Charting Elimination in the Pandemic:
A SARS-CoV-2 Serosurvey of Blood Donors in New Zealand

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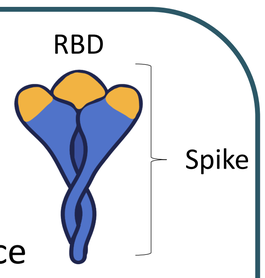
Background:

- New Zealand has a strategy of eliminating SARS-CoV-2 that has resulted in a low incidence of COVID-19.
- The spike protein is expressed on the surface of SARS-CoV-2. At the tip of the spike protein is the Receptor Binding Domain (RBD) which has been shown to be immunogenic and induces a long-lasting antibody response.[3]
- This study investigates the seroprevalence of SARS-CoV-2 in New Zealand using spike-based assays and New Zealand blood donors as a sentinel population.



Methods:

- Due to the low number of reported cases of COVID-19 in New Zealand, the method was optimised for specificity.
- Samples (n=9806) were first screened on well-established spike based 2-step ELISA.[2] Samples above the cut-off were run on two commercial assays.

Samples were collected from New Zealand Blood Service sites between 3rd December 2020 and 6th January 2021.

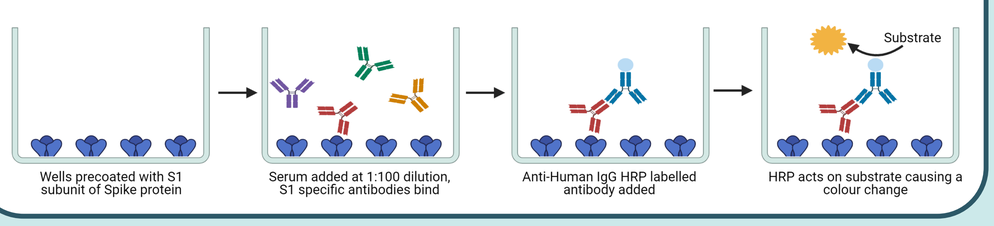
Screen:

2-Step ELISA[2]

The two-step ELISA consists of a single point dilution against the RBD followed by titration against trimeric S protein.

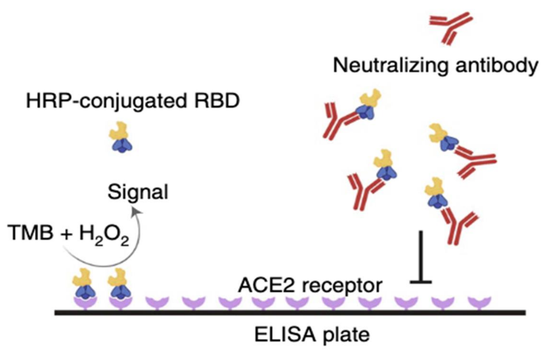
Commercial Assay 1:

Euroimmun SARS-CoV-2 IgG ELISA



Commercial Assay 2:

cPass surrogate Viral Neutralisation Test (sVNT)[3]



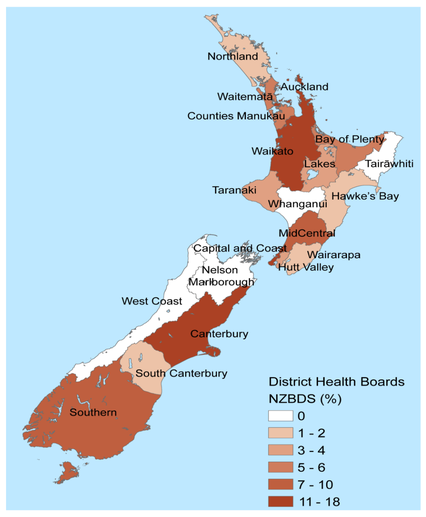
Serum is pre-incubated with HRP-RBD
↓
Added to h-ACE2 receptor coated plate
↓
Nabs inhibit interaction between HRP-RBD & h-ACE2
↓
Lower signal

Samples above the cut-off on both commercial assays were deemed seropositive.

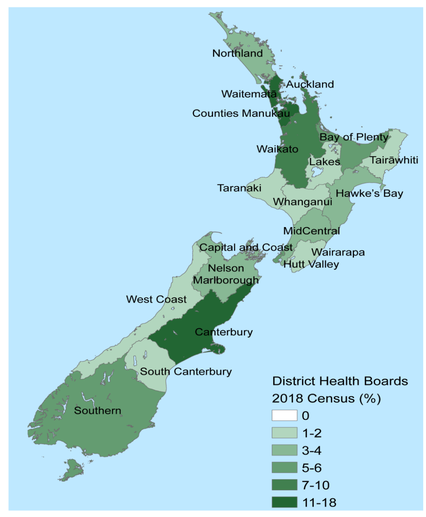
Demographics:

- Participants geographically spread, 16 of 20 district health regions represented.
- Compared to the 2018 New Zealand Census, participants:
  - more likely to be aged 40-59 years (43.3% vs 25.9%) and of European ethnicity (77.8% vs 61.0%).
  - had a similar proportion of females (49.1% vs 50.7%).

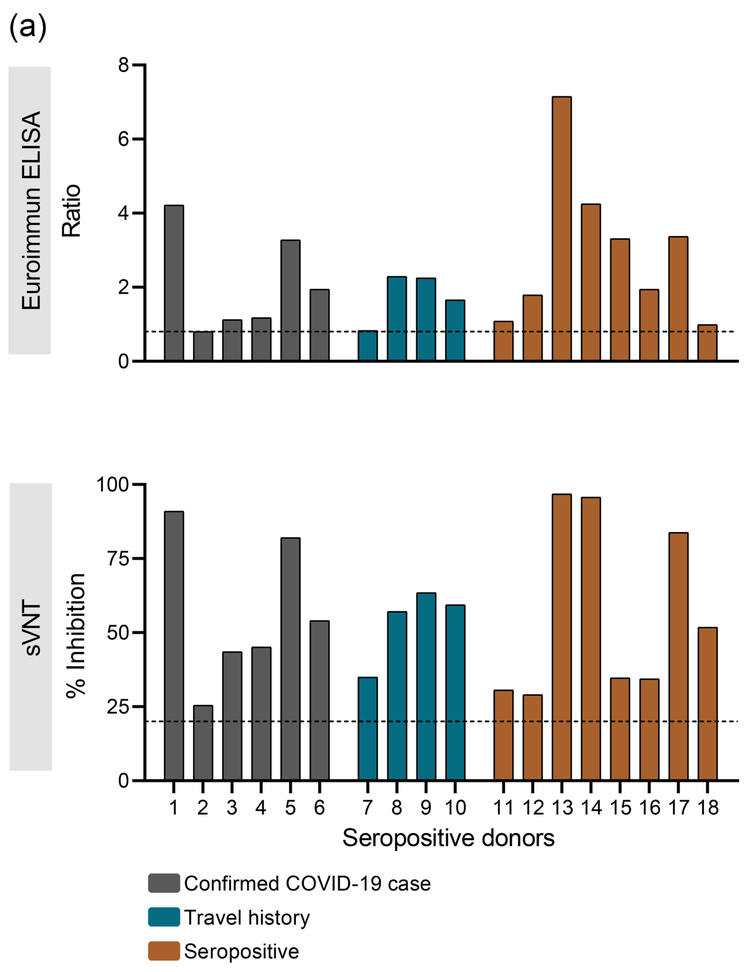
2018 Census New Zealand Population (%)

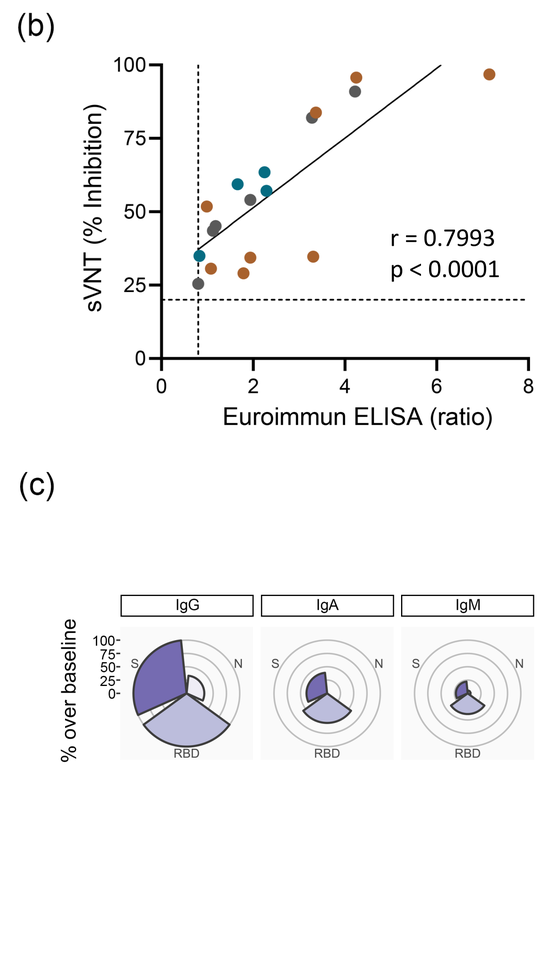


New Zealand Blood Donor Study Population (%)



Results:





Seropositivity and Antibody Characterisation

- Of the 18 seropositive participants:
  - 6 previously had a confirmed COVID-19 infection.
  - 4 had travel history to high-risk SARS-CoV-2 settings in 2020.
- Dominance of IgG antibodies to the RBD and S protein, consistent with infections that occurred weeks-months prior.[4]
- Adjusting for assay sensitivity and specificity (Rogan Gladen estimate with the Lang-Reiczigel Confidence Interval method) gave a true seroprevalence estimate of 0.103% (95% CI 0.09-0.12%).

Conclusions:

- The very low seroprevalence of SARS-CoV-2 infection in New Zealand implies undetected community transmission has been limited[1].
- This study highlights the value of a nationwide blood donor service to monitor viral spread during the pandemic.

References:

- [1]Carlton *et al* (2021). Charting Elimination in a Pandemic: A SARS-CoV-2 Serosurvey of Blood Donors in New Zealand. Epidemiology and Infection (in press).
- [2]McGregor and Whitcombe *et al* (2020). Collaborative networks enable the rapid establishment of serological assays for SARS-CoV-2 during nationwide lockdown in New Zealand. PeerJ. 8:e9863.
- [3]Tan *et al* (2020). A SARS-CoV-2 surrogate virus neutralisation test based on antibody-mediated blockage of ACE-2-spike protein-protein interaction. Nature Biotechnology. 38:1073-1078.
- [4]Whitcombe *et al* (2021). Comprehensive analysis of SARS-CoV-2 antibody dynamics in New Zealand. Clinical and Transnational Immunology. 10(3):e1261.