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Research Brief

Characterization of healthcare-associated infections with the severe acute respiratory coronavirus virus 2 (SARS-CoV-2) omicron variant at a tertiary healthcare center

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Healthcare-associated infections (HAIs) from coronavirus disease 2019 (COVID-19) have been reported worldwide, accounting for up to 8.2% of all cases in a cohort of UK hospitals during the first wave of the pandemic in 2020.[1,2] The potential for COVID-19 HAI has continued to cause concern and strategies to prevent inpatient transmission have targeted reducing aerosol spread with the use of respirators by healthcare personnel (HCP), the use of airborne isolation rooms for aerosol-generating procedures,[3] testing of symptomatic and asymptomatic patients at admission,[4] and standard infection prevention strategies (eg, hand hygiene).[5] The severe acute respiratory coronavirus virus 2 (SARS-CoV-2) (omicron) variant appeared at the end of 2021 and marked a shift in the patterns of infection, with increased transmissibility but reduced severity.[6] We investigated the impact of the different transmission properties of the SARS-CoV-2 (omicron) variant on rates and features of COVID-19 HAI in comparison to the SARS-CoV-2 δ (delta) variant.

Methods

All cases of COVID-19 infection based on positive SARS-CoV-2 polymerase chain reaction (PCR) testing were reviewed in adult and pediatric patients hospitalized at a single ~950-bed tertiary-care medical center in North Carolina from July 1, 2021 to January 30, 2022. Possible COVID-19 HAI was defined as a positive test ≥4 days into hospitalization (ie, the median incubation time for the SARS-CoV-2 δ [delta] variant of concern) in a patient who had a negative test without symptoms consistent with COVID-19 at the time of admission.[7] Based on sequencing data from our microbiology laboratory, the SARS-CoV-2 δ (delta) variant represented >95% of >1,800 isolates from hospitalized patients between July 1, 2021, and December 6, 2021, and the SARS-CoV-2 (omicron) variant represented >95% of ~1,000 isolates from hospitalized patients from December 30, 2021, onward. There were no COVID-19 HAIs between December 6 and December 30; thus, we assumed that COVID-19 HAIs prior to December 30, 2021, were due to the SARS-CoV-2 δ (delta) variant and afterward were due to the (omicron) variant. There were no major differences in infection surveillance and/or prevention/control policies during these periods, except as noted below.

Results

From December 30, 2021, to January 30, 2022, there were 663 COVID-19 admissions, including 50 cases of (omicron)-variant HAI (8%). In comparison, from July 1, 2021, to December 29, 2021, there were 1,105 COVID-19 admissions, including 10 cases of δ (delta)-variant HAI (0.9%). The characteristics of patients with (omicron)-variant HAI are summarized (Table 1). In some cases, acquisition may have occurred prior to hospitalization with subsequent onset of symptoms and detectability; however, many of these cases occurred after 10 days of hospitalization at which point HAI is highly probable.[7] Importantly, clinical and demographic characteristics did not differ greatly between patients diagnosed with COVID-19 HAI before or after 10 days of hospitalization (data not shown). In 28% of cases, family visitation prior to positive testing was documented by a clinician or nurse in the patient chart, and 38% of cases occurred in "clusters" in which 3 or more patients in the same unit experienced COVID-19 HAIs within 1 week. In particular, 8 cases occurred in a single psychiatric unit, likely representing patient-to-patient spread. In many cases, however, the exposure within the hospital remained unknown.

Most patients with SARS-CoV-2 (omicron)-variant HAI presented with upper respiratory symptoms including cough, congestion, sore throat, and fever. Only 26% of patients were asymptomatic with testing performed for clearance for procedure, for transfer or discharge, or for surveillance due to presumed exposure. Additionally, many patients with SARS-CoV-2 (omicron)-variant HAI had mild-to-moderate disease, with only 8% progressing to severe disease and 1 death. In contrast, SARS-CoV-2 δ (delta)-variant HAI was associated with progression to severe disease in 20% of patients.

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Table 1. Demographic and Clinical Characteristics of Patients With SARS-CoV-2 Delta-Variant and Omicron-Variant Hospital-Acquired Infections

Total No.	SARS-CoV-2 Delta Variant		SARS-CoV-2 Omicron Variant	
	10		50	
	No.	%	No.	%
Age				
≤19 y	0	0	7	14
20–64 y	5	50	25	50
≥65 years	5	50	18	36
Sex				
Female	5	50	18	36
Male	5	40	32	64
Race, no.				
White	5	50	26	52
Black	3	30	18	36
Hispanic	1	10	2	4
Asian	1	10	2	4
Other[a]	0	0	2	4
Risk factors				
None	2	20	3	6
Immunocompromised	4	40	18	36
Other comorbidity[b]	4	40	29	58
Vaccine status				
Primary series completed	6	60	27	54
1 dose	1	10	6	12
None	3	30	17	34
Booster received	0	0	10	20
Length of stay				
<10 d	5	50	18	36
≥10 d	5	50	32	64
Exposures				
Family visitors	4	40	14	28
Cluster[c]	0	0	19	38
Unknown	6	60	17	34
Symptoms				
None	5	50	14	28
Fever only	2	20	6	12
Upper respiratory	1	10	28	56
Hypoxemia	2	20	1	2
Gastrointestinal	0	0	1	2
Outcome				
Asymptomatic	5	50	13	26
Mild/Moderate disease	3	30	33	66
Severe disease	2	20	4	8
Death	1	10	1	2

[a]1 American Indian and 1 unknown race.
[b]Includes age ≥65 y, obesity, type 2 diabetes, cardiovascular disease, chronic lung disease, and cancer.
[c]Cluster defined as 3 or more cases on a single hospital unit identified within 1 week.

Discussion

Our experience with SARS-CoV-2 (omicron)-variant HAI was most notable for the dramatically elevated number of cases over a single month compared to the 6 months prior when the δ (delta) variant predominated, representing a roughly 8-fold increase in the proportion of HAI to non-HAI COVID-19 admissions. Acquisition from visitors was a likely mechanism; many remove their masks while in patient rooms, and maskless patient-to-patient spread may have occurred in the HAI cluster in the milieu of inpatient psychiatric units. Transmission from HCP was mitigated by universal pandemic precautions; however, early in January 2022, SARS-CoV-2–positive HCP were allowed to return to work as early as 6 days after positive testing based on updated guidelines from the Centers for Disease Control and Prevention (CDC).[8]

This study had several limitations. Most patients with the SARS-CoV-2 (omicron) variant were symptomatic at the time of positive testing, perhaps to a greater degree than during the prior months of δ (delta)-variant predominance, although the significance of this contrast is likely limited by small case numbers. Also, exposure investigations were restricted to chart review. We did not conduct genomic investigation of HAI strains for determination of strain identity, acquisition in the hospital rather than community, or likely source of transmission.

Our findings suggest that COVID-19 HAI was far more common during the SARS-CoV-2 (omicron)–variant surge. If future variants demonstrate similar transmissibility, hospitals may consider more rigorous testing protocols, which could include reflexive testing of any patient with appropriate symptoms or possible exposures from infected patients or visitors as well as repeated surveillance testing of patients in congregate settings (eg, inpatient psychiatry units). Furthermore, detailed screening of visitors and staff per CDC guidelines must be undertaken alongside enforcement of universal masking while in the hospital. Lastly, a uniform system of defining and reporting COVID-19 HAI should be established because current CDC definitions are inadequate in capturing the broad range of symptomatic and asymptomatic presentations that have real epidemiologic and clinical significance for hospitalized patients.[9]

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