# Vaccine effect on household transmission of omicron and delta SARS-CoV-2 variants

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## Introduction

We evaluated the household secondary attack rate (SAR) of the omicron and delta SARS-CoV-2 variants, according to the vaccination status of the index case and household contacts; further, in vaccinated index cases, we evaluated the effect of the antibody levels on household transmission.

## Methods

A prospective cross-sectional study of 92 index cases and 197 quarantined household contacts was performed. Tests for SARS-CoV-2 variant type and antibody level were conducted in index cases, and results of PCR tests (during the quarantine period) were collected from contacts. Association of antibody levels in vaccinated index cases and SAR was evaluated by multivariate regression analysis.

## Results

SAR was higher in households exposed to omicron variant than those exposed to delta variant. SAR was 35% and 23% for unvaccinated and vaccinated delta variant exposed contacts, respectively. SAR was 44% and 41% for unvaccinated and vaccinated omicron exposed contacts, respectively. Booster dose immunisation of contacts or vaccination of index cases reduced SAR of vaccinated omicron variant exposed contacts. In a model with adjustment, anti-receptor binding domain antibody levels in vaccinated index cases were inversely correlated with household transmission of both delta and omicron variants. Neutralising antibody levels had a similar relationship.

## Conclusions

Our data suggest that immunisation of household members may help to mitigate the current pandemic.

## Table and figure

**Table 1. The secondary attack rate among household contacts of index cases with delta and omicron variant infections according to vaccination status of contacts**

| | Household exposed to delta variant | | | Household exposed to omicron variant | | | *P* value |
|---|---|---|---|---|---|---|---|
| | Total | PCR (+) | SAR (95% CI) | Total | PCR (+) | SAR (95% CI) | |
| **All contacts** | 77 | 21 | 0.27 (0.18–0.39) | 120 | 50 | 0.42 (0.33–0.51) | *0.04 |
| **Unvaccinated contacts** | 29 | 10 | 0.35 (0.18–0.54) | 34 | 15 | 0.44 (0.27–0.62) | 0.436 |
| **Vaccinated contacts** | 48 | 11 | 0.23 (0.12–0.37) | 86 | 35 | 0.41 (0.3–0.52) | *0.038 |
| **Booster-vaccinated contacts** | 10 | 3 | 0.3 (0.07–0.65) | 30 | 9 | 0.3 (0.15–0.49) | >.999[a] |

SAR, secondary attack rate; CI, confidence interval
[a]*P* value was calculated using the Fisher's Exact Test.

**Table 2. The secondary attack rate according to vaccination status of household contacts linked to that of index cases**

| | Total | | | Household exposed to delta variant | | | Household exposed to omicron variant | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | PCR (+) | SAR (95% CI) | Total | PCR (+) | SAR (95% CI) | Total | PCR (+) | SAR (95% CI) |
| **Unvaccinated index cases-unvaccinated contacts** | 32 | 14 | 0.44 (0.26–0.62) | 24 | 10 | 0.42 (0.22–0.63) | 8 | 4 | 0.5 (0.16–0.84) |
| **Unvaccinated index cases-vaccinated contacts** | 28 | 13 | 0.46 (0.28–0.66) | 16 | 5 | 0.31 (0.11–0.59) | 12 | 8 | 0.67 (0.35–0.9) |
| **Vaccinated index cases-unvaccinated contacts** | 31 | 11 | 0.36 (0.19–0.55) | 5 | 0 | NA | 26 | 11 | 0.42 (0.23–0.63) |
| **Vaccinated index cases-vaccinated contacts** | 106 | 33 | 0.31 (0.28–0.66) | 32 | 6 | 0.19 (0.07–0.36) | 74 | 27 | 0.37 (0.26–0.49) |

SAR, secondary attack rate; CI, confidence interval

**Fig. 1. Study flow chart**

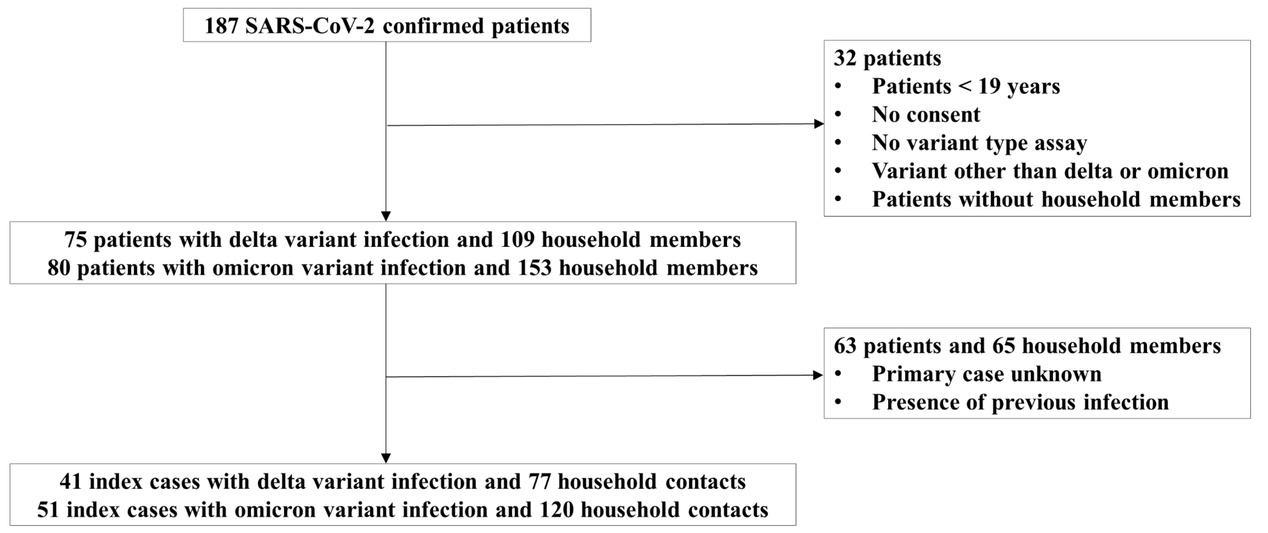


**Fig. 2. The link between index cases and household contacts based on their vaccination status**

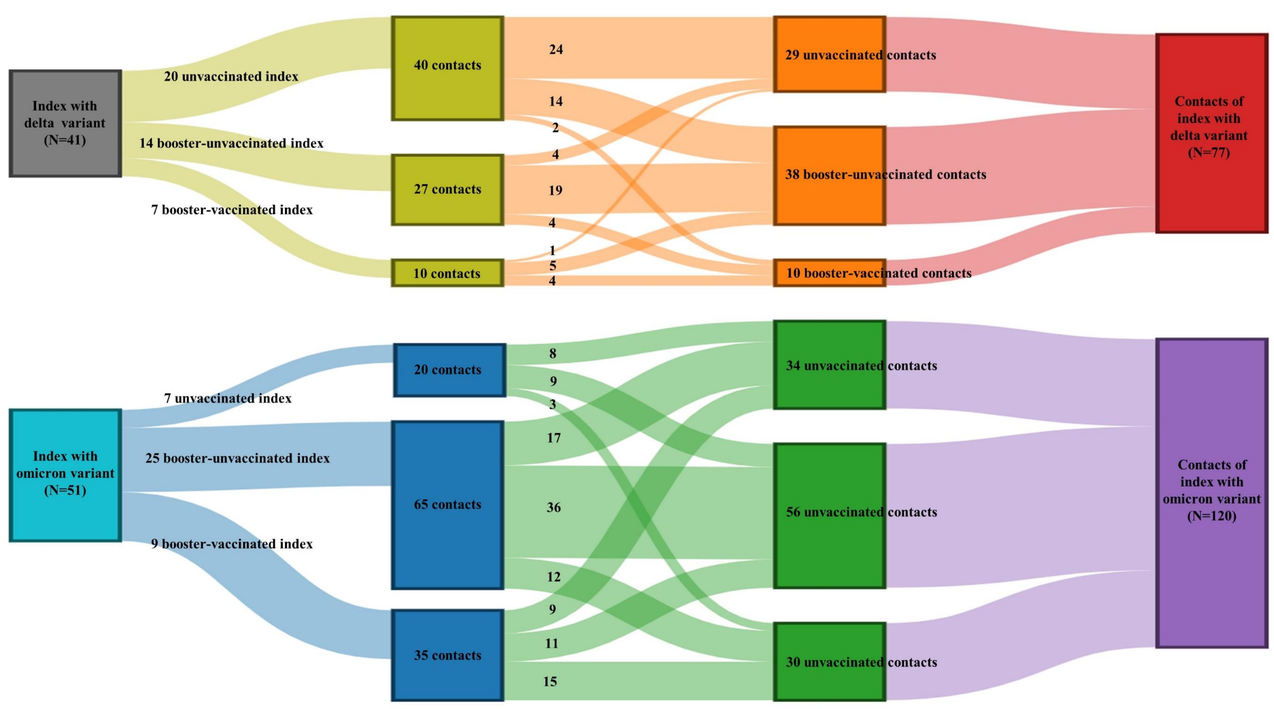


**Fig. 3. The association of antibody levels in vaccinated index cases and household transmission. In a model with adjustment for factors that could affect the household transmission, the estimated probabilities of SARS-CoV-2 infection among 132 contacts according to the level of anti-RBD antibodies (A) and neutralising antibodies (B) of 62 index cases. Serum samples for antibody tests were collected within 7 days of symptom onset or diagnosis, whichever was earlier, in vaccinated index cases. Shaded areas indicate 95% confidence intervals.**