Article Type: Letter to the Editor

Transmission of SARS-CoV-2 Virus, Delta Variant, Between Two Fully Vaccinated Healthcare Personnel

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Manuscript Word Count: 597
Introduction
Breakthrough SARS-CoV-2 virus infection causing COVID-19 in fully vaccinated individuals occurs, and the frequency is increasing since the SARS-CoV-2 delta variant virus began circulating widely.\(^1\) COVID-19 vaccines are highly effective at reducing SARS-CoV-2 shedding and transmission.\(^2\) The question of whether fully vaccinated people with breakthrough COVID-19 can transmit the SARS-CoV-2 virus to others is central to the debate around the need for mitigation efforts including masking and physical distancing for fully vaccinated individuals. We report apparent SARS-CoV-2 viral transmission between two fully vaccinated healthcare workers (HCW) in the setting of occupational unmasked close contact.

Methods
Healthcare personnel are screened daily and report COVID-19 symptoms to occupational health. Symptomatic HCW are tested for SARS-CoV-2 using a nasopharyngeal swab sample and the cobas SARS-CoV-2 assay (Roche). Contact tracing is conducted by interviewing personnel who test positive and their close contacts. Whole genome sequencing is conducted for all SARS-CoV-2 viral isolates as previously described.\(^3\) Consensus sequences were analyzed with Clustal omega (ebi.ac.uk) and visualized with interactive tree of life (itol.embl.de).

Results
In late July, a fully vaccinated HCW (two doses COVID-19 mRNA vaccine > 6 months earlier) developed new onset headache, cough, fatigue, muscle aches and sore throat, progressing to fever and loss of taste and smell. Four days after symptom onset, a nasopharyngeal swab was positive for SARS-CoV-2 with cycle threshold (Ct) values of 25 and 26 for the E and ORF1ab genes, respectively. Risk factors for COVID-19 included international travel and interacting unmasked with others in the two weeks prior to symptom onset. Contact tracing identified 8 exposed HCW contacts; seven were fully vaccinated and one was unvaccinated. No patient exposures occurred. One exposed, fully vaccinated HCW (two doses COVID-19 mRNA vaccine > 6 months earlier) developed headache, fever, muscle aches, cough, fatigue and chills 4 days after unmasked, close contact (less than 6 feet) for approximately 120 minutes while the index case was asymptomatic and approximately 30 minutes while the index case was symptomatic during the infectious period. Both exposures involved eating together, unmasked, in a shared space. The exposed HCW tested positive for SARS-CoV-2 (Ct values of 17 and 18) one day after symptom onset and 4 days after the first exposure to the index HCW. The second HCW had no other known COVID-19 exposures but did interact unmasked with coworkers in the two weeks before testing positive. Whole genome sequencing detected the SARS-CoV-2 delta variant (B.1.617.2). Genome alignment to 41 other delta variants isolated at our institution from April through July 2021 confirmed the relatedness of the two HCW viruses and their distinctiveness from other SARS-CoV-2 isolates (Figure).
Discussion
Recent CDC guidance says that fully vaccinated individuals may not need to wear masks indoors or practice physical distancing due to vaccine effectiveness and the low likelihood of a fully vaccinated person transmitting the virus to others.\(^4\) The genetic and epidemiological data from our investigation of two HCW with breakthrough SARS-CoV-2 infection strongly suggest transmission of the SARS-CoV-2 virus delta variant from one fully vaccinated individual to another in the setting of unmasked close contact. Limitations include the fact that source of the infection for the first HCW is unknown; it remains possible that both HCWs were infected with SARS-CoV-2 from a common source or through separate exposures. SARS-CoV-2 variants, such as the delta variant, can have higher viral loads, potentially increasing transmissibility and requiring enhanced public health measures.\(^5\) This apparent transmission of SARS-CoV-2 from one fully vaccinated person to another demonstrates that masking and physical distancing remain vital infection prevention measures for fully vaccinated people while the SARS-CoV-2 virus is still evolving and circulating.

Acknowledgements:
This report was made possible by the Johns Hopkins Clinical Microbiology Laboratory faculty and staff. HHM is supported by the HIV Prevention Trials Network (HPTN) sponsored by the National Institute of Allergy and Infectious Diseases (NIAID), National Institute on Drug Abuse, National Institute of Mental Health, and Office of AIDS Research, of the NIH, DHHS (UM1 AI068613), the NIH RADx-Tech program (3U54HL143541-02S2), National Institute of Health RADx-UP initiative (Grant R01 DA045556-04S1), National Institute of Allergy and Infectious Diseases (Johns Hopkins Center of Excellence in Influenza Research and Surveillance HHSN272201400007C), Johns Hopkins University President’s Fund Research Response, the Johns Hopkins Department of Pathology, the Maryland Department of Health, and the CDC. The views expressed in this manuscript are those of the authors and do not necessarily represent the views of the National Institute of Biomedical Imaging and Bioengineering; the National Heart, Lung, and Blood Institute; the National Institutes of Health, or the U.S. Department of Health and Human Services.

Whole genome sequencing was supported by funds through the CDC Broad Agency Announcement awards as a part of the SARS-CoV-2 Sequencing for Public Health Emergency Response, Epidemiology, and Surveillance (SPHERES) Initiative. This study was also made possible by efforts from our contact tracing team. A.M. was supported by the National Institute of Allergy and Infectious Diseases of the National Institutes of Health [K24AI141580].
References


Figure. Analysis of SARS-CoV-2 Delta Variant Genomes from Two Fully Vaccinated Healthcare Workers (HCW) Compared with Other Viral Isolates from April Through July 2021.

A) Relationship between the two HCW SARS-CoV-2 genomes to a total of 41 other SARS-CoV-2 delta variants identified at Johns Hopkins Molecular Virology diagnostic laboratory and characterized by whole genome sequencing. Genomes from the two HCW are highlighted in red.

B) Genomic alignment of the two HCW genomes that shows the amino acid changes as compared to the reference genome using Nextclade version 1.5.2. Amino acid changes are shown as colored vertical lines while dark gray bars indicate genomic gaps or deletions. The inset of the Spike region shows the amino acid changes carried by the two HCW genomes including the S: T859I which was exclusively detected in these two genomes as compared to the whole cohort.