COVID-19 Seroprevalence Report

November 7th, 2022

Report #26: September 2022 Survey

The advance of Omicron

Summary

September 2022

September 1 - September 30 2022 (n=31,606)

- **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 100.00% (95% CI 100.00, 100.00%) (based on results from the Spike antibody assay). This was predominantly driven by vaccination.
- Spike antibody concentrations were high by September 2021, but gradually decreased. A peak in values followed by decline is expected after vaccination. Concentrations increased in all age groups by February 2022 likely due to third vaccine dose administration. Recently rising values in most age groups may be related to vaccination or infection.
- **Natural Infections (Based on results from the Nucleocapsid antibody assay):**
- Seroprevalence (natural infection) in September was 63.23% (95% CI 62.69, 63.77), higher than in August (58.54% (95% CI 58.02, 59.06)), $P < 0.0001$). There was a modest week-to-week change over September from 61.14% (95% CI 60.03, 62.26) to 63.43% (95% CI 62.41, 64.45) to 62.85% (95% CI 61.84, 63.86) to 65.41% (95% CI 64.32, 66.51).
- Consistent with previous surveys, donors aged 17-24 years old had the highest seroprevalence rate (78.25% (95% CI 76.94, 79.56) compared to other age groups. However, the seroprevalence rate increased in all age groups compared to August.
- Seroprevalence rates increased in September compared to August in all provinces, however the increase was not statistically significant in Newfoundland and Prince Edward Island.
- Racialized groups have a higher seroprevalence rate (70.14% (95% CI 68.97, 71.32)) compared to white donors (61.76% (95% CI 61.13, 62.38)).

August 2022

August 1 - August 31 2022 (n=35,165)

- **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 100.00% (95% CI 100.00, 100.00%) (based on results from the Spike antibody assay). This was predominantly driven by vaccination.
- Spike antibody concentrations were high by September 2021, but gradually decreased. A peak in values followed by decline is expected after vaccination. Concentrations increased in all age groups by February 2022 likely due to third vaccine dose administration.
- **Natural Infections (Based on results from the Nucleocapsid antibody assay):**
- Seroprevalence (natural infection) in August was 58.54% (95% CI 58.02, 59.06), higher than in July (54.01% (95% CI 53.45, 54.56)), $P < 0.0001$). There was a modest week-to-week change over August from 56.80% (95% CI 55.64, 57.96) to 58.29% (95% CI 57.30, 59.27) to 58.59% (95% CI 57.59, 59.59) to 59.87% (95% CI 58.89, 60.86).
- Consistent with previous surveys, donors aged 17-24 years old had the highest seroprevalence rate (74.98% (95% CI 73.68, 76.28) compared to other age groups. However, the seroprevalence rate increased in all age groups compared to July.
- Seroprevalence rates increased in August compared to July in all provinces, however the increase was not statistically significant in Saskatchewan and Prince Edward Island.
- Racialized groups have a higher seroprevalence rate (67.44% (95% CI 66.30, 68.58)) compared to white donors (56.62% (95% CI 56.02, 57.23)).

July 2022

July 1 - July 31 2022 (n=31,275)

- **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 100.00% (95% CI 100.00, 100.00%) (based on results from the Spike antibody assay). This was predominantly driven by vaccination.
- Spike antibody concentrations were high by September 2021, but gradually decreased. A peak in values followed by decline is expected after vaccination. Concentrations increased in all age groups by February 2022 likely due to third vaccine dose administration. A slight increase in concentration in those over 60 was observed in May and June, consistent with a fourth dose, however this increase levelled off in July.

- **Natural Infections (Based on results from the Nucleocapsid antibody assay):**
- Seroprevalence (natural infection) in July was 54.01% (95% CI 53.45, 54.56), higher than in June (50.7% (95% CI 50.15, 51.26)) $P < 0.0001$). There was a modest week-to-week change over July from 52.32% (95% CI 51.22, 53.42) to 52.70% (95% CI 51.62, 53.77) to 54.68% (95% CI 53.61, 55.74) to 56.51% (95% CI 55.35, 57.67).
- Consistent with previous surveys, donors aged 17-24 years old had the highest seroprevalence rate (71.15% (95% CI 69.71, 72.59) compared to other age groups. However, the seroprevalence rate increased in all age groups compared to June.
- Seroprevalence rates increased in July compared to June in all provinces except PEI, however the increase was only statistically significant in British Columbia, Ontario, New Brunswick and Newfoundland.
- Racialized groups have a higher seroprevalence rate (62.27% (95% CI 61.03, 63.51)) compared to white donors (52.01% (95% CI 51.37, 52.06)).

June 2022

June 1 - June 30 2022 (n=32,121)

- **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 100.00% (95% CI 100.00, 100.00%) (based on results from the Spike antibody assay). This was predominantly driven by vaccination.
- Spike antibody concentrations were high by September 2021, but gradually decreased. A peak in values followed by decline is expected after vaccination. Concentrations increased in all age groups by February 2022 likely due to third vaccine dose administration. An increase in concentration in those over 60 is observed in May and contunued into June consistent with a fourth dose.

- **Natural Infections (Based on results from the Nucleocapsid antibody assay):**
- Seroprevalence (natural infection) in June was 50.7% (95% CI 50.15, 51.26), higher than in May 2022 (46.32% (95% CI 45.77, 46.87) $P < 0.0001$). There was minimal week-to-week change over June from 50.47% (95% CI 49.32, 51.63) to 51.07% (95% CI 50.04, 52.10) to 50.26% (95% CI 49.25, 51.27) to 50.76% (95% CI 49.58, 51.94).
- Consistent with previous surveys, donors aged 17-24 years old had the highest seroprevalence rate (66.29% (95% CI 64.81, 67.77) compared to other age groups. However, the seroprevalence rate increased in all age groups compared to May.
- Seroprevalence rates increased in June compared to May in all provinces.
- Racialized groups have a higher seroprevalence rate (58.03% (95% CI 56.79, 59.27)) compared to white donors (49.01% (95% CI 48.38, 49.65)).

May 2022

May 1 - May 31 2022 (n=31,764)

- **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 100.00% (95% CI 100.00, 100.00%) (based on results from the Spike antibody assay). This was predominantly driven by vaccination.
- Spike antibody concentrations were high by September 2021, but gradually decreased. A peak in values followed by decline is expected after vaccination. Concentrations increased in all age groups by February 2022 likely due to third vaccine dose administration. An increase in concentration in those over 60 is observed in May.

- **Natural Infections (Based on results from the Nucleocapsid antibody assay):**
- Seroprevalence (natural infection) in May 2022 was 46.32% (95% CI 45.77, 46.87), higher than April 2022 (36.71% (95% CI 36.16, 37.26), $P < 0.0001$). There was a gradual increase over May from 42.74% (95% CI 41.65, 43.84) to 46.11% (95% CI 45.00, 47.21) to 47.03% (95% CI 45.96, 48.10) to 48.96% (95% CI 47.87, 50.06) with the persistence of the Omicron variant.
- Consistent with previous surveys, donors aged 17-24 years old had the highest seroprevalence rate (64.47% (95% CI 62.96, 65.98) compared to other age groups. However, the seroprevalence rate increased in all age groups compared to April.
- Seroprevalence rates increased in May compared to April in all provinces except PEI.
- Racialized groups have a higher seroprevalence rate (54.35% (95% CI 53.12, 55.58)) compared to white donors (44.31% (95% CI 43.67, 44.95)).
- Among repeat tested donors, new infections in unvaccinated donors have increased from June 2021 1.53% (95% CI 1.14, 2.00) to 9.12% (95% CI 8.24, 10.07) in January 2022 and 46.83% (95% CI 44.57, 49.10) in May 2022
- Potential breakthrough infections remained low from June 2021 to December 2021, but increased from 5.19% (95% CI 4.68, 5.74) in January 2022 to 31.02% (95% CI 30.17, 31.88) in May 2022.

April 2022

April 1 - April 30 2022 (n=29,787)

- **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 99.74% (95% CI 99.60, 99.88%) (based on results from the Spike antibody assay). This was predominantly driven by vaccination.
- Spike antibody concentrations were high by September 2021, but gradually decreased. A peak in values followed by decline is expected after vaccination. Concentrations increased in all age groups by February 2022 likely due to third vaccine dose administration, but are now declining.

- **Natural Infections (Based on results from the Nucleocapsid antibody assay):**
- Seroprevalence (natural infection) in April 2022 was 36.71% (95% CI 36.16, 37.26), higher than March 2022 (28.70% (95% CI 28.15, 29.26), $P < 0.0001$). There was a gradual increase over April from 32.83% (95% CI 31.67, 33.98) to 35.54% (95% CI 34.47, 36.60) to 37.64% (95% CI 36.62, 38.65) to 40.04% (95% CI 38.90, 41.18) with the persistence of the Omicron variant.
- Consistent with previous surveys, donors aged 17-24 years old had the highest seroprevalence rate (55.37% (95% CI 53.76, 56.99) compared to other age groups. However, the seroprevalence rate increased in all age groups compared to March.
- Seroprevalence rates increased in April compared to March in all provinces.
- Racialized groups have a higher seroprevalence rate (45.06% (95% CI 43.77, 46.34)) compared to white donors (34.78% (95% CI 34.15, 35.42)).
- Among repeat tested donors, new infections in unvaccinated donors have increased from June 2021 1.53% (95% CI 1.14, 2.00) to 9.12% (95% CI 8.24, 10.07) in January 2022 and 37.19% (95% CI 35.14, 39.28) in April 2022
- Potential breakthrough infections remained low from June 2021 to December 2021, but increased from 5.19% (95% CI 4.68, 5.74) in January 2022 to 21.99 (95% CI 21.19. 22.80) in April 2022.

March 2022

March 1 - March 31 2022 (n=26,026)

- **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 99.57% (95% CI 99.42, 99.73%) (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. Concentrations increased in all age groups by February likely due to third vaccine dose administration, but were starting to decline in March.

- **Natural Infections (Based on results from the Nucleocapsid antibody assay):**
- Seroprevalence (natural infection) in March 2022 was 28.70% (95% CI 28.15, 29.25), higher than February 2022 (23.68% (95% CI 23.18, 24.18).($P < 0.0001$). There was a gradual increase over the 31 day reporting period from 27.02% (95% CI 25.95, 28.09) to 27.54% (95% CI 26.47, 28.61) to 30.68% (95% CI 29.61, 31.75) to 29.52% (95% CI 28.34, 30.69) consistent with the persistence of the Omicron variant.
- Consistent with previous surveys, donors aged 17-24 years old had the highest seroprevalence rate (44.27% (95% CI 42.54, 46.01) compared to other age groups. However, the seroprevalence rate increased in all age groups compared to February.
- Seroprevalence rates increased in March compared to February in all provinces with the exception of Prince Edward Island and Newfoundland and Labrador where sample sizes are smaller.
- Racialized groups have a higher seroprevalence rate (38.58% (95% CI 37.21, 39.95)) compared to white donors (26.27% (95% CI 25.65, 26.89)).
- Among repeat tested donors, new infections in unvaccinated donors have increased from June 1.53% (95% CI 1.14, 2.00) to 9.12% (95% CI 8.24, 10.07) in January and 29.49% (95% CI 27.57, 31.48) in March
- Potential breakthrough infections remained low from June to December, but increased from 5.19% (95% CI 4.68, 5.74) in January to 17.50 (95% CI 16.66, 18.37) in March.

February 2022

February 1 - February 28 2022 (n=28,616)

- **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 99.60% (95% CI 99.45, 99.75%) (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. Concentrations increased in all age groups by February likely due to third vaccine dose administration.

- **Natural Infections (Based on results from the Nucleocapsid antibody assay):**
- Seroprevalence (natural infection) in February 2022 was 23.68% (95% CI 23.18, 24.18), higher than January 2022 (12.12% (95% CI 11.76, 12.48).($P < 0.0001$). There was a gradual increase over the 28 day reporting period from 21.39% (20.31, 22.48) to 23.43% (22.41, 24.45) to 23.68% (22.77, 24.58) to 25.25% (95% CI 24.30, 26.20) consistent with emergence of the Omicron variant.
- Consistent with previous surveys, donors aged 17-24 years old had the highest seroprevalence rate (36.27% (95% CI 34.68, 37.86%)) compared to other age groups. However, the seroprevalence rate increased in all age groups compared to January.
- Seroprevalence rates increased in February compared to January in all provinces.
- Racialized groups have a higher seroprevalence rate (33.45% (95% CI 32.16, 34.73)) compared to white donors (21.17% (95% CI 20.62, 21.72%)).
- Among repeat tested donors, new infections in unvaccinated donors have increased from June 1.53% (1.14, 2.00) to 9.12% (95% CI 8.24, 10.07) in January, and more than doubled in February (23.71%, 95% CI 22.10, 25.37).
- Potential breakthrough infections remained low from June to December, but increased from 5.19% (95% C I4.68, 5.74) in January to 15.56% (95% CI 14.72, 16.42) in February.

January 2022

January 1 - January 31 2022 (n=32,505)

- **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 98.89% (95% CI 98.73, 99.06%) (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. Concentrations increased in all age groups by January likely due to third vaccine dose administration.

- **Natural Infections (Based on results from the Nucleocapsid antibody assay):**
- Seroprevalence (natural infection) in January 2022 was 12.12% (95% CI 11.76, 12.48), higher than December 2021 at 6.39% (95% CI 6.01, 6.76) ($P < 0.001$). There was a gradual increase over the 31 day reporting period from 7.16% (6.62, 7.71) to 10.09% (9.46, 10.71) to 12.65% (11.84, 13.45) to 16.30% (95% CI 15.51, 17.09) consistent with emergence of the Omicron variant.
- Consistent with previous surveys, donors aged 17-24 years old had the highest seroprevalence rate (22.22% (95% CI 20.93, 23.51%)) compared to other age groups. However, the seroprevalence rate increased in all age groups compared to December.
- Seroprevalence rates increased in January compared to December in almost all provinces.
- Racialized groups have a higher seroprevalence rate (18.29% (95% CI 17.27, 19.32)) compared to white donors (10.73% (95% CI 10.34, 11.12%)).
- Among repeat tested donors, new infections in unvaccinated donors have increased from June 1.53% (1.14, 2.00) to 3.91% (3.11, 4.83%) in December and more than doubled in January to 9.012% (95% CI 8.24, 10.07).
- Potential breakthrough infections remained low from June to December, but increased from 0.74% (95% CI 0.48, 1.10) in December to 5.19% (95% CI 4.68, 5.74) in January.

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 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 3.91% (3.11, 4.83%) in December but vaccine breakthrough infections are low, 0.74% (0.48, 1.10%).

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 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. Seroprevalance 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. In mid-December 2021, a fifth wave began and subsided somewhat over January with a sixth wave in March/April and a seventh in July. As of October 1, 2022, 4,336,860 cases of COVID-19 had been reported in Canada.

Beginning in January 2021, Alpha (B.1.1.7) began to establish itself as the primary variant of concern (VOC). In late June 2021, Delta (B.1.617.2) was transitioning to be the primary VOC. In mid-December 2021, a new more contagious VOC, Omicron (B.1.1.529) began to establish itself as a primary VOC followed by subvariants. Omicron BA.5 and its subvariants made up most cases in Canada by September 2022. Peak timepoints when each VOC became dominant varied between provinces. 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 informs public health policies.

Antibody concentrations typically peak within a month of vaccination and then gradually decrease. Antibody concentrations can be much higher after a subsequent dose of vaccine, or when an infection occurs pre- or post-vaccination. More than 88% of the people in Canada aged 18 and older had received a primary vaccine series as of October 9th, 2022. Starting in November 2021, some Canadians became eligible for a third dose with 59% of Canadians aged 18 and older having received at least one additional dose. A fourth dose was encouraged in risk groups and older individuals and bi-valent vaccines became widely available in August 2022. 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

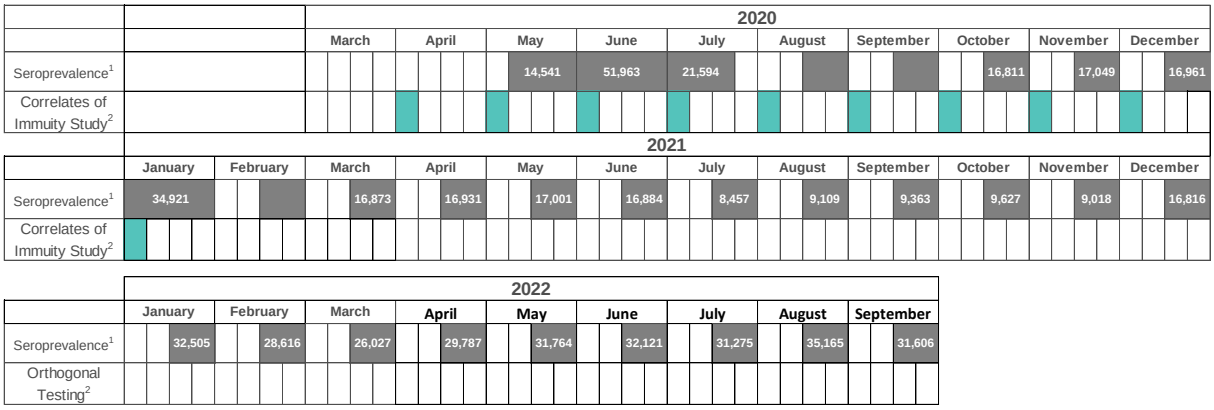
Before each donation, blood donors must answer screening questions to ensure that they are in good health and do not have risk factors for infections that may be transmitted to blood recipients. There is no evidence that SARS-CoV-2 can be transmitted through blood transfusion, but it is important to 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 for 2 weeks after symptoms disappear (3 weeks if hospitalized) if they have been in contact with someone who was infected or if they have had the infection. Donors also have their temperature and their hemoglobin level 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 and 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 2021 samples from 2 weeks were tested without sorting in order to be able to report more quickly, and as of January 2022 samples from all weeks of the month were tested. 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.



[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 2021 to August 2021 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 2021 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 monitored[2]. 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 equation[3]. 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.

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, 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 September 1 and September 30, 2022, a total of 31,606 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 100.00% (95% CI 100.00, 100.00%). The adjusted seroprevalence by Nucleocapsid antibody (proxy for natural infection) was 63.23% (95% CI 62.69, 63.77) (please refer to points of interpretation). There was an increase over the 30-day reporting period from 61.14% (95% CI 60.03, 62.26) to 63.43% (95% CI 62.41, 64.45) to 62.85% (95% CI 61.84, 63.86) to 65.41% (95% CI 64.32, 66.51).

Figure 1 illustrates temporal trends of SARS-CoV-2 seroprevalence from April 4, 2020, until September 30, 2022, 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 2021 onwards, mirroring wider first and second dose vaccine roll out. Figure 2 stratifies seroprevalence by regions. Much of the humoral immunity was induced by vaccines (compared to natural infections) across the country. The largest increase in seroprevalence using Roche N began in February 2022 and has continued to increase consistent with the Omicron variant wave. Appendix Tables A1.1-A1.6 compare seroprevalence rates by sex, age groups and material deprivation in different regions.

Table 2 compares temporal changes in seroprevalence rates by natural infection (**Nucleocapsid antibody** between August 2022 and September 2022). Overall, the seroprevalence rate for natural infections was higher in September (63.23% (95% CI 62.69, 63.77) compared to August (58.54% (95% CI 58.02, 59.06) ($P < 0.0001$)), and natural infections increased compared to the previous month across all demographics, although the increases did not reach statistical significance in the provinces of Newfoundland and Prince Edward Island, the metro area of Calgary, among the ‘other’ ethnic group and among the indigenous ethnic group where sample size was smaller. Donors aged 17-24 years old continued to have the highest seroprevalence rate at 78.25% (95% CI 76.94, 79.56) compared to other age groups.

After vaccination an increase in antibody concentration followed by gradual decline is expected. From September 2021 to September 2022 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 September.

From June to October 2021 the percentage of incident breakthrough infections were rare and varied by month with no clear trend (See Table 3). There was a small increase over November

and December which increased from January and in September was 38.36% (95% CI 37.44, 39.29). Table 4 shows the percentage of incident cases by month in likely unvaccinated donors. Since June 2021 the percentage slowly increased to 3.91% (95% CI 3.11, 4.83) by December 2021 then increased much higher to 61.64% (95% CI 58.83, 64.39) by September 2022.

Figure 4 shows regional weekly trends since December 2021 for Nucleocapsid by age group. 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 2021 to September 2022. Differences in natural infections between white and racialized groups were seen from January 2021 to September 2022 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. Tables A 1.1 to A 1.6 show selected demographic results for September by region (Nucleocapsid and Spike), and additional weekly breakdown of Nucleocapsid results are shown in Tables A 2.1 and A 2.2

Conclusion

As of September 2022**,** adjusted seroprevalence by the Spike antibody assay (proxy for humoral immunity) was 100.00% (95% CI 100.00, 100.00). While humoral immunity has been largely driven by vaccination, the fraction of the population naturally exposed (with hybrid immunity) has increase sharply since December 2021 consistent with the arrival of the Omicron variant and subsequent subvariants.

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 63.07% (95% CI 62.53, 63.60), and after weighting factors applied it was 62.99% (95% CI 62.45, 63.52), then after the weighted seroprevalence was adjusted for sensitivity and specificity, 63.23% (95% 62.69, 63.77). Using the Spike antibody assay, the unweighted SARS-CoV-2 seroprevalence for the full

sample was 99.29% (95% CI 99.20, 99.38), and after weighting factors applied it was 99.33% (95% CI 99.23, 99.42), then after the weighted seroprevalence was adjusted for sensitivity and specificity, 100% (95% CI 100.00, 100.00).

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 160 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. Many Spike antibody positive results are related to vaccination. However, Spike antibody positives are also 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 September the two most common positive antibody profiles were positive on Spike antibody/positive on Nucleocapsid antibody (62.9%) and positive on Spike antibody/negative on Nucleocapsid antibody (36.4%) (see below).

Diagnostic phenotypes in September 2022 (unadjusted)

	Nucleocapsid Antibody	Spike Antibody	Total N (%)
	Negative	Negative	171 (0.5)
	Negative	Positive	11,502 (36.4)
	Positive	Negative	52 (0.2)
	Positive	Positive	19,881 (62.9)
Total			31,606

References

1. https://diagnostics.roche.com/global/en/products/params/elecsys-anti-sars-cov-2-s.html
2. Whitaker HJ, Elgohari S, Rowe C, Otter AD, Brooks T, Linley E, et al., Impact of COVID-19 vaccination program on seroprevalence in blood donors in England, 2021, Journal of Infection (2021), doi: https://doi.org/10.1016/j.jinf.2021.04.037
3. Lang Z, Reiczigel J. Confidence limits for prevalence of disease adjusted for estimated sensitivity and specificity. Preventive Veterinary Medicine. 2014:113;13-2

Table 1. Comparing SARS-CoV-2 seroprevalence by sociodemographic variables by Nucleocapsid and Spike antibody results in September 2022

	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	13,986	8,891	62.71	61.96, 63.46	13,986	13,896	100.00	100.00, 100.00
Male	17,620	11,042	63.78	63.02, 64.55	17,620	17,487	100.00	100.00, 100.00
Age								
17-24	2,342	1,839	78.25	76.94, 79.56	2,342	2,337	100.00	100.00, 100.00
25-39	8,322	5,998	72.40	71.40, 73.41	8,322	8,283	100.00	100.00, 100.00
40-59	12,164	7,910	64.81	63.91, 65.70	12,164	12,073	100.00	100.00, 100.00
60+	8,778	4,186	46.73	45.69, 47.78	8,778	8,690	100.00	100.00, 100.00
Province								
British Columbia	5,507	3,457	63.73	62.45, 65.01	5,507	5,472	100.00	100.00, 100.00
Alberta	6,084	4,254	71.33	70.01, 72.65	6,084	6,039	100.00	100.00, 100.00
Saskatchewan	1,492	952	64.57	61.86, 67.29	1,492	1,475	99.99	99.37, 100.00
Manitoba	1,666	1,092	66.91	64.43, 69.38	1,666	1,652	100.00	99.51, 100.00
Ontario	13,910	8,428	60.80	60.04, 61.56	13,910	13,811	100.00	100.00, 100.00
New Brunswick	966	602	63.29	60.09, 66.50	966	961	100.00	100.00, 100.00
Nova Scotia	1,396	777	55.82	52.85, 58.79	1,396	1,391	100.00	100.00, 100.00
Prince Edward Island	121	74	64.02	56.65, 71.38	121	120	99.63	97.73, 100.00
Newfoundland	464	297	63.27	59.43, 67.10	464	462	100.00	99.93, 100.00
Metro area								
Vancouver	2,980	1,996	67.43	65.77, 69.09	2,980	2,965	100.00	100.00, 100.00
Calgary	2,304	1,623	72.38	70.07, 74.69	2,304	2,287	100.00	99.87, 100.00
Edmonton	1,779	1,204	68.66	66.33, 70.99	1,779	1,772	100.00	100.00, 100.00

Ottawa	1,269	744	57.94	55.54, 60.34	1,269	1,267	100.00	100.00, 100.00
Toronto	4,644	2,879	62.02	60.84, 63.20	4,644	4,615	100.00	100.00, 100.00
Winnipeg	940	593	64.20	60.82, 67.58	940	935	100.00	99.71, 100.00
Ethnicity[1,2]								
White	24,105	14,886	61.76	61.13, 62.38	24,105	23,939	100.00	100.00, 100.00
Indigenous	384	272	68.18	63.51, 72.85	384	382	100.00	99.09, 100.00
Asian	1,651	1,099	65.27	63.10, 67.45	1,651	1,642	100.00	100.00, 100.00
Other racialized groups	3,458	2,478	72.83	71.38, 74.28	3,458	3,439	100.00	100.00, 100.00
Social Deprivation[3]								
1 (least deprived)	6,147	4,001	65.53	64.32, 66.75	6,147	6,120	100.00	100.00, 100.00
2	5,937	3,665	61.97	60.72, 63.22	5,937	5,873	100.00	99.89, 100.00
3	5,347	3,321	61.98	60.68, 63.28	5,347	5,317	100.00	100.00, 100.00
4	5,111	3,234	63.76	62.45, 65.08	5,111	5,073	100.00	100.00, 100.00
5 (most deprived)	5,085	3,149	61.87	60.53, 63.20	5,085	5,043	100.00	100.00, 100.00
Material Deprivation[3]								
1 (least deprived)	7,895	4,984	63.02	61.95, 64.10	7,895	7,851	100.00	100.00, 100.00
2	6,816	4,231	62.49	61.32, 63.66	6,816	6,768	100.00	100.00, 100.00
3	5,819	3,610	62.42	61.16, 63.68	5,819	5,776	100.00	100.00, 100.00
4	4,526	2,886	63.56	62.16, 64.95	4,526	4,481	100.00	99.88, 100.00
5 (most deprived)	2,571	1,659	65.04	63.25, 66.83	2,571	2,550	100.00	100.00, 100.00
Total	31,606	19,933	63.23	62.69, 63.77	31,606	31,383	100.00	100.00, 100.00

[1]Self reported ethnicity was missing for 2,008 (6.4%) donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 59.94% (95% CI 57.69, 62.18); and Spike antibody was 99.42% (95% CI 98.82, 100,00).

[2]Combining all racialized groups together resulted in adjusted SARS-CoV-2 seroprevalence of 70.14% (95% CI 68.97, 71.32) by the Nucleocapsid antibody assay, and 100.00% (95% CI 100.00, 100.00) by Spike antibody.

[3]Postal codes were missing for 3,979 (12.6%) of donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 64.42% (95% CI 62.91, 65.94) and Spike antibody was 100.00% (95% CI 100.00, 100.00).

Table 2. Changes in SARS-CoV-2 seroprevalence by **Nucleocapsid Antibody assay (proxy for natural infection)** by sociodemographic variables between August and September 2022

	August 2022 (crude)		August 2022 (adjusted)		September 2022 (crude)		September 2022 (adjusted)		
	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	Number Tested	Number Positive	Percent Positive	95% Confidence Interval	P-Value*
Sex									
Female	16,089	9,272	57.39	56.66, 58.12	13,986	8,891	62.71	61.96, 63.46	<0.0001
Male	19,076	10,997	59.76	59.02, 60.50	17,620	11,042	63.78	63.02, 64.55	<0.0001
Age									
17-24	2,648	1,975	74.98	73.68, 76.28	2,342	1,839	78.25	76.94, 79.56	0.0005
25-39	9,507	6,335	67.53	66.53, 68.53	8,322	5,998	72.40	71.40, 73.41	<0.0001
40-59	12,895	7,750	60.53	59.65, 61.40	12,164	7,910	64.81	63.91, 65.70	<0.0001
60+	10,115	4,209	41.06	40.08, 42.03	8,778	4,186	46.73	45.69, 47.78	<0.0001
Province									
British Columbia	6,104	3,513	59.15	57.92, 60.38	5,507	3,457	63.73	62.45, 65.01	<0.0001
Alberta	6,483	4,221	66.41	65.12, 67.70	6,084	4,254	71.33	70.01, 72.65	<0.0001
Saskatchewan	1,510	858	59.37	56.75, 61.98	1,492	952	64.57	61.86, 67.29	0.0070
Manitoba	1,740	1,060	62.64	60.26, 65.02	1,666	1,092	66.91	64.43, 69.38	0.0152
Ontario	15,998	8,818	56.03	55.29, 56.77	13,910	8,428	60.80	60.04, 61.56	<0.0001
New Brunswick	1,060	594	57.22	54.13, 60.31	966	602	63.29	60.09, 66.50	0.0078
Nova Scotia	1,518	756	50.86	48.05, 53.67	1,396	777	55.82	52.86, 58.79	0.0175
Prince Edward Island	271	148	54.79	47.62, 61.96	121	74	64.02	56.65, 71.38	0.0803
Newfoundland	481	301	62.71	59.08, 66.35	464	297	63.27	59.43, 67.10	0.8371
Metro area									
Vancouver	3,121	1,935	62.33	60.75, 63.92	2,980	1,996	67.43	65.77, 69.09	<0.0001
Calgary	2,469	1,678	69.33	67.09, 71.57	2,304	1,623	72.38	70.07, 74.69	0.0636
Edmonton	1,993	1,183	60.35	58.04, 62.66	1,779	1,204	68.66	66.33, 70.99	<0.0001
Ottawa	1,860	960	51.59	48.77, 54.42	1,269	744	57.94	55.54, 60.34	0.0008

Toronto	5,167	3,034	58.91	57.79, 60.04	4,644	2,879	62.02	60.84, 63.20	0.0002
Winnipeg	1,169	673	58.66	55.48, 61.84	940	593	64.20	60.82, 67.58	0.0196
Ethnicity[1,2]									
White	26,886	15,037	56.62	56.02, 57.23	24,105	14,886	61.76	61.13, 62.38	<0.0001
Indigenous	449	288	64.61	60.29, 68.92	384	272	68.18	63.51, 72.85	0.2721
Asian	1,813	1,102	60.99	58.85, 63.13	1,651	1,099	65.27	63.10, 67.45	0.0060
Other racialized groups	3,814	2,632	70.98	69.58, 72.39	3,458	2,478	72.83	71.38, 74.28	0.0734
Social Deprivation[3]									
1 (least deprived)	6,600	3,967	61.01	59.84, 62.17	6,147	4,001	65.53	64.32, 66.75	<0.0001
2	6,477	3,704	58.23	57.03, 59.43	5,937	3,665	61.97	60.72, 63.22	<0.0001
3	6,199	3,504	57.45	56.21, 58.69	5,347	3,321	61.98	60.68, 63.28	<0.0001
4	5,767	3,217	57.19	55.90, 58.48	5,111	3,234	63.76	62.45, 65.08	<0.0001
5 (most deprived)	5,877	3,323	56.89	55.59, 58.19	5,085	3,149	61.87	60.53, 63.20	<0.0001
Material Deprivation[3]									
1 (least deprived)	9,204	5,223	56.98	55.93, 58.03	7,895	4,984	63.02	61.95, 64.10	<0.0001
2	7,739	4,422	58.12	57.00, 59.24	6,816	4,231	62.49	61.32, 63.66	<0.0001
3	6,295	3,560	57.67	56.44, 58.89	5,819	3,610	62.42	61.16, 63.68	<0.0001
4	4,874	2,819	59.08	57.73, 60.43	4,526	2,886	63.56	62.16, 64.95	<0.0001
5 (most deprived)	2,808	1,691	61.84	60.13, 63.55	2,571	1,659	65.04	63.25, 66.83	0.0114
Total	35,165	20,269	58.54	58.02, 59.06	31,606	19,933	63.23	62.69, 63.77	<0.0001

*P-value reflects the difference between August and September results.

[1]In August, self reported ethnicity was missing for 2,203 (6.3%) donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 54.92% (95% CI 52.83, 57.01). In September, self reported ethnicity was missing for 2,008 (6.4%) donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 59.94% (95% CI 57.69, 62.18).

[2]In August, combining all racialized groups together resulted in adjusted SARS-CoV-2 seroprevalence of 67.44% (95% CI 66.30, 68.58) by the Nucleocapsid antibody assay. In September, combining all racialized groups together resulted in adjusted SARS-CoV-2 seroprevalence of 70.14% (95% CI 68.97, 71.32) by the Nucleocapsid antibody assay.

[3]In August, postal codes were missing for 4,245 (12.1%) of donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 60.70% (95% CI 59.22, 62.19) and Spike antibody was 100.00% (95% CI 100.00, 100.00). In September, postal codes were missing for 3,979 (12.6%) of donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 64.42% (95% CI 62.91, 65.94) and Spike antibody was 100.00% (95% CI 100.00, 100.00).

Table 3. SARS-CoV-2 incidence among anti-S positive donors by month from June 2021 – September 2022.

Month	Total donors tested	Repeat Donors	Previous S positive, N negative	S Positive, N Positive		
				N	%	95% CI
Jun	16,884	4,452	929	2	0.22	0.03, 0.78
Jul	8,457	2,853	1,054	5	0.47	0.15, 1.10
Aug	9,109	5,400	2,719	8	0.29	0.13, 0.58
Sep	9,363	5,728	2,915	3	0.10	0.02, 0.30
Oct	9,627	5,898	3,313	12	0.36	0.19, 0.63
Nov	9,018	5,290	3,318	20	0.60	0.37, 0.93
Dec	16,817	5,560	3,241	24	0.74	0.48, 1.10
Jan	32,505	11,296	6,973	362	5.19	4.68, 5.74
Feb	28,616	10,200	7,065	1,099	15.56	14.72, 16.42
Mar	26,056	10,650	7,753	1,359	17.53	16.69, 18.39
Apr	29,786	14,128	10,365	2,279	21.99	21.19, 22.80
May	31,764	15,665	11,344	3,519	31.02	30.17, 31.88
Jun	32,121	16,134	11,075	3,565	32.19	31.32, 33.07
Jul	31,275	17,142	11,264	3,578	31.76	30.91, 32.63
Aug	35,118	18,392	11,393	4,105	36.03	35.15, 36.92
Sep	31,606	18,568	10,685	4,099	38.36	37.44, 39.29

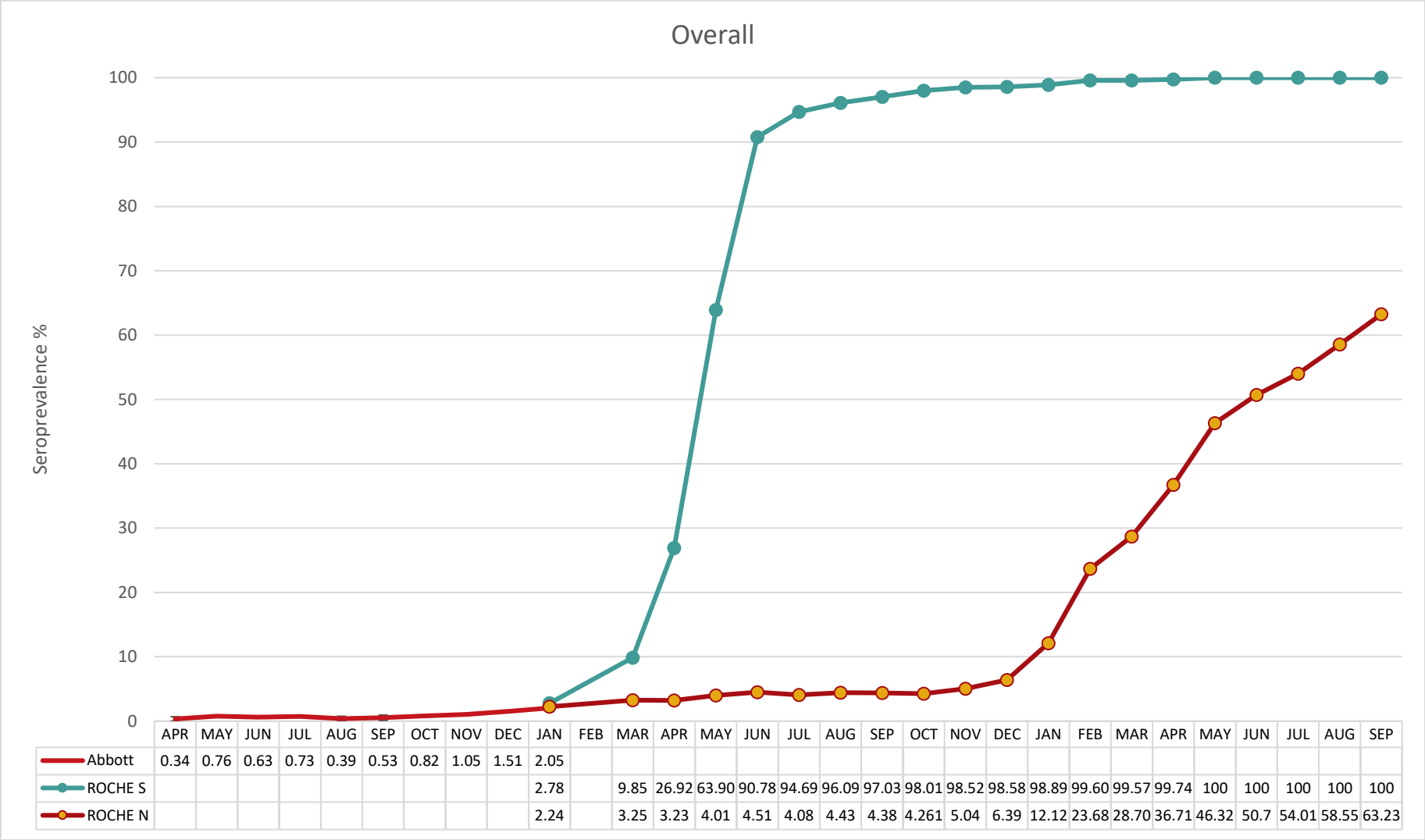
Note: A donation was considered a potential breakthrough incident infection if donors tested S positive and N negative on their previous donation and then tested S positive and N positive on their following donation.

Table 4. SARS-CoV-2 incidence among anti-S negative donors by month from June 2021 – September 2022.

Month	Total donors tested	Repeat Donors	Previous S negative, N negative	S Positive, N Positive		
				N	%	95% CI
Jun	16,884	4,452	3,409	52	1.53	1.14, 2.00
Jul	8,457	2,853	1,697	24	1.41	0.91, 2.10
Aug	9,109	5,400	2,487	29	1.17	0.78, 1.67
Sep	9,363	5,728	2,628	53	2.02	1.51, 2.63
Oct	9,627	5,898	2,385	61	2.56	1.96, 3.27
Nov	9,018	5,290	1,754	56	3.19	2.42, 4.13
Dec	16,817	5,560	2,073	81	3.91	3.11, 4.83
Jan	32,505	11,296	3,924	358	9.12	8.24, 10.07
Feb	28,616	10,200	2,666	632	23.71	22.10, 25.37
Mar	26,056	10,650	2,138	630	29.47	27.54, 31.45
Apr	29,786	14,128	2,143	797	37.19	35.14, 39.28
May	31,764	15,665	1,907	893	46.83	44.57, 49.10
Jun	32,121	16,134	1,784	934	52.35	50.01, 54.69
Jul	31,275	17,142	1,446	762	52.70	50.09, 55.30
Aug	35,118	18,392	1,450	851	58.69	56.11, 61.24
Sep	31,606	18,568	1,207	744	61.64	58.83, 64.39

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.

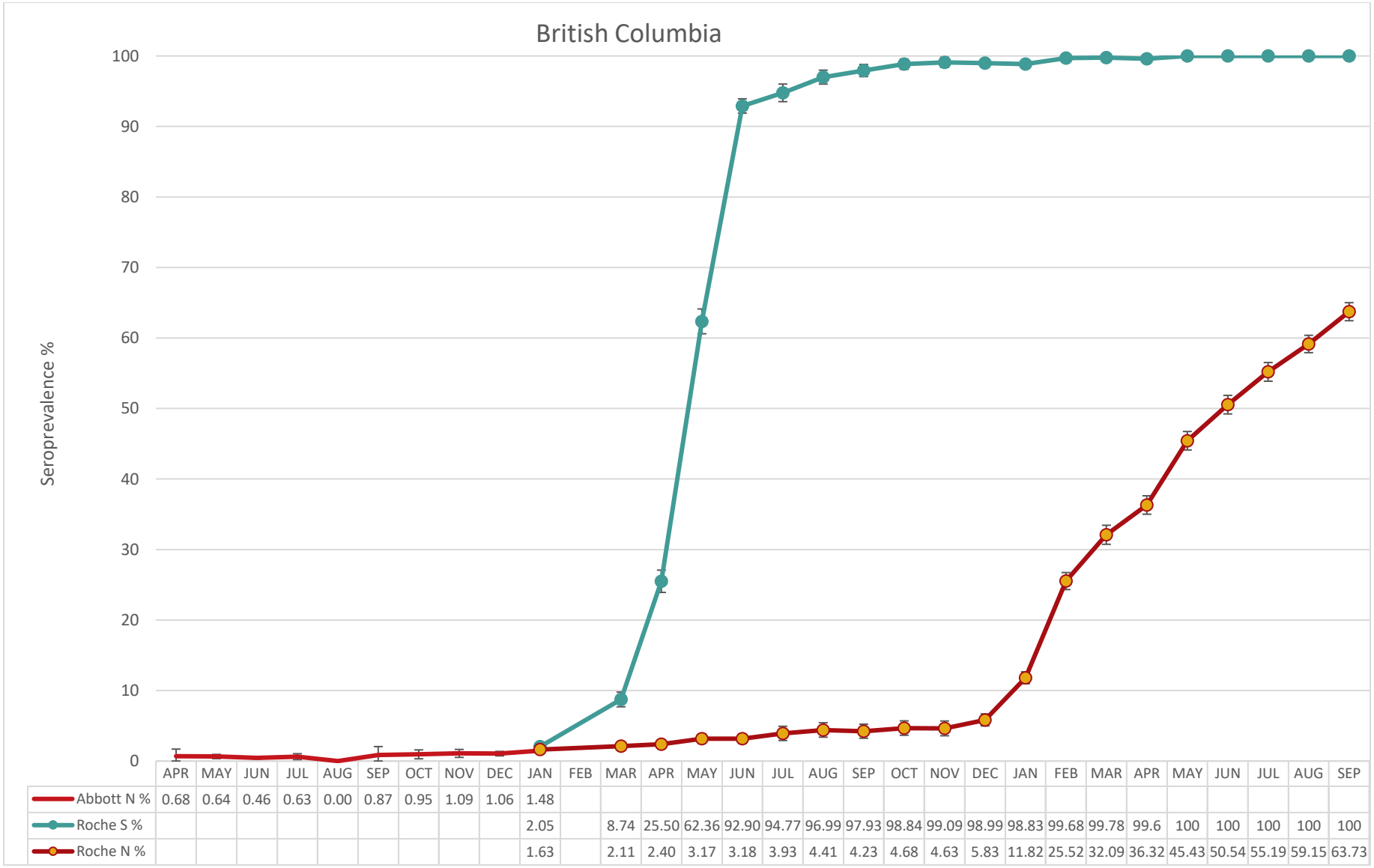
Figure 1. Overall temporal trends of SARS-CoV-2 seroprevalence by monthly intervals from April 2020 - September 2022 (comparing results from Abbott N (until January 2021) followed by seroprevalence estimated by Roche N and Roche S results.



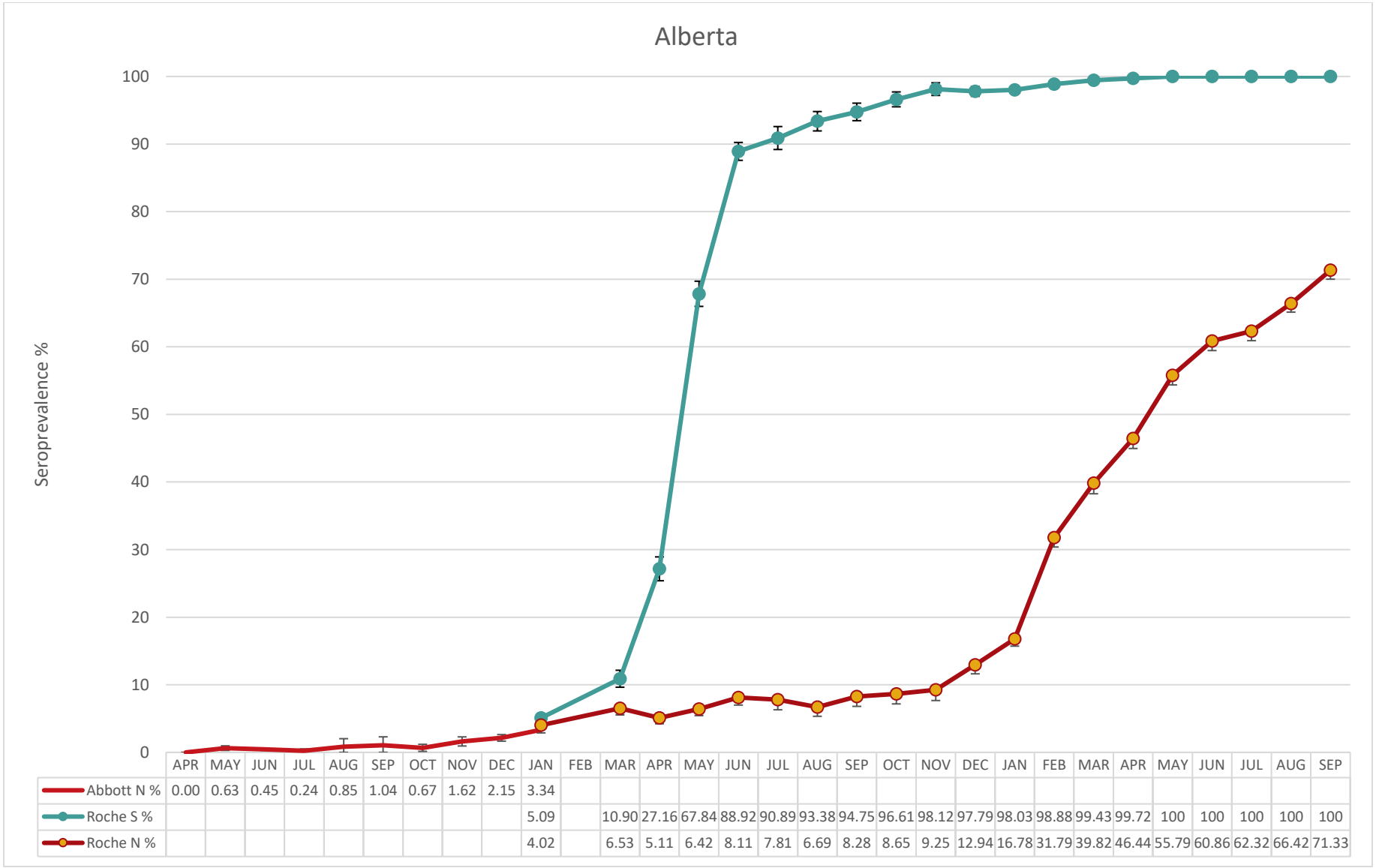
	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Abbott	0.34	0.76	0.63	0.73	0.39	0.53	0.82	1.05	1.51	2.05																				
ROCHE S										2.78		9.85	26.92	63.90	90.78	94.69	96.09	97.03	98.01	98.52	98.58	98.89	99.60	99.57	99.74	100	100	100	100	100
ROCHE N										2.24		3.25	3.23	4.01	4.51	4.08	4.43	4.38	4.261	5.04	6.39	12.12	23.68	28.70	36.71	46.32	50.7	54.01	58.55	63.23

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.

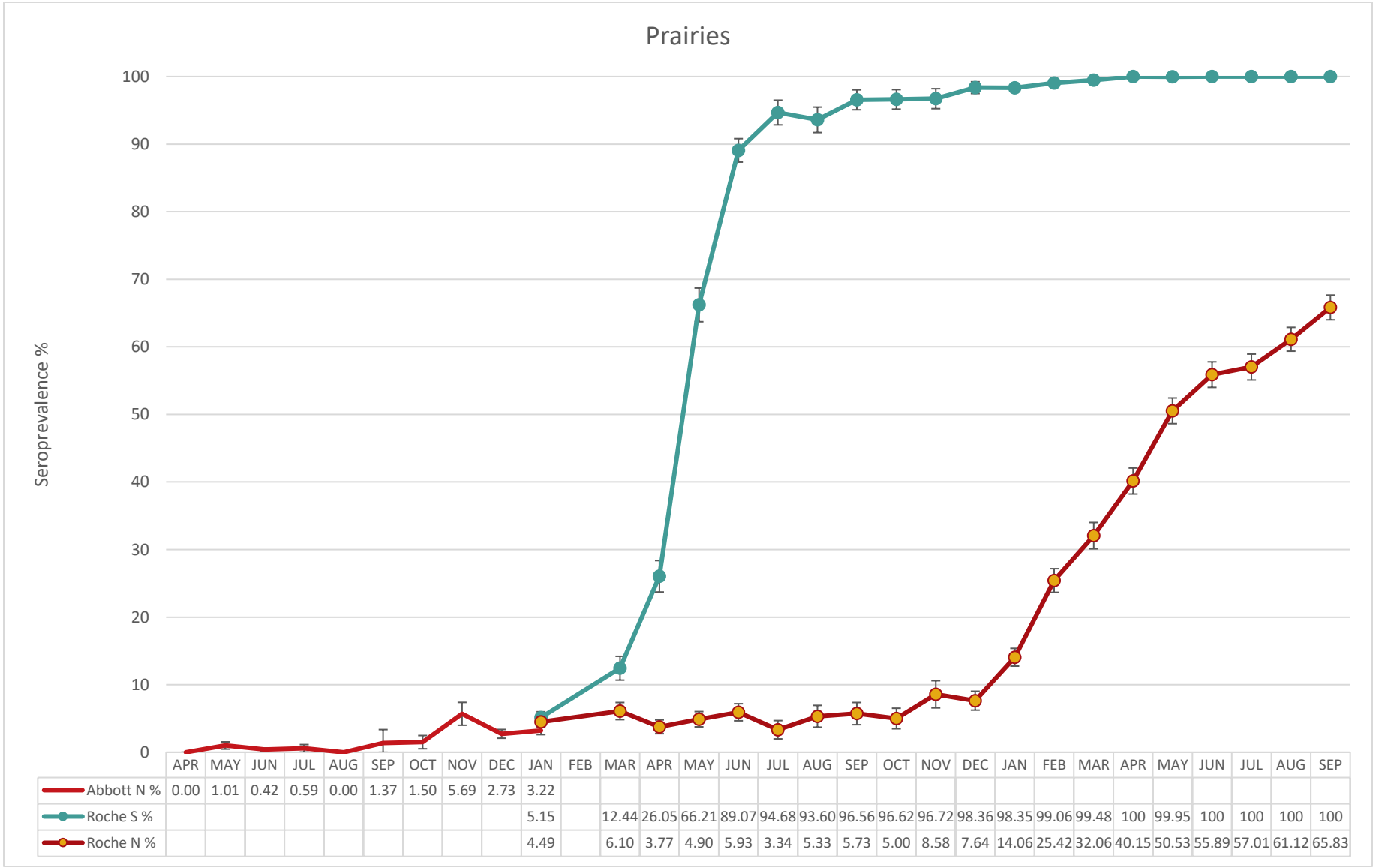
Figure 2. Regional temporal trends of SARS-CoV-2 seroprevalence monthly from April 2020 - September 2022 (by Abbott N, Roche N and Roche S assays)



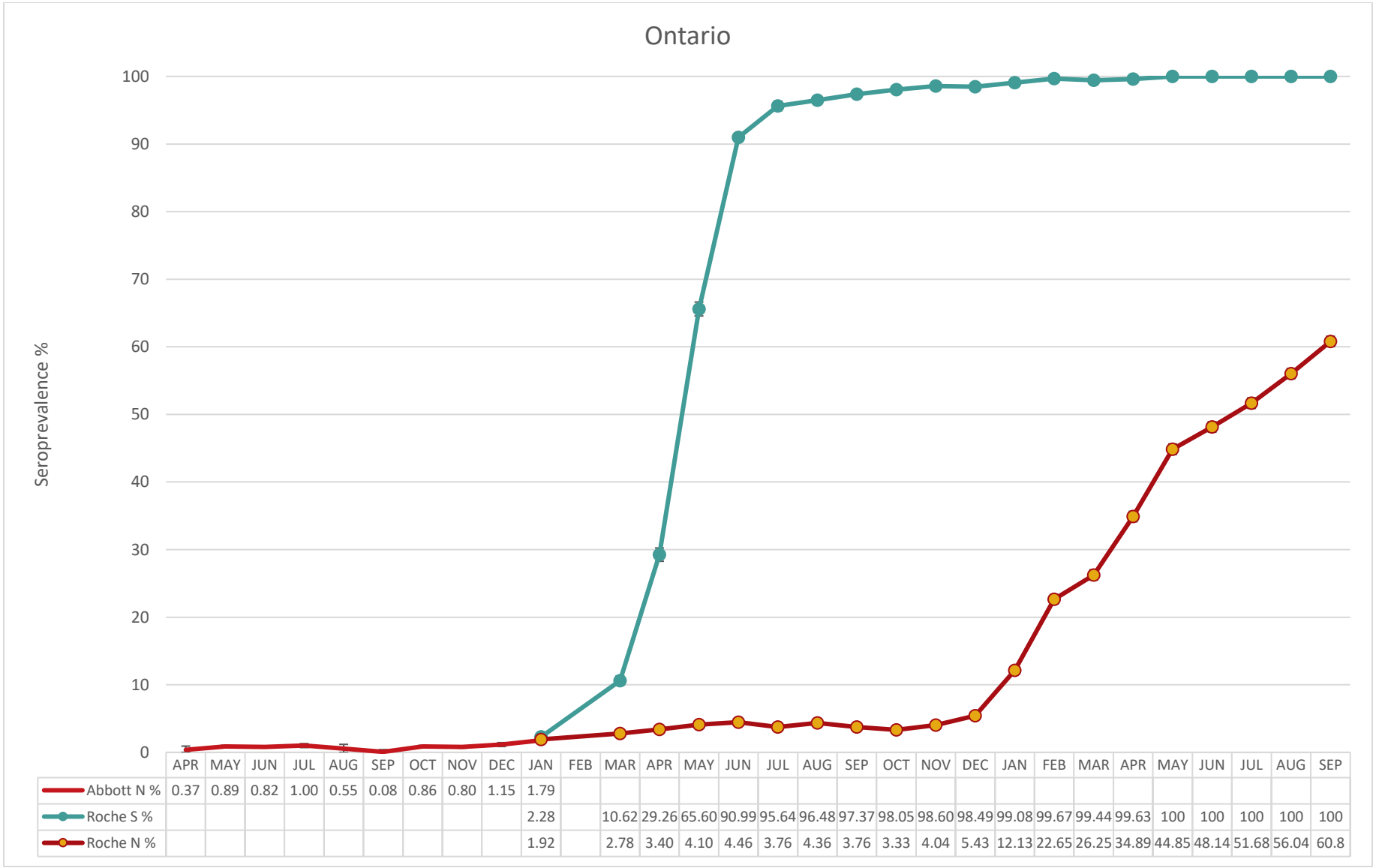
	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Abbott N %	0.68	0.64	0.46	0.63	0.00	0.87	0.95	1.09	1.06	1.48																				
Roche S %										2.05		8.74	25.50	62.36	92.90	94.77	96.99	97.93	98.84	99.09	98.99	98.83	99.68	99.78	99.6	100	100	100	100	100
Roche N %										1.63		2.11	2.40	3.17	3.18	3.93	4.41	4.23	4.68	4.63	5.83	11.82	25.52	32.09	36.32	45.43	50.54	55.19	59.15	63.73



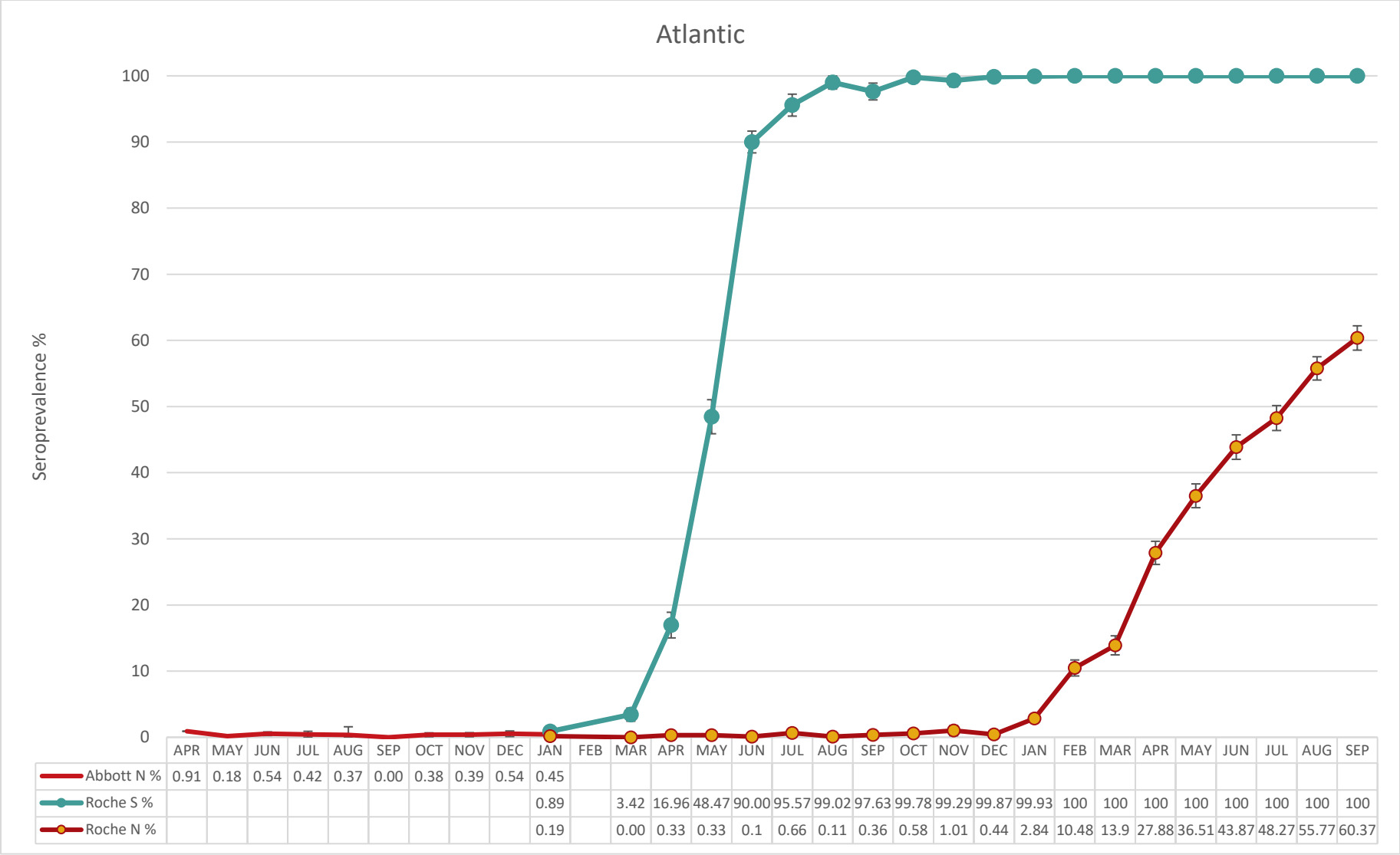
	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Abbott N %	0.00	0.63	0.45	0.24	0.85	1.04	0.67	1.62	2.15	3.34																				
Roche S %										5.09		10.90	27.16	67.84	88.92	90.89	93.38	94.75	96.61	98.12	97.79	98.03	98.88	99.43	99.72	100	100	100	100	100
Roche N %										4.02		6.53	5.11	6.42	8.11	7.81	6.69	8.28	8.65	9.25	12.94	16.78	31.79	39.82	46.44	55.79	60.86	62.32	66.42	71.33



	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Abbott N %	0.00	1.01	0.42	0.59	0.00	1.37	1.50	5.69	2.73	3.22																				
Roche S %										5.15		12.44	26.05	66.21	89.07	94.68	93.60	96.56	96.62	96.72	98.36	98.35	99.06	99.48	100	99.95	100	100	100	100
Roche N %										4.49		6.10	3.77	4.90	5.93	3.34	5.33	5.73	5.00	8.58	7.64	14.06	25.42	32.06	40.15	50.53	55.89	57.01	61.12	65.83



	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Abbott N %	0.37	0.89	0.82	1.00	0.55	0.08	0.86	0.80	1.15	1.79																				
Roche S %										2.28		10.62	29.26	65.60	90.99	95.64	96.48	97.37	98.05	98.60	98.49	99.08	99.67	99.44	99.63	100	100	100	100	100
Roche N %										1.92		2.78	3.40	4.10	4.46	3.76	4.36	3.76	3.33	4.04	5.43	12.13	22.65	26.25	34.89	44.85	48.14	51.68	56.04	60.8



	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Abbott N %	0.91	0.18	0.54	0.42	0.37	0.00	0.38	0.39	0.54	0.45																				
Roche S %										0.89		3.42	16.96	48.47	90.00	95.57	99.02	97.63	99.78	99.29	99.87	99.93	100	100	100	100	100	100	100	100
Roche N %										0.19		0.00	0.33	0.33	0.1	0.66	0.11	0.36	0.58	1.01	0.44	2.84	10.48	13.9	27.88	36.51	43.87	48.27	55.77	60.37

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) (grey circle represents the median and the bar represents the IQR) in spike antibody seropositive donations from September 2021 to September 2022 stratified by age group.

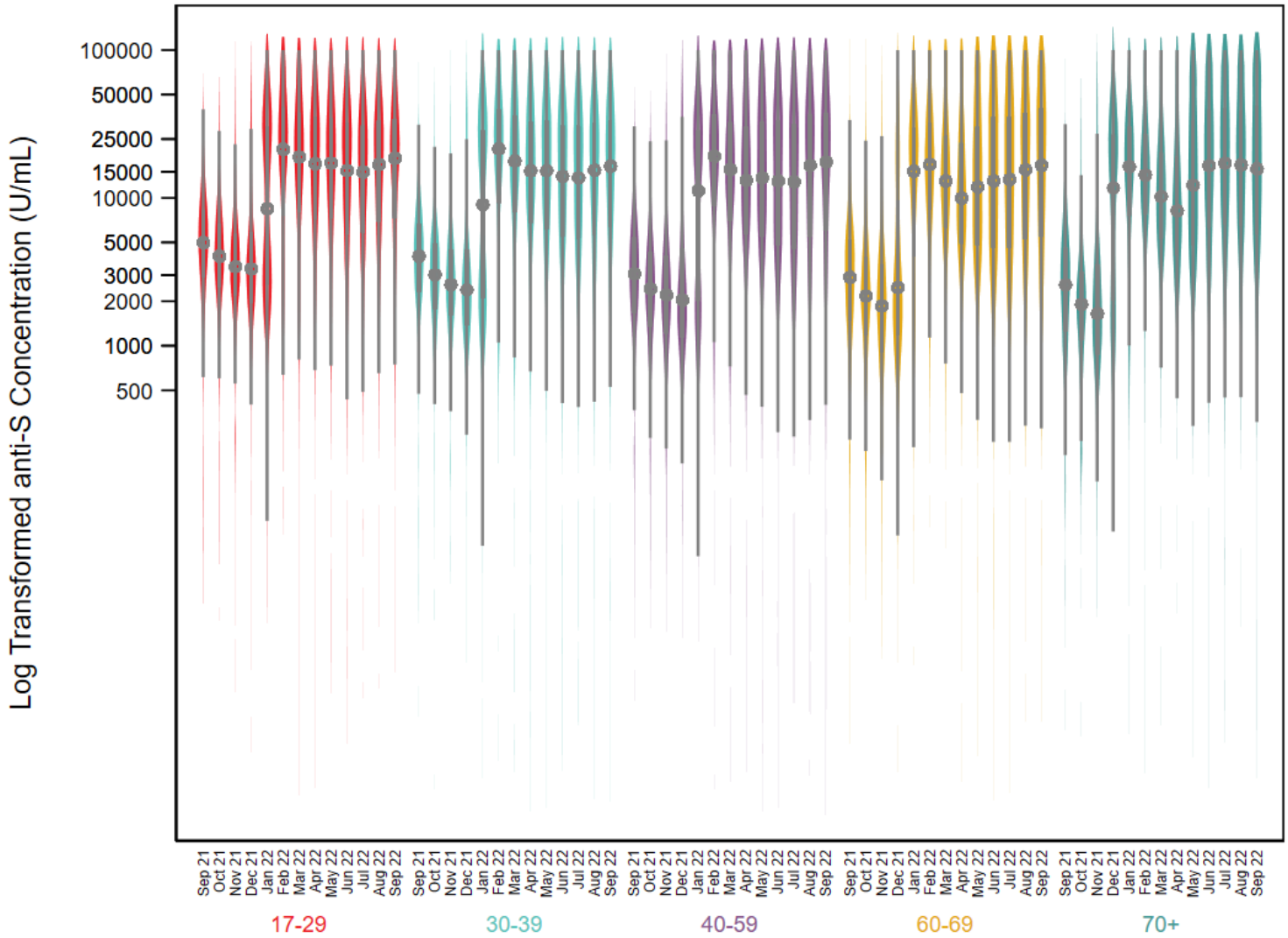
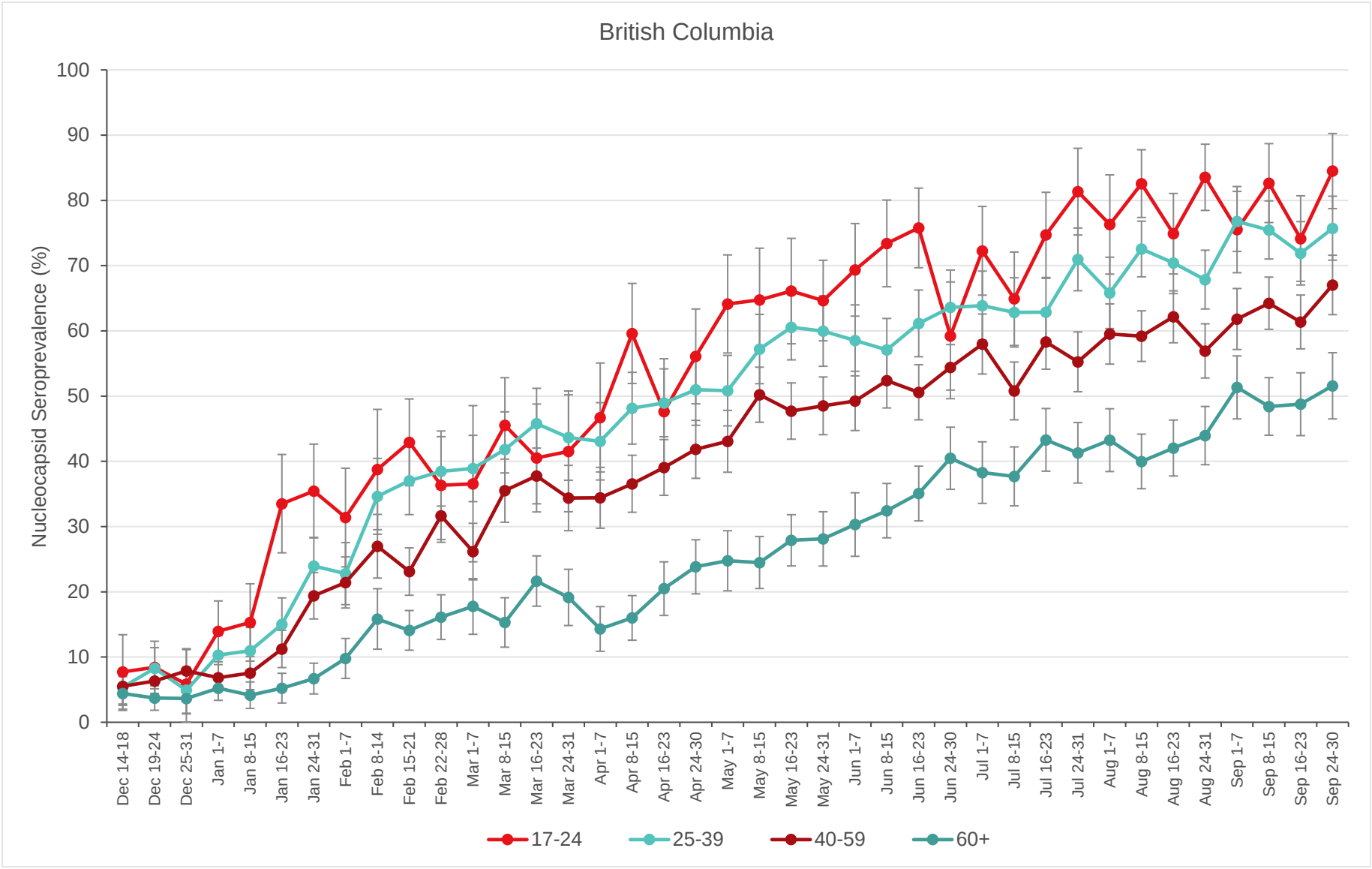
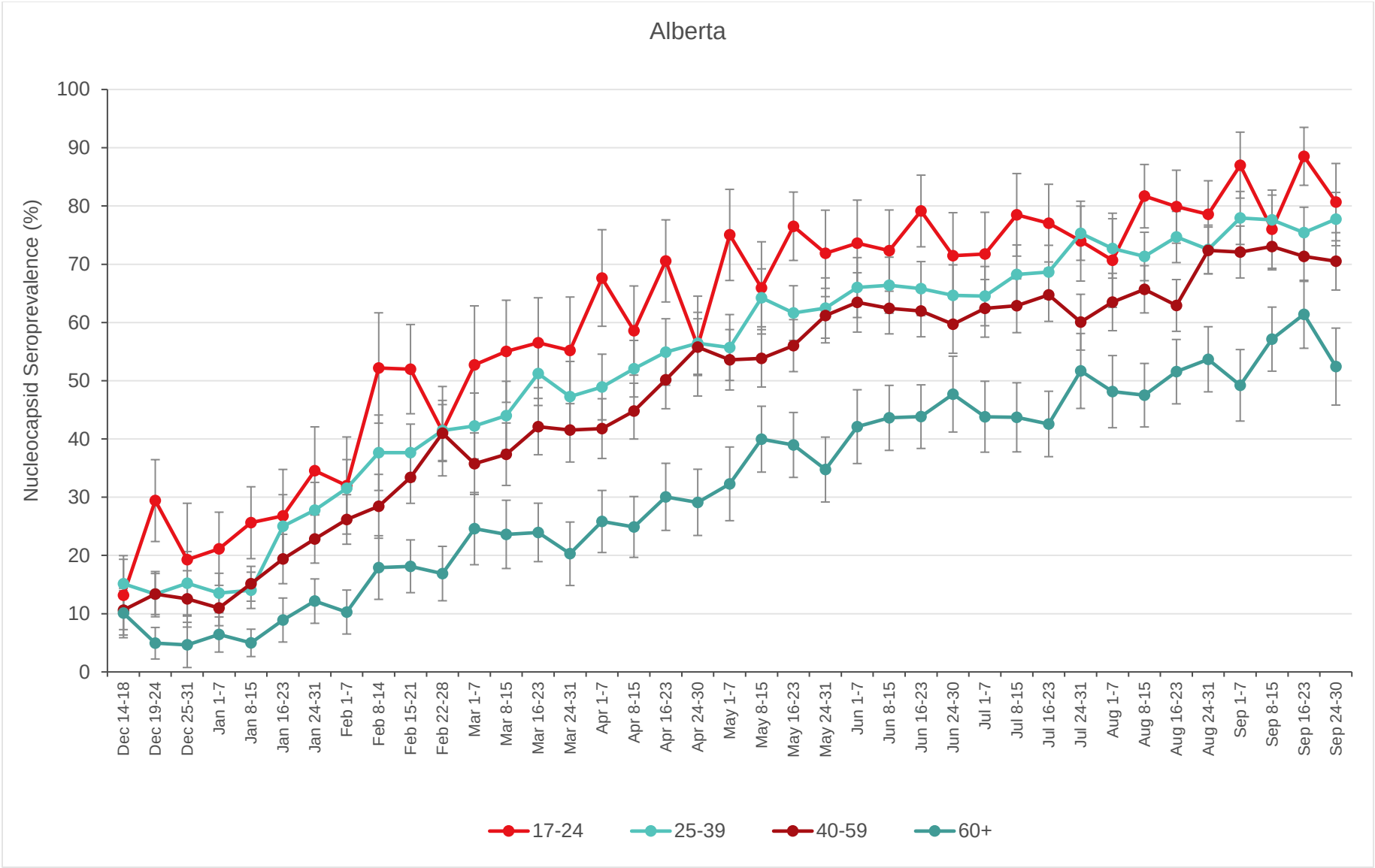
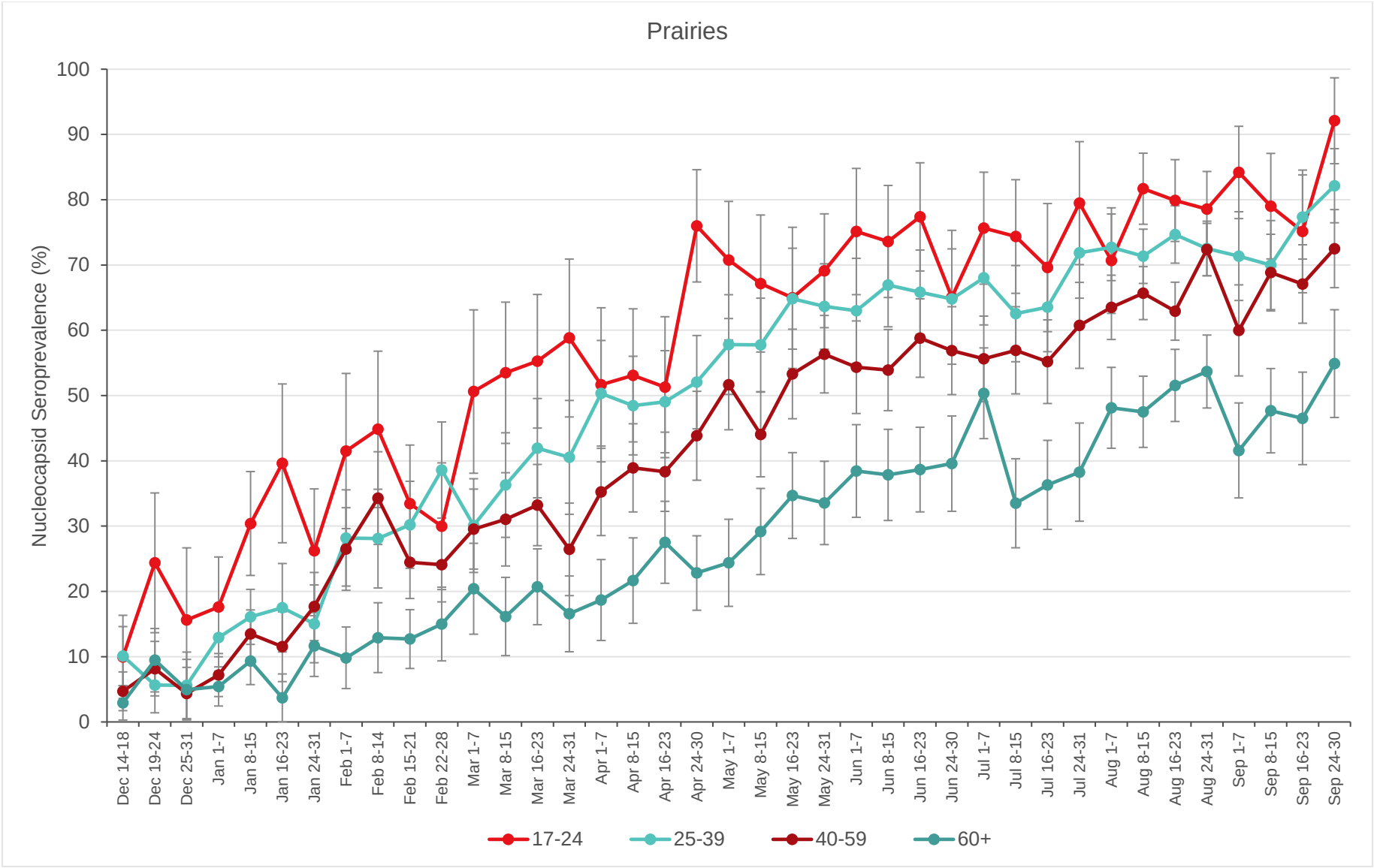
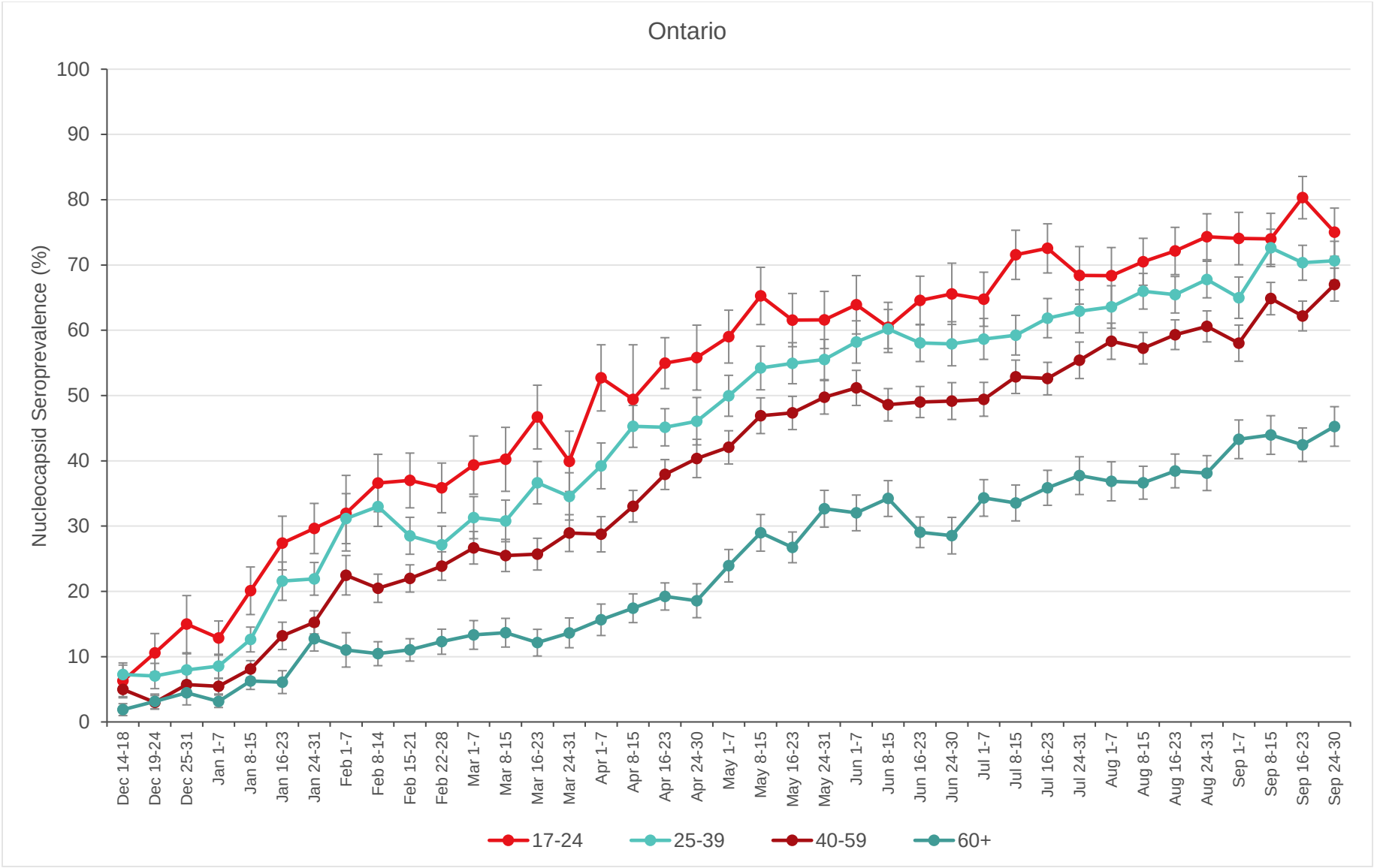


Figure 4. Regional temporal trends of SARS-CoV-2 Nucleocapsid (infection) seroprevalence by age group weekly from December 2021 - September 2022




Alberta
Nucleocapsid Seroprevalence (%)
100
90
80
70
60
50
40
30
20
10
0
Dec 14-18
Dec 19-24
Dec 25-31
Jan 1-7
Jan 8-15
Jan 16-23
Jan 24-31
Feb 1-7
Feb 8-14
Feb 15-21
Feb 22-28
Mar 1-7
Mar 8-15
Mar 16-23
Mar 24-31
Apr 1-7
Apr 8-15
Apr 16-23
Apr 24-30
May 1-7
May 8-15
May 16-23
May 24-31
Jun 1-7
Jun 8-15
Jun 16-23
Jun 24-30
Jul 1-7
Jul 8-15
Jul 16-23
Jul 24-31
Aug 1-7
Aug 8-15
Aug 16-23
Aug 24-31
Sep 1-7
Sep 8-15
Sep 16-23
Sep 24-30
17-24
25-39
40-59
60+


Prairies
Nucleocapsid Seroprevalence (%)
100
90
80
70
60
50
40
30
20
10
0
Dec 14-18
Dec 19-24
Dec 25-31
Jan 1-7
Jan 8-15
Jan 16-23
Jan 24-31
Feb 1-7
Feb 8-14
Feb 15-21
Feb 22-28
Mar 1-7
Mar 8-15
Mar 16-23
Mar 24-31
Apr 1-7
Apr 8-15
Apr 16-23
Apr 24-30
May 1-7
May 8-15
May 16-23
May 24-31
Jun 1-7
Jun 8-15
Jun 16-23
Jun 24-30
Jul 1-7
Jul 8-15
Jul 16-23
Jul 24-31
Aug 1-7
Aug 8-15
Aug 16-23
Aug 24-31
Sep 1-7
Sep 8-15
Sep 16-23
Sep 24-30
17-24
25-39
40-59
60+


Ontario
Nucleocapsid Seroprevalence (%)
100
90
80
70
60
50
40
30
20
10
0
Dec 14-18
Dec 19-24
Dec 25-31
Jan 1-7
Jan 8-15
Jan 16-23
Jan 24-31
Feb 1-7
Feb 8-14
Feb 15-21
Feb 22-28
Mar 1-7
Mar 8-15
Mar 16-23
Mar 24-31
Apr 1-7
Apr 8-15
Apr 16-23
Apr 24-30
May 1-7
May 8-15
May 16-23
May 24-31
Jun 1-7
Jun 8-15
Jun 16-23
Jun 24-30
Jul 1-7
Jul 8-15
Jul 16-23
Jul 24-31
Aug 1-7
Aug 8-15
Aug 16-23
Aug 24-31
Sep 1-7
Sep 8-15
Sep 16-23
Sep 24-30
17-24
25-39
40-59
60+

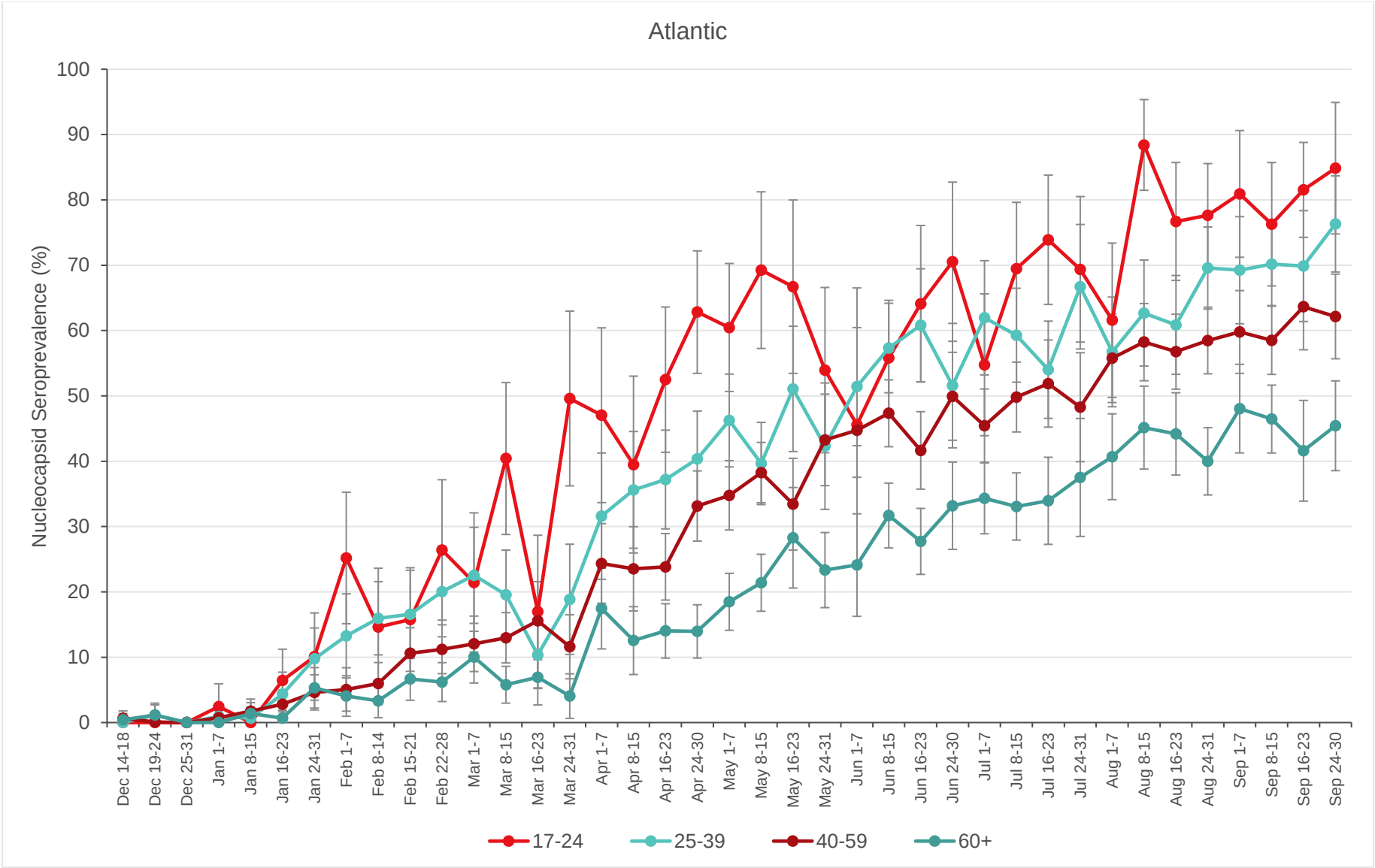

Atlantic
Nucleocapsid Seroprevalence (%)
100
90
80
70
60
50
40
30
20
10
0
Dec 14-18
Dec 19-24
Dec 25-31
Jan 1-7
Jan 8-15
Jan 16-23
Jan 24-31
Feb 1-7
Feb 8-14
Feb 15-21
Feb 22-28
Mar 1-7
Mar 8-15
Mar 16-23
Mar 24-31
Apr 1-7
Apr 8-15
Apr 16-23
Apr 24-30
May 1-7
May 8-15
May 16-23
May 24-31
Jun 1-7
Jun 8-15
Jun 16-23
Jun 24-30
Jul 1-7
Jul 8-15
Jul 16-23
Jul 24-31
Aug 1-7
Aug 8-15
Aug 16-23
Aug 24-31
Sep 1-7
Sep 8-15
Sep 16-23
Sep 24-30
17-24
25-39
40-59
60+

Figure 5A. Temporal trends of SARS-CoV-2 seroprevalence by monthly intervals from January 2021 - September 2022 estimated by Nucleocapsid antibody results by ethnicity.

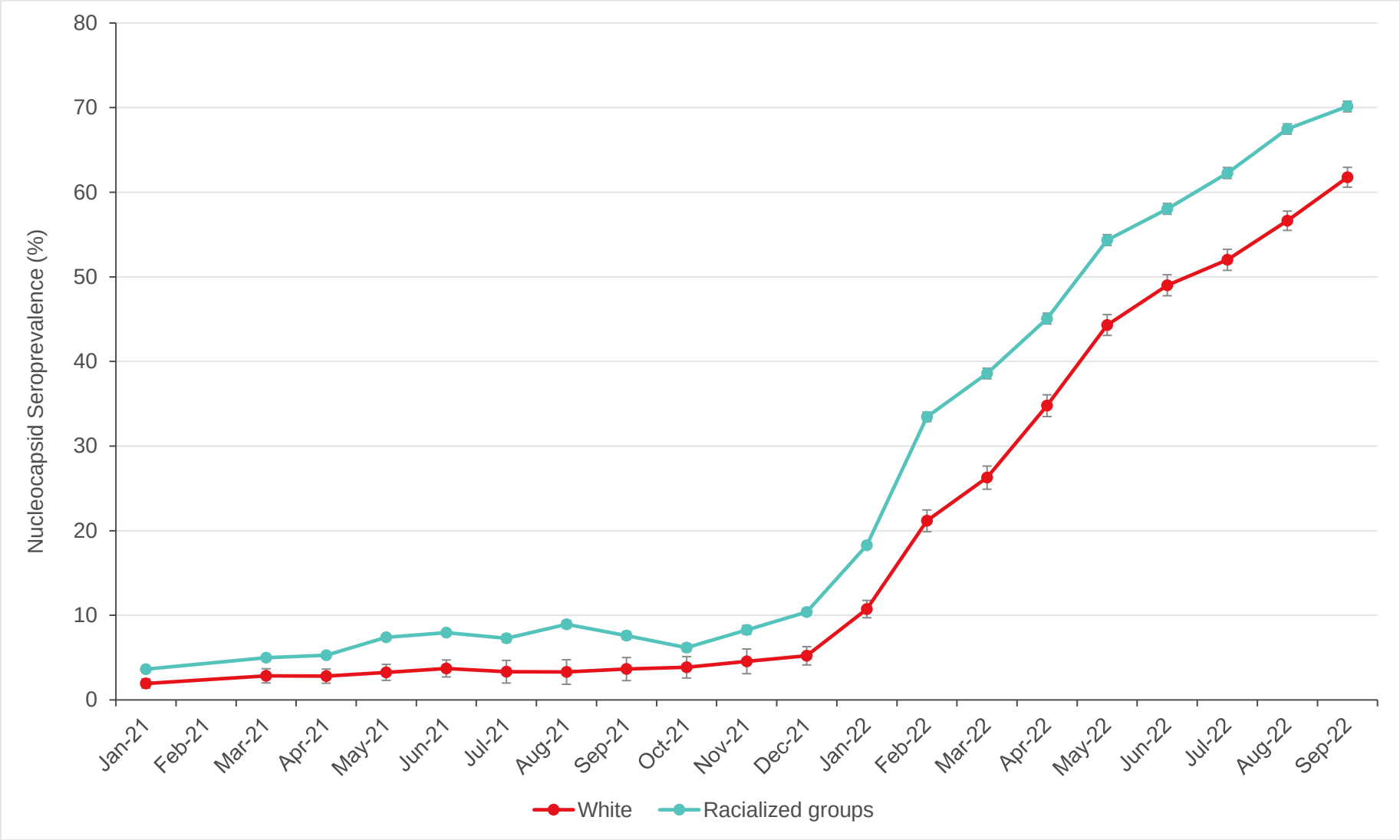


Figure 5B. Temporal trends of SARS-CoV-2 seroprevalence by monthly intervals from January 2021 - September 2022 estimated by Spike antibody results by ethnicity.

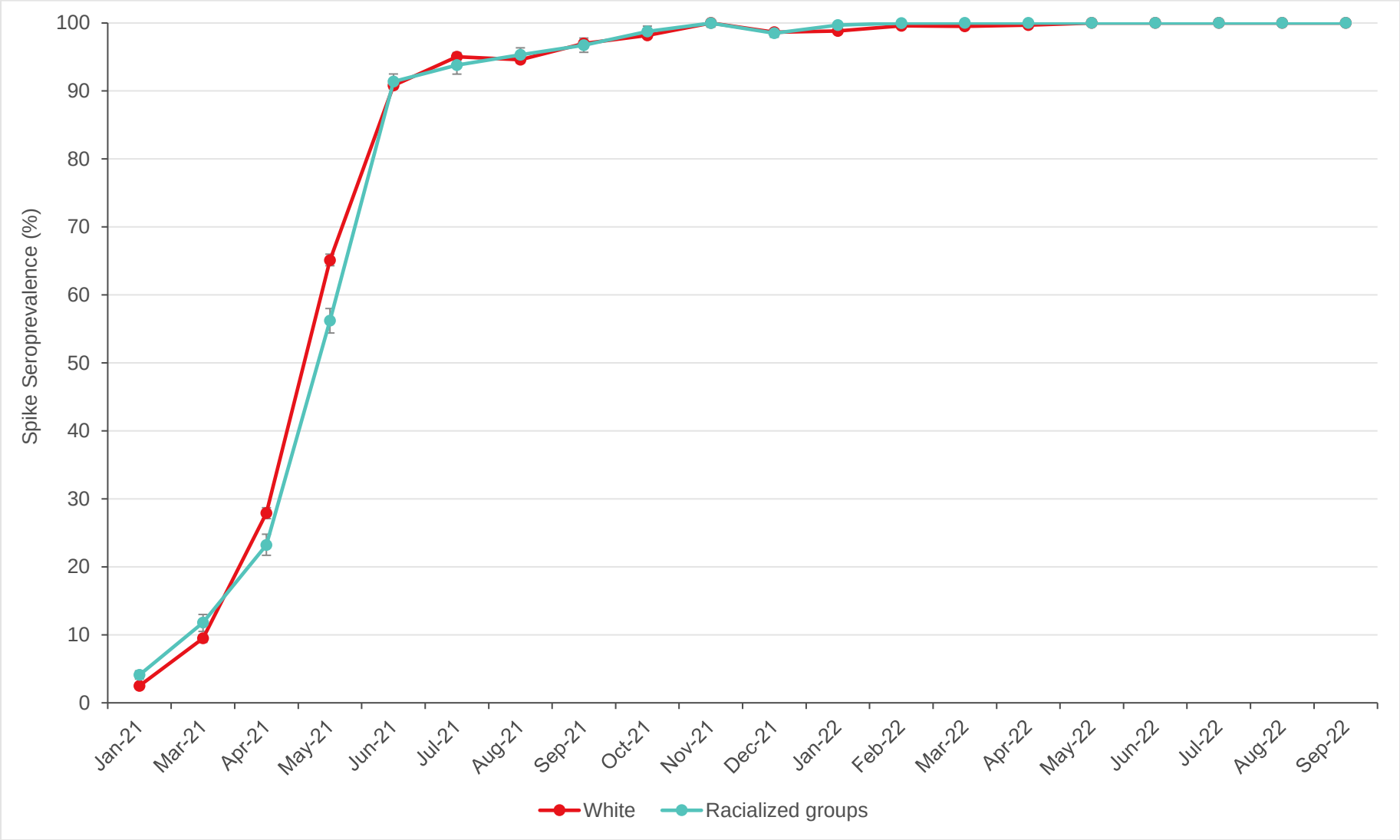


Figure 5C. Temporal trends of SARS-CoV-2 seroprevalence by monthly intervals from January 2021 - September 2022 estimated by Nucleocapsid antibody results by age group.

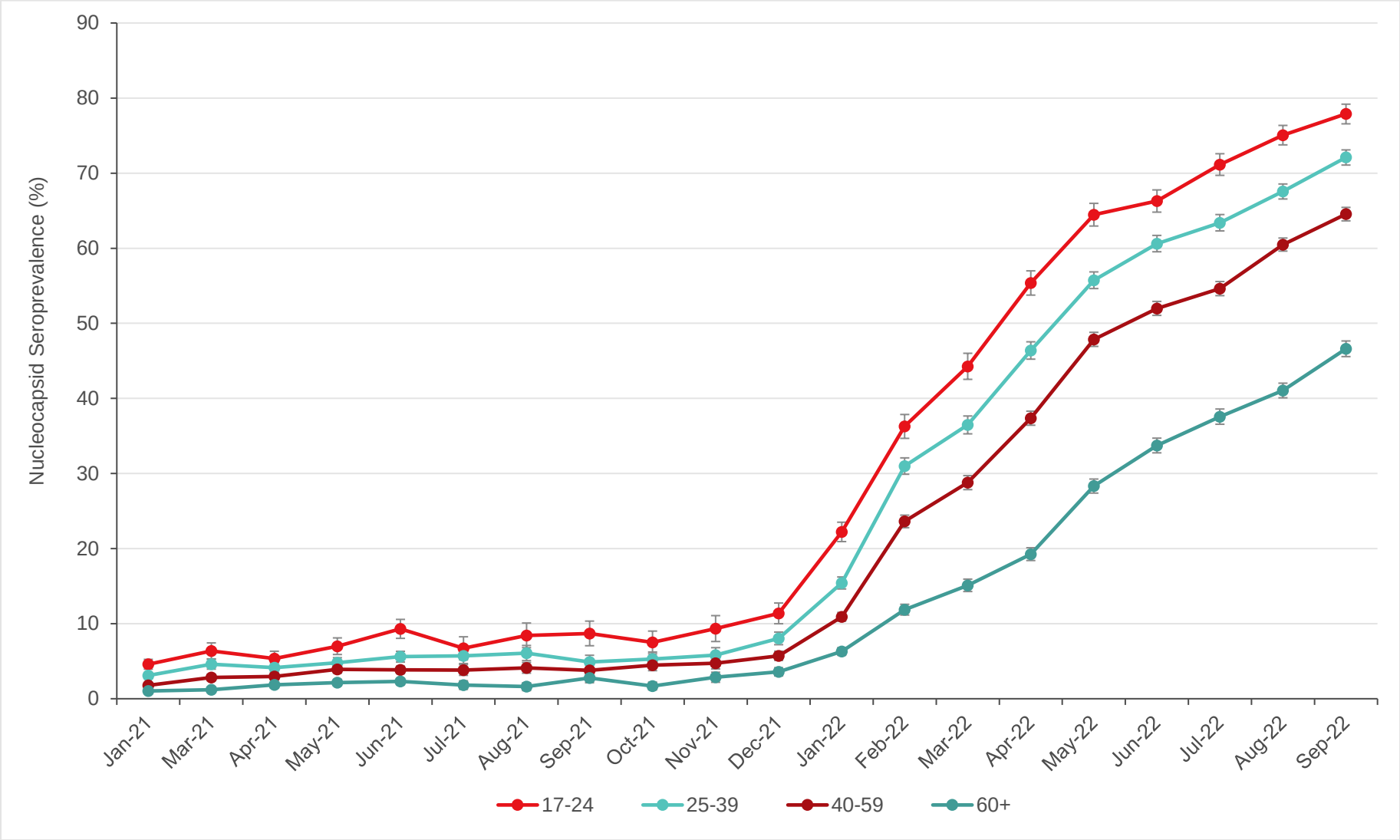


Figure 5D. Temporal trends of SARS-CoV-2 seroprevalence by monthly intervals from January 2021 - September 2022 estimated by Spike antibody results by age group.

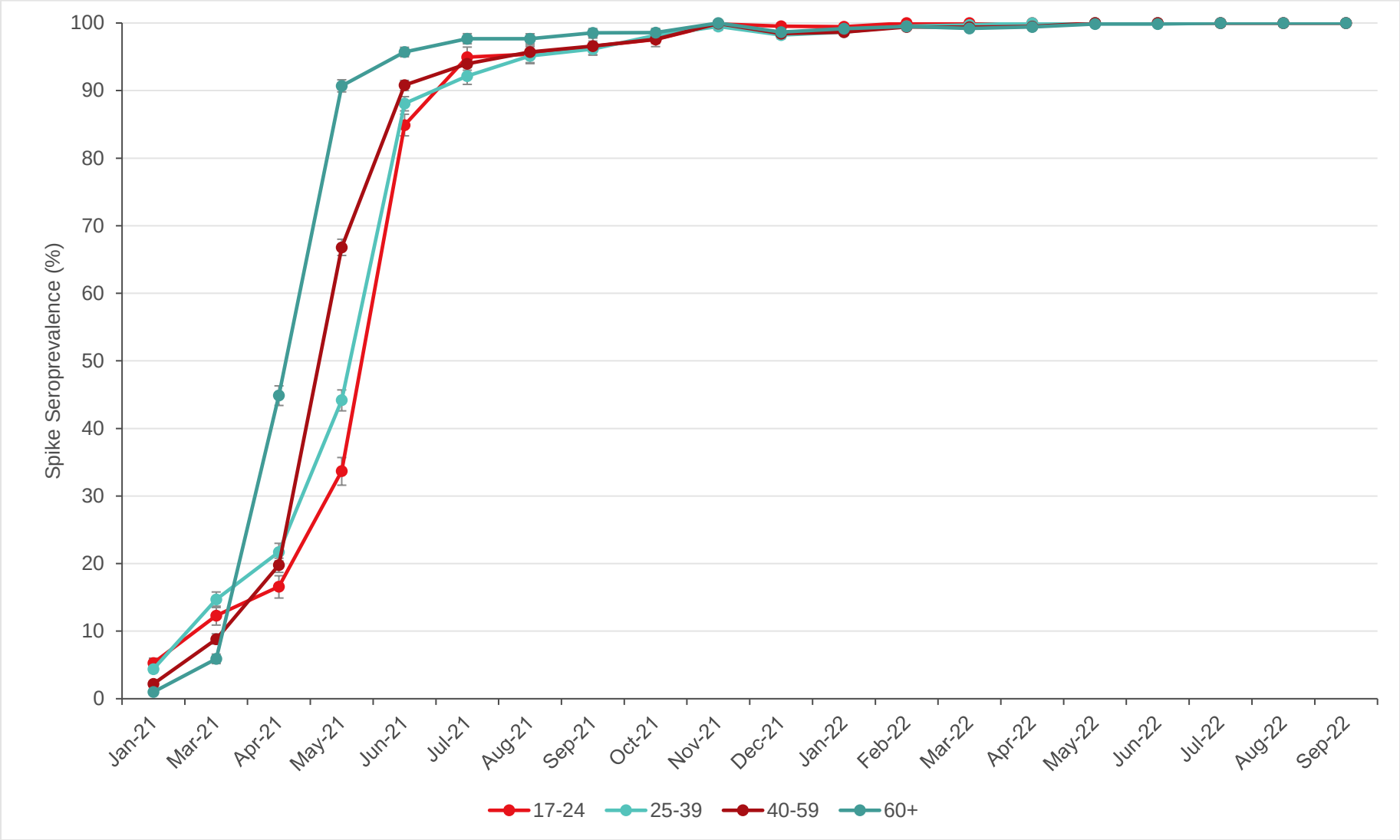


Figure 5E. Temporal trends of SARS-CoV-2 seroprevalence by monthly intervals from January 2021 - September 2022 estimated by Nucleocapsid antibody results by material deprivation level (1 = least deprived and 5 = most deprived).

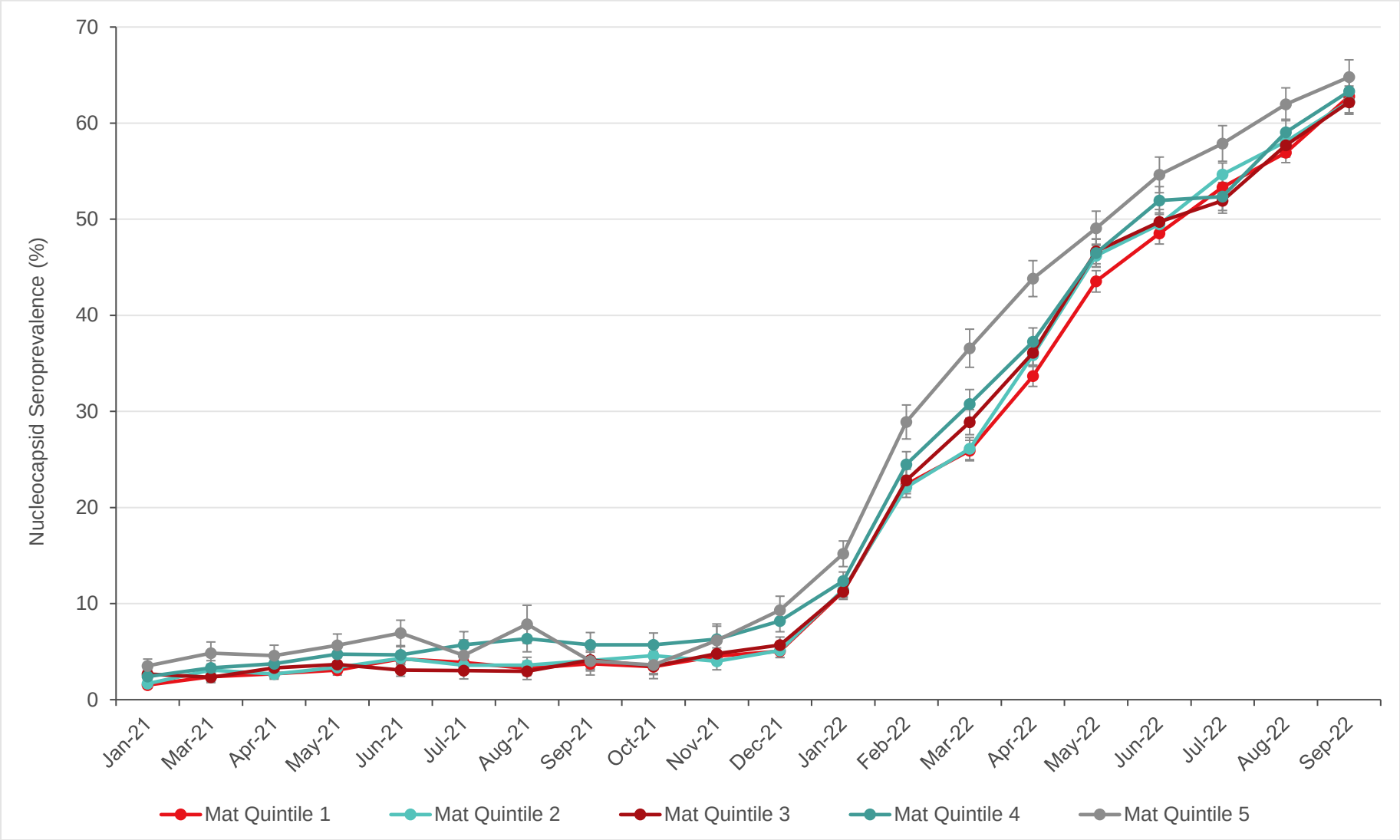


Figure 5F. Temporal trends of SARS-CoV-2 seroprevalence by monthly intervals from January 2021 - September 2022 estimated by Spike antibody results by material deprivation level (1 = least deprived and 5 = most deprived).

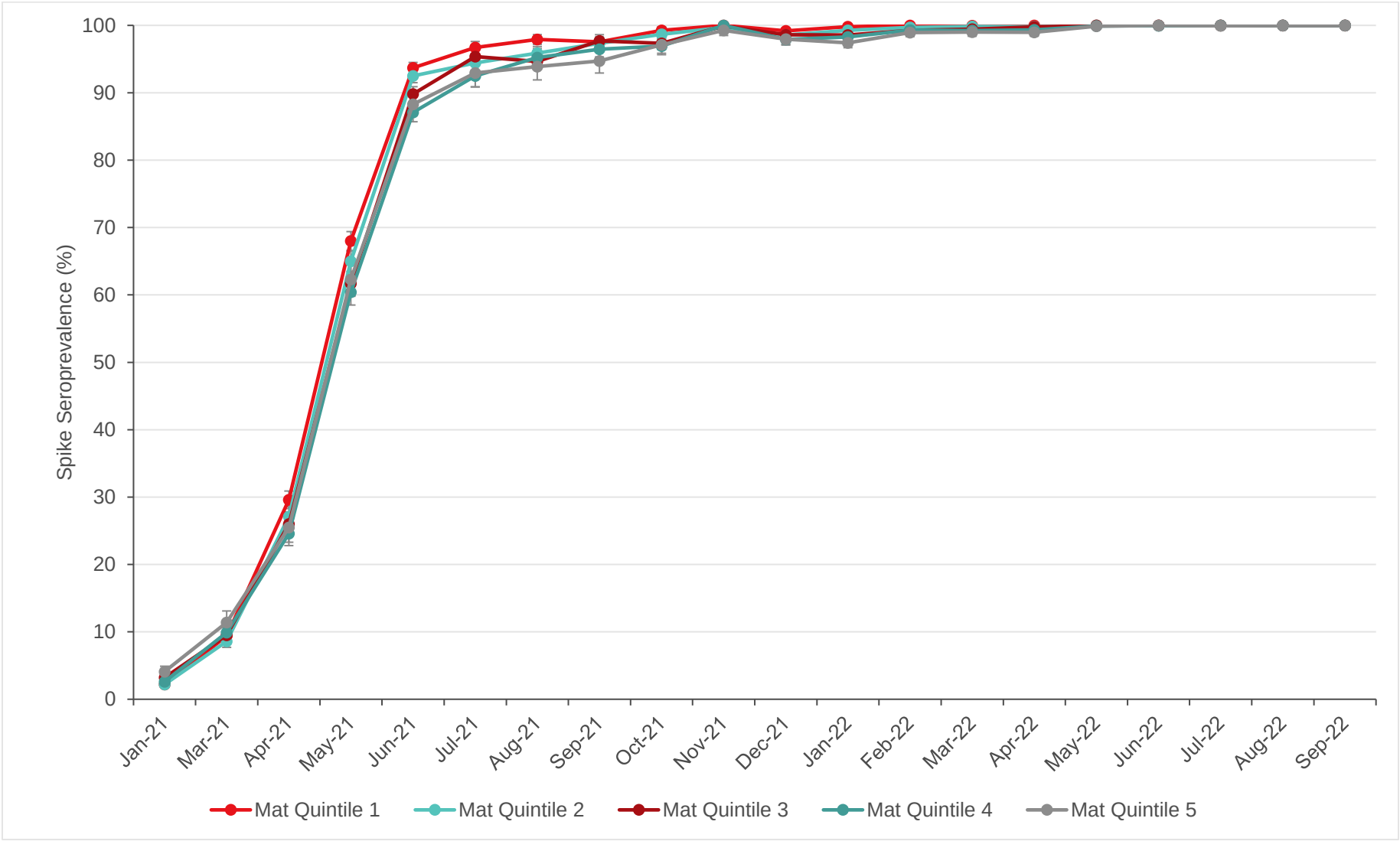


Figure 5G. Temporal trends of SARS-CoV-2 seroprevalence by monthly intervals from January 2021 - September 2022 estimated by Nucleocapsid antibody results by social deprivation level (1 = least deprived and 5 = most deprived).

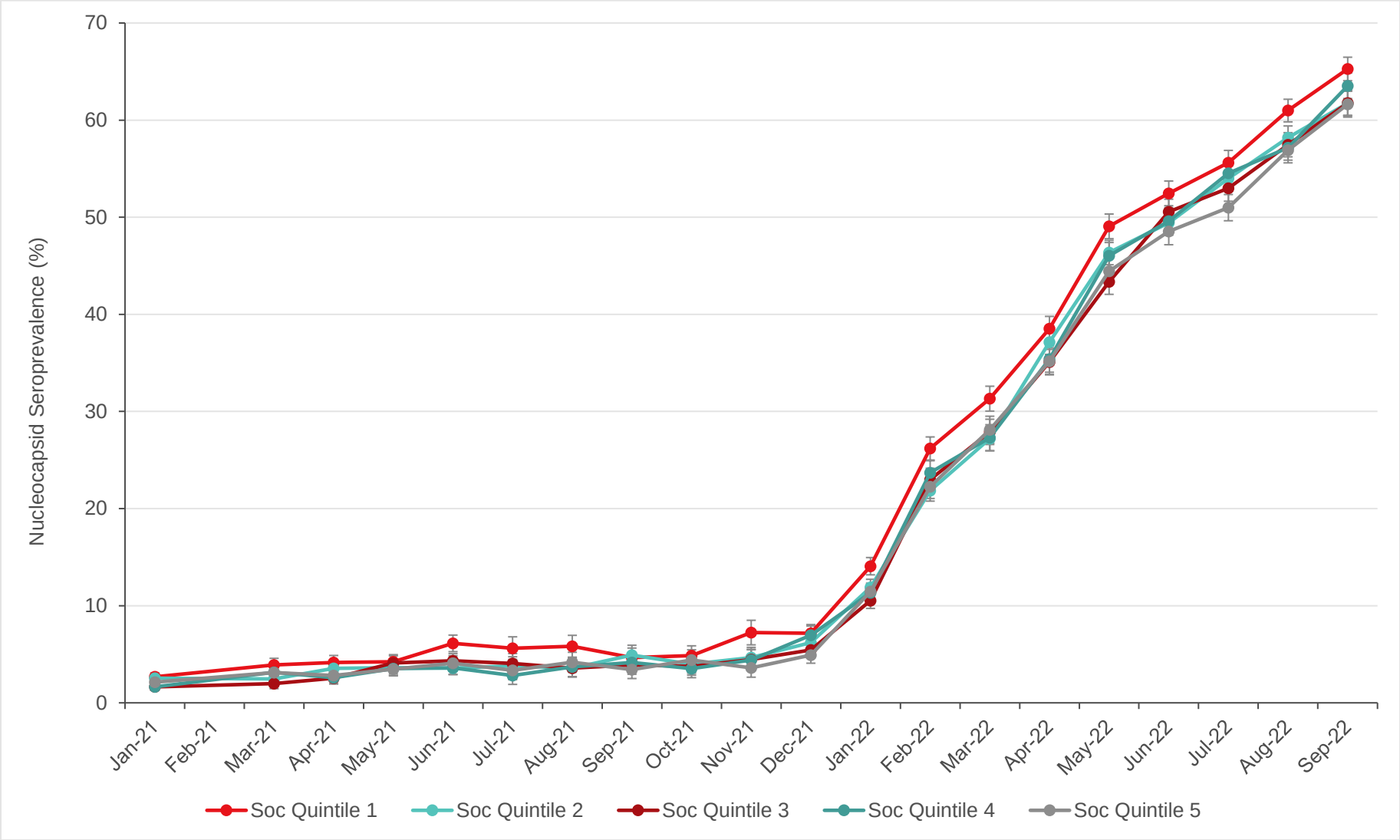


Figure 5H. Temporal trends of SARS-CoV-2 seroprevalence by monthly intervals from January 2021 - September 2022 estimated by Spike antibody results by social deprivation level (1 = least deprived and 5 = most deprived).

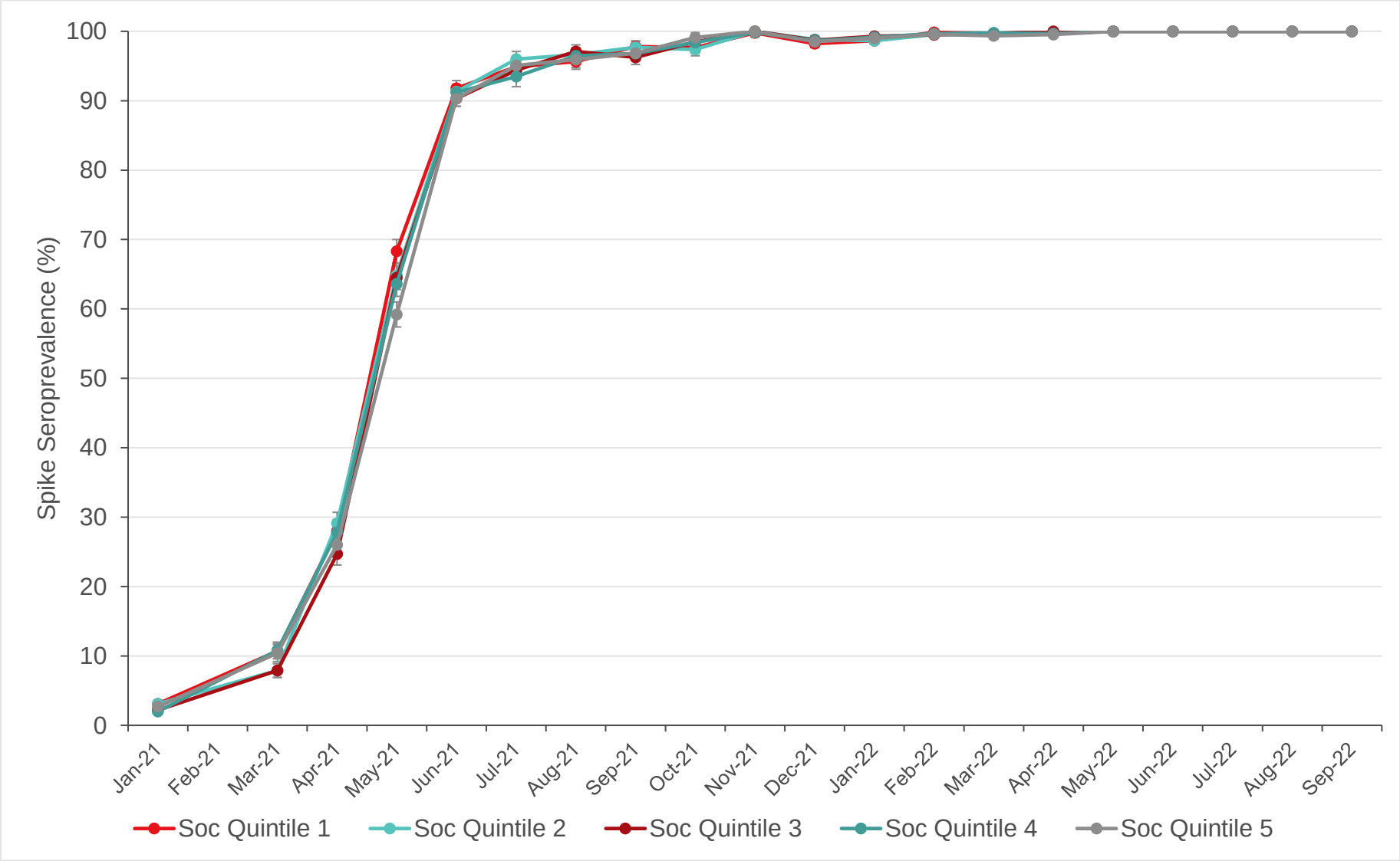


Table A1.1 British Columbia SARS-CoV-2 seroprevalence, Nucleocapsid vs. Spike results in September 2022

	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	2,549	1,620	63.94	62.16, 65.72	2,549	2,537	100.00	100.00, 100.00
Male	2,958	1,837	63.50	61.66, 65.34	2,958	2,935	100.00	100.00, 100.00
Age								
17-24	319	251	78.67	75.46, 81.89	319	319	100.00	100.00, 100.00
25-39	1,485	1,103	74.94	72.56, 77.32	1,485	1,480	100.00	100.00, 100.00
40-59	2,086	1,317	63.56	61.37, 65.74	2,086	2,069	100.00	99.89, 100.00
60+	1,617	786	49.49	47.08, 51.90	1,617	1,604	100.00	99.84, 100.00
Material Deprivation[1]								
1 (least)	1,316	861	66.23	63.72, 68.75	1,316	1,312	100.00	100.00, 100.00
2	1,320	798	61.58	58.90, 64.27	1,320	1,311	100.00	99.93, 100.00
3	1,015	620	62.97	59.91, 66.02	1,015	1,008	100.00	99.87, 100.00
4	758	490	63.96	60.53, 67.39	758	749	99.93	99.13, 100.00
5 (most)	402	257	65.07	60.50, 69.63	402	399	99.91	98.84, 100.00
Total	5,507	3,457	63.73	62.45, 65.01	5,507	5,472	100.00	100.00, 100.00

[1]Postal codes were missing for 696 (12.6%) of donors which could not be included in the quintiles of Material Deprivation; 431/696 were positive by the Nucleocapsid antibody, adjusted SARS-CoV-2 seroprevalence among missing postal codes was 62.65% (95% CI 58.99, 66.30); and 693/696 were positive by the Spike antibody, adjusted SARS-CoV-2 seroprevalence was 100.00% (95% CI 99.90, 100.00).

Table A1.2 Alberta SARS-CoV-2 seroprevalence, Nucleocapsid vs. Spike antibody results in September 2022

	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	2,655	1,855	70.38	68.50, 72.26	2,655	2,635	100.00	99.98, 100.00
Male	3,429	2,399	72.28	70.44, 74.13	3,429	3,404	100.00	100.00, 100.00
Age								
17-24	547	448	82.50	79.39, 85.61	547	545	100.00	99.95, 100.00
25-39	1,699	1,306	77.22	74.98, 79.47	1,699	1,689	100.00	99.96, 100.00
40-59	2,219	1,583	72.15	69.93, 74.36	2,219	2,201	100.00	99.60, 100.00
60+	1,619	917	55.97	52.93, 59.00	1,619	1,604	100.00	99.55, 100.00
Material Deprivation[1]								
1 (least)	2,174	1,500	70.57	68.28, 72.87	2,174	2,161	100.00	100.00, 100.00
2	1,246	860	70.57	67.65, 73.50	1,246	1,238	100.00	99.74, 100.00
3	860	604	72.06	68.66, 75.46	860	854	100.00	99.60, 100.00
4	534	390	73.13	69.00, 77.26	534	528	99.81	98.72, 100.00
5 (most)	245	176	72.72	66.37, 79.07	245	240	99.10	97.05, 100.00
Total	6,084	4,254	71.33	70.01, 72.65	6,084	6,039	100.00	100.00, 100.00

[1]Postal codes were missing for 1,025 (16.8%) of donors which could not be included in the quintiles of Material Deprivation; 724/1,025 were positive by the Nucleocapsid antibody, adjusted SARS-CoV-2 seroprevalence among missing postal codes was 71.70% (95% CI 68.53, 74.87); 1,018/1,025 were positive by the Spike antibody, adjusted SARS-CoV-2 seroprevalence was 100% (95% CI 99.56, 100.00).

Table A1.3 Saskatchewan SARS-CoV-2 seroprevalence, Nucleocapsid vs. Spike antibody results in September 2022

	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	633	414	64.39	60.58, 68.20	633	622	99.44	98.39, 100.00
Male	859	538	64.76	60.90, 68.62	859	853	100.00	99.45, 100.00
Age								
17-24	106	82	78.01	71.44, 84.57	106	106	99.99	98.29, 100.00
25-39	431	318	74.76	69.97, 79.56	431	427	99.65	98.29, 100.00
40-59	565	373	66.77	62.10, 71.44	565	558	99.91	98.79, 100.00
60+	390	179	46.07	40.73, 51.42	390	384	99.29	97.82, 100.00
Material Deprivation[1]								
1 (least)	508	320	63.97	59.10, 68.84	508	504	99.96	98.84, 100.00
2	366	232	66.07	60.71, 71.43	366	363	99.84	98.53, 100.00
3	201	130	62.84	55.60, 70.07	201	197	98.94	96.71, 100.00
4	139	91	63.95	55.36, 72.53	139	135	97.96	94.79, 100.00
5 (most)	49	32	65.58	51.05, 80.11	49	47	97.03	90.91, 100.00
Total	1,492	952	64.57	61.86, 67.29	1,492	1,475	99.99	99.37, 100.00

[1]Postal codes were missing for 229(15.3%) of donors which could not be included in the quintiles of Material Deprivation 147/229 were positive by the Nucleocapsid antibody, adjusted SARS-CoV-2 seroprevalence among missing postal codes was 65.14% (95% CI 58.34, 71.95); 229/229 were positive by the Spike antibody, adjusted SARS-CoV-2 seroprevalence was 100.00% (95% CI 98.80, 100.00).

Table A1.4 Manitoba SARS-CoV-2 seroprevalence, Nucleocapsid vs. Spike antibody results in September 2022

	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	752	509	66.93	63.47, 70.38	752	745	99.93	99.10, 100.00
Male	914	583	66.89	63.35, 70.43	914	907	99.93	99.09, 100.00
Age								
17-24	137	116	85.55	80.49, 90.60	137	135	99.50	97.65, 100.00
25-39	427	321	75.53	71.02, 80.04	427	425	100.00	99.18, 100.00
40-59	641	433	68.00	63.77, 72.23	641	637	100.00	99.21, 100.00
60+	461	222	48.48	43.49, 53.47	461	455	99.63	98.39, 100.00
Material Deprivation[1]								
1 (least)	342	215	64.08	58.44, 69.72	342	340	100.00	98.72, 100.00
2	302	192	65.21	59.30, 71.12	302	299	99.92	98.53, 100.00
3	330	221	67.99	62.53, 73.45	330	328	100.00	98.77, 100.00
4	269	184	68.93	62.90, 74.95	269	268	99.68	98.09, 100.00
5 (most)	136	95	70.91	62.49, 79.32	136	131	96.34	92.36, 100.00
Total	1,666	1,092	66.91	64.43, 69.38	1,666	1,652	100.00	99.51, 100.00

[1]Postal codes were missing for 287 (17.2%) of donors which could not be included in the quintiles of Material Deprivation; 185/287 were positive by the Nucleocapsid antibody, adjusted SARS-CoV-2 seroprevalence among missing postal codes was 66.91% (95% CI 61.00, 72.81); 286/287 were positive by the Spike antibody, adjusted SARS-CoV-2 seroprevalence was 100.00% (95% CI 98.80, 100.00).

Table A1.5 Ontario SARS-CoV-2 seroprevalence, Nucleocapsid vs. Spike antibody results in September 2022

	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	6,069	3,683	60.02	58.96, 61.08	6,069	6,031	100.00	100.00, 100.00
Male	7,841	4,745	61.65	60.56, 62.74	7,841	7,780	100.00	100.00, 100.00
Age								
17-24	1,030	782	75.88	74.00, 77.75	1,030	1,029	100.00	100.00, 100.00
25-39	3,610	2,480	69.47	68.00, 70.95	3,610	3,592	100.00	100.00, 100.00
40-59	5,503	3,503	63.38	62.12, 64.64	5,503	5,465	100.00	100.00, 100.00
60+	3,767	1,663	43.61	42.16, 45.06	3,767	3,725	100.00	99.82, 100.00
Material Deprivation[1]								
1 (least)	3,097	1,793	58.36	56.78, 59.94	3,097	3,078	100.00	100.00, 100.00
2	2,991	1,803	60.46	58.79, 62.13	2,991	2,970	100.00	100.00, 100.00
3	2,825	1,690	60.14	58.41, 61.87	2,825	2,803	100.00	100.00, 100.00
4	2,272	1,412	62.43	60.55, 64.31	2,272	2,248	100.00	99.75, 100.00
5 (most)	1,259	818	65.06	62.64, 67.48	1,259	1,256	100.00	100.00, 100.00
Total	13,910	8,428	60.80	60.04, 61.56	13,910	13,811	100.00	100.00, 100.00

[1]Postal codes were missing for 1,466 (10.5%) of donors which could not be included in the quintiles of Material Deprivation; 912/1,466 were positive by the Nucleocapsid antibody, adjusted SARS-CoV-2 seroprevalence among missing postal codes was 61.85% (95% CI 59.54, 64.17); 1,456/1,466 were positive by the Spike antibody, adjusted SARS-CoV-2 seroprevalence was 100.00% (95% CI 99.98, 100.00).

Table A1.6 Atlantic Region SARS-CoV-2 seroprevalence, Nucleocapsid vs. Spike antibody results in September 2022

	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	1,328	810	60.67	58.12, 63.23	1,328	1,326	100.00	100.00, 100.00
Male	1,619	940	60.04	57.39, 62.70	1,619	1,608	100.00	99.93, 100.00
Age								
17-24	203	160	80.59	76.05, 85.12	203	203	100.00	99.66, 100.00
25-39	670	470	71.21	67.43, 75.00	670	670	100.00	100.00, 100.00
40-59	1,150	701	61.14	58.07, 64.21	1,150	1,143	100.00	99.87, 100.00
60+	924	419	46.21	42.96, 49.47	924	918	100.00	99.86, 100.00
Material Deprivation[1]								
1 (least)	458	295	65.30	60.78, 69.82	458	456	100.00	99.46, 100.00
2	591	346	59.60	55.39, 63.82	591	587	100.00	99.50, 100.00
3	588	345	59.38	55.23, 63.54	588	586	100.00	99.83, 100.00
4	554	319	57.64	53.31, 61.97	554	553	100.00	100.00, 100.00
5 (most)	480	281	60.49	56.11, 64.87	480	477	100.00	99.31, 100.00
Total	2,947	1,750	60.37	58.53, 62.21	2,947	2,934	100.00	100.00, 100.00

[1]Postal codes were missing for 276 (9.4%) of donors which could not be included in the quintiles of Material Deprivation; 164/276 were positive by the Nucleocapsid antibody, adjusted SARS-CoV-2 seroprevalence among missing postal codes was 60.91% (95% CI 54.90, 66.92); 275/276 were positive by the Spike antibody, adjusted SARS-CoV-2 seroprevalence was 100% (95% CI 98.98, 100.00).

Table A2.1. Weekly SARS-CoV-2 seroprevalence by sociodemographic variables by Nucleocapsid results in September 2022

	September 1-7			September 8-15			September 16-23			September 24-30		
	Crude	Adjusted		Crude	Adjusted		Crude	Adjusted		Crude	Adjusted	
	N Tested (N Positive)	Percent Positive	95% CI	N Tested (N Positive)	Percent Positive	95% CI	N Tested (N Positive)	Percent Positive	95% CI	N Tested (N Positive)	Percent Positive	95% CI
Sex												
Female	3,287 (2,004)	60.18	58.61, 61.75	4,049 (2,616)	64.16	62.76, 65.55	3,741 (2,365)	61.89	60.48, 63.30	3,059 (1,989)	64.71	63.14, 66.27
Male	4,301 (2,617)	62.14	60.56, 63.73	4,842 (3,000)	62.61	61.10, 64.11	4,885 (3,075)	63.89	62.44, 65.33	4,210 (2,715)	66.11	64.57, 67.64
Age												
17-24	563 (445)	77.84	75.17, 80.52	607 (470)	76.38	73.70, 79.06	666 (528)	80.30	77.95, 82.65	543 (430)	79.16	76.55, 81.77
25-39	2,033 (1,432)	70.29	68.18, 72.39	2,261 (1,638)	73.56	71.64, 75.48	2,212 (1,592)	72.01	70.08, 73.93	1,942 (1,428)	74.25	72.23, 76.26
40-59	2,773 (1,702)	61.24	59.31, 63.18	3,463 (2,266)	65.61	63.92, 67.31	3,383 (2,198)	63.75	62.07, 65.43	2,805 (1,893)	67.52	65.69, 69.35
60+	2,219 (1,042)	45.88	43.77, 48.00	2,560 (1,242)	47.22	45.25, 49.19	2,365 (1,122)	45.86	43.89, 47.84	1,979 (953)	47.96	45.75, 50.16
Province												
British Columbia	1,295 (827)	63.95	61.36, 66.55	1,606 (1,008)	63.66	61.27, 66.05	1,458 (878)	61.68	59.18, 64.18	1,274 (826)	66.65	64.01, 69.28
Alberta	1,522 (1,044)	70.41	67.72, 73.10	1,824 (1,274)	70.91	68.45, 73.38	1,727 (1,218)	72.69	70.20, 75.19	1,401 (966)	70.26	67.44, 73.09
Saskatchewan	381 (222)	59.06	53.55, 64.58	373 (239)	63.78	58.41, 69.15	403 (259)	63.87	58.67, 69.08	344 (238)	72.47	67.26, 77.68
Manitoba	380 (236)	64.50	59.37, 69.62	506 (318)	64.02	59.50, 68.54	404 (257)	65.55	60.51, 70.58	381 (281)	74.38	69.55, 79.21
Ontario	3,304 (1,878)	57.38	55.77, 58.99	3,536 (2,182)	62.11	60.59, 63.63	4,042 (2,465)	60.52	59.15, 61.89	3,201 (1,988)	63.07	61.54, 64.61
New Brunswick	292 (191)	67.53	61.87, 73.19	288 (170)	58.92	52.89, 64.95	216 (138)	65.47	58.78, 72.15	199 (120)	61.30	54.10, 68.50
Nova Scotia	338 (174)	50.52	44.49, 56.56	515 (279)	55.05	50.13, 59.98	204 (121)	61.02	53.64, 68.40	359 (209)	58.00	52.22, 63.78
Prince Edward Island	3 (2)	58.80	12.42, 100.00	69 (44)	64.74	54.69, 74.78	52 (28)	60.72	49.62, 71.82	1 (1)	65.29	25.12, 100.00
Newfoundland	73 (47)	64.82	55.08, 74.55	174 (102)	59.27	53.08, 65.46	120 (76)	60.53	52.68, 68.37	109 (75)	68.23	60.46, 75.99
Metro area												
Vancouver	645 (432)	67.47	63.98, 70.96	858 (591)	68.60	65.55, 71.65	791 (507)	64.34	61.10, 67.58	719 (489)	70.23	66.89, 73.57
Calgary	601 (410)	70.21	65.52, 74.90	694 (500)	73.34	69.08, 77.59	580 (409)	73.63	69.03, 78.23	554 (385)	72.00	67.14, 76.86
Edmonton	459 (312)	69.19	64.53, 73.84	546 (356)	66.91	62.58, 71.23	492 (340)	70.90	66.44, 75.35	392 (259)	66.27	61.18, 71.37

Ottawa	327 (181)	55.69	49.89, 61.49	418 (238)	57.47	52.32, 62.62	269 (177)	65.61	59.37, 71.86	270 (151)	54.92	48.37, 61.48
Toronto	916 (530)	58.76	56.00, 61.52	966 (630)	65.47	62.92, 68.02	1741 (1,051)	59.78	57.88, 61.68	1,050 (684)	65.37	62.96, 67.77
Winnipeg	224 (131)	60.25	53.43, 67.08	239 (145)	61.60	54.82, 68.37	228 (132)	61.01	54.08, 67.93	253 (185)	72.65	66.59, 78.71
Ethnicity[1]												
White	5,737 (3,435)	60.03	58.73, 61.33	6,981 (4,320)	61.94	60.77, 63.11	6,576 (4,065)	61.48	60.30, 62.65	5,465 (3,440)	63.23	61.94, 64.52
Indigenous	99 (73)	71.30	62.46, 80.14	102 (67)	63.23	53.63, 72.82	95 (65)	63.41	53.57, 73.26	94 (73)	78.03	69.66, 86.40
Asian	407 (253)	59.02	54.54, 63.49	384 (266)	68.18	63.67, 72.69	462 (295)	63.71	59.68, 67.74	417 (299)	71.51	67.38, 75.65
Other racialized groups	846 (590)	71.49	68.51, 74.48	873 (627)	72.76	69.84, 75.69	949 (681)	72.01	69.29, 74.72	846 (621)	75.76	72.95, 78.57
Social Deprivation[2]												
1 (least deprived)	1,443 (926)	64.86	62.29, 67.44	1,652 (1,092)	66.92	64.55, 69.29	1,833 (1,177)	63.84	61.65, 66.04	1,384 (920)	66.72	64.22, 69.23
2	1,434 (828)	58.03	55.46, 60.60	1,690 (1,055)	62.44	60.08, 64.80	1,581 (986)	61.83	59.43, 64.22	1,341 (860)	65.22	62.62, 67.81
3	1,261 (759)	59.95	57.21, 62.70	1,576 (999)	63.75	61.33, 66.18	1,390 (842)	60.35	57.81, 62.88	1,267 (805)	64.49	61.83, 67.16
4	1,263 (776)	62.60	59.90, 65.29	1,405 (880)	62.09	59.51, 64.66	1,389 (884)	64.32	61.87, 66.77	1,201 (773)	65.78	63.10, 68.46
5 (most deprived)	1,300 (773)	58.93	56.25, 61.62	1,417 (851)	61.00	58.46, 63.55	1,336 (834)	62.14	59.57, 64.70	1,164 (755)	64.72	62.06, 67.39
Material Deprivation[2]												
1 (least deprived)	1,920 (1,172)	60.62	58.37, 62.87	2,273 (1,442)	63.60	61.54, 65.67	2,268 (1,426)	62.22	60.24, 64.19	1,681 (1,080)	64.68	62.36, 67.00
2	1,584 (956)	61.49	59.01, 63.96	1,969 (1,241)	63.50	61.29, 65.71	1,861 (1,147)	62.15	59.92, 64.38	1,585 (1,002)	63.98	61.58, 66.39
3	1,386 (853)	61.73	59.14, 64.31	1,647 (1,017)	62.03	59.62, 64.44	1,591 (947)	59.47	57.06, 61.88	1,326 (872)	66.62	64.11, 69.13
4	1,154 (686)	59.10	56.27, 61.92	1,172 (746)	63.04	60.29, 65.79	1,148 (749)	64.70	62.04, 67.37	1,156 (759)	66.50	63.81, 69.19
5 (most deprived)	657 (395)	61.17	57.50, 64.84	679 (431)	64.80	61.42, 68.18	661 (454)	67.83	64.45, 71.21	609 (400)	66.08	62.42, 69.74
Total	7,588 (4,621)	61.14	60.03, 62.26	8,891 (5,616)	63.43	62.41, 64.45	8,626 (5,440)	62.85	61.84, 63.86	7,269 (4,704)	65.41	64.32, 66.51

[1]In Week 1, self reported ethnicity was missing for 499 (6.6%) donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 54.25% (95% CI 49.67, 58.84).
In Week 2, self reported ethnicity was missing for 551 (6.2%) donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 62.51% (95% CI 58.23, 66.80).
In Week 3, self reported ethnicity was missing for 544 (6.3%) donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 60.73% (95% CI 56.44, 65.02).
In Week 4, self reported ethnicity was missing for 447 (6.1%) donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 61.65% (95% CI 56.98, 66.33).

[2]In Week 1, postal codes were missing for 887 (11.7%) of donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 63.58% (95% CI 60.30, 66.87).
In Week 2, postal codes were missing for 1,151 (12.3%) of donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 64.45% (95% CI 61.59, 67.30).
In Week 3, postal codes were missing for 1,097 (12.7%) of donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 64.88% (95% CI 62.05, 67.72).
In Week 4, postal codes were missing for 912 (12.5%) of donors; Adjusted seroprevalence by the Nucleocapsid antibody assay was 65.44% (95% CI 62.32, 68.55).

Table A2.2. Weekly SARS-CoV-2 seroprevalence by province and age group by Nucleocapsid results in September 2022

	September 1-7			September 8-15			September 16-23			September 24-31		
	Adjusted			Adjusted			Adjusted			Adjusted		
	N Tested (N Positive)	Percent Positive	95% CI	N Tested (N Positive)	Percent Positive	95% CI	N Tested (N Positive)	Percent Positive	95% CI	N Tested (N Positive)	Percent Positive	95% CI
British Columbia												
17-24	80 (63)	75.52	68.91, 82.12	80 (66)	82.65	76.60, 88.70	92 (68)	74.14	67.59, 80.70	72 (59)	84.50	78.74, 90.25
25-39	369 (280)	76.77	72.17, 81.37	416 (311)	75.46	71.01, 79.92	376 (267)	71.89	67.03, 76.74	344 (260)	75.73	70.83, 80.64
40-59	453 (279)	61.81	57.14, 66.49	621 (395)	64.23	60.23, 68.24	572 (350)	61.36	57.24, 65.49	482 (318)	67.03	62.48, 71.59
60+	393 (205)	51.33	46.50, 56.16	489 (236)	48.41	44.00, 52.83	418 (193)	48.76	43.94, 53.57	376 (189)	51.58	46.50, 56.65
Total	1,295 (827)	63.95	61.36, 66.55	1,606 (1,008)	63.66	61.27, 66.05	1,458 (878)	61.68	59.18, 64.18	1274 (826)	66.65	64.01, 69.28
Alberta												
17-24	130 (109)	87.01	81.35, 92.68	162 (127)	76.02	69.31, 82.73	151 (132)	88.52	83.55, 93.50	131 (105)	80.67	74.03, 87.30
25-39	411 (324)	77.94	73.40, 82.49	466 (358)	77.60	73.33, 81.87	481 (360)	75.41	71.03, 79.79	409 (315)	77.75	73.18, 82.33
40-59	548 (389)	72.10	67.64, 76.55	680 (490)	73.05	69.03, 77.07	622 (438)	71.36	67.05, 75.67	486 (342)	70.50	65.57, 75.42
60+	433 (222)	49.21	43.07, 55.35	516 (299)	57.14	51.64, 62.64	473 (288)	61.41	55.57, 67.25	375 (204)	52.42	45.82, 59.03
Total	1,522 (1,044)	70.41	67.72, 73.10	1,824 (1,274)	70.91	68.45, 73.38	1,727 (1218)	72.69	70.20, 75.19	1,401 (966)	70.26	67.44, 73.09
Saskatchewan												
17-24	28 (23)	82.84	71.05, 94.62	29 (21)	69.05	54.87, 83.23	23 (15)	64.58	48.89, 80.27	26 (23)	93.76	86.16, 100.00
25-39	116 (74)	64.61	54.38, 74.84	111 (81)	73.40	63.91, 82.90	102 (80)	78.37	69.21, 87.53	104 (85)	84.05	75.87, 92.22
40-59	134 (80)	59.61	49.75, 69.47	132 (85)	66.42	56.74, 76.10	163 (112)	69.81	61.42, 78.21	139 (97)	70.17	61.12, 79.21
60+	103 (45)	42.05	31.65, 52.45	101 (52)	50.02	39.79, 60.24	115 (52)	45.02	35.19, 54.86	75 (33)	48.45	36.33, 60.57
Total	381 (222)	59.06	53.55, 64.58	373 (239)	63.78	58.41, 69.15	403 (259)	63.87	58.67, 69.08	344 (238)	72.47	67.26, 77.68
Manitoba												
17-24	46 (39)	85.02	76.20, 93.83	41 (35)	86.10	77.07, 95.13	32 (26)	83.34	72.49, 94.19	18 (16)	89.48	77.56, 100.00
25-39	103 (80)	77.91	69.14, 86.68	107 (71)	66.83	57.12, 76.54	100 (76)	76.43	67.35, 85.51	117 (94)	80.64	72.80, 88.48
40-59	127 (75)	60.36	50.49, 70.22	196 (137)	70.33	62.96, 77.70	161 (103)	64.46	55.89, 73.04	158 (118)	74.49	66.56, 82.43
60+	104 (42)	41.15	30.97, 51.33	162 (75)	46.12	37.80, 54.44	111 (52)	48.08	37.89, 58.27	88 (53)	60.55	49.44, 71.66
Total	380 (236)	64.50	59.37, 69.62	506 (318)	64.02	59.50, 68.54	404 (257)	65.55	60.51, 70.58	381 (281)	74.38	69.55, 79.21

Ontario												
17-24	237 (178)	74.06	70.04, 78.07	240 (179)	74.00	70.09, 77.92	295 (230)	80.33	77.08, 83.57	263 (199)	75.03	71.33, 78.72
25-39	879 (568)	64.99	61.83, 68.16	927 (654)	72.63	69.76, 75.49	1,023 (719)	70.35	67.67, 73.02	814 (560)	70.65	67.66, 73.63
40-59	1,227 (710)	58.03	55.25, 60.80	1,439 (929)	64.86	62.38, 67.34	1,638 (1,049)	62.19	59.91, 64.47	1275 (853)	67.00	64.48, 69.51
60+	961 (422)	43.30	40.34, 46.26	930 (420)	43.96	41.00, 46.92	1,086 (467)	42.47	39.90, 45.04	849 (376)	45.27	42.23, 48.30
Total	3,304 (1,878)	57.38	55.77, 58.99	3,536 (2,182)	62.11	60.59, 63.63	4,042 (2,465)	60.52	59.15, 61.89	3,201 (1,988)	63.07	61.54, 64.61
Atlantic Canada												
17-24	42 (33)	80.92	71.22, 90.62	55 (42)	76.28	66.84, 85.72	73 (57)	81.53	74.27, 88.80	33 (28)	84.85	74.79, 94.92
25-39	155 (106)	69.24	61.05, 77.44	234 (163)	70.16	63.83, 76.49	130 (90)	69.87	61.39, 78.35	154 (114)	76.33	68.97, 83.68
40-59	284 (169)	59.78	53.45, 66.12	395 (230)	58.51	53.29, 63.73	227 (146)	63.64	57.06, 70.22	265 (165)	62.16	55.68, 68.64
60+	225 (106)	48.05	41.27, 54.83	362 (160)	46.45	41.26, 51.65	162 (70)	41.60	33.89, 49.31	216 (98)	45.43	38.56, 52.30
Total	706 (414)	59.89	56.04, 63.73	1046 (595)	57.97	54.88, 61.07	592 (363)	62.33	58.41, 66.26	668 (405)	61.47	57.56, 65.38
Total	7,588 (4,621)	61.14	60.03, 62.26	8,891 (5,616)	63.43	62.41, 64.45	8,626 (5,440)	62.85	61.84, 63.86	7,269 (4,704)	65.41	64.32, 66.51