Research Brief

Correlation of healthcare worker vaccination with inpatient healthcare-associated coronavirus disease 2019 (COVID-19)

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Hospitalized patients often have underlying health conditions placing them at risk for complications of severe acute respiratory coronavirus 2 (SARS-CoV-2) infection.¹ Although measures such as screening for coronavirus disease 2019 (COVID-19), universal masking of healthcare workers (HCWs), and SARS-CoV-2 testing protocols help to mitigate HCW-to-patient transmission events, healthcare-associated COVID-19 (HA-COVID-19) continues to occur in inpatient settings. Vaccination for SARS-CoV-2 has resulted in dramatic reductions in the incidence of COVID-19 among HCWs,^{2,3} but its impact on HA-COVID-19 is unknown. We sought to determine whether there was a correlation between HCW vaccination and HA-COVID-19 occurrence.

Methods

Starting on December 16, 2020, medical staff and employees at Yale New Haven Hospital (YNHH), a 1,541-bed hospital with 70 clinical units in New Haven, Connecticut, were offered either the mRNA-1273 vaccine (Moderna) or the BNT162b2 vaccine (Pfizer-BioNTech). We evaluated the incidence of HA-COVID-19 and HCW vaccination rates by clinical unit. HCW were defined as frontline clinical staff and were classified according to primary unit assignment. All patients were tested for SARS-CoV-2 on admission. HA-COVID-19 was defined as any positive SARS-CoV-2 nucleic acid amplification test (NAAT) >14 days after admission regardless of symptoms in a patient without a prior diagnosis of COVID-19 to exclude any patient with potential community-acquired SARS-CoV-2 infection. SARS-CoV-2 testing after admission was typically performed for patients with new symptoms of COVID-19, for preprocedure testing when moderate sedation or general anesthesia was required, or for required discharge screening. Surveillance for HA-COVID-19 was performed by prospective review of SARS-CoV-2 testing results and medical record review. HCWs on COVID-19 units were excluded from the comparison. Hospital policies significantly limited visitation during the evaluation period. This quality improvement initiative did

not qualify for evaluation by the Yale University Institutional Review Board.

Results

In total, 16,768 HCWs were invited to receive 1 of the 2 SARS-CoV-2 vaccines. Before vaccination, a voluntary survey showed 85% of Yale HCWs with willingness to get the vaccine.⁴ Among all HCWs, 12,870 (76.8%) scheduled vaccinations, and 11,885 (70.9%) completed both doses of the vaccine series by March 14, 2021.

In total, 16 cases of HA-COVID-19 were observed (1.7 per 10,000 patient days), and 181 HCWs tested positive. No patients diagnosed with HA-COVID-19 had been vaccinated. Also, 8 inpatient units (11.4%) had 1 or more patients with HA-COVID-19. Comparing units with and without occurrences of HA-COVID-19, 197 (56.1%) of 351 invited HCWs in units with occurrences of HA-COVID-19 completed the vaccine series compared to 11,553 (71.2%) of 16,215 invited HCWs on units without HA-COVID-19 ($P < .001$). HCWs on units with at least 1 HA-COVID-19 occurrence had higher rates of failure to present for either the first or second vaccination dose at the scheduled time: 30 (13.2%) of 227 scheduled HCWs on units with at least 1 HA-COVID-19 occurrence versus 940 (7.5%) of 12,493 HCWs scheduled on units without HA-COVID-19 ($P = .001$). By comparison, 66.8% of HCWs with primary assignments on COVID-19 units and 80.1% of physicians and other licensed independent practitioners completed the vaccine series. Aggregate vaccination totals of healthcare workers who were invited, scheduled, and received the second dose of the vaccination series are listed by group in Table 1. A sensitivity analysis defining HA-COVID-19 as a positive SARS-CoV-2 NAAT >7 days from admission yielded similar results; 32 cases of HA-COVID-19 in 16 units (22.9%) were observed. The cumulative vaccination rate of HCW working on units with a case of HA-COVID-19 was 61.7% (373 of 605 invited) compared to 71.1% for the remainder of HCWs on other units (11,362 of 15,961 invited; $P < .001$).

Discussion

HCWs on units with at least 1 inpatient HA-COVID-19 occurrence had lower vaccination rates. This association suggests that vaccination of HCWs against SARS-CoV-2 may protect patients

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Table 1. Aggregate of HCWs Invited to be Vaccinated, Scheduled for Vaccination, and Completed the Vaccine Series^a

Staff Type	Total Invited	Total Scheduled, No. (%)	Received Second Dose
All YNHH HCW	16,768	12,870	11,885 (70.9% of invited, 92.3% of scheduled)
Medical staff	2,181	1,866 (85.6)	1,746 (80.1% of invited, 93.6% of scheduled)
HCWs on COVID-19 units	202	150 (74.3)	135 (66.8% of invited, 90.0% of scheduled)
HCWs on units with at least 1 HA-COVID-19 case	351	227 (64.7)	197 (56.1% of invited, 86.6% of scheduled)

Note. HCW, healthcare worker; YNHH, Yale New Haven Hospital.

^aFor comparison, medical staff and HCW working primarily on COVID-19 units are included.

from acquiring COVID-19, although it could also indicate that the practices and behaviors of HCWs who are vaccinated may drive this protective effect. Higher failure rates to show for vaccination after scheduling vaccination in these HCWs suggests that targeted communication and outreach may be of benefit.

The study had several limitations. We were unable to determine potential SARS-CoV-2 exposures and true secondary infections. We classified HCWs to units based solely on primary assignment, so HCWs who performed patient care activities on multiple units or those with secondary unit assignments may have introduced selection bias. Additionally, HCWs may have deferred vaccination due to prior SARS-CoV-2 infection.

We observed a relatively low frequency of HA-COVID-19 cases. These results may have been due to the restrictive definition of classifying HA-COVID-19 cases as patients found to be SARS-CoV-2 positive >14 days from admission, a definition initially chosen to maximize specificity for HA-COVID-19 and to exclude any potential community-acquired SARS-CoV-2 infections. A sensitivity analysis using 7, rather than 14 days, as a definition for HA-COVID-19 yielded twice the number of HA-COVID-19 cases with similar findings in HCW vaccination rates. Nevertheless, the true burden of HA-COVID-19 was likely underestimated for the following reasons: (1) HA-COVID-19 cases with shorter incubation periods would not be captured with our definition, (2) asymptomatic cases are difficult to diagnose without active surveillance, and (3) exposed inpatients may have presented with

COVID-19 after discharge. Ensuring HCW vaccination against SARS-CoV-2 may reduce HA-COVID-19 and improve patient outcomes in addition to protecting the HCWs themselves against COVID-19.

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