.7292

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Metro area									
Vancouver	721	47	5.91	4.24, 7.57	1,821	133	7.20	5.90, 8.50	0.2433
Calgary	852	63	7.06	4.91, 9.21	1,203	112	9.12	7.17, 11.06	0.1758
Edmonton	768	54	6.96	4.71, 9.22	984	74	7.59	5.60, 9.58	0.6841
Ottawa	309	6	1.53	0.21, 2.86	521	11	2.27	1.08, 3.46	0.4394
Toronto	842	49	5.41	4.36, 6.46	2,891	234	7.78	6.90, 8.67	0.0013
Winnipeg	470	22	4.56	1.86, 7.25	535	32	6.34	4.19, 8.50	0.3360
Ethnicity^{1,2}									
White	6,989	372	4.56	4.05, 5.07	12,432	751	5.21	4.81, 5.61	0.0516
Indigenous	124	8	5.27	1.22, 9.32	196	12	4.84	1.79, 7.89	0.8685
Asian	337	15	4.54	2.42, 6.66	931	59	6.81	5.15, 8.47	0.1246
Other racialized groups	816	89	10.32	8.30, 12.33	2,022	263	12.58	11.12, 14.05	0.0846
Social Deprivation³									
1 (least deprived)	1,682	138	7.23	5.96, 8.49	3,224	248	7.15	6.24, 8.06	0.9263
2	1,715	84	4.67	3.63, 5.70	3,250	221	6.19	5.35, 7.03	0.0310
3	1,555	82	4.46	3.41, 5.51	2,924	181	5.44	4.60, 6.28	0.1627
4	1,507	75	4.41	3.35, 5.48	2,773	217	6.95	5.99, 7.91	0.0012
5 (most deprived)	1,475	64	3.61	2.65, 4.58	2,692	152	4.91	4.08, 5.74	0.0556
Material Deprivation³									
1 (least deprived)	2,477	119	4.54	3.69, 5.39	4,403	236	5.06	4.39, 5.74	0.3512
2	1,932	92	4.01	3.11, 4.91	3,588	208	5.13	4.39, 5.86	0.0695
3	1,484	89	4.78	3.67, 5.90	3,113	208	5.69	4.86, 6.51	0.2126
4	1,261	96	6.31	4.97, 7.64	2,326	216	8.20	7.08, 9.33	0.0394

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5 (most deprived)	780	47	6.18	4.48, 7.89	1,433	151	9.32	7.87, 10.77	0.0100
Total	9,018	523	5.04	4.58, 5.50	16,816	1192	6.39	6.01, 6.76	< 0.001

*P-value reflects the difference between November and December results.

¹ In November, self reported ethnicity was missing for 752 (7.5%) donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 3.35% (95% CI 2.03, 4.68). In December, self reported ethnicity was missing for 1,235 (7.3%) donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 8.20% (95% CI 6.61, 9.78).

² In November, combining all racialized groups together resulted in adjusted SARS-CoV-2 seroprevalence of 8.28% (95% CI 6.82, 9.74) by the Nucleocapsid antibody assay. In December, combining all racialized groups together resulted in adjusted SARS-CoV-2 seroprevalence of 10.40% (95% CI 9.32, 11.48) by the Nucleocapsid antibody assay.

³ In November, postal codes were missing for 1,084 (12.0%) of donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 5.95% (95% CI 4.51, 7.38). In December, postal codes were missing for 1,953 (11.6%) of donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 8.23% (95% CI 6.97, 9.50).

Table 2b. Changes in SARS-CoV-2 seroprevalence using **Spike antibody results (proxy for natural infection or vaccine induced immunity)** by sociodemographic variables between November and December 2021

	November 2021 (crude)		November 2021 (adjusted)		December 2021 (crude)		December 2021 (adjusted)		P-Value*
	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	
Sex									
Female	3,489	3,410	99.21	98.81, 99.62	6,997	6,812	98.58	98.24, 98.92	0.0242
Male	5,529	5,338	97.79	97.25, 98.33	9,819	9,550	98.58	98.23, 98.93	0.0122
Age									
17-24	1,121	1,095	99.18	98.34, 100.00	1,576	1,551	99.54	98.99, 100.00	0.4654
25-39	2,238	2,166	98.34	97.64, 99.04	4,418	4,289	98.21	97.68, 98.74	0.7764
40-59	2,922	2,829	98.25	97.65, 98.84	6,520	6,333	98.44	98.01, 98.86	0.6072
60+	2,737	2,658	98.73	98.12, 99.34	4,302	4,189	98.66	98.20, 99.11	0.8536
Province									
British Columbia	1,421	1,388	99.09	98.38, 99.80	3,390	3,314	98.99	98.46, 99.52	0.8306
Alberta	2,048	1,983	98.12	97.19, 99.06	3,455	3,334	97.79	97.07, 98.50	0.5814
Saskatchewan	661	629	96.01	93.68, 98.33	882	860	99.05	97.94, 100.00	0.0092
Manitoba	790	760	97.35	95.47, 99.23	807	780	97.77	96.47, 99.06	0.7134
Ontario	2,835	2,747	98.60	98.13, 99.07	7,178	6,988	98.49	98.14, 98.84	0.7002
New Brunswick	374	360	97.03	94.54, 99.52	185	181	99.49	98.25, 100.00	0.0542
Nova Scotia	537	533	99.98	98.77, 100.00	649	638	99.69	98.69, 100.00	0.2464
Prince Edward Island	120	119	96.88	91.33, 100.00	134	132	99.91	97.55, 100.00	0.7351
Newfoundland	232	229	99.84	98.12, 100.00	136	135	100.00	98.95, 100.00	0.3281

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Metro area									
Vancouver	721	705	99.27	98.30, 100.00	1,821	1,794	99.70	99.09, 100.00	0.4408
Calgary	852	827	98.21	96.79, 99.63	1,203	1,171	98.70	97.65, 99.75	0.5830
Edmonton	768	752	98.99	97.70, 100.00	984	960	98.98	97.88, 100.00	0.9958
Ottawa	309	306	100.00	98.95, 100.00	521	512	99.20	98.12, 100.00	0.0912
Toronto	842	826	99.53	98.94, 100.00	2,891	2,830	98.87	98.37, 99.37	0.1112
Winnipeg	470	459	98.94	97.05, 100.00	535	526	99.68	98.60, 100.00	0.4810
Ethnicity^{1,2}									
White	6,989	6,789	98.66	98.28, 99.04	12,432	12,102	98.65	98.37, 98.93	0.9675
Indigenous	124	121	99.44	97.09, 100.00	196	184	94.95	91.55, 98.35	0.0631
Asian	337	334	99.66	98.43, 100.00	931	920	99.86	99.11, 100.00	0.5505
Other racialized groups	816	790	98.44	97.36, 99.52	2,022	1,962	98.12	97.36, 98.88	0.6441
Social Deprivation³									
1 (least deprived)	1,682	1,624	98.34	97.54, 99.15	3,224	3,127	98.24	97.64, 98.83	0.8364
2	1,715	1,659	98.36	97.56, 99.16	3,250	3,165	98.83	98.31, 99.36	0.3163
3	1,555	1,521	99.18	98.48, 99.89	2,924	2,848	98.72	98.15, 99.29	0.3322
4	1,507	1,460	98.48	97.65, 99.32	2,773	2,703	98.65	98.05, 99.24	0.7545
5 (most deprived)	1,475	1,438	98.77	97.99, 99.55	2,692	2,623	98.51	97.90, 99.13	0.6164
Material Deprivation³									
1 (least deprived)	2,477	2,423	99.53	99.02, 100.00	4403	4314	99.20	98.78, 99.62	0.3399
2	1,932	1,862	97.87	97.07, 98.68	3588	3486	98.56	98.02, 99.09	0.1533
3	1,484	1,445	98.65	97.84, 99.47	3113	3031	98.62	98.06, 99.18	0.9445
4	1,261	1,226	98.70	97.84, 99.55	2326	2248	97.92	97.19, 98.65	0.19

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5 (most deprived)	780	746	97.47	96.14, 98.80	1433	1387	97.96	97.08, 98.84	0.5385
Total	9,018	8,748	98.52	98.18, 98.86	16,816	16,362	98.58	98.34, 98.82	0.7767

*P-value reflects the difference between November and December results.

¹ In November, self reported ethnicity was missing for 752 (7.5%) donors; Adjusted seroprevalence by the Spike antibody was 96.61% (95% CI 95.10, 98.12). In December, self reported ethnicity was missing for 1,235 (7.3%) donors; Adjusted seroprevalence by the Spike antibody was 98.07% (95% CI 97.07, 99.08).

² In November, combining all racialized groups together resulted in adjusted SARS-CoV-2 seroprevalence of 98.87% (95% CI 98.07, 99.66) by Spike antibody. In December, combining all racialized groups together resulted in adjusted SARS-CoV-2 seroprevalence of 98.49% (95% CI 97.92, 99.07) by Spike antibody.

³ In November, postal codes were missing for 1,084 (12.0%) of donors; Adjusted seroprevalence by the Spike antibody was 97.79% (95% CI 96.70, 98.88). In December, postal codes were missing for 1,953 (11.6%) of donors; Adjusted seroprevalence by the Spike antibody was 98.50% (95% CI 97.76, 99.24).

Table 3. SARS-CoV-2 incidence among anti-S positive donors by month from June 2021 – December 2021.

Month	Total donors tested	Repeat Donors	Previous S positive, N negative	S Positive, N Positive		
				N	%	95% CI
Jun	16884	4452	929	2	0.215	0.03, 0.78
Jul	8457	2853	1054	5	0.474	0.15, 1.10
Aug	9109	5400	2719	8	0.294	0.13, 0.58
Sep	9363	5728	2915	3	0.103	0.02, 0.30
Oct	9627	5898	3313	12	0.362	0.19, 0.63
Nov	9018	5290	3318	20	0.603	0.37, 0.93
Dec	16816	5560	3251	23	0.710	0.45, 1.06

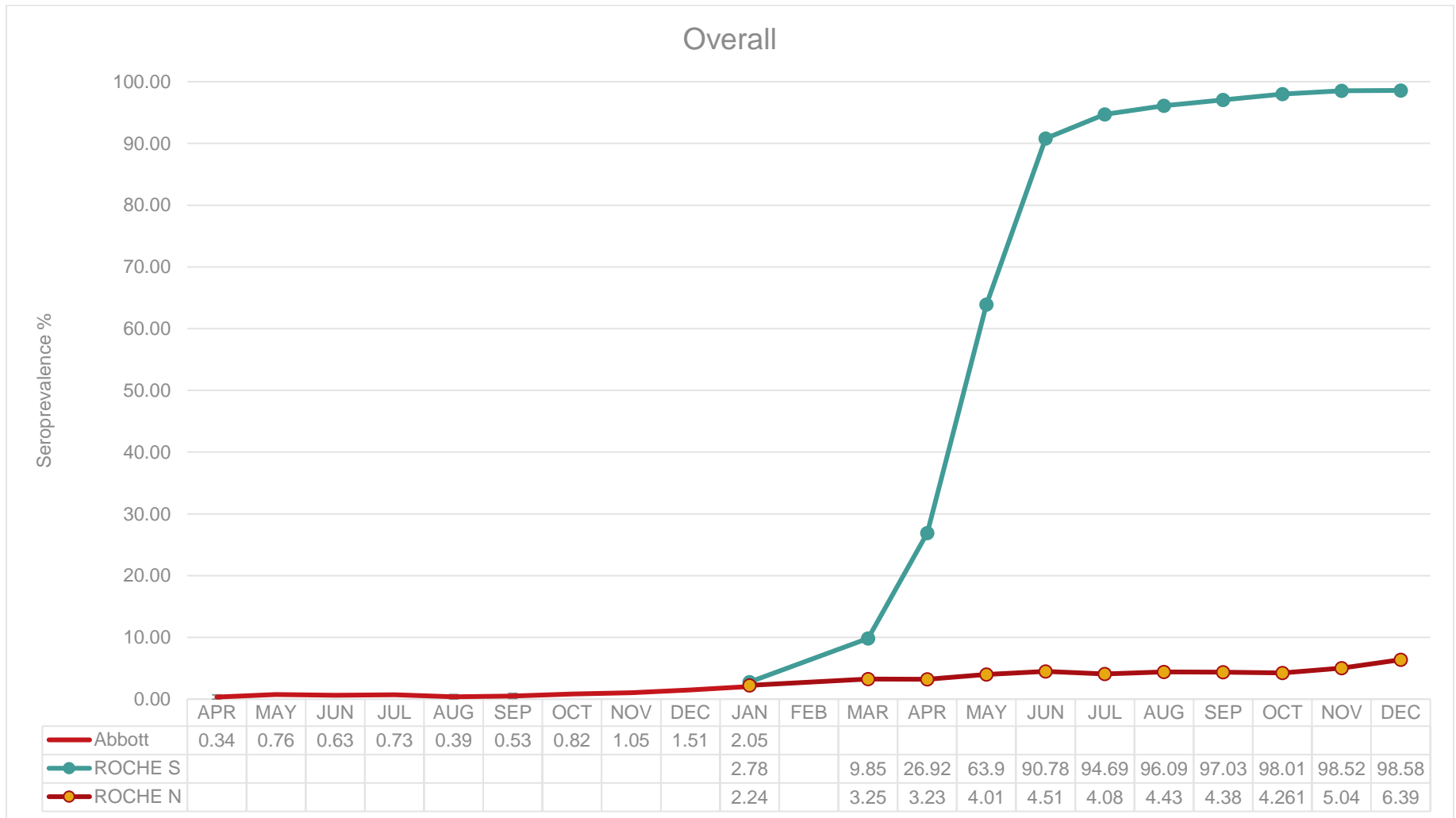
Note: A donation was considered a potential breakthrough incident infection if donors tested S positive and N negative on their previous donation and then tested S positive and N positive on their following donation.

Table 4. SARS-CoV-2 incidence among anti-S negative donors by month from June 2021 – December 2021.

Month	Total donors tested	Repeat Donors	Previous S negative, N negative	S Positive, N Positive		
				N	%	95% CI
Jun	16884	4452	3409	52	1.53	1.14, 2.00
Jul	8457	2853	1697	24	1.41	0.91, 2.10
Aug	9109	5400	2487	29	1.17	0.78, 1.67
Sep	9363	5728	2628	53	2.02	1.51, 2.63
Oct	9627	5898	2385	61	2.56	1.96, 3.27
Nov	9018	5290	1754	56	3.19	2.42, 4.13
Dec	16816	5560	2063	81	3.93	3.13, 4.86

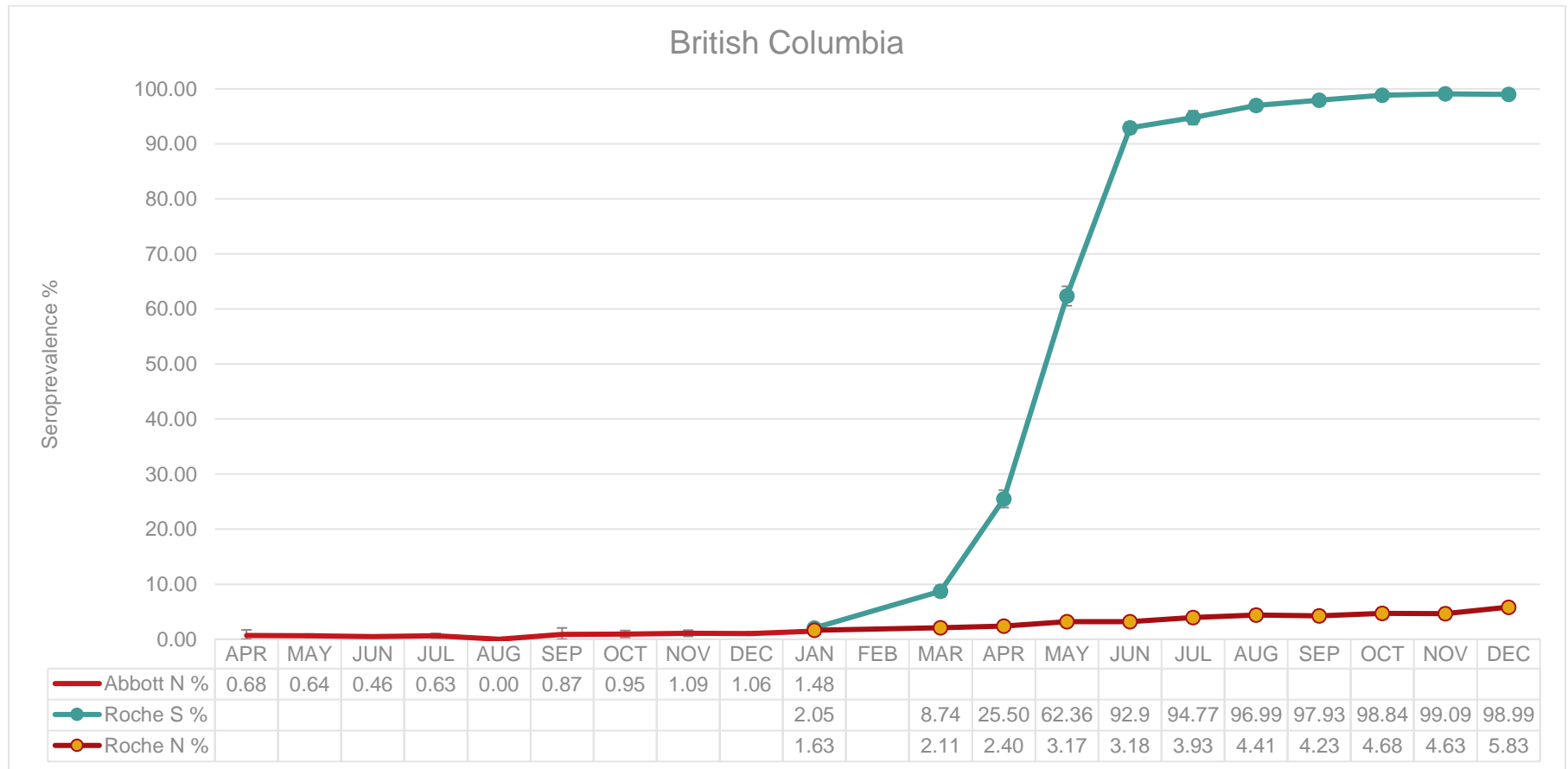
Note: A donation was considered a potential incident infection if donors tested S negative and N negative on their previous donation and then tested S positive and N positive on their following donation.

Figure 1. Overall temporal trends of SARS-CoV-2 seroprevalence by monthly intervals from April 2020-December 2021 (comparing results from Abbott N (until January 2021) followed by seroprevalence estimated by Roche N and Roche S results).

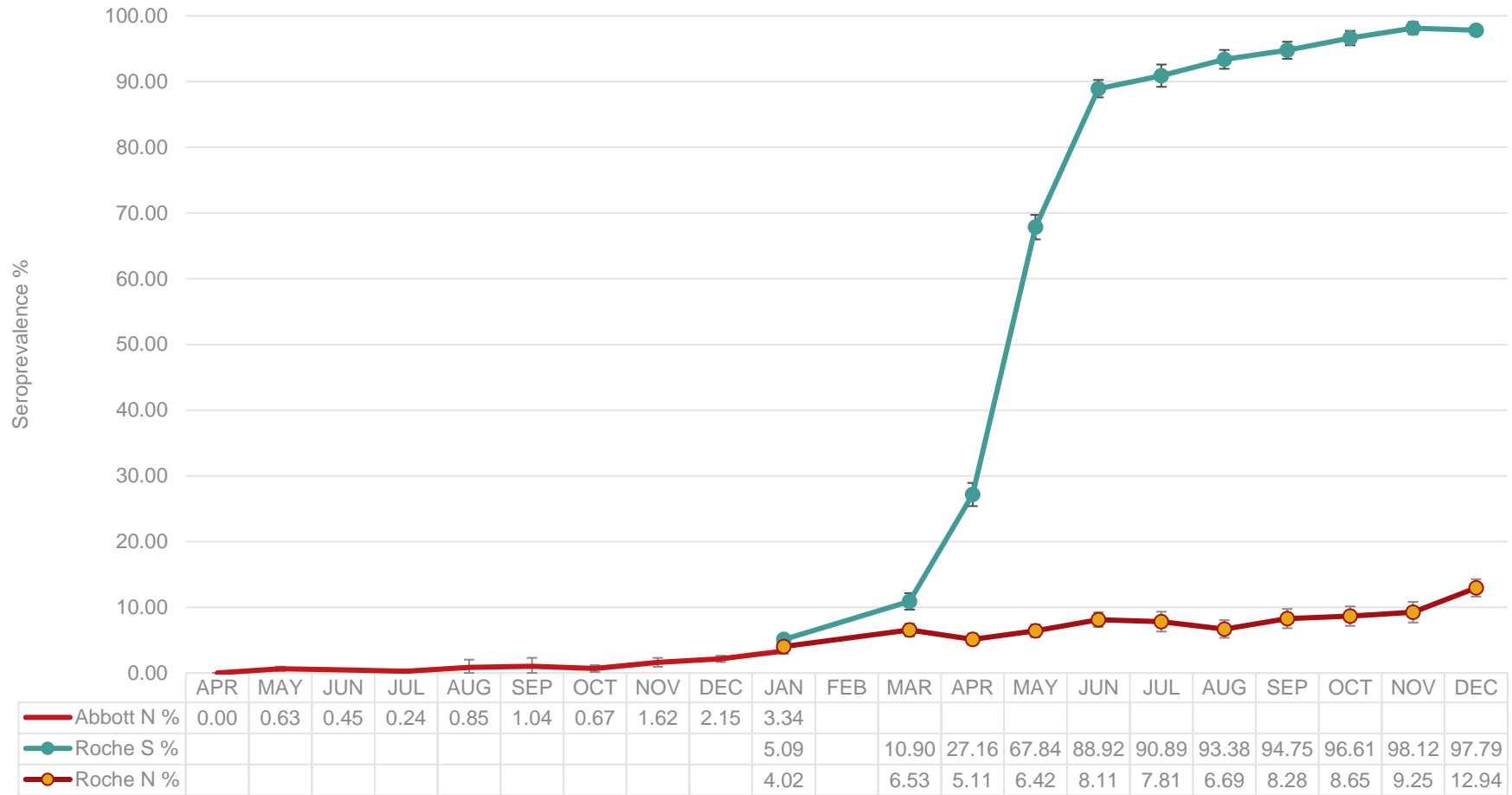


Notes: SARS-CoV-2 seroprevalence rates (95% CI), that have been weighted and adjusted for test characteristics. Data from the CIHR funded study (Correlates of Immunity) from April 9, 2020-January 31, 2021, have been included.

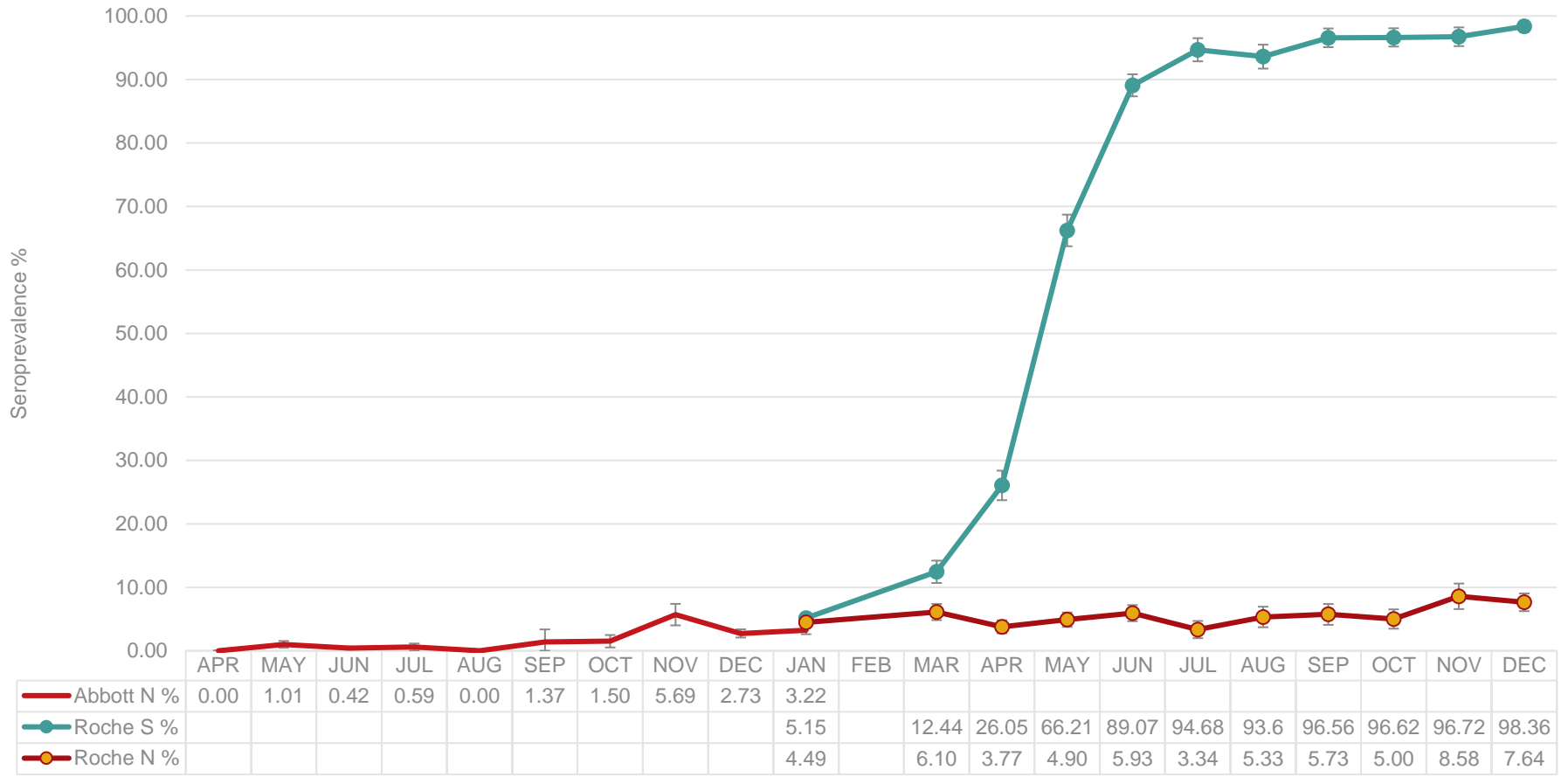
Figure 2. Regional temporal trends of SARS-CoV-2 seroprevalence monthly from April 2020-December 2021 (by Abbott N, Roche N and Roche S assays)



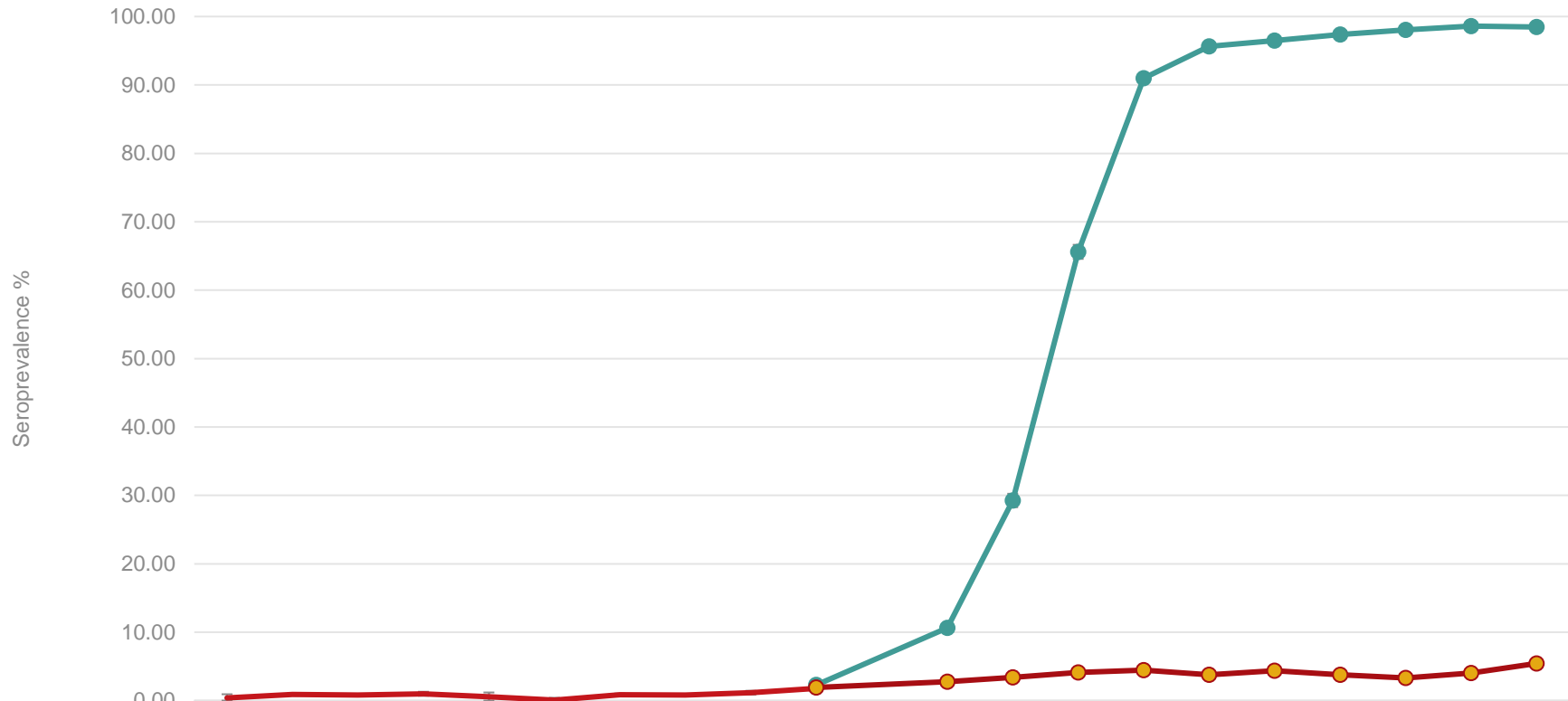
Alberta

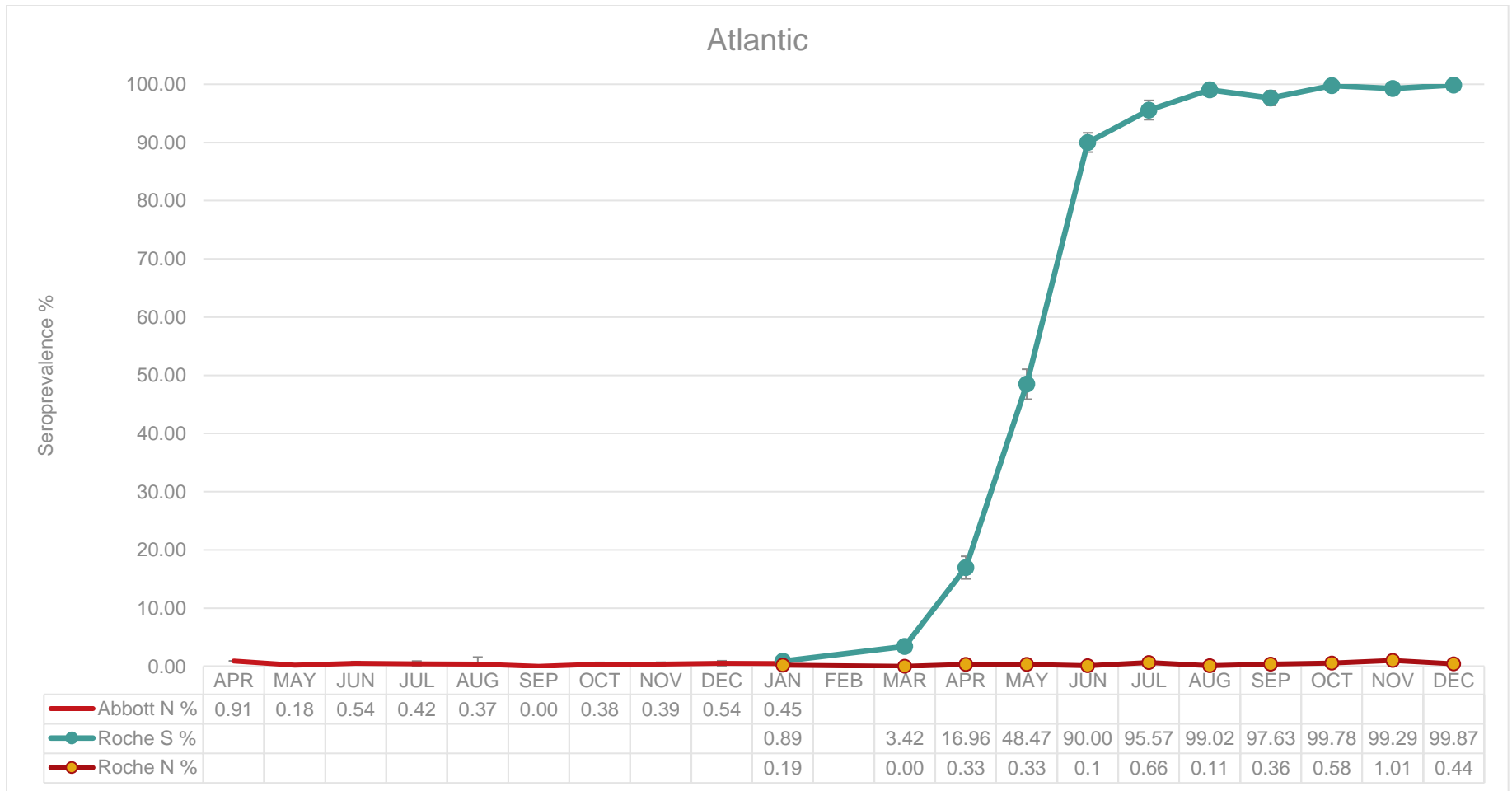


Prairies



Ontario





Note: SARS-CoV-2 seroprevalence rates (95% CI), that have been weighted and adjusted for test characteristics. Data from the CIHR funded study (Correlates of Immunity) from April 9, 2020-January 31, 2021, have been included.

Figure 3. Distributions of log transformed Spike antibody concentration results (U/mL) (white circle represents the median and the bar represents the IQR) in spike antibody seropositive donations from September to December 2021 (dilution method was changed in September to measure up to 100,000 U/mL) stratified by age group.

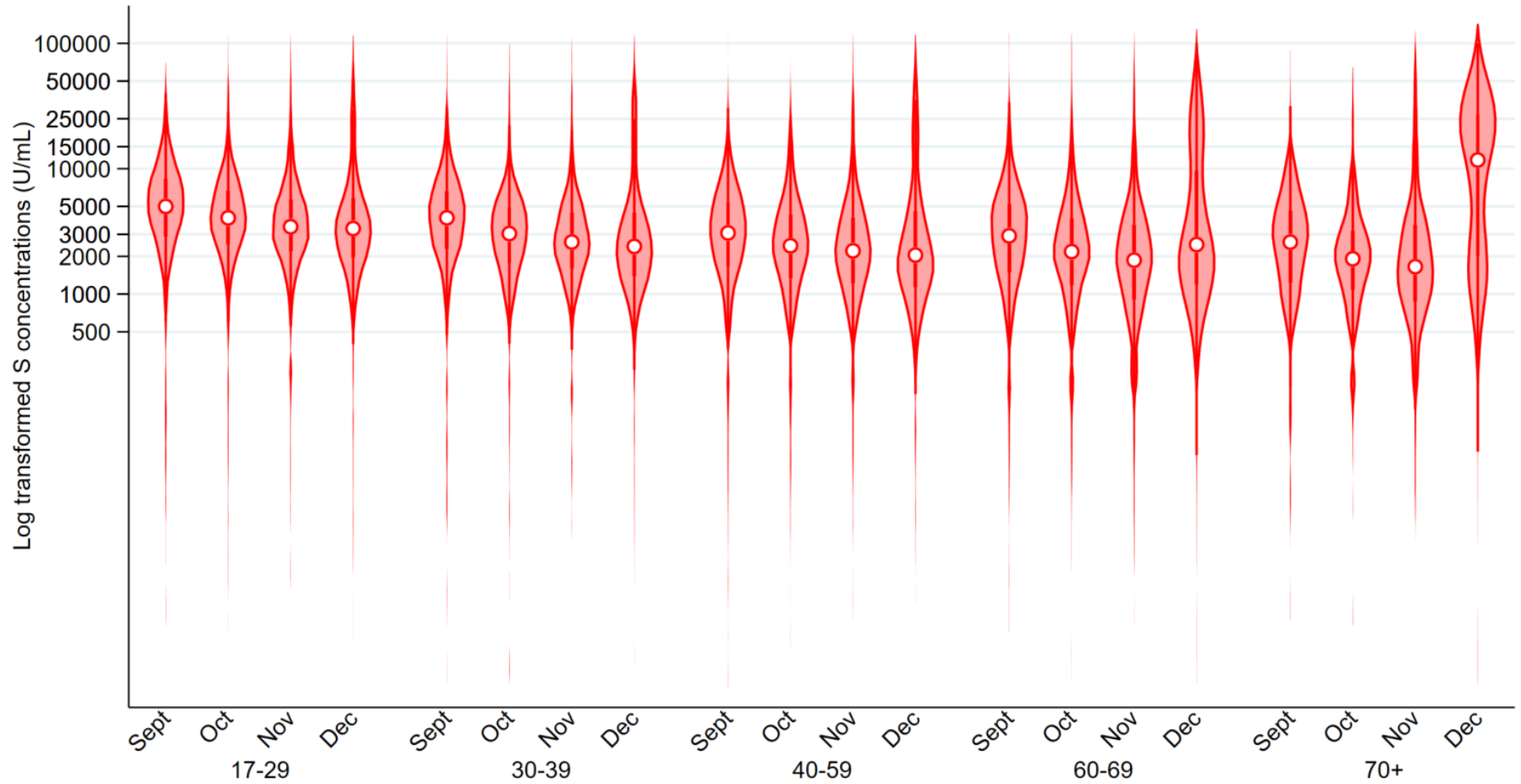
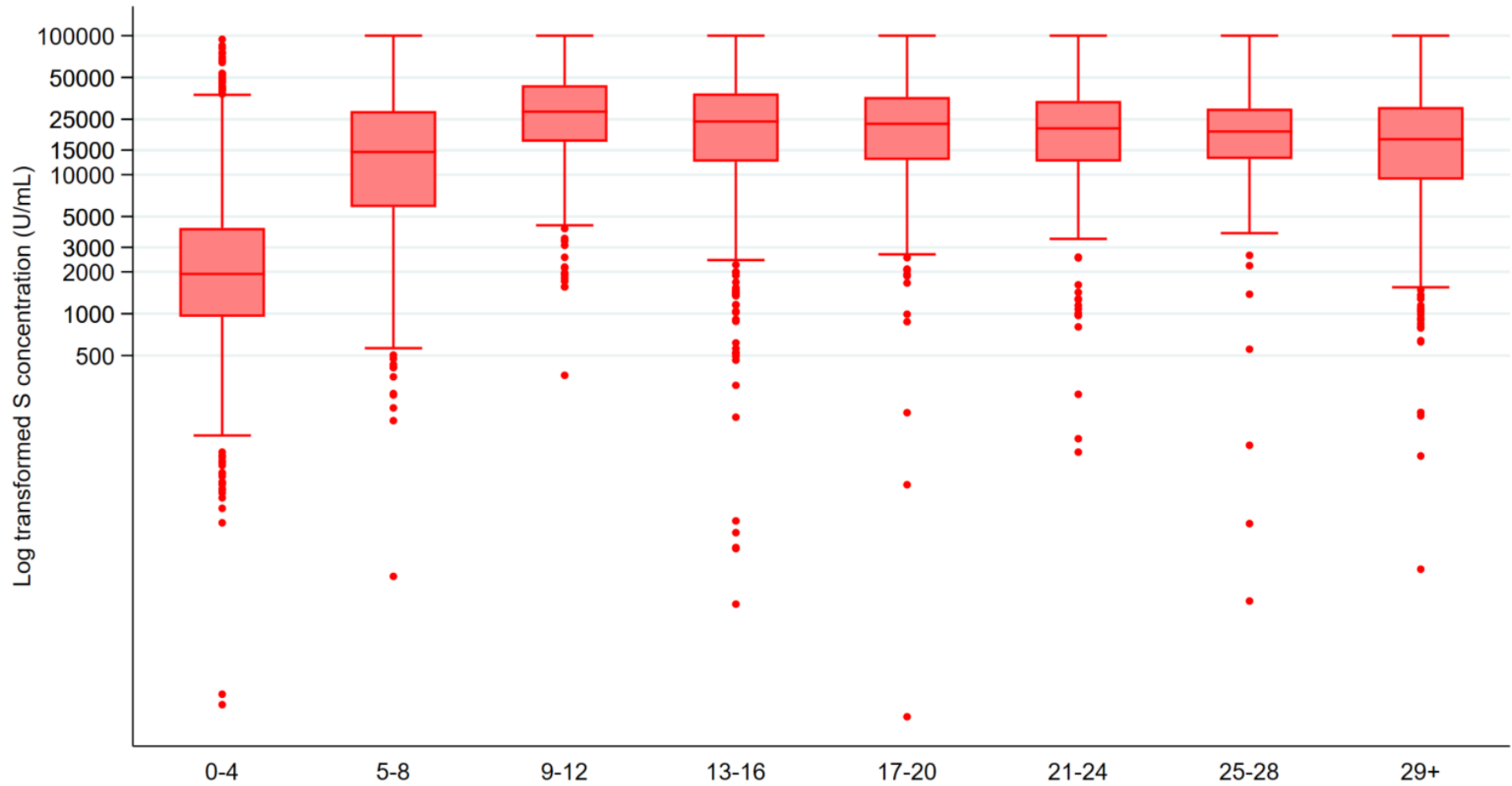


Figure 4. Roche S quantitative results (median (IQR)) by time since vaccination for donors who received a vaccine*



***Note:** Data is from donors who reported receiving a vaccine in the 3 months previous to donating, provided a vaccination date, and had received their vaccine November 1st, 2021, or later.

Figure 5A. Temporal trends of SARS-CoV-2 seroprevalence by monthly intervals from January 2021-December 2021 estimated by Nucleocapsid antibody results by ethnicity.

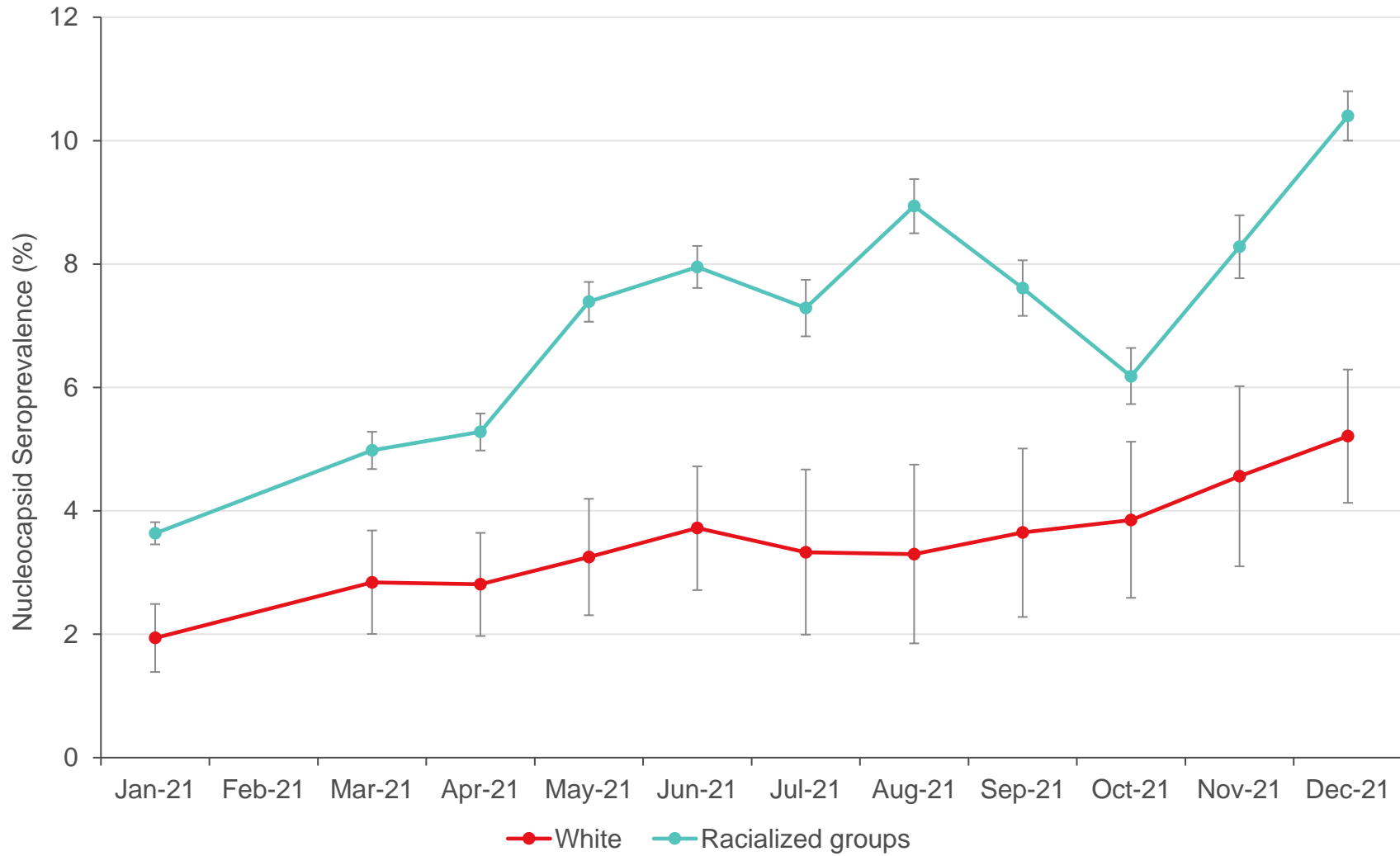


Figure 5B. Temporal trends of SARS-CoV-2 seroprevalence by monthly intervals from January 2021-December 2021 estimated by Spike antibody results by ethnicity.

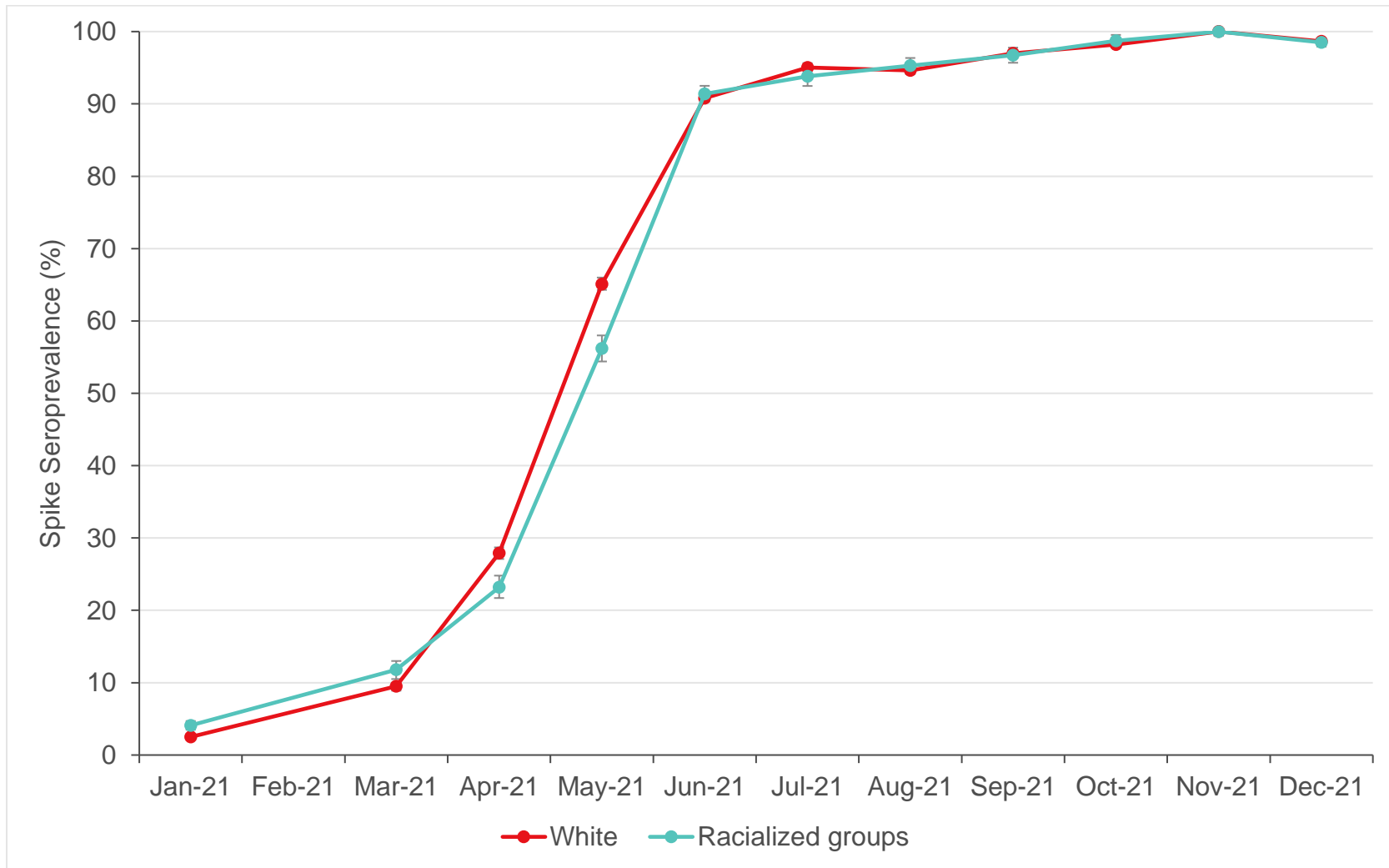


Figure 5C. Temporal trends of SARS-CoV-2 seroprevalence by monthly intervals from January 2021-December 2021 estimated by Nucleocapsid antibody results by age group.

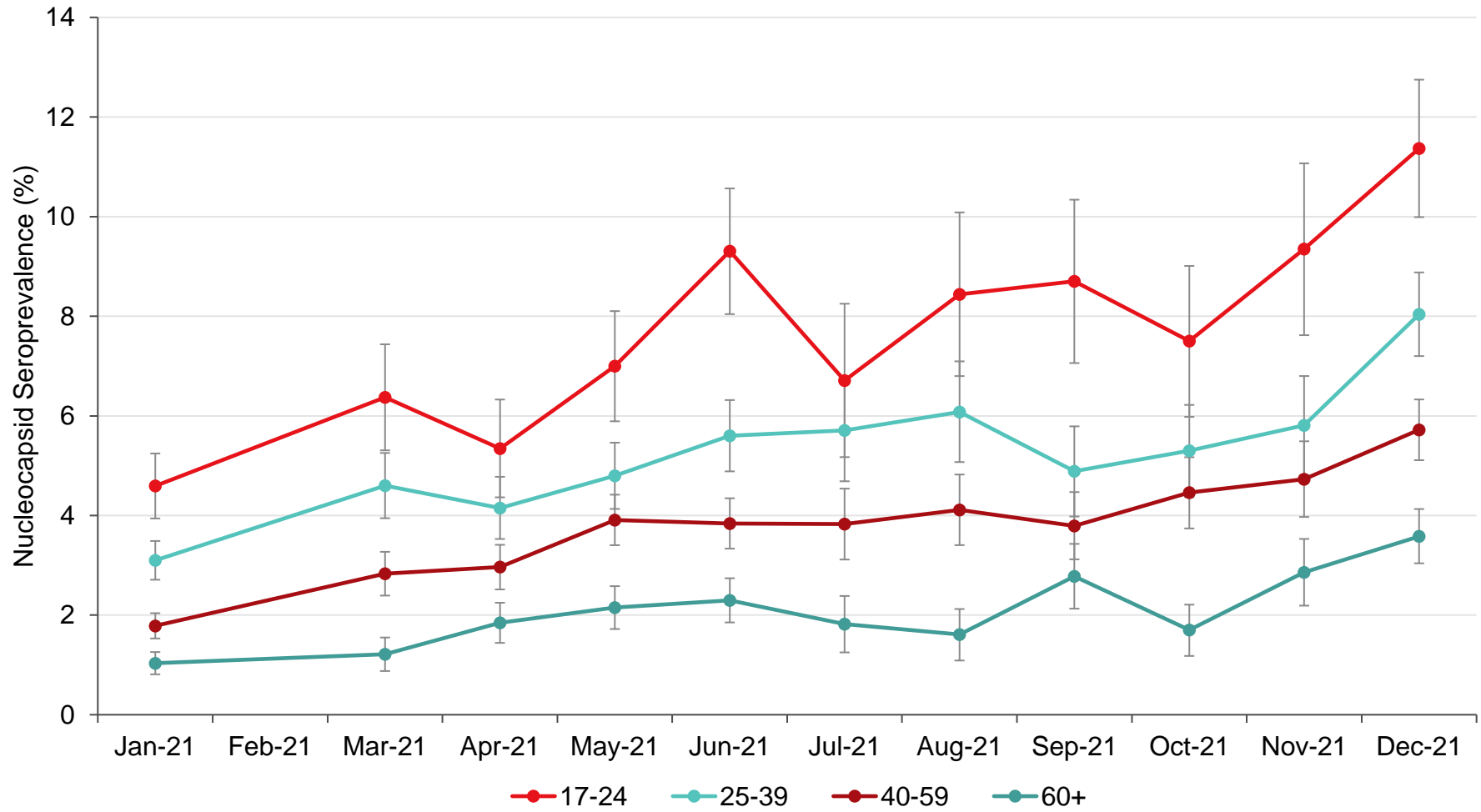


Figure 5D. Temporal trends of SARS-CoV-2 seroprevalence by monthly intervals from January 2021-December 2021 estimated by Spike antibody results by age group.

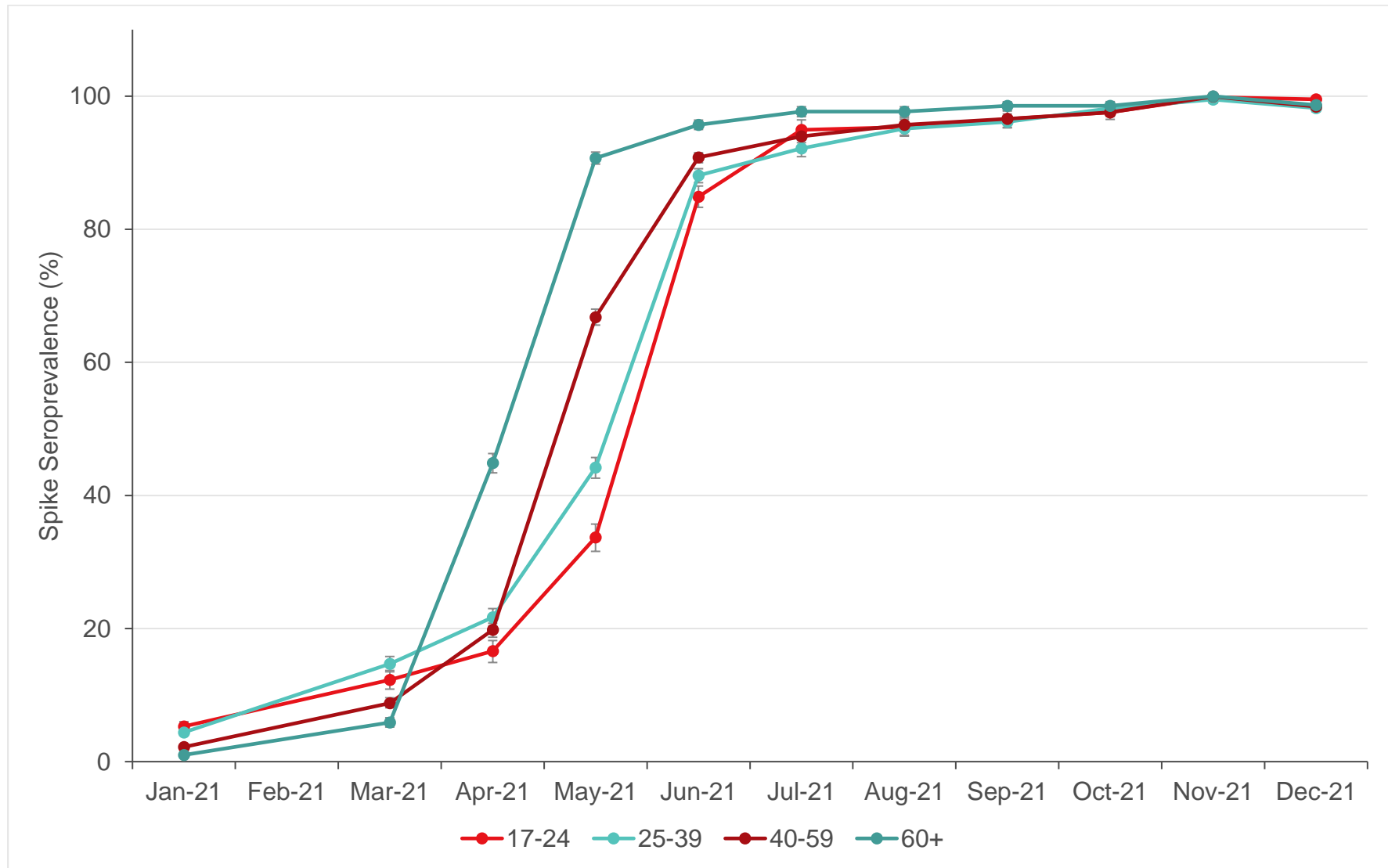


Figure 5E. Temporal trends of SARS-CoV-2 seroprevalence by monthly intervals from January 2021-December 2021 estimated by Nucleocapsid antibody results by material deprivation level (1 = least deprived and 5 = most deprived).

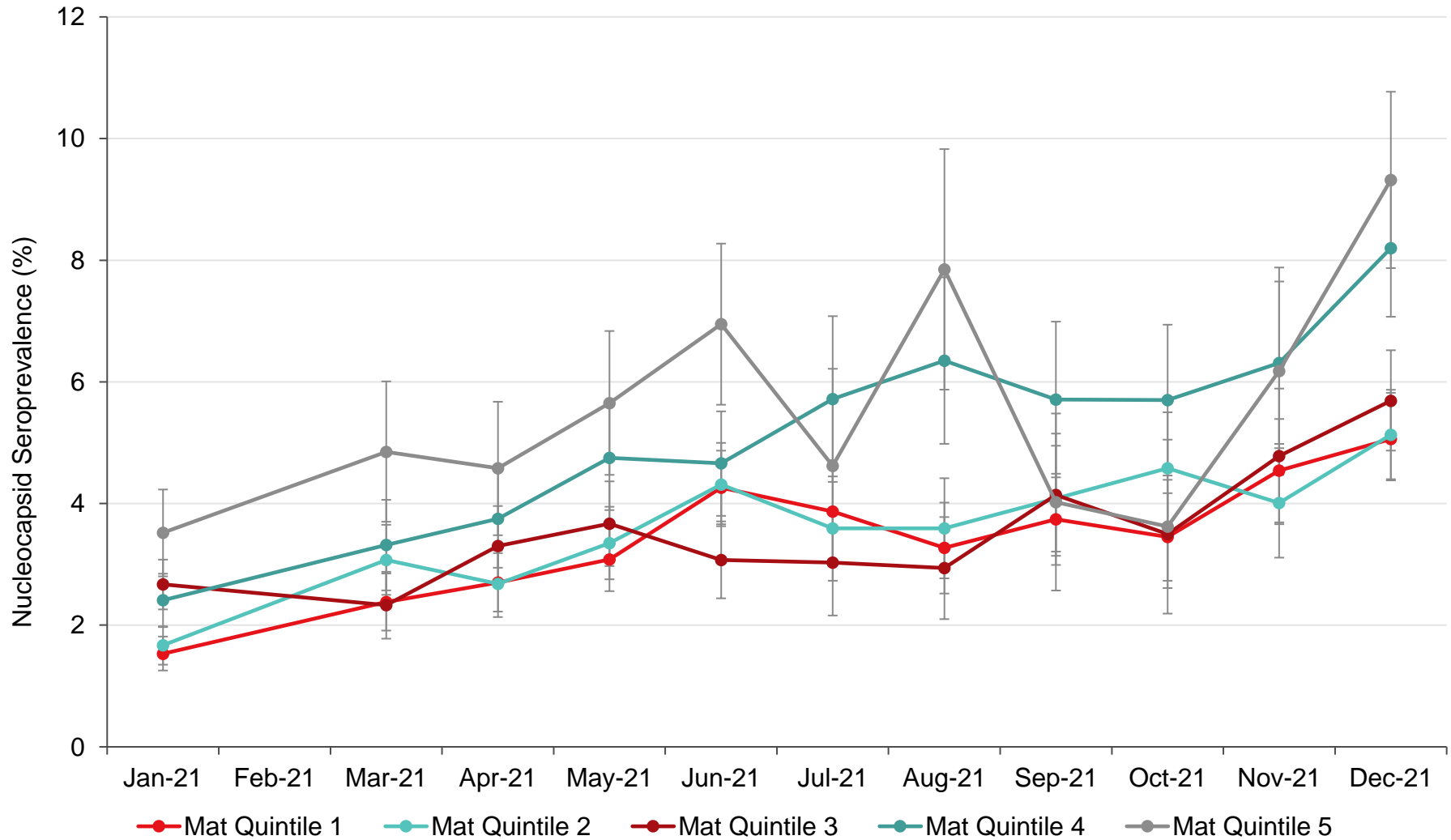


Figure 5F. Temporal trends of SARS-CoV-2 seroprevalence by monthly intervals from January 2021-December 2021 estimated by Spike antibody results by material deprivation level (1 = least deprived and 5 = most deprived).

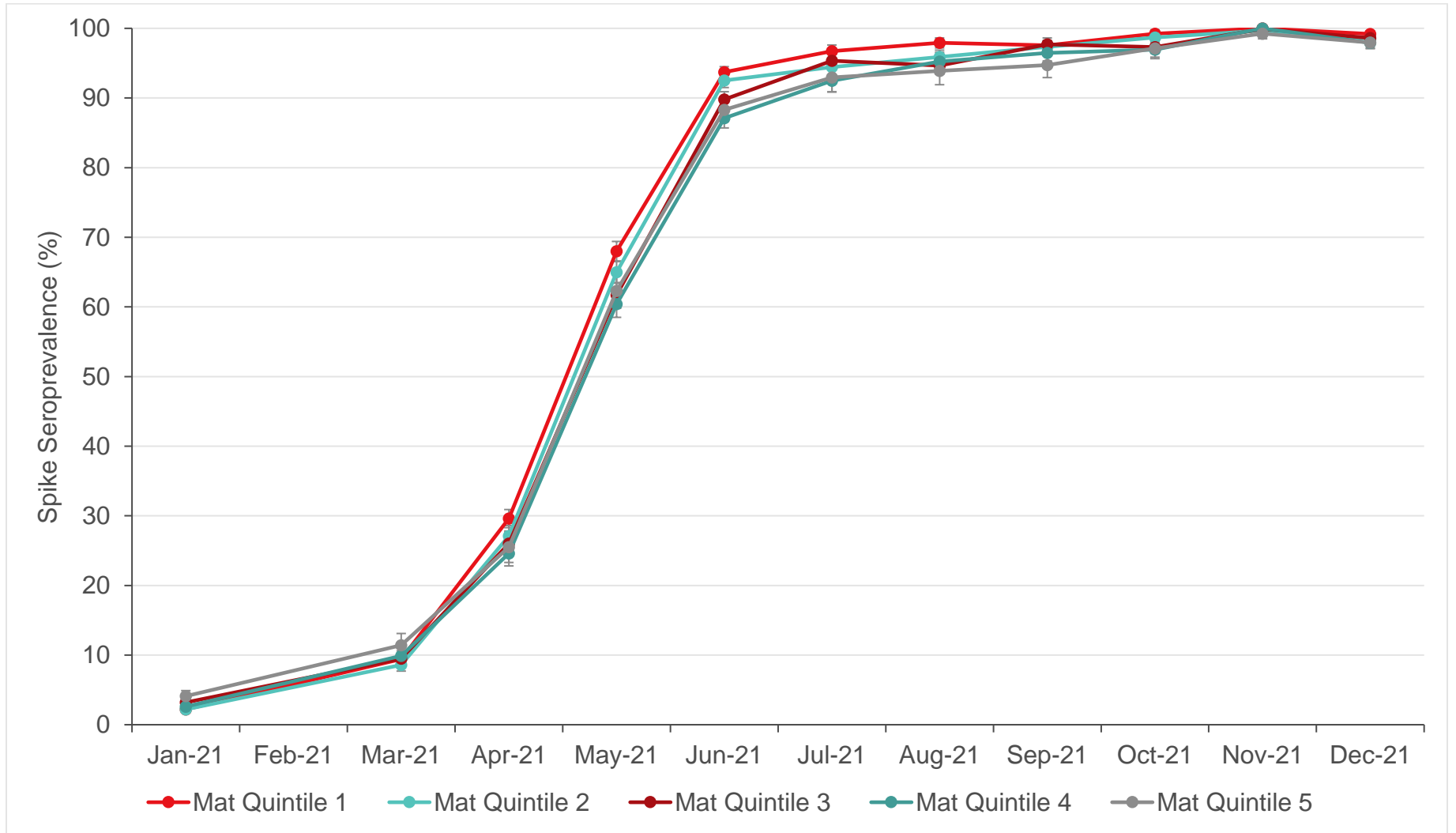


Figure 5G. Temporal trends of SARS-CoV-2 seroprevalence by monthly intervals from January 2021-December 2021 estimated by Nucleocapsid antibody results by social deprivation level (1 = least deprived and 5 = most deprived).

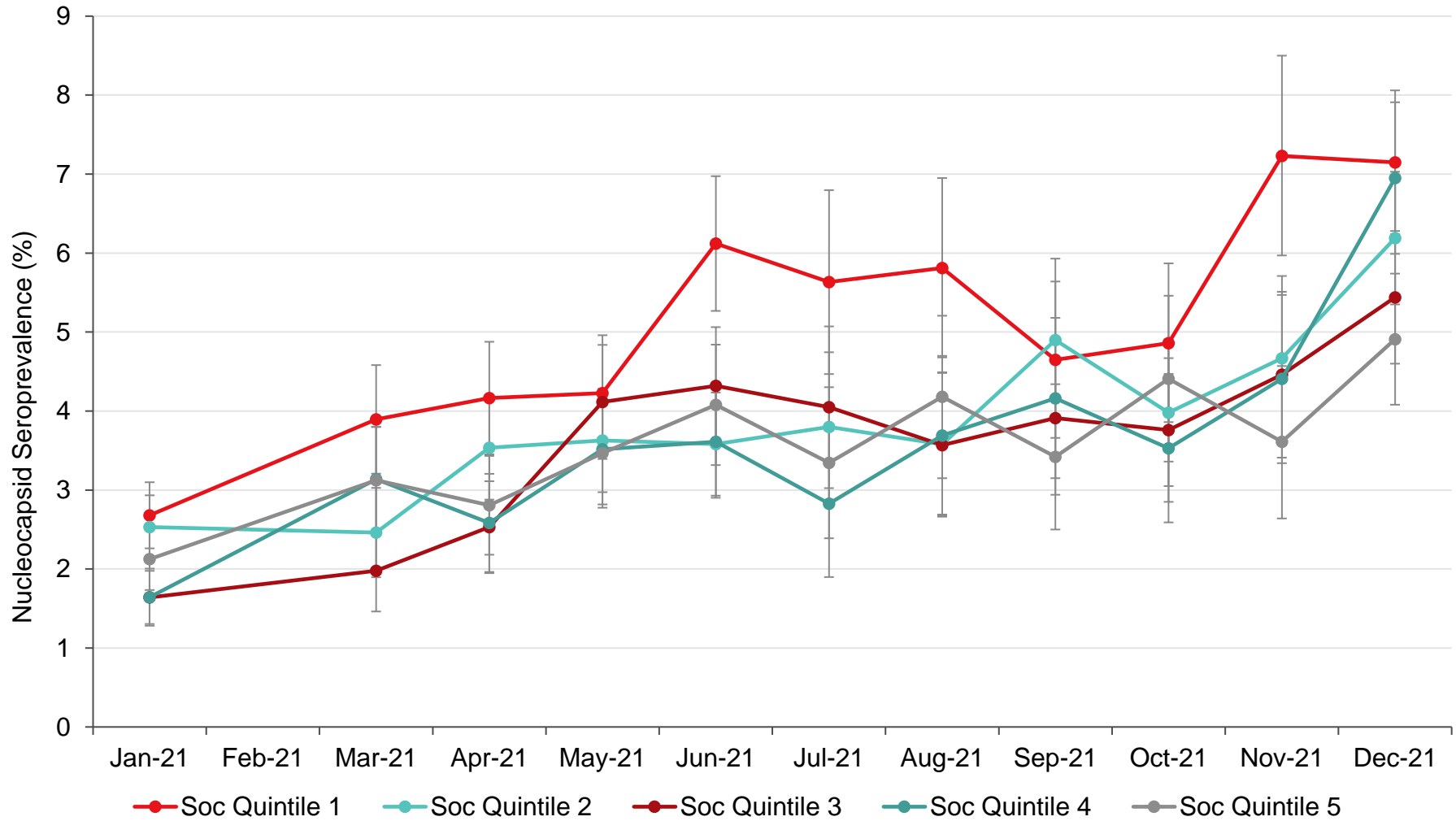


Figure 5H. Temporal trends of SARS-CoV-2 seroprevalence by monthly intervals from January 2021-December 2021 estimated by Spike antibody results by social deprivation level (1 = least deprived and 5 = most deprived).

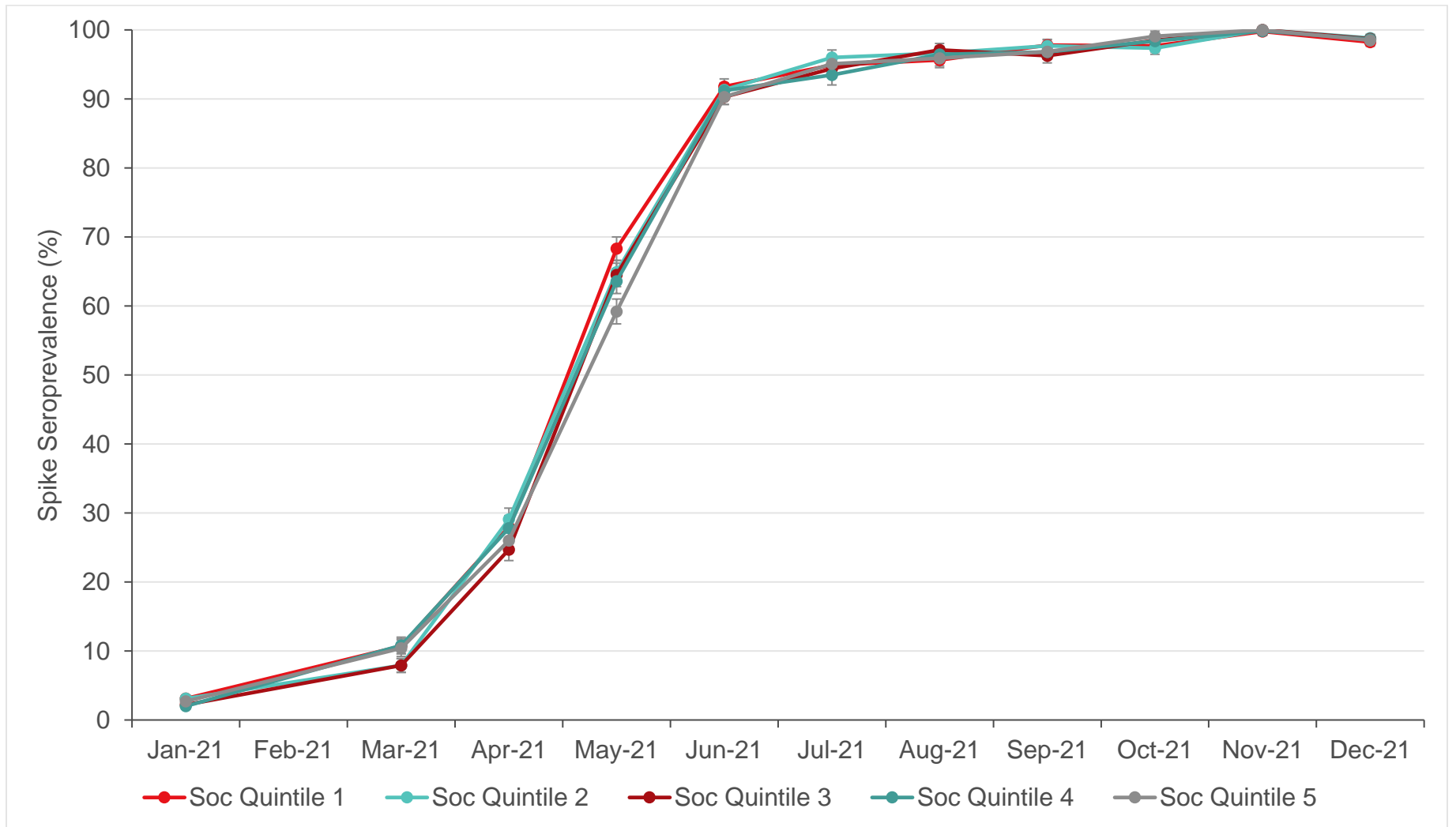


Table A1.1 British Columbia SARS-CoV-2 seroprevalence, Nucleocapsid vs. Spike results in December 2021

	Nucleocapsid Antibody Results (proxy for natural infection)				Spike Antibody Results (proxy for humoral immunity by either natural infection or vaccination)			
	Crude		Adjusted		Crude		Adjusted	
	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	Number Tested	Number Positive	Percent Positive	95% Confidence Interval
Sex								
Female	1,426	83	5.38	4.23, 6.53	1,426	1,398	99.22	98.51, 99.92
Male	1,964	125	6.31	5.04, 7.59	1,964	1,916	98.76	97.96, 99.56
Age								
17-24	299	24	7.80	4.94, 10.66	299	295	99.78	98.52, 100.00
25-39	894	60	6.54	4.69, 8.40	894	873	98.83	97.70, 99.96
40-59	1,302	85	6.46	4.93, 7.98	1,302	1269	98.76	97.81, 99.71
60+	895	39	3.82	2.54, 5.11	895	877	99.09	98.14, 100.00
Material Deprivation¹								
1 (least)	913	48	4.91	3.40, 6.43	913	894	99.21	98.25, 100.00
2	792	39	4.81	3.18, 6.43	792	778	99.37	98.36, 100.00
3	613	38	6.10	4.04, 8.17	613	600	99.01	97.77, 100.00
4	439	30	6.40	3.93, 8.86	439	426	98.11	96.38, 99.84
5 (most)	248	29	10.55	6.40, 14.69	248	240	98.18	95.87, 100.00
Total	3,390	208	5.83	4.98, 6.69	3,390	3,314	98.99	98.46, 99.52

¹Postal codes were missing for 385 (11.4%) of donors therefore we couldn't calculate quintiles of Material Deprivation; 24/385 were positive by the Nucleocapsid antibody, adjusted SARS-CoV-2 seroprevalence among missing postal codes was 6.08% (95% CI 3.50, 8.67); and 376/385 were positive by the Spike antibody, adjusted SARS-CoV-2 seroprevalence was 99.21% (95% CI 97.71, 100.00).

Table A1.2 Alberta SARS-CoV-2 seroprevalence, Nucleocapsid vs. Spike antibody results in December 2021

	Nucleocapsid Antibody Results (proxy for natural infection)				Spike Antibody Results (proxy for humoral immunity by either natural infection or vaccination)			
	Crude		Adjusted		Crude		Adjusted	
	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	Number Tested	Number Positive	Percent Positive	95% Confidence Interval
Sex								
Female	1,411	205	13.70	11.78, 15.62	1,411	1,364	97.80	96.79, 98.81
Male	2,044	245	12.18	10.35, 14.01	2,044	1,970	97.77	96.76, 98.79
Age								
17-24	330	85	22.57	17.97, 27.17	330	325	99.73	98.40, 100.00
25-39	965	141	14.40	11.86, 16.94	965	936	98.10	96.85, 99.35
40-59	1,332	164	12.16	9.97, 14.35	1,332	1,279	97.20	95.89, 98.51
60+	828	60	6.77	4.67, 8.87	828	794	97.18	95.55, 98.81
Material Deprivation¹								
1 (least)	1,245	92	7.37	5.64, 9.11	1,245	1,217	99.19	98.26, 100.00
2	704	95	14.07	11.02, 17.12	704	676	97.56	95.92, 99.20
3	507	84	15.97	12.22, 19.71	507	488	97.37	95.41, 99.34
4	359	89	24.60	19.34, 29.86	359	343	96.79	94.27, 99.30
5 (most)	146	20	12.99	6.59, 19.40	146	139	96.18	92.02, 100.00
Total	3,455	450	12.94	11.62, 14.27	3,455	3,334	97.79	97.07, 98.50

¹Postal codes were missing for 494 (14.3%) of donors therefore we couldn't calculate quintiles of Material Deprivation; 70/494 were positive by the Nucleocapsid antibody, adjusted SARS-CoV-2 seroprevalence among missing postal codes was 13.71% (95% CI 10.11, 17.32); 471/494 were positive by the Spike antibody, adjusted SARS-CoV-2 seroprevalence was 96.20% (95% CI 93.92, 98.49).

Table A1.3 Saskatchewan SARS-CoV-2 seroprevalence, Nucleocapsid vs. Spike antibody results in December 2021

	Nucleocapsid Antibody Results (proxy for natural infection)				Spike Antibody Results (proxy for humoral immunity by either natural infection or vaccination)			
	Crude		Adjusted		Crude		Adjusted	
	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	Number Tested	Number Positive	Percent Positive	95% Confidence Interval
Sex								
Female	361	29	7.21	4.40, 10.03	361	354	99.57	98.19, 100.00
Male	521	35	6.79	4.01, 9.57	521	506	98.53	96.76, 100.00
Age								
17-24	86	9	10.29	3.77, 16.82	86	86	99.02	95.96, 100.00
25-39	259	21	8.01	3.93, 12.09	259	251	98.12	95.53, 100.00
40-59	335	24	7.26	3.75, 10.78	335	322	97.42	94.85, 99.98
60+	202	10	4.22	1.24, 7.19	202	201	99.84	98.17, 100.00
Material Deprivation¹								
1 (least)	300	22	7.60	4.04, 11.15	300	297	99.50	97.79, 100.00
2	193	11	5.89	2.03, 9.76	193	184	97.11	93.89, 100.00
3	130	12	7.97	2.56, 13.39	130	126	98.76	95.68, 100.00
4	68	5	6.45	0.00, 13.21	68	64	96.37	90.53, 100.00
5 (most)	24	3	10.50	0.00, 25.10	24	24	92.00	79.57, 100.00
Total	882	64	7.00	5.03, 8.98	882	860	99.05	97.94, 100.00

¹Postal codes were missing for 167 (18.9%) of donors therefore we couldn't calculate quintiles of Material Deprivation; 11/167 were positive by the Nucleocapsid antibody, adjusted SARS-CoV-2 seroprevalence among missing postal codes was 6.25% (95% CI 1.90, 10.59); 165/167 were positive by the Spike antibody, adjusted SARS-CoV-2 seroprevalence was 98.65% (95% CI 95.88, 100.00).

Table A1.4 Manitoba SARS-CoV-2 seroprevalence, Nucleocapsid vs. Spike antibody results in December 2021

	Nucleocapsid Antibody Results (proxy for natural infection)				Spike Antibody Results (proxy for humoral immunity by either natural infection or vaccination)			
	Crude		Adjusted		Crude		Adjusted	
	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	Number Tested	Number Positive	Percent Positive	95% Confidence Interval
Sex								
Female	331	23	7.35	4.73, 9.96	331	318	97.37	95.46, 99.28
Male	476	38	9.05	6.11, 11.98	476	462	98.18	96.44, 99.93
Age								
17-24	77	16	20.48	12.70, 28.26	77	76	99.94	97.77, 100.00
25-39	186	14	7.47	3.72, 11.22	186	176	95.55	92.28, 98.82
40-59	328	17	4.66	2.03, 7.29	328	318	98.00	95.83, 100.00
60+	216	14	7.03	3.54, 10.53	216	210	98.45	96.23, 100.00
Material Deprivation¹								
1 (least)	176	9	5.64	2.10, 9.19	176	171	98.42	95.91, 100.00
2	141	6	3.20	0.07, 6.33	141	139	98.71	96.04, 100.00
3	204	12	5.89	2.54, 9.24	204	202	99.52	97.73, 100.00
4	117	15	14.65	8.00, 21.31	117	112	96.60	92.66, 100.00
5 (most)	69	6	9.82	2.80, 16.84	69	61	89.53	81.98, 97.07
Total	807	61	8.18	6.21, 10.14	807	780	97.77	96.47, 99.06

¹Postal codes were missing for 100 (12.4%) of donors therefore we couldn't calculate quintiles of Material Deprivation; 13/100 were positive by the Nucleocapsid antibody, adjusted SARS-CoV-2 seroprevalence among missing postal codes was 15.60% (95% CI 8.17, 23.03); 95/100 were positive by the Spike antibody, adjusted SARS-CoV-2 seroprevalence was 95.21% (95% CI 90.36, 100.00).

Table A1.5 Ontario SARS-CoV-2 seroprevalence, Nucleocapsid vs. Spike antibody results in December 2021

	Nucleocapsid Antibody Results (proxy for natural infection)				Spike Antibody Results (proxy for humoral immunity by either natural infection or vaccination)			
	Crude		Adjusted		Crude		Adjusted	
	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	Number Tested	Number Positive	Percent Positive	95% Confidence Interval
Sex								
Female	2,968	142	4.59	3.96, 5.23	2,968	2884	98.32	97.82, 98.82
Male	4,210	260	6.33	5.57, 7.10	4,210	4104	98.67	98.18, 99.16
Age								
17-24	704	70	10.06	8.24, 11.88	704	690	99.23	98.39, 100.00
25-39	1,901	145	7.36	6.19, 8.52	1,901	1,845	98.08	97.30, 98.85
40-59	2,754	133	4.47	3.71, 5.23	2,754	2,685	98.62	98.04, 99.19
60+	1,819	54	2.94	2.23, 3.64	1,819	1,768	98.34	97.67, 99.02
Material Deprivation¹								
1 (least)	1,624	64	4.13	3.23, 5.03	1,624	1,591	99.08	98.44, 99.72
2	1,560	56	3.51	2.64, 4.38	1,560	1,512	98.20	97.40, 98.99
3	1,453	60	3.97	3.01, 4.93	1,453	1,412	98.36	97.56, 99.17
4	1,069	77	6.91	5.46, 8.35	1,069	1,034	97.86	96.84, 98.88
5 (most)	750	91	11.16	9.07, 13.25	750	734	98.35	97.25, 99.45
Total	7,178	402	5.43	4.94, 5.92	7,178	6,988	98.49	98.14, 98.84

¹Postal codes were missing for 722 (10.1%) of donors therefore we couldn't calculate quintiles of Material Deprivation; 54/722 were positive by the Nucleocapsid antibody, adjusted SARS-CoV-2 seroprevalence among missing postal codes was 7.31% (95% CI 5.53, 9.10); 705/722 were positive by the Spike antibody, adjusted SARS-CoV-2 seroprevalence was 99.04% (95% CI 98.05, 100.00).

Table A1.6 Atlantic Provinces SARS-CoV-2 seroprevalence, Nucleocapsid vs. Spike antibody results in December 2021

	Nucleocapsid Antibody Results (proxy for natural infection)				Spike Antibody Results (proxy for humoral immunity by either natural infection or vaccination)			
	Crude		Adjusted		Crude		Adjusted	
	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	Number Tested	Number Positive	Percent Positive	95% Confidence Interval
Sex								
Female	500	2	0.23	0.00, 0.71	500	494	100.00	99.24, 100.00
Male	604	5	0.67	0.00, 1.36	604	592	99.42	98.42, 100.00
Age								
17-24	80	0	.	.	80	79	99.58	97.59, 100.00
25-39	213	2	0.44	0.00, 1.36	213	208	99.73	98.33, 100.00
40-59	469	2	0.36	0.00, 1.01	469	460	99.50	98.37, 100.00
60+	342	3	0.75	0.00, 1.63	342	339	100.00	99.07, 100.00
Material Deprivation¹								
1 (least)	145	1	0.93	0.00, 2.45	145	144	99.84	98.17, 100.00
2	198	1	0.22	0.00, 1.01	198	197	100.00	98.92, 100.00
3	206	2	0.36	0.00, 1.25	206	203	99.73	98.29, 100.00
4	274	0	.	.	274	269	99.61	98.20, 100.00
5 (most)	196	2	0.89	0.00, 2.11	196	189	99.16	97.49, 100.00
Total	1,104	7	0.44	0.03, 0.86	1,104	1,086	99.87	99.27, 100.00

¹Postal codes were missing for 85 (7.7%) of donors therefore we couldn't calculate quintiles of Material Deprivation; 1/85 were positive by the Nucleocapsid antibody, adjusted SARS-CoV-2 seroprevalence among missing postal codes was 0.95% (95% CI 0.00, 2.84); 84/85 were positive by the Spike antibody, adjusted SARS-CoV-2 seroprevalence was 98.79% (95% CI 96.10, 100.00).

Table A2.1. Weekly SARS-CoV-2 seroprevalence by sociodemographic variables by Nucleocapsid results in December 2021

	December 14 - 18				December 19-24				December 25-30			
	Crude		Adjusted		Crude		Adjusted		Crude		Adjusted	
	Number Tested	Number Positive	Percent Positive	95% CI	Number Tested	Number Positive	Percent Positive	95% CI	Number Tested	Number Positive	Percent Positive	95% CI
Sex												
Female	2,599	155	5.06	4.29, 5.83	2,903	214	6.15	5.34, 6.96	1,495	115	6.95	5.78, 8.12
Male	3,830	257	6.15	5.31, 7.00	3,924	283	6.98	6.09, 7.87	2,065	168	8.13	6.81, 9.45
Age												
17-24	544	44	7.07	5.20, 8.94	707	114	13.6	11.35, 15.85	325	46	14.06	10.77, 17.35
25-39	1,797	157	8.00	6.68, 9.31	1,667	139	7.84	6.48, 9.20	954	87	8.47	6.61, 10.33
40-59	2,449	146	5.39	4.43, 6.35	2,654	169	5.35	4.42, 6.28	1,417	110	6.95	5.54, 8.36
60+	1,639	65	3.05	2.24, 3.87	1,799	75	3.72	2.86, 4.58	864	40	4.32	2.98, 5.66
Province												
British Columbia	1,012	57	5.38	3.86, 6.89	1,545	101	6.38	5.14, 7.62	833	50	5.61	3.91, 7.30
Alberta	1,281	156	12.18	10.05, 14.31	1,469	205	13.85	12.07, 15.64	705	89	12.64	9.72, 15.55
Saskatchewan	514	39	7.06	4.46, 9.66	232	15	6.31	3.12, 9.50	136	10	7.88	2.53, 13.23
Manitoba	261	14	5.42	2.53, 8.31	326	36	10.92	7.49, 14.35	220	11	5.69	2.50, 8.88
Ontario	2,826	144	4.83	4.09, 5.58	2,702	135	4.83	4.00, 5.66	1,650	123	7.21	6.05, 8.38
New Brunswick	44	0	.	.	129	2	1.36	0.00, 3.51	12	0	.	.
Nova Scotia	277	0	.	.	371	3	0.61	0.00, 1.53	1	0	.	.
Prince Edward Island	81	0	.	.	53	0	.	.	0	0	.	.
Newfoundland	133	2	0.98	0.00, 2.16	0	0	.	.	3	0	.	.
Metro area												
Vancouver	646	40	5.98	3.98, 7.99	840	68	8.17	6.15, 10.19	335	25	7.11	4.09, 10.14
Calgary	387	26	6.48	3.50, 9.45	490	44	9.03	6.00, 12.07	326	42	12.23	8.04, 16.42
Edmonton	318	27	8.31	4.65, 11.98	440	31	7.17	4.29, 10.05	226	16	7.42	3.28, 11.56

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Ottawa	298	4	1.05	0.00, 2.18	183	6	4.31	1.65, 6.96	40	1	1.67	0.00, 5.38
Toronto	1,090	87	7.54	6.13, 8.95	989	71	7.09	5.63, 8.56	812	76	8.92	7.16, 10.68
Winnipeg	229	13	5.77	2.59, 8.95	200	15	7.76	3.95, 11.56	106	4	4.80	0.51, 9.09
Ethnicity^{1,2}												
White	4,755	248	4.31	3.72, 4.90	5,113	323	5.43	4.80, 6.07	2,564	180	6.45	5.48, 7.42
Indigenous	94	8	6.85	1.84, 11.85	57	2	2.47	0.00, 6.79	45	2	3.12	0.00, 8.45
Asian	376	18	4.98	2.73, 7.23	337	18	5.92	3.30, 8.55	218	23	11.21	7.00, 15.41
Other racialized groups	798	93	11.11	8.91, 13.31	743	103	13.60	11.08, 16.12	481	67	13.49	10.43, 16.54
Social Deprivation³												
1 (least deprived)	1,208	72	5.34	4.06, 6.63	1,311	118	8.26	6.73, 9.78	705	58	8.30	6.22, 10.39
2	1,174	67	4.97	3.74, 6.20	1,403	102	6.67	5.33, 8.00	673	52	7.49	5.47, 9.51
3	1,137	75	5.98	4.58, 7.38	1,175	70	5.00	3.73, 6.28	612	36	5.29	3.48, 7.09
4	1,096	76	5.91	4.48, 7.33	1,133	90	7.08	5.55, 8.60	544	51	8.74	6.36, 11.12
5 (most deprived)	1,059	57	4.64	3.34, 5.94	1,061	59	4.93	3.62, 6.25	572	36	5.35	3.48, 7.23
Material Deprivation³												
1 (least deprived)	1,734	80	4.29	3.30, 5.28	1,755	101	5.35	4.25, 6.45	914	55	5.98	4.41, 7.56
2	1,306	69	4.54	3.38, 5.70	1,575	91	5.13	4.01, 6.24	707	48	6.22	4.38, 8.06
3	1,196	79	5.24	3.95, 6.52	1,218	83	6.37	4.99, 7.75	699	46	5.26	3.57, 6.96
4	834	56	6.00	4.36, 7.63	1,010	114	9.32	7.50, 11.14	482	46	9.69	7.06, 12.32
5 (most deprived)	604	63	8.93	6.80, 11.06	525	50	8.43	6.08, 10.77	304	38	11.68	8.14, 15.22
Total	6,429	412	5.60	5.03, 6.18	6,827	497	6.55	5.95, 7.15	3,560	283	7.51	6.63, 8.39

¹ In Week 1, self reported ethnicity was missing for 406 (6.3%) donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 10.43% (95% CI 7.39, 13.48). In Week 2, self reported ethnicity was missing for 577 (8.5%) donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 8.37% (95% CI 6.02, 10.72). In Week 3, self reported ethnicity was missing for 252 (7.1%) donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 4.03% (95% CI 1.45, 6.60).

² In Week 1, postal codes were missing for 755 (11.7%) of donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 7.53% (95% CI 5.56, 9.50). In Week 2, postal codes were missing for 744 (10.9%) of donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 7.43% (95% CI 5.48, 9.38). In Week 3, postal codes were missing for 454 (12.6%) of donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 10.64% (95% CI 7.75, 13.54).