Seroprevalence of SARS-CoV-2-specific antibodies among Australian blood donors: Round 4 update

Prepared by the Australian COVID-19 Serosurveillance Network

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Overview

Why are we doing the surveys?

- Routine surveillance based on reporting diagnosed cases provides an incomplete picture of SARS-CoV-2 infection in populations because of under-detection and under-reporting of cases.
- The Australian COVID-19 Serosurveillance Network is conducting regular serological surveys among Australian blood donors (aged 18 years and over) to provide estimates of the proportion of the population with SARS-CoV-2 antibodies (also known as SARS-CoV-2 seroprevalence).

How are we doing the surveys?

- During 2022, 4 serosurvey rounds were conducted at intervals of 13 weeks (approximately) using residual blood donations. This report presents new results for Round 4, with blood donations received between 29 November and 13 December 2022, alongside results previously presented from Rounds 1–3, which were presented in more detail in earlier reports (Available here).
- In Round 4, 4,996 de-identified specimens from all Australian states and territories were tested for the presence of 2 types of antibodies to SARS-CoV-2 using commercially available Roche assays. The presence of anti-spike antibodies indicates exposure to vaccination and/or natural infection, while anti-nucleocapsid protein antibodies specifically indicate infection with SARS-CoV-2 because the vaccines used in Australia do not generate this antibody.
- Detection of anti-nucleocapsid antibodies is most likely within 3-6 months of infection as the antibody response wanes at longer intervals.

What did we find?

- The prevalence of anti-spike antibodies was 99.6%, with little variation across jurisdictions or age groups, consistent with Rounds 1–3.
- The prevalence of anti-nucleocapsid antibodies increased modestly from 65% in Round 3 to 71% in Round 4.
- All states and territories, and age groups experienced an increase in the prevalence of anti-nucleocapsid antibodies compared to Round 3, with increments smaller than those observed between Rounds 1 and 2 and between Rounds 2 and 3.
- As in previous rounds, the prevalence of anti-nucleocapsid antibodies was highest for the 18–29-year-old age group and decreased with age.

What do our findings mean?

- These results suggest that by December 2022, more than two-thirds of the adult population had been infected with SARS CoV-2, virtually all subsequent to the appearance of the Omicron variant in late 2021.
- Anti-nucleocapsid seroprevalence appears to be plateauing, following strong increases in the first 3 quarters of the year.
- Available local data show that the sensitivity of the Roche assay to detect anti-nucleocapsid antibodies generated by infection with the Omicron strain of SARS-CoV-2 infection in vaccinated people is 84%, suggesting that seroprevalence estimates based on this assay may underestimate the prevalence of infection by some 15-20%.
- UK serosurveillance data showed similar patterns, with rapid increases in anti-nucleocapsid seroprevalence from 25% to 60% in the first three months after the emergence of Omicron, followed by only marginal increases and plateauing at 80–90% to the end of 2022.
- Population prevalence of anti-nucleocapsid antibodies will likely peak at 80-90% due to the combined impacts of assay under-ascertainment and antibody waning.

What is next?

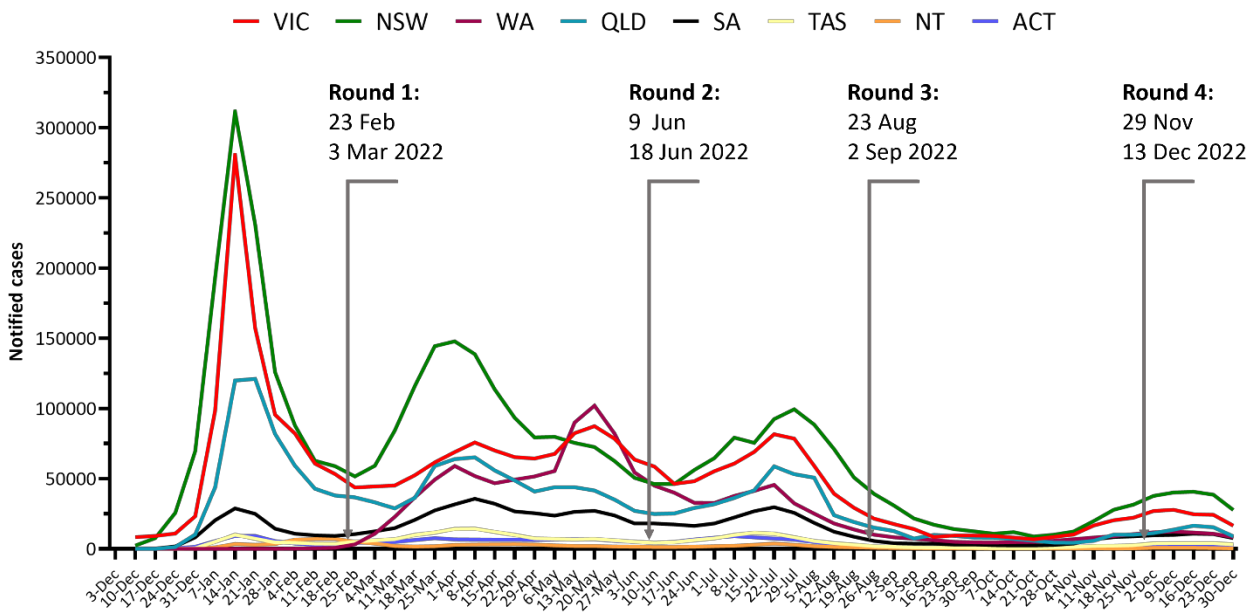
- Additional surveys are being considered, with more specific assays likely to be used to further characterise the immunological responses in the population. The frequency of survey rounds may also be reduced in future iterations.

Update on SARS-CoV-2 situation in Australia since the previous report

Key developments since the previous report includes the following:

- Mandatory isolation requirements for people diagnosed with SARS-CoV-2 infection ended on 14 October 2022.
- There were approximately 775,000 new reported cases of COVID-19 reported in the total Australian population between September and November 2022[1], with a mixture of Omicron subvariants including BA.4, BA.5, XBB and BQ.1 in circulation.
- All jurisdictions experienced a steady decrease in cases in October 2022 to the lowest 7-day average since December 2021, followed by a steady rise in November 2022, caused by the emergence of XBB and BQ1 subvariants.
- Estimates of cumulative case numbers based on routine case notifications are likely to underestimate the extent of infections in the community due to asymptomatic cases, rapid antigen test performance, and community behaviour.
- At 24 January 2023, national 2-dose vaccine coverage was 96.1%, uptake of the third (booster) dose has remained stable at 72.4% since the Round 3 report, and uptake of the fourth dose was 44.6% among eligible populations[2].

Figure 1. Count of SARS-CoV-2 case notifications by jurisdiction and timing of serosurvey rounds



Source: https://www.covid19data.com.au/

Characteristics of the study population

Round 4 results were available for 4,996 specimens: 1,090 in Victoria, 1,171 in NSW, 992 in Queensland, 989 in WA, 203 in SA, 199 in Tasmania, 184 in NT, and 168 in ACT. The median age of donors included in Round 4 was 47 years (IQR 34–59; range 18–84), and 55.7% were male.

More information on the survey populations at each round are available here.

Anti-spike protein seroprevalence

Overall, anti-spike seroprevalence was very high across jurisdictions in Round 4 (99.6%; 99.4–99.7), with no differences between jurisdictions (Figure 2A).

The prevalence of anti-spike antibodies was very high across all age groups nationally (Figure 2B), and within Victoria, NSW, Queensland, and WA (Figure 2C). Seroprevalence was the same for males and females (99.6% [99.2–99.8]) (See supplementary file, which is available here).

The majority (>96%) of donors had high antibody titres (i.e., >250 U/ml), with little variation by jurisdiction (Figure 3A) and age group (Figure 3B).

These findings are consistent with observations from previous rounds.

Anti-nucleocapsid protein seroprevalence

Overall, anti-nucleocapsid seroprevalence increased modestly from 65.2% (63.9–66.5) in Round 3 to 70.8% (69.5–72.0) in Round 4 (Figure 4A). All states and territories experienced small increases in the prevalence of anti-nucleocapsid antibodies. Seroprevalence was highest in the NT (73.4%; 66.5–79.6), NSW (71.3%; 68.5–75.5)and ACT (73.2%; 66.0–69.4). Tasmania had the lowest seroprevalence at 64.3% (57.4–70.7) (Figure 4A).

Anti-nucleocapsid seroprevalence increased in all age groups in Round 4 compared with Round 3, but the differences in seroprevalence between rounds were greatest in donors aged 60–69 years and 70–79 years. The overall patterns were consistent between all three rounds (Figure 4B). Seroprevalence was highest among donors aged 18–29 years at 83.2% (80.5–85.5), declining steadily to 51.4% (46.0–56.8) in donors aged 70–89 years (Figure 4B). These age-specific patterns were also observed within Victoria, NSW, Queensland, and WA. Seroprevalence was similar for males and females (70.7% [69.0–72.4] vs 70.9% [69.0–72.8]) (See supplementary file, which is available here).

Overall, the proportion of anti-spike seropositive samples that were negative for anti-nucleocapsid antibodies decreased from 82.8% in Round 1 to 29.0% in Round 4.

Figure 2: Crude SARS-CoV-2 anti-spike protein seroprevalence among Australian blood donors by jurisdiction (A), age groups (B), and age groups within Victoria, NSW, Queensland, and WA (C)

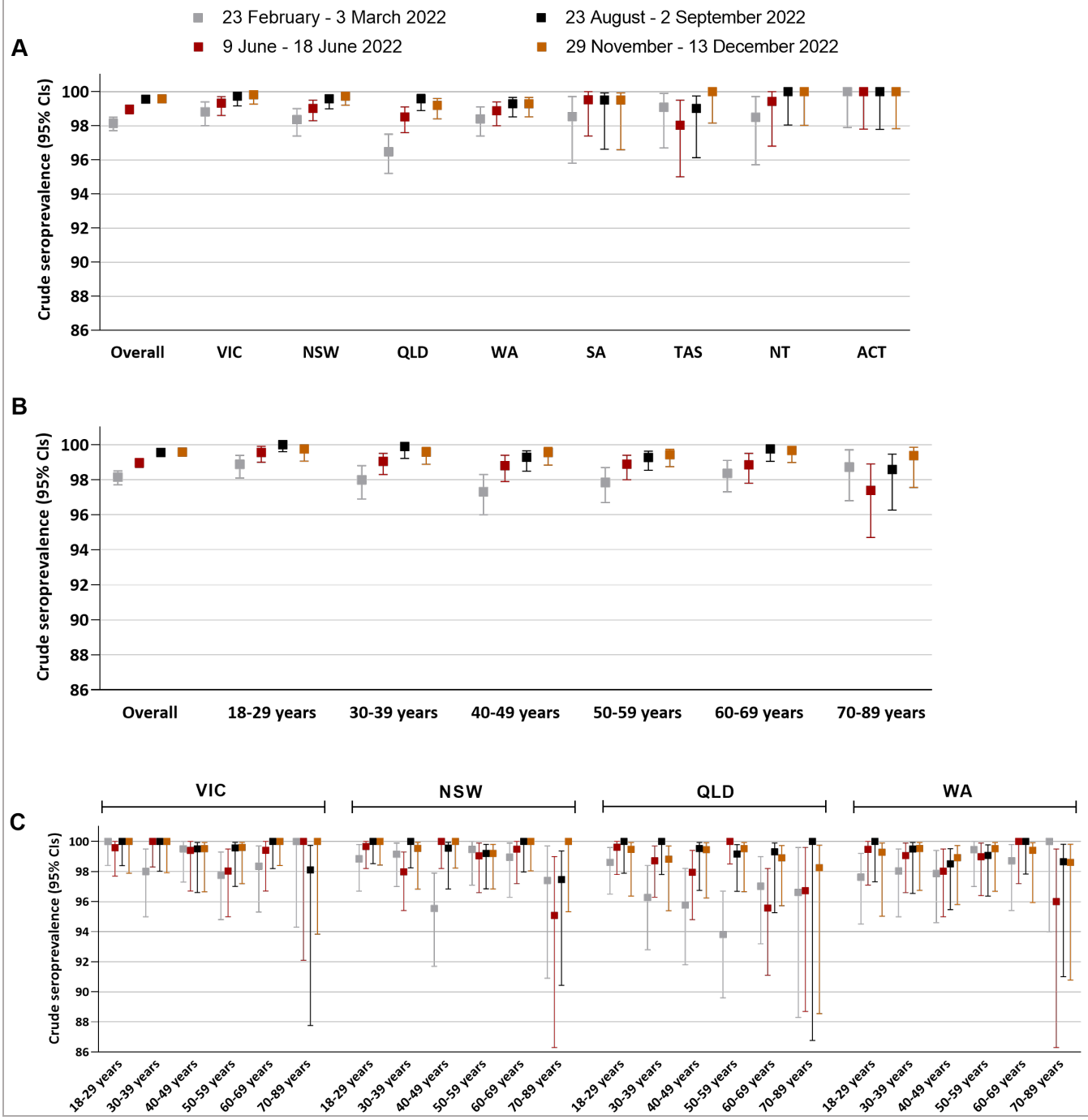


Figure 3: SARS-CoV-2 anti-spike protein antibody concentration levels among Australian blood donors by jurisdiction (A) and age groups (B)

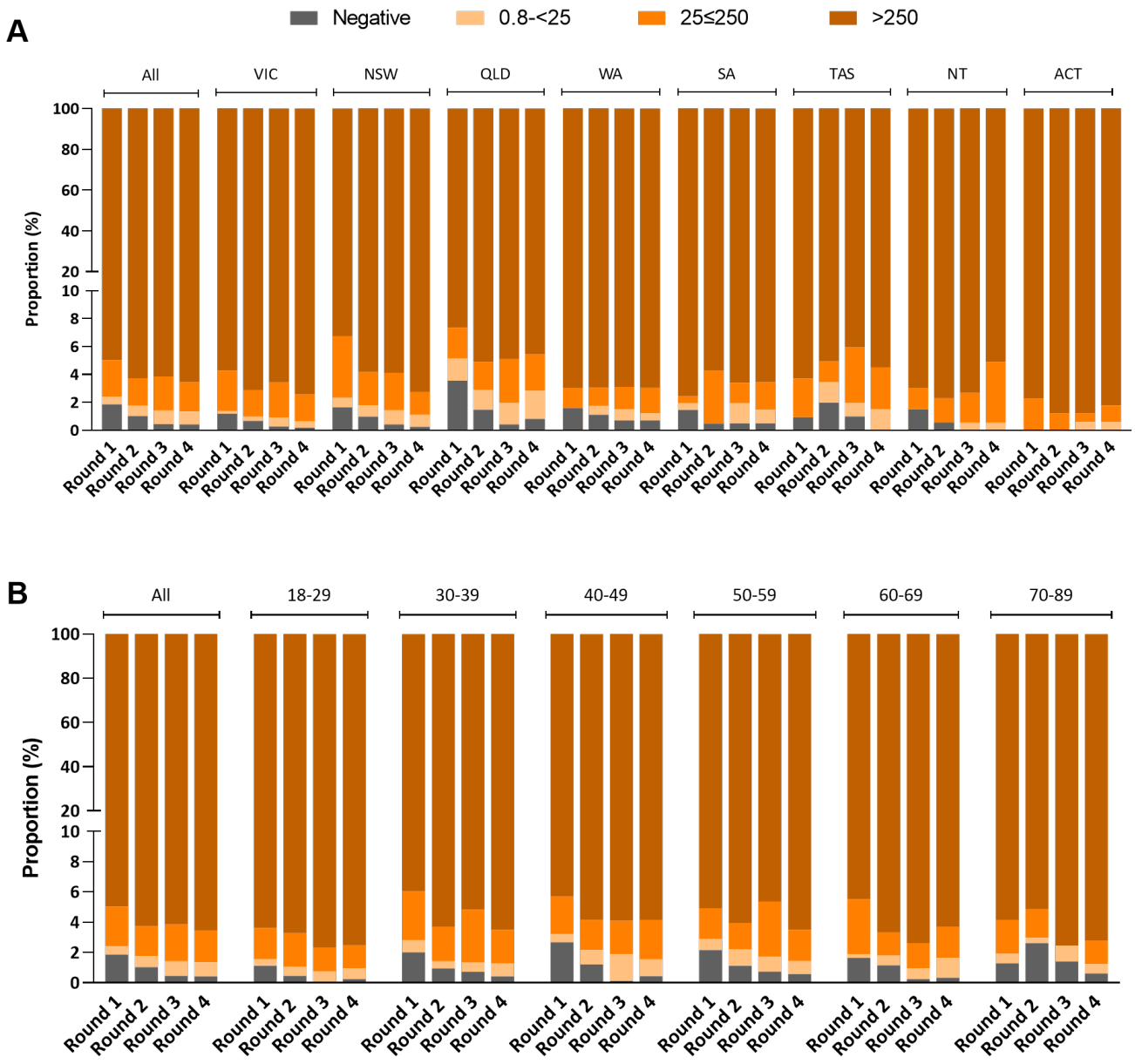
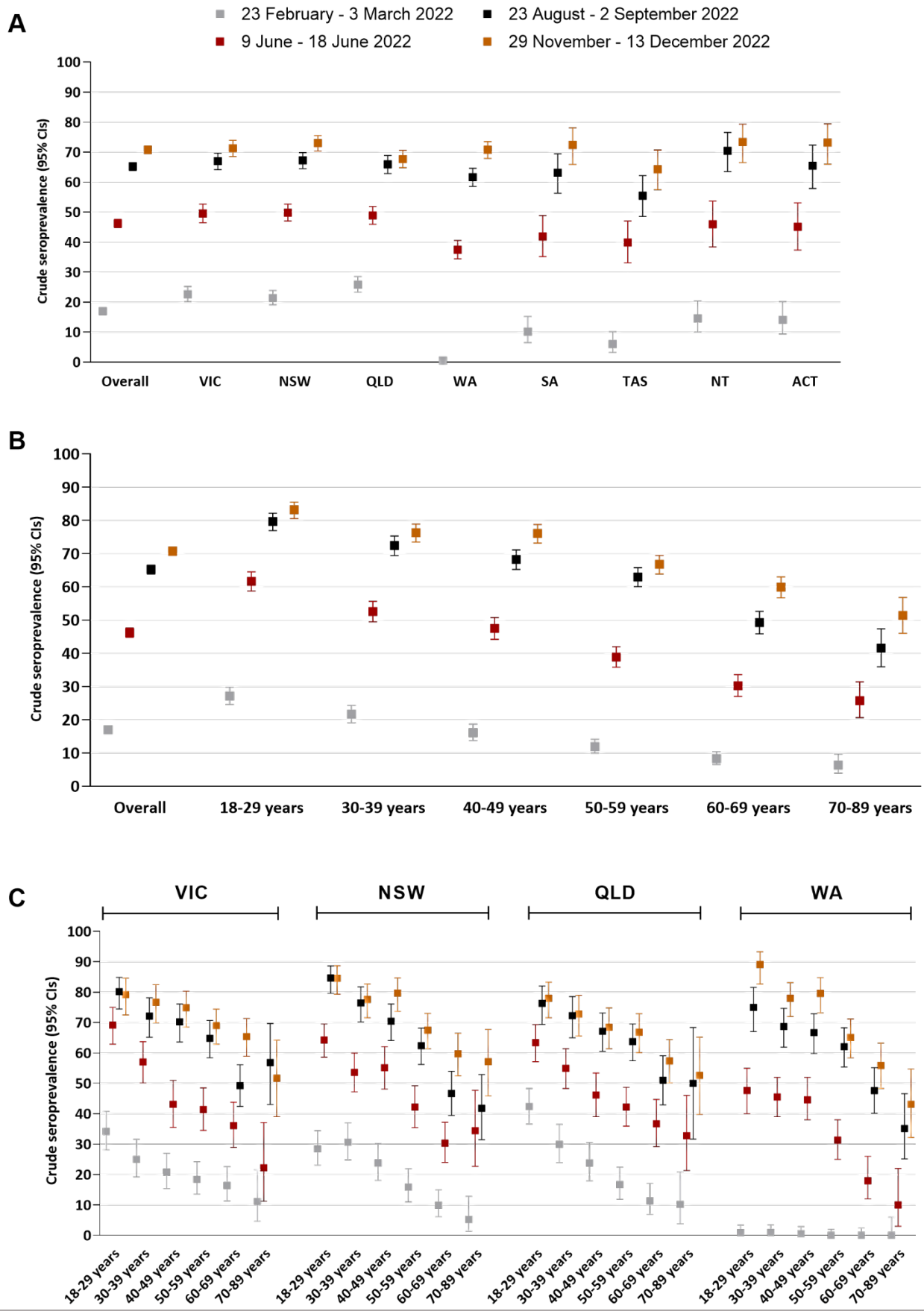


Figure 4. Crude SARS-CoV-2 anti-nucleocapsid protein seroprevalence among Australian blood donors by jurisdiction (A), age group (B) and age groups within Victoria, NSW, Queensland, and WA (C)



Interpretation and data considerations

- The prevalence of anti-spike antibodies remained high (>99%) overall with little variation by jurisdiction, age group or sex, consistent with Rounds 1–3.
- Anti-nucleocapsid seroprevalence increased from 65% in Round 3 to 71% in Round 4. All states and territories, and age groups experienced small increases in the prevalence of anti-nucleocapsid antibodies compared to Round 3.
- These results suggest that by December 2022, more than two-thirds of the adult population had been infected with SARS-CoV-2, virtually all subsequent to the appearance of the Omicron variant in late 2021.
- The changes in prevalence of anti-nucleocapsid antibodies between Round 3 and Round 4 was smaller than those observed between earlier rounds and may reflect the lower number of cases reported for the study period, as well as new infections combined with waning of infection-related antibodies acquired during earlier Omicron waves.
- Anti-nucleocapsid seroprevalence gives an estimate of cumulative infections in the populations, most likely within the past 3-6 months, but these antibodies do not necessarily confer immunity. Furthermore, current evidence suggests that circulating subvariants have substantial immune escape, and re-infections are common[3]. It is not possible to distinguish first infections from repeat infections in this study.
- Both anti-spike and anti-nucleocapsid seroprevalence estimates are crude and unadjusted for test sensitivity and specificity or differences in sample characteristics. In the UK and USA, crude seroprevalence estimates (i.e., without adjustment for sensitivity and specificity of the assay) have been useful in tracking the spread of SARS-CoV-2 infections over time using the Roche assay[4-6].
- Evidence suggests that anti-nucleocapsid antibodies are produced at lower levels and wane faster in people who acquire infection following vaccination than those who have not been vaccinated, reducing the sensitivity of anti-nucleocapsid assays in detecting previous infection[7,8]. As vaccine coverage in Australia is high, measures of anti-nucleocapsid antibodies will underestimate SARS-CoV-2 seroprevalence in the population.
- Available local data show that the sensitivity of the Roche assay to detect anti-nucleocapsid antibodies generated by infection with the Omicron strain of SARS-CoV-2 infection in vaccinated people is 84%, suggesting that seroprevalence estimates based on this assay may underestimate the prevalence of infection by some 15-20%.
- UK serosurveillance data showed similar patterns, with rapid increases in anti-nucleocapsid seroprevalence from 25% to 60% in the first three months after the emergence of Omicron, followed by only marginal increases and plateauing at 80–90% to the end of 2022[9].
- Population prevalence of anti-nucleocapsid antibodies will likely peak at 80-90% due to the combined impacts of assay under-ascertainment and antibody waning.
- Additional surveys are being considered, with more specific assays likely to be used to further characterise the immunological responses in the population. The frequency of survey rounds may also be reduced in future iterations.

Related materials

You can find more information on serological surveillance here

Results of previous survey rounds and further details on methods are available here

Additional information on the survey populations at each round and results in table format is available here.

References

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