

Research Brief

Increase in the coronavirus disease 2019 (COVID-19) attack rate of fully vaccinated healthcare workers with high-risk household exposures correlates with the rise of the severe acute respiratory coronavirus virus 2 (SARS-CoV-2) B.1.617.2 (delta) variant

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As we previously reported, healthcare workers (HCWs) fully vaccinated with mRNA coronavirus disease 2019 (COVID-19) vaccines with a subsequent household contact diagnosed with COVID-19 had a 17% rate of severe acute respiratory coronavirus virus 2 (SARS-CoV-2) infection.^{1,2} However, these initial data were collected prior to the B.1.617.2 δ (delta) variant becoming the primary SARS-CoV-2 variant in the United States.

Based on genomic sequencing from the Nebraska Public Health Laboratory, the δ variant was first documented in Nebraska Medicine employees at the end of June 2021, and it quickly became the predominant variant in the community as well as the cause of HCW infections after July 1, 2021.

When mRNA vaccines became available in December 2020, the Nebraska Medicine Employee Health Department implemented a screening program for fully vaccinated employees who had had a high-risk exposure. Fully vaccinated employees who reported a household exposure to a close contact with active COVID-19 infection, and who were deemed essential and unable to work remotely, were eligible to enroll in a screening program rather than completing a home-quarantine period. Employees were eligible for the screening program if their exposure was >7 days after the second dose of SARS-CoV-2 vaccine and they remained asymptomatic. If these criteria were met, the employees underwent a nasopharyngeal swab (NP) for SARS-CoV-2 testing by polymerase chain reaction (PCR) through Nebraska Medicine and, if negative, they were allowed to return to work. The employee was then tested serially by NP swab every 5–7 days until at least 7 days from their last exposure to the SARS-CoV-2-positive household member during the period of viral shedding (typically 10 days). Employees were instructed to self-isolate from the positive individual in the home, if logistically feasible. Employees unable to do so were not excluded from the serial testing program, but their period of serial testing was extended until 7 days after the household contact was considered noninfectious.

As of October 5, 2021, 234 HCWs had completed the screening program, and 84 employees had tested positive either on initial screening test or during the screening program. Furthermore, 63 HCWs (75%) who tested positive reported symptoms. Of those who tested positive, 78% were positive on their initial PCR test, 13% were positive after a second test 5–7 days later, and 9% were positive after 3 tests. Overall, 231 HCWs were vaccinated with mRNA vaccines; the remaining 3 were vaccinated with the Janssen COVID-19 vaccine.

Prior to the rise of the δ variant, fully vaccinated HCWs who had a household member diagnosed with COVID-19 had an attack rate of 17% (Table 1). However, data collected since July 1, 2021, demonstrate a 47% acquisition rate of employees in the screening program, which is significantly higher than prior data show (Table 1). For the 21 nonvaccinated HCWs who reported household exposure after July 1, the attack rate was 57%. These HCWs were not eligible for the screening program while working but were all tested prior to returning to work. None of the vaccinated HCWs who acquired COVID-19 required hospitalization or developed severe disease, which is consistent with other studies conducted before and after the δ variant became dominant.^{3,4}

Our data suggest that the δ variant affected the attack rate following household exposure of HCWs compared to previous SARS-CoV-2 variants, even after HCWs were fully vaccinated. Spousal relationship has previously been shown to be a high risk for secondary infection; the mean household secondary attack rate of spouses was 37.8% in prevaccination data.⁵

Several additional factors other than the spread of the δ variant could also be contributing to the increase in the household attack rate over time. Immunity through mRNA vaccines wanes with time, and most HCWs in our data set had completed the 2-dose vaccine series by February 2021.⁶ Thus, it is possible that HCWs who acquired COVID-19 in September 2021 had less protection from their initial vaccine series than those who were exposed earlier.

Notably, Nebraska schools returned to in-person education in August 2021, which corresponded with increased rates of HCWs reporting exposures to children who tested positive for SARS-CoV-2. Furthermore, 29% of household exposures were children prior to return to school, but this increased to 43% after the

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Table 1. COVID-19 Test Results Among Healthcare Workers After Household Exposure

Exposure	Positive	Negative	Total Results	Rate, %
Before the δ variant (Jan–Jun 2021)				
Partner	12	44	56	21
Child	1	24	25	4
Other	3	11	14	21
Total	16	79	95	17
During the δ variant (Jul 1–Oct 5, 2021)				
Partner	25	23	48	52
Child	27	32	59	46
Other	14	18	32	44
Total	66	73	139	47

Note. δ , delta.

August return-to-school date. Prior to returning to school, most HCWs reported being able to isolate themselves from their positive adult household member. But with an increase in child cases, the ability of HCWs to practice strict isolation diminished due to the need to provide care to their children. This situation may have resulted in more frequent and closer contact exposures, which may have resulted in higher rates of secondary infection. Finally, Nebraska Medicine relies on employees to self-report their exposures and symptoms, which remains a limitation of our data.

Although it was likely multifactorial, the increased secondary attack rate of fully vaccinated HCWs with the spread of the δ variant demonstrates the importance of (1) continued monitoring of employees with high-risk household exposures, (2) following CDC recommendations for vaccine boosters to combat waning vaccine immunity, and (3) considering alterations of employee

isolation protocols. Testing HCWs after household exposure to COVID-19 should be strongly considered, even if the HCW is asymptomatic, prior to return to work due to high attack rates after these types of exposures.

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