

Title: Natural vs. Acquired Immunity and COVID-19 Infectivity in a Highly Vaccinated community: Marin County, California

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Background: Marin County, CA, with 90% of its eligible population vaccinated, experienced a nearly 80% decrease in COVID-19 cases in early 2021 that may be attributed to a combination of acquired immunity from vaccination and natural immunity from prior COVID-19 infection. The Delta variant surge in summer 2021 prompted an examination of whether acquired or natural immunity provided more protection from infection by the Delta variant.

Methods: We used the County's COVID-19 data system, CoDa, and the California Immunization Registry to identify cases based on first and last name and birthdate. The exposure was the "pre-Delta period" (January 1-June 30, 2021) as compared to the "peri-Delta period" (July 1-September 19, 2021), prior to booster availability. Outcomes were vaccine breakthrough (positive test 90+ days post-vaccine series completion) or unvaccinated reinfection (positive test 90+ days post prior infection without vaccination). Logistic regression was used to examine the exposure-outcome relationship controlled for age ($\alpha=0.05$). Analyses were performed in Stata 16.1.

Results: From January 1-September 19, 2021 there were 5296 cases, with 1545 cases (29%) among vaccinated individuals and 3735 cases (71%) among unvaccinated individuals. During the pre-Delta period, there were 3456 cases, with 12 vaccinated and two reinfection cases and during the Delta period, there were 1840 cases, with 1064 vaccinated and 12 reinfection cases. Individuals with acquired immunity had 7.06 (95% CI: 6.48, 7.65) times the odds of becoming a breakthrough case during the Delta period compared to the pre-Delta Period. The odds of becoming a breakthrough case was 1.53 (95% CI: 0.59, 2.46) times higher among those with vaccinated immunity compared to unvaccinated prior-infected individuals during Delta compared to pre-Delta, adjusted for age.

Conclusions: The higher frequency of COVID-19 cases during the Delta surge suggests that either protection from natural and acquired immunity is lower among variants, there is waning immunity, or, most likely, a combination of the two. Although there was a higher frequency of vaccine breakthrough cases compared to reinfections during the Delta surge, due in part to higher vaccination rates, cases were equally as likely to be reinfection or vaccine breakthroughs during both exposure periods after age adjustment. Equal protection against Delta from natural vs acquired immunity has policy implications for equating full vaccination with proof of prior infection; however, immunity for new variants is still unknown.