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Concise Communication

The impact of a comprehensive coronavirus disease 2019 (COVID-19) infection prevention bundle on non–COVID-19 hospital-acquired respiratory viral infection (HA-RVI) rates

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Abstract

After implementing a coronavirus disease 2019 (COVID-19) infection prevention bundle, the incidence rate ratio (IRR) of non–severe acute respiratory coronavirus virus 2 (non–SARS-CoV-2) hospital-acquired respiratory viral infection (HA-RVI) was significantly lower than the IRR from the pre–COVID-19 period (IRR, 0.322; 95% CI, 0.266–0.393; $P < .01$). However, HA-RVIs incidence rates mirrored community RVI trends, suggesting that hospital interventions alone did not significantly affect HA-RVI incidence.

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During the coronavirus disease 2019 (COVID-19) pandemic, influenza activity and circulation of respiratory syncytial viruses, parainfluenza viruses, and endemic human coronaviruses hit historical lows in the United States.[1] In part, this decrease was attributed to the broad implementation of nonpharmaceutical interventions such as mask wearing and physical distancing.[2] Concurrently, hospitals instituted additional infection prevention measures to prevent intrahospital spread of severe acute respiratory coronavirus virus 2 (SARS-CoV-2): patient, visitor, and healthcare personnel (HCP) symptom screening, visitor restriction, rigorous contact tracing, and enhanced personal protective equipment (PPE) utilization, including universal masking and eye protection.[3] However, we do not know whether these additional interventions affected the acquisition of non–SARS-CoV-2 respiratory viral illnesses (RVI) in the hospital. We sought to determine whether hospital-specific infection prevention measures decreased the incidence of hospital-associated non–SARS-CoV-2 respiratory viral infections (HA-RVIs) during the pandemic compared to HA-RVI incidence prior to the pandemic.

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Methods

We performed a retrospective analysis of prospectively collected respiratory viral tests over 4.5 years (April 2017 to September 2021) at 2 tertiary-care hospitals (978 beds and 803 beds, respectively) and 2 community hospitals (369 beds and 186 beds, respectively) located in North Carolina. The pre–COVID-19 period was defined as April 2017 to March 2020 and the post–COVID-19 period was defined as April 2020 to September 2021. We defined HA-RVI as initial identification of a non–SARS-CoV-2 respiratory virus on a polymerase chain reaction (PCR) panel collected on or after hospital day 7.[4] Patients who had subsequent positive viral tests with the same organism within 8 weeks were counted once, whereas patients with multiple pathogens identified on viral testing were counted once for each unique organism. We excluded patients from the study if they had a positive viral PCR panel with a matching organism within 7 days of admission.

Using an electronic infection prevention database, we collected the following descriptive variables for each case: patient age, sample source, days from admission to test, intensive care unit admission at time of sample collection, and identified pathogen(s). We calculated incidence rates (IRs) for HA-RVIs as cases per 1,000 patient days. We compared incidence rate ratios (IRRs) between the post–COVID-19 and pre–COVID-19 periods and yearly IRRs compared to the standard of March 2020–April 2021.

We obtained commonly reported non–SARS-CoV-2 RVI case rates reported by the North Carolina public health epidemiologist program.[5] We calculated community IRs for pre-COVID-19 and post–COVID-19 periods as cases per 1,000 population, using population data from the national census bureau for the counties

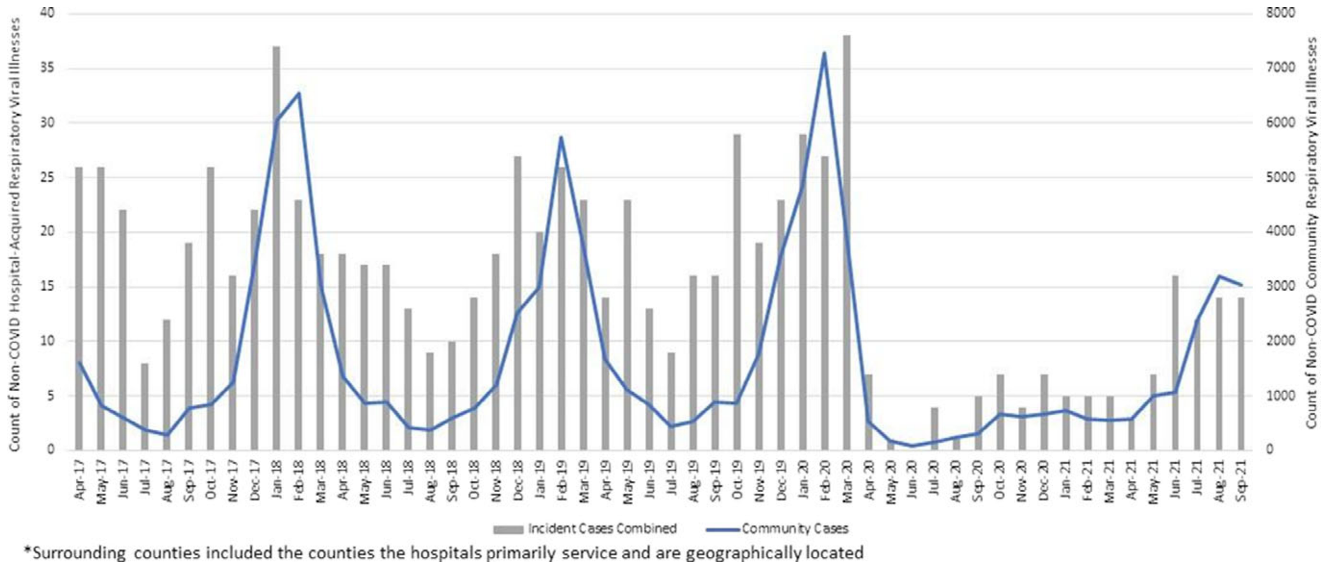

Figure 1. Monthly case count for hospital-acquired and community-onset non-COVID-19 respiratory viral illnesses in two academic and two community hospitals and their surrounding counties* in North Carolina: April 2017 to September 2021.

served by the 2 academic centers. Population data for 2021 were not available at the time of this publication. Thus, the same population denominators were used for the last 2 periods of the study. Finally, we calculated HA-RVI IRRs and community RVI IRRs for the pre–COVID-19 and post–COVID-19 periods to assess HA-RVIs trends in comparison to community incidence.

The COVID-19 infection prevention bundle in all the academic and community centers consisted of the following measures: universal masking; eye protection; HCP, patient, and visitor symptom screening; contact tracing; admission and preprocedure testing; visitor restrictions; discouraging presenteeism; population density control and/or physical distancing; and ongoing attention to basic horizontal infection prevention strategies including hand hygiene, PPE compliance, and environmental cleaning.

Results

During the 4.5-year period, we identified 840 non–SARS-CoV-2 HA-RVIs in 826 patients over 3,446,595 hospital days (IR, 0.24 HA-RVIs per 1,000 hospital days). Among the 826 patients with a non–SARS-CoV-2 HA-RVI during the study period, the median age was 35 years (interquartile range [IQR], 3–62). Overall, 625 patients (76%) had a positive viral test from an upper respiratory tract specimen and 201 patients (24%) had a positive viral test from a lower respiratory tract sample. The median time from admission to specimen collection was 14 days (IQR, 10–28).

Overall, 723 HA-RVIs occurred over 2,295,939 inpatient days (IR, 0.32 per 1,000 hospital days) in the pre–COVID-19 period and 117 HA-RVIs occurred over 1,150,656 hospital days (IR, 0.10 per 1,000 hospital days) in the post–COVID-19 period (IRR, 0.32; 95% CI, 0.27–0.39; $P < .001$). Rhinovirus, influenza, and parainfluenza were the most common HA-RVIs during the study period.

The incidence of non–SARS-CoV-2 HA-RVI visually tracked with the incidence of non–SARS-CoV-2 community RVI (Fig. 1). In other words, the peaks of HA-RVI incident cases mirrored the peaks of the community RVI incident cases and the troughs of the HA-RVI incident cases mirrored the troughs of the community RVI incident cases. The yearly HA-RVI IRRs and community RVI IRRs remained stable across the entire study period (Table 1).

Discussion

Non–SARS-CoV-2 HA-RVIs declined considerably during the post–COVID-19 period. However, the decrease mirrored the decrease in non–COVID-19 RVI incidence in the surrounding community during the study period. Thus, we cannot conclude that hospital-based interventions played a primary role in decreasing HA-RVI incidence rates during the post–COVID-19 era. Moreover, from June to September of 2021, we saw an increase in non–COVID-19 HA RVIs even though COVID-19 prevention processes were still in effect. Therefore, our observations reinforce that transmission of respiratory viruses in healthcare settings reflect disease activity in the local community.

We acknowledge that universal masking is an effective strategy in curtailing the transmission of respiratory viral illnesses inside and outside hospitals.[6] However, the ongoing transmission of RVIs in the hospital and community likely includes several factors: overall prevalence, masking compliance, presenteeism, vaccination adherence, hand hygiene, etc.

One of the reasons that HA-RVI trends reflected community RVI incidence is because respiratory viral illnesses are often introduced into the hospital environment from the community through a variety of mechanisms.[7] Patients may be in the incubation period at the time of admission or may be exposed to visitors or HCP. We know that presenteeism and nonadherence to transmission-based precautions may result in transmission events. However, presenteeism is not a new problem and has been a consistent issue prior to COVID-19.[8] To effectively limit HA-RVI, we need to address reasons for presenteeism and vaccine hesitancy among HCP.

Moreover, if respiratory viral trends in the community potentially predict HA-RVI trends, then ongoing surveillance of community RVIs may be critical in informing hospital decisions about universal masking protocols. Future studies may be able to investigate the efficacy of such strategies on HA-RVI incidence.

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Table 1. Cases and Incidence Rates of Non–COVID-19 Hospital-Acquired Respiratory Viral Infections (HA-RVIs) and Non–COVID-19 Community Respiratory Viral Infections (Co-RVIs) by Pre- and Post–COVID-19 Period and Year

Period	HA-RVIs	Hospital Days	Co-RVIs	Community Population	HA RVI IR[a]	Comm IR[b]	HA-RVI IR/ Co RVI IR	HA IRR
4/2017–3/2018	255	748,583	25,671	1,697,384	0.341	15.124	0.0225	
4/2018–3/2019	212	770,494	21,571	1,728,774	0.275	12.478	0.0220	
4/2019–3/2020	256	776,862	27,817	1,756,128	0.330	15.840	0.0208	
4/2020–3/2021	51	749,384	5,355	1,779,586	0.068	3.009	0.0226	
4/2021–9/2021	66	401,272	11,272	1,779,586[c]	0.164	6.334	0.0259	
Before COVID-19 (4/2017–3/2020)	723	2,295,939	75,059	5,182,286	0.315	14.484	0.0217	1.00
After COVID-19 (4/2020–9/2021)	117	1,150,656	16,627	3,559,172	0.102	4.672	0.0218	0.322 (0.266–0.393) $P < .001$

Note. HA, hospital-associated; IR, incidence rate; IRR, incidence rate ratio, RVI, respiratory viral infection.
[a]Per 1,000 inpatient days.
[b]Per 1,000 people.
[c]Population data for this period were not available at the time of this manuscript. We used population data from the year prior as an estimate.

Our study had several limitations. Specifically, we defined "hospital associated" as a positive polymerase chain reaction (PCR) test on or after hospital day 7, which may have led to a misclassification bias if certain respiratory pathogens were acquired in the community and only tested for after hospital day 7. Moreover, we may have underestimated the amount of HA-RVI if patients were not tested for a non–SARS-CoV-2 RVI during the hospital stay. In addition, testing reagent shortages during the pandemic may have biased clinician decisions to test for a non–SARS-CoV-2 RVI.

As healthcare systems and communities move forward from the throes of the COVID-19 pandemic, additional studies will be needed to determine best practices to prevent spread of both SARS-CoV-2 and non–SARS-CoV-2 respiratory viruses within in healthcare settings. Although enhanced infection prevention strategies employed in the hospital setting during the COVID-19 pandemic may have affected the incidence of HA-RVI, we cannot attribute its direct effect due to the large role community incidence and prevention strategies likely play. Following the COVID-19 pandemic, healthcare systems should focus HA-RVI reduction efforts on community RVI surveillance, HCP presenteeism, and appropriate use of PPE.

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