

Final report summary

COVID-19 and National Immunisation
Programme research

Submitted by
ESR

Project title

PROP-028 The impact of COVID-19 vaccination on disease burden and transmission and its vaccine effectiveness among participants of SHIVERS/WellKiwis community and household cohorts

Section 1: Contact information

1.1 Point of Contact for this report

Item	Detail
Contact person	Professor Sue Huang
Position	Principal Investigator of this grant. Director – WHO National Influenza Centre, ESR
Phone number	+64 27 216 7833
Mobile number	+64 27 216 7833
Email address	Sue.Huang@esr.cri.nz

Section 2: Reporting

2.1 Overview

Key points from the three publications:

- When the world is transitioning to COVID-19 endemicity and cocirculation with influenza, estimates of burden for mild spectrum of illness in community become increasingly important in understanding the full disease pyramid, and informing preventative measures, vaccination eligibility and prioritization, and future pandemic preparedness and prediction.
- Widespread community transmission of COVID-19 in Aotearoa NZ began with the first Omicron wave starting in February 2022. Our analyses show a significantly lower infection risk for adults who had three vaccine doses, compared with two doses. Unfortunately, children were not eligible for this level of protection and they experienced high infection rates. These findings show the importance of a strategic approach to protecting children during a respiratory pandemic.
- Households have been one of the most important sites of COVID-19 transmission in New Zealand. Our findings indicate the overall secondary attack rate was 60.6% which was higher than many previous studies. Sharing bathrooms, hand towels/toothpaste, and hugging/touching hands were related to transmission within the household and suggest that effective isolation within the home could reduce household transmission.

2.2 What is the problem or issue that your research investigated?

Built on specimens and data from the SHIVERS/WellKiwis community and household cohort with a study population of 3165, we aimed to conduct data analysis and publications on the impact of COVID-19 vaccination on disease burden and transmission and its vaccine effectiveness among participants of the community and household cohorts including a household transmission subcohort (75 households with 306 participants), particularly those at-risk vulnerable Māori and Pacific groups during the study period of 7-February to 2-October 2022.

2.3 What are the practical solutions and implementation options that you recommend?

Publication No.1: Comparison of the incidence and risk factors of COVID-19 and influenza associated acute respiratory illnesses

While comparative studies on severe outcome among hospitalized patients with COVID-19 and influenza are published, comparative studies on community transmission and mild spectrum of illnesses associated with COVID-19 and influenza are lacking. To the best of our knowledge, this is the first comparative evaluation of the acute respiratory infections (ARI) among participants of prospective community cohorts who experienced concurrent SARS-CoV-2 variant Omicron and seasonal influenza infections. One strength of our study is that we followed participants of all ages (adults and children) over 10 months (7-February to 2-October 2022) by systematically characterizing and comparing the duration and spectrum of their COVID-19 or influenza associated ARI. Among the SHIVERS-II, III, IV community and household participants who had never had any prior COVID-19 natural infections but had high level of COVID-19 vaccination, we found Omicron incidence rate was 4.7 times higher than seasonal influenza (51% Omicron-associated ARI vs 11% influenza-associated ARI). Among participants with COVID-19, children (0-17 years) consisted of a third (32.7%) of all. Those aged ≥ 18 years with high vaccine coverage of the 3rd dose (booster) had nearly 3 times lower peak incidence rate compared to those school aged children (5-17 years) when the booster was mostly not available to them. Participants with Omicron, when compared with influenza, had milder illness with lesser febrile illnesses, but presented more symptoms of sore throat, muscle ache and taste loss.

Our study provides important estimates on the impact of COVID-19 variant Omicron on community transmission and associated mild illnesses when influenza was used as a reference pathogen which co-circulated among SHIVERS community cohort participants at the same time within the same population. Our findings support prioritization for childhood vaccination, including expanding vaccine eligibility and

availability, for direct and indirect benefits including reducing complications from severe disease, long COVID-19 symptoms, minimizing overall hospitalization through herd immunity. When the world is transitioning to COVID-19 endemicity and cocirculation with influenza, the community cohort study is increasingly important to understand the full spectrum of disease burden and inform future modelling to plan and predict viral transmission, model the impact of vaccination, and better prepare for the next pandemic.

Publication No.2: COVID-19 vaccine effectiveness against the Omicron variant in Aotearoa New Zealand

What is new in this study:

- This study of COVID-19 vaccine effectiveness was conducted with a cohort of participants who were infection-naïve but highly vaccinated, during a time period of extremely high Omicron variant incidence. This situation presented a unique opportunity to estimate vaccine effectiveness without a confounding effect of immune response from prior infection.
- Results for adults are indicative of a 30% additional protective effect against PCR-positive infection for adults who had received three vaccine doses compared with those who had received two (adjusted hazard ratio 0.70; 95%CI 0.53 – 0.92). These results are consistent with international evidence of additional protection from a third vaccine dose.
- Depending on age and eligibility, children had generally received zero, one or two doses during the Omicron waves of 2022 and they had higher infection incidence than adult age groups.

Implications for policy and practice:

- The study findings support the principle of ensuring good vaccination coverage during times of anticipated high COVID-19 transmission.
- High infection rates in children suggest that earlier and more widespread availability of vaccines for younger age groups might have provided better protection during the 2022 Omicron waves, if this option had been available to them. These findings show the importance of a strategic approach to protecting children during a respiratory pandemic.
- The high quality of the data available for this analysis illustrates the value of having a well-established longitudinal cohort in place before the onset of a pandemic. The SHIVERS WellKiwis cohorts are providing unique evidence and policy insights about COVID-19 in the community. The need to sustain and further develop this high-quality respiratory surveillance platform is a key lesson for future pandemic preparedness.

Publication No.3: Household transmission of COVID-19 Omicron variant

Households have been one of the most important sites of transmission. To measure transmissibility and identify risk factors, the current study was conducted during the Omicron variant-dominant period of COVID-19 in New Zealand. To our knowledge, this is the first study examining the household transmission characteristics of SARS-CoV-2 Omicron variant.

We recruited 75 households (306 participants) from the SHIVERS/WellKiwis household cohort for a transmission sub-study during a period of 7-February to 2-October 2022.

The median serial interval was 4 (IQR: 2.5-6), shorter than previous variants. The overall secondary attack rate (SAR) was 60.6%, higher than many previous studies. Although 60% of primary cases were children <18 years old, they were less likely to be secondary cases.

The SAR varied by vaccination history, household size, and socioeconomic status; it was lowest among those who received two or three doses of the vaccine and highest in those who lived in larger households with low socioeconomic status.

The transmission rate was highest (88%) when both primary cases and household contacts were unvaccinated or had only one dose of the vaccine (P value=0.03). This transmission rate was three times higher than those vaccinated primary cases and household contacts.

Our findings indicate that sharing bathrooms, hand towels/toothpaste, and hugging/touching hands were related to transmission within the household, suggesting that effective isolation within the home could reduce household transmission.

Our findings indicate that sharing bathrooms, hand towels/toothpaste, and hugging/touching hands were related to transmission within the household, suggesting that effective isolation within the home could reduce household transmission.

2.4 What considerations need to be taken into account when implementing the solutions?

These three publications all highlighted the importance of the COVID-19 vaccination in reducing community transmission. In particular, the 3rd dose (booster) provided 30% improved protection for adults compared with 2 doses. Children aged 5-17 years for whom the booster vaccination was largely not available, presented with higher incidence rate than adults. Our findings support prioritization for childhood vaccination, including expanding vaccine eligibility and availability.

Our findings also highlighted the value to maintain the community longitudinal cohort study in the future in NZ in understanding the full spectrum of disease burden and assessing vaccine effectiveness and informing future modelling to plan and predict viral transmission, model the impact of vaccination and better prepare for the next pandemic.

Note: HDEC provided ethics approval for the SHIVERS/WellKiwis study (NTX/11/11/102)

Attach infographics file