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## Brief Report

## Association of visitation policy and health care-acquired respiratory viral infections in hospitalized children

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Key Words:  
Epidemiology  
Visitor Management  
Pediatric

Visitor restriction policies are meant to prevent health care-acquired viral infections; however, data on their efficacy in hospitalized children are limited. We report a 37% reduction in health care-acquired respiratory viral infections in a children's hospital following standardization of the visitation policy that limited the number of visitors during a patient's hospitalization.

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Health care-acquired respiratory viral infections in critically ill children have been associated with adverse medical outcomes and increased health care costs.<sup>1-4</sup> Visitor restriction policies are implemented as part of multifaceted approaches to reduce health care-acquired infection, especially in high-risk areas such as intensive care units (ICUs), bone marrow transplant wards, and oncology wards.<sup>5-9</sup> There are limited data, however, on the efficacy of these restrictions in the reduction of health care-related respiratory viral transmission. The purpose of this study was to describe the incidence of health care-acquired respiratory viral infections following changes to the visitation policy at a pediatric quaternary care hospital.

## METHODS

Cincinnati Children's Hospital Medical Center (CCHMC) is a free-standing academic medical center that houses dedicated neonatal, pediatric, and cardiac ICUs totaling 119 beds. The remaining 408 beds are distributed amongst the non-ICU floors, including the general medicine and surgical wards, a bone marrow transplant ward, and an inpatient psychiatric unit.

From 2005 to the spring of 2015, CCHMC implemented visitor restrictions during the winter respiratory viral season coinciding with

the peak of local transmission (December 1 through March 31). These restrictions limited nonsibling child and ill visitors hospitalwide. In the ICUs, an additional restriction limited the number of visitors to a fixed list of up to 4 nonparent, nonlegal guardian persons. No limit was placed on the number of visitors allowed on the visitor list outside of ICUs.

During fall 2015, a universal hospitalwide visitor policy allowing families to identify a fixed list of up to 6 nonparent, nonlegal guardian persons as visitors was adopted with the approval of a family advisory group in an effort to standardize practice across the hospital and reduce the potential risk of acquiring community pathogens during hospitalization. Nonsibling child and ill visitor restrictions continued during the winter respiratory viral season.

To determine the influence of this policy change on hospital respiratory viral transmission, health care-acquired respiratory viral infections were identified during the preintervention season (December 1, 2014-March 31, 2015) and the postintervention season (December 1, 2015-March 31, 2016). Health care-acquired respiratory viral infections were defined as a positive nasopharyngeal respiratory viral polymerase chain reaction panel (detects respiratory syncytial virus, rhinovirus, influenza A and B, parainfluenza 1-3, coronavirus, and human metapneumovirus), respiratory syncytial virus antigen, or influenza A or B antigen obtained on or after hospital day 5 in a child without a previous positive test either during or in the 30 days preceding his or her hospitalization. Positive tests obtained before hospital day 3 were defined as infections present on admission. Testing obtained between hospital day 3 and 5 were excluded to account for incubating viruses present on admission. Of note, no viral surveillance screening programs exist at CCHMC; all testing performed is at clinicians' discretion guided by clinical symptoms. No additional infection control interventions directed

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The results of this study were presented in part at IDWeek 2016, New Orleans, LA, October 26-30, 2016.

Conflicts of interest: None to report.

**Table 1**  
Respiratory viral infections present on admission

	Preintervention (December 2014- March 2015)	Postintervention (Dec 2015 – Mar 2016)	<i>P</i> value
Admissions			
Non-ICU floors	8,920	8,878	
ICUs	518	445	
Infections present on admission*			
Non-ICU floors	446 (5.0)	322 (3.6)	< .01
ICUs	52 (10)	29 (6.5)	.05
Viruses identified on admission*			
RSV	240 (43)	187 (47)	.21
Rhinovirus	116 (21)	102 (26%)	.09
Influenza	99 (18)	36 (9)	< .01
Parainfluenza	30 (5)	5 (1)	< .01
Coronavirus	30 (5)	36 (9)	.03
hMPV	47 (8)	33 (8)	> .99

NOTE. Values are presented as n or n (%).

hMPV, human metapneumovirus; ICU, intensive care unit; RSV, respiratory syncytial virus.

\*Positive tests obtained before hospital day 3.

against respiratory pathogen transmission were implemented between the pre- and postintervention seasons.

Incidence rates of health care-acquired respiratory viral infections were calculated based on total at-risk patient-days, defined as hospital days on or after hospital day 5. Rates were calculated separately for the ICUs, where existing restrictions were liberalized, and for the non-ICU floors, where new restrictions were placed. Rates were compared using the 2-sample Poisson exact test. Proportions were compared using a 2-tailed  $\chi^2$  or Fisher exact test. All analyses were performed using R version 3.1.2 (R Foundation for Statistical Computing, Vienna, Austria) (<http://www.r-project.org>).

## RESULTS

Respiratory viral testing results obtained on admission and during hospitalization are displayed in Tables 1 and 2. Seventy-six children developed health care-acquired respiratory viral infections (60 in non-ICUs and 16 in ICUs) in the preintervention season compared with 52 (37 in non-ICUs, 15 in ICUs) during the postintervention season. The proportion of health care-acquired infections and infections present on admission due to influenza decreased during the postintervention season ( $P < .01$ ). The incidence rate of health care-acquired respiratory viral infections due to any viral pathogen significantly decreased in the non-ICU floors (3.37-2.14 infections per 1,000 at-risk patient days; rate ratio, 0.63; confidence interval [CI], 0.41-0.97;  $P = .03$ ) during the postintervention season but not in the ICUs (1.95-1.57 infections per 1,000 at-risk patient days; rate ratio, 0.81; CI, 0.37-1.74;  $P = .67$ ).

## DISCUSSION

Health care-acquired respiratory viral infections can prolong hospital stays and increase mortality in critically ill children.<sup>1</sup> Visitor restriction policies during the respiratory viral season are implemented in many pediatric hospitals to reduce patient exposures to infectious individuals; however, there are few data on the efficacy of these interventions. By limiting direct access to the support network of patients and their families, these policies may create additional stress without providing benefit.

We report a 37% reduction in the incidence rate of suspected health care-acquired respiratory viral infections following standardization of the visitor restriction policy to limit the number

**Table 2**  
Health care-acquired respiratory viral infections by season

	Preintervention (December 2014- March 2015)	Postintervention (December 2015- March 2016)	<i>P</i> value
At-risk patient-days*			
Non-ICU floors	17,780	17,289	
ICUs	8,212	9,537	
Health care-acquired viral infections†			
Non-ICU floors	60	37	
ICUs	16	15	
Viruses identified during hospitalization‡			
RSV	24 (26)	16 (28)	.84
Rhinovirus	31 (34)	27 (47)	.12
Influenza	15 (16)	1 (2)	< .01
Parainfluenza	6 (7)	2 (3)	.49
Coronavirus	9 (10)	6 (10)	.91
hMPV	7 (8)	6 (10)	.56
Noninfluenza viral incidence rate‡			
Non-ICU floors	2.76	2.08	.24
ICUs	1.70	1.57	.97
All viral pathogen incidence rate‡			
Non-ICU floors	3.37	2.14	.03
ICUs	1.95	1.57	.67

NOTE. Values are presented as n or n (%).

hMPV, human metapneumovirus; ICU, intensive care unit; RSV, respiratory syncytial virus.

\*Defined as hospital days on or after hospital day 5.

†Positive tests obtained  $\geq$  hospital day 5; excludes prior positive tests either during or in the 30 days preceding hospitalization.

‡Per 1,000 at-risk patient-days.

of visitors during a patient's hospital stay. No significant changes in the incidence rate occurred in the ICUs where the restriction policy was liberalized, although functionally changed little. The postintervention respiratory season was milder, particularly for influenza, as illustrated by national surveillance data as well as the reduced number of children with positive admission tests that may have overestimated the effectiveness of the visitor restriction policy changes in both the ICU and non-ICU floors.<sup>10</sup> When excluding influenza testing, the incidence rate remained decreased on the non-ICU floors, although the effect size was not significant.

This study is limited by its observational design and by potential indication bias (where the criteria for viral testing may have differed among providers). Because this was an institutional quality improvement project, individual patient-level data were not collected and adjustment for potential confounding variables in the analysis was not performed. These findings can be used to guide institutional visitor restriction policies and to help convey to families and other visitors the potential risks of respiratory viral transmission within the hospital during periods of high community prevalence. Prospective controlled studies involving the collection of samples from both patients and bedside visitors are needed to more completely assess the role that visitors play in transmission of viral infections in hospitalized children.

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