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*Published in:*
Hospital pediatrics

*DOI:*
10.1542/hpeds.2018-0222

**IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.**

*Document Version*
Publisher's PDF, also known as Version of record

*Publication date:*
2019

Link to publication in University of Groningen/UMCG research database

*Citation for published version (APA):*
Bekhof, J., Wessels, M., Ten Velde, E., Hoekstra, M., Langenhorst, V., Bruijnesteijn, L., Brand, P. L. P., & Ruijs, G. J. H. M. (2019). Room Sharing in Hospitalized Children With Bronchiolitis and the Occurrence of Hospital-Acquired Infections: A Prospective Cohort Study. *Hospital pediatrics*, *9*(6), 415-422. https://doi.org/10.1542/hpeds.2018-0222

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RESEARCH ARTICLE

# Room Sharing in Hospitalized Children With Bronchiolitis and the Occurrence of Hospital-Acquired Infections: A Prospective Cohort Study

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ABSTRACT

**OBJECTIVES:** To determine the prevalence and severity of hospital-acquired infections (HAIs) in children hospitalized for bronchiolitis when patients share a room, irrespective of the causative virus.

**METHODS:** A prospective cohort study during 4 winter seasons (2012–2016) was conducted in a Dutch general pediatric ward including otherwise healthy children <2 years of age hospitalized for bronchiolitis. Patients shared a 1-to-4–bed hospital room irrespective of virological diagnosis. The main outcome measures were HAIs assessed through multiplex polymerase chain reaction and disease severity.

**RESULTS:** HAIs occurred in 28 of 218 included patients (12.8%), most frequently with rhinovirus (17 of 28; 60.7%). In 3 (10.7%) of 28 HAIs, the same virus was identified in roommates. Only 1 patient became cross-infected with respiratory syncytial virus, although this patient never shared a room with a patient infected with respiratory syncytial virus. HAI was not associated with more severe disease. The median length of hospitalization was 3.5 days (interquartile range [IQR] 1–6) compared with 3 days (IQR 2–6; $P = .86$); the number of PICU admissions was 0% versus 5.3% ($P = .21$); the median days of oxygen supplementation was 2.5 (IQR 1–4) versus 2 (IQR 1–4; $P = .58$); the median days of tube feeding was 2 (IQR 0–5) versus 2 (interquartile range: 0–5; $P = .77$); and the readmission rate was 0% versus 5.8% ($P = .19$) in patients with and without HAI, respectively.

**CONCLUSIONS:** HAIs among patients with bronchiolitis are common but not associated with more severe disease. Room sharing with appropriate hygiene does not play a relevant role in the transmission of viruses between patients with bronchiolitis, regardless of the viruses involved. On the basis of these findings, we suggest that room sharing of patients with bronchiolitis is safe.

www.hospitalpediatrics.org
**DOI:**https://doi.org/10.1542/hpeds.2018-0222
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HOSPITAL PEDIATRICS (ISSN Numbers: Print, 2154-1663; Online, 2154-1671).

**FINANCIAL DISCLOSURE:** The authors have indicated they have no financial relationships relevant to this article to disclose.

**FUNDING:** No external funding.

**POTENTIAL CONFLICT OF INTEREST:** The authors have indicated they have no potential conflicts of interest to disclose.

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Dr Bekhof conceptualized and designed the study, coordinated and supervised the process, and wrote all versions, including the final draft as submitted; Ms Wessels and Drs ten Velde and Hoekstra conducted the data collection during the different seasons and helped with data analysis and interpretation of the data; Drs Langenhorst, Brand, Bruijnesteijn, and Ruijs were largely involved in the design of the study, interpretation of the data, and writing of the manuscript; and all authors were involved in drafting the different versions of the manuscript, approved the final manuscript as submitted, and agree to be accountable for all aspects of the work.

This trial has been registered at www.clinicaltrials.gov (identifier NCT01441466).

Data sharing statement: All of the individual participant data collected during the trial after deidentification as well as the study protocol, informed consent form, and clinical study reports will be available immediately after publication until 36 months after article publication to researchers who provide a methodologically sound proposal for the purpose of individual participant data meta-analysis. Proposals should be directed to j.bekhof@isala.nl; to gain access, data requestors will need to sign a data access agreement.



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Acute bronchiolitis is an important cause for hospitalization in young children.[1,2] Respiratory syncytial virus (RSV) is the most frequently identified virus, detected in 70% to 85% of hospitalized infants during the winter epidemic, followed by human metapneumovirus, rhinovirus, adenovirus, influenza virus, and parainfluenza virus in frequency.[1–3] RSV is considered to be associated with more severe disease and need for hospitalization.[4] Hospitalizing a young child who is RSV-positive, however, means a risk of hospital-acquired infection (HAI) for RSV-negative children sharing the same room. For this reason, cohorting RSV-positive patients separately from RSV-negative patients is commonly performed to prevent HAI.[5,6] Separating bronchiolitis patients who are RSV-positive from those who are RSV-negative and thus performing virological tests for this purpose would be justified if it prevents HAI and if coinfection leads to more severe disease.[1,7] There is no consensus, however, on the impact of coinfection on disease severity, although it appears that coinfection does not lead to longer hospitalization duration or increased mortality.[8–11] It has been shown that a combination of isolation measures (gowns, gloves, and hand-washing), including cohorting of patients, lowers the risk of nosocomial cross-infection of other patients.[5,7,12–14] Still, no good information is available on the effectiveness of cohorting in preventing HAI among patients with bronchiolitis. Because it is unclear which isolation measures are most effective, it is advised that the choice of infection control measures be decided by individual institutions depending on the patients, type of ward, and the benefit relative to cost.[14,15]

We hypothesized that contact isolation measures and maintaining enough distance between beds in a shared room should be sufficient to prevent HAI because the major route of transmission of respiratory viruses is close contact with infected secretions and not by small-particle aerosol.[7,15,16] Earlier, we showed that room sharing between patients who are RSV-positive and those who are RSV-negative on the first day of admission did not influence the risk of HAI.[17] Our purpose of the current study was to determine the prevalence and severity of HAI when patients with bronchiolitis share the same room, irrespective of the causative virus, during the entire course of hospital admission. Our secondary goal was to determine the severity of illness in patients who get a second HAI and the potential route of transmission.

## METHODS

### Study Design and Participants

This prospective cohort study was conducted at the 54-bed pediatric inpatient ward in a general teaching hospital in the Netherlands. During 4 consecutive winter seasons (December 1, 2012 through March 31, 2016), all otherwise healthy children <2 years of age hospitalized for the first time for acute bronchiolitis were eligible for inclusion. Bronchiolitis was defined as acute respiratory disease accompanied by coryza, cough, and inspiratory crackles and/or expiratory wheezing on auscultation. Patients with chronic lung disease; congenital heart, lung, or neuromuscular disease; and chromosomal disease were excluded.

In this observational cohort study, we used a convenience sample, including patients during 4 winter seasons to account for seasonal variation in disease severity. The study was approved by Isala medical ethics committee (Isalakl075). Written informed consent was obtained from parents before inclusion. Separate written informed consent was obtained for collecting the nasal swabs from visitors and personnel.

### Procedures

We prospectively collected the following demographic and clinical information: age, medical history, presence and number of roommates, results of viral diagnostics of the patients and their roommates, oxygen supplementation, apnea, tube feeding, intensive care admission, daily dyspnea scores (Supplemental Table 4) assessed by an independent researcher who was unaware of the virological diagnosis, and readmissions within 4 weeks. For patients admitted to the PICU, we included the PICU admission for assessing length of hospitalization, oxygen supplementation, and tube feeding.

A nasopharyngeal aspirate was collected immediately at admission, every fourth day during admission, at discharge (independent of length of stay), and 4 to 7 days after discharge, accounting for an incubation period of 4 to 7 days in most respiratory viral pathogens.[18] In patients transferred to the PICU, we used the virological results of the aspirates taken shortly after intubation for determination of the occurrence of HAI. The specimens were stored with saline, transported to the laboratory, and frozen at −85°C for later analysis. All specimens were analyzed batchwise for the purpose of this study. In the first season (2012–2013), the RespiFinder TwoStep kit was used on the basis of the multiplex ligation-dependent probe amplification technology (PathoFinder, Maastricht, Netherlands).[19] This assay was used to detect 14 respiratory viruses: influenza viruses A and B, parainfluenza viruses 1 to 4, RSVs A and B, rhinovirus, coronavirus-229E, coronavirus-OC43, coronavirus-NL63, human metapneumovirus, and adenovirus. Samples collected in the subsequent seasons (2013–2016) were tested by using a commercial kit using multiplex real-time polymerase chain reaction (PCR) targeting all the viruses included in the RespiFinder kit as well as enterovirus and parechovirus (PathoFinder).[19] Sensitivity of the RespiFinder has been reported to be from 43% to 100% depending on the different viruses; specificity is 100% for all viruses.[20] Samples were only collected for research purposes. Neither the parents of the patients nor the nurses or doctors were aware of the diagnostic results. The attending physician had the opportunity to use the samples for analysis of virological data when this was judged to be clinically necessary.

In the second season (2013–2014), we collected oropharyngeal swabs from parents and other visitors, and during the third and fourth season (2014–2015 and 2015–2016), we also collected daily swabs from medical personnel to detect the source of eventual HAIs. These swabs were handled in a comparable way to the nasopharyngeal aspirates taken from patients, but we tested the swabs only in case of HAI in patients.

### Treatment Protocol and Hygienic Measures

All patients were managed according to our local bronchiolitis practice guideline based



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on national and international guidelines on bronchiolitis.[15] Infants <3 months of age were monitored for ≥3 days for apnea and oxygen saturation. Supplemental oxygen was supplied by nasal cannula when saturation fell to <92%. Patients were discharged when respiratory support was no longer needed and their oral intake was at least two-thirds of their normal intake according to their age and weight.

All patients were treated with standard contact hygienic measures. Materials used on patients (thermometer, oxygen sensor and other monitoring devices, and stethoscopes) were used only on the same patient and cleaned and disinfected (with alcohol-containing tissues) after discharge by the hospital's facility service. Medical and nursing personnel wore multiple-use gowns and gloves during patient contact and washed their hands before and after each instance of patient contact. The use of face or eye protections was not warranted because their use has merely been advised to prevent infection of the personnel, and their use in prevention of transmission to other patients has not been established. Parents and visitors were asked to wash their hands before leaving the room. They were allowed to use the ward's general facilities, such as the visitor's toilets and the sitting room. The pediatric ward consists of a 16-bed neonatal medium-to-high–care facility, a 5-bed non-neonatal high-care facility, three 4-bed rooms, seven 2-bed rooms, and 7 single rooms. For the purpose of this study, during the winter seasons, 1 of the 4-bed rooms was reserved for patients with bronchiolitis. Included patients were hospitalized together in a 4-bed room, with beds separated by at least 1.5 m. Depending on the occupancy of the ward, it was possible that a patient shared this room with 0 to 3 other patients with bronchiolitis. When >4 patients participating in this study were admitted at the same time, the fifth patient as well as additional patients were hospitalized in another room.

### Follow-up

Data from included patients were collected during the entire admission, as well as during an outpatient appointment 4 to 7 days after discharge. During this outpatient visit, the last nasopharyngeal aspirate was collected, as well as the presence of respiratory symptoms and the assessment of the dyspnea score (Supplemental Table 4).

### Outcome

The primary outcome was HAI, defined as the identification of a virus in a patient's nasopharyngeal aspirate through multiplex PCR during admission or shortly after discharging other than those found at admission.

The secondary outcome was the severity of the disease, defined by length of admission, transferal to the PICU, duration of oxygen supplementation and nasogastric feedings, dyspnea scores, and readmission rate (Supplemental Table 4).

### Statistical Analysis

$\chi^2$ test or Fisher's exact test was used to compare categorical data, and Mann–Whitney *U* tests were used for continuous data because of skewed distributions. Statistical analyses were performed by using SPSS version 20 (IBM SPSS Statistics, IBM Corporation).

## RESULTS

Of the 335 patients hospitalized for first-time bronchiolitis during the study period, 218 were included. We excluded 122 patients (36%) because of the following reasons: 32 were excluded because of background disease (syndromal, cardiac, chronic, or congenital lung disease), 42 were excluded because parents declined to consent, 5 were excluded because of parental language or intellectual barriers, 6 were excluded because they were >2 years of age, and 3 were excluded because of acute respiratory failure with a need for immediate intubation on arrival to our hospital and transferal to a PICU. One patient was excluded because of too much missing data. This patient was transferred to the PICU on the second day of admission, was diagnosed with pertussis, and died after 4 weeks of mechanical ventilation. Another 33 patients were missed, mostly because of short admissions or admissions in single rooms. A total of 218 patients completed the study. Demographic and clinical data are given in Table 1.

### Compliance to the Study Protocol and Missing Data

During the study, 90 of 809 nasopharyngeal aspirates from patients were missed (11.1%). Follow-up data 4 to 7 days after discharge were available for 190 (87.2%) patients. Sampling compliance for visitors and personnel was not assessed. In none of the cases did the treating physician ask for the results of virological diagnosis.

### Virological Diagnosis at Admission

RSV was the major pathogen detected in 182 (83.4%) of patients on admission. Fifty-five (25.2%) patients were infected with ≥2 viruses at admission (Table 1).

### Room Sharing

Data on room sharing are presented in Table 1. The majority of patients (75.7%) shared a room with ≥2 other patients with bronchiolitis, and 19 patients (8.7%) never shared a room.

### HAI: Cross-Infection During Admission

Data on HAIs are presented in Table 2, Fig 1, and Supplemental Table 5. HAI was found in 28 patients (12.8%). One patient was cross-infected with RSV; however, this patient never shared a room with another patient who was RSV-positive. HAI occurred with rhinovirus ($n = 17$), enterovirus ($n = 5$), coronavirus ($n = 4$), adenovirus ($n = 2$), parainfluenza ($n = 2$), influenza A virus ($n = 1$), and metapneumovirus ($n = 1$). Three of the cross-infected patients were cross-infected with ≥1 virus (2 patients with 2 viruses and 1 patient with 3 other viruses). Three (10.7%) of the 28 cross-infected patients were cross-infected with a virus identified in 1 of the roommates; all 3 patients were initially RSV-positive and were coinfected with rhinovirus.

Most HAIs were found in the first 4 days of admission ($n = 15$; 54%). Another 43% were found at the outpatient follow-up 4 to 7 days after discharge, and only 1 HAI was discovered after 8 days of admission (see Supplemental Table 5).

### Disease Severity

Patients with HAI did not suffer from more severe disease than patients without HAI (Table 3). None of the included patients or



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**TABLE 1** Patient Characteristics of the 218 Patients Completing the Study

| Characteristics | $N = 218$ |
|---|---|
| Age, mo, median (IQR) | 4.9 (1.6–7.0) |
| Male sex, *n* (%) | 129 (59) |
| Birth characteristics | |
| Gestational age, $wk^{+d}$, median (IQR) | $38^{+4}$ ($37^{+1}$–$40^{+0}$) |
| Preterm birth, <37 wk, *n* (%) | 37 (17.0) |
| Birth wt, g, median (IQR) | 3335 (2835–3711) |
| Environmental factors, *n* (%) | |
| Day care attendance | 47 (21.6) |
| Has siblings | 168 (77.1) |
| Disease severity | |
| Length of hospitalization, d, median (IQR) | 3 (2–6) |
| $O_2$ supplementation, *n* (%) | 173 (79.4) |
| Duration of $O_2$ supplementation, d, median (IQR) | 2 (1–4) |
| Tube feeding, *n* (%) | 135 (61.9) |
| Duration of tube feeding, d, median (IQR), | 2 (0–5) |
| Highest dyspnea score 0–10, median (IQR) | 5 (3–6) |
| Admission to the PICU for mechanical ventilation, *n* (%) | 10 (4.6) |
| Readmission <4 wk after discharge, *n* (%) | 11 (5.0) |
| Virological results at admission, *n* (%) | |
| RSV | 182 (83.4) |
| Rhinovirus | 38 (17.4) |
| Coronavirus | 17 (7.8) |
| Adenovirus | 7 (3.2) |
| Influenza A or B | 8 (3.7) |
| Parainfluenza | 6 (2.8) |
| Human metapneumovirus | 7 (3.2) |
| Enterovirus | 5 (2.3) |
| Parechovirus | 3 (1.4) |
| No virus | 5 (2.3) |
| Coinfection at admission, *n* (%) | 55 (25.2) |
| Room sharing, *n* (%) | |
| Yes | 199 (91.3) |
| Room sharing with patient with another virus | 125 (57.3) |
| HAI, *n* (%) | 28 (12.8) |

All continuous variables are nonnormally distributed; namely, they are skewed to the right except for gestational age, which had a distribution skewed to the left, and the highest dyspnea score, which is normally distributed (mean 4.4; SD 1.9). IQR, interquartile range.

patients referred to the PICU died. To assess the influence of age on disease severity, we corrected for age and gestational age through linear or logistic regression analysis. We found no significant association between age and length of hospitalization ($\beta = .02$; $P = .81$), duration of oxygen supplementation ($\beta = .06$; $P = .36$), tube feeding ($\beta = -.03$; $P = .66$), highest dyspnea score ($\beta = .07$; $P = .29$), or PICU admission (odds ratio [OR]: 1.00; 95% confidence interval [CI]: 0.992 to 1.004). Age was significantly but weakly associated with readmission rate (OR: 1.01; 95% CI: 1001 to 1.009). Gestational age revealed a statistically significant association with length of hospitalization ($\beta = -.16$; $P = .02$) and tube feeding ($\beta = -.14$; $P = .05$), but not with oxygen supplementation ($\beta = .36$; $P = .20$), highest dyspnea score ($\beta = .04$, $P = .38$), PICU admission (OR: 0.99; 95% CI: 0.805 to 1.226), or readmission (OR: 1.2; 95% CI: 0.821 to 1.762). However, no confounding was present because gestational age did not differ between the different patient categories, as shown in Table 3.

### Source of HAIs

During the first season (2012–2013), when we only collected nasopharyngeal aspirates in patients, none of the 10 HAIs could be related to roommates. During the second season (2013–2014), we extended our analysis of clinical specimens to parents and visitors. This revealed a possible source of HAI from family members in 3 patients and from roommates in another 3 out of a total of 8 HAIs in this season. During the final 2 seasons (2014–2015 and 2015–2016), apart from patients and visitors, we also analyzed daily throat swabs from all medical personnel caring for the bronchiolitis patients. In these seasons, we found a possible source of 4 of the 10 HAIs in the medical personnel and none in family members or in roommates.

## DISCUSSION

In this study, 1 in 8 patients hospitalized for bronchiolitis experienced HAI. The source of these HAIs may be other patients, personnel, or visitors. These sources may be vectors for viruses from other patients or they may be carriers of the virus themselves. Although it is difficult to point out the exact source of HAI, judging from the causative viruses in roommates, HAI between patients sharing a room is rare, occurring in only 3 patients (1.3%) in our study. The majority of patients admitted for bronchiolitis were infected with RSV (83.4%). Only 1 of the patients who were RSV-negative at admission was cross-infected with RSV, but this patient never shared a room with an RSV-infected patient. This is an important finding because the main reason for cohorting bronchiolitis patients who are RSV-positive from those who are RSV-negative is to prevent nosocomial spread of RSV infection from bronchiolitis patients who are RSV-positive to those who are RSV-negative.

HAI was not associated with more severe disease. Our findings therefore suggest that



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**TABLE 2** Frequency of HAI in Patients Hospitalized for Bronchiolitis

| | *n* | HAI, *n* (%) |
|---|---|---|
| Room sharing | 199 | 24 (12.1) |
| With patients with other viruses | 125 | 15 (12.0) |
| With patients with the same virus | 65 | 8 (12.3) |
| With patients with unknown virology | 9 | 1 (11.1) |
| No room sharing | 19 | 4 (21) |

$P = .74$ (by $\chi^2$).

room sharing of patients with bronchiolitis is safe if correct hygienic precautions are implemented, irrespective of the virological diagnosis.

Little evidence is available on transmission prevention in hospitalized patients with viral respiratory disease.[14,21,22] Typically, guidelines discuss the potential value of viral testing in cohorting patients without underpinning this by studies or data.[15,23] In this study, we separately investigated the impact of omitting physical measures (ie, cohorting of patients infected with the same virus), whereas other general measures, such as the use of protective equipment (gown and gloves) and hand-washing, were done. In most studies, authors assess the impact of all this as a bundle.[22] Respiratory viruses are primarily spread through droplets, traversing relatively short distances of <1 m through air or by close contact with an infected individual.[14] Controlling nosocomial respiratory infections in pediatric units, therefore, may depend less on identifying a specific virus than assuring compliance with appropriate precautions such as the cleansing of hands and fomites and separating infants in multiple-bed rooms by ≥1 m.[14]

## Strengths and Limitations

We purposely used 4 consecutive seasons to include different patients and to account for the variability in viral prevalence and virulence between different years. Because the first season's results suggested that most HAIs had not been acquired from roommates, we extended our investigations

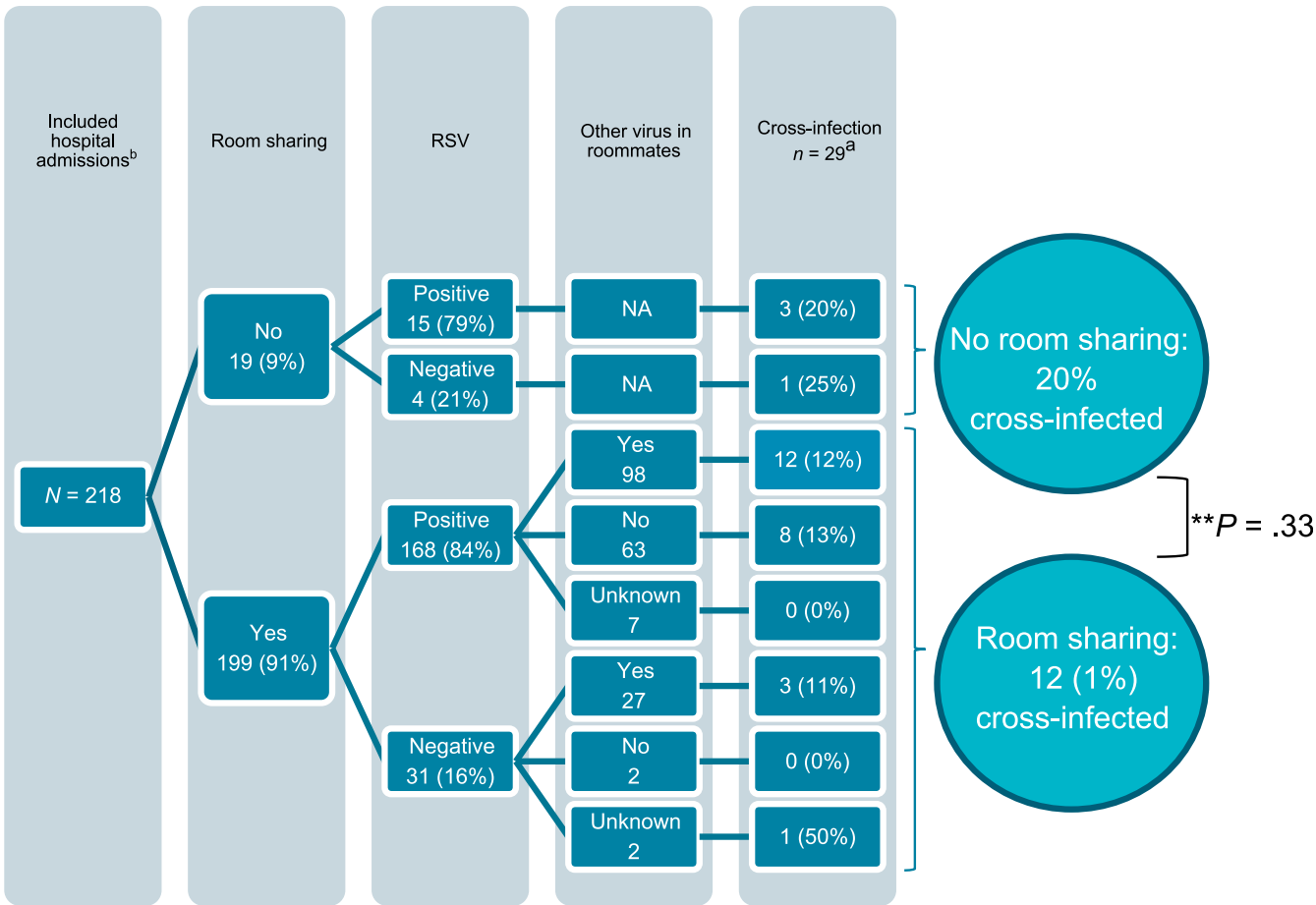


**FIGURE 1** Room sharing and occurrence of cross-infections in included patients hospitalized for bronchiolitis. NA, not applicable. [a] None of the patients who were RSV-negative became cross-infected with RSV. Three (10.7%) of the 28 patients who were cross-infected were cross-infected with a virus identified in 1 of the roommates; all 3 patients were initially RSV-positive and were coinfected with rhinovirus. ** $\chi^2$.



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**TABLE 3** Disease Severity in Patients Admitted for Bronchiolitis With and Without HAI, $N = 218$

| | HAI ($n = 28$) | No HAI ($n = 190$) | Difference (95% CI) |
|---|---|---|---|
| Age, mo, median (IQR) | 3.7 (1.6–7.4) | 3.5 (1.6–7.0) | 0.0 (−1.2 to 1.3) |
| Gestational age, $wk^{+d}$, median (IQR) | $38^{3}$ ($38^{0}$–$39^{4}$) | $38^{3}$ ($37^{0}$–$40^{0}$) | $0^{1}$ ($-0^{2}$ to $0^{3}$) |
| Birth wt, g, median (IQR) | 3210 (3010–3780) | 3340 (2808–3700) | −25 (−725 to 700) |
| Length of hospitalization, d, median (IQR) | 3.5 (1–6) | 3 (2–6) | 0 (−1 to 1) |
| Mechanical ventilation /admission to ICU, *n* (%)[a] | 0 (0) | 10 (5.3) | −5.3% (−8.6% to −2.1%) |
| $0_2$ supplementation, d, median (IQR) | 2.5 (1–4) | 2 (1–4) | 0 (−1 to 2) |
| Tube feeding, d, median (IQR) | 2 (0–5) | 2 (0–5) | 0 (−1 to 1) |
| Highest dyspnea score 0–9, median (IQR) | 5 (4–6) | 4 (3–6) | 0 (0 to 1) |
| Follow-up 4–7 d after discharge[b] | | | |
| Respiratory symptoms, *n* (%) | 10 (37.0) | 46 (28.2) | 8.8% (−10.2% to 27.8%) |
| Dyspnea score, median (IQR) | 0 (0–0) | 0 (0–0) | NA |
| Readmission <4 wk, *n* (%) | 0 (0) | 11 (5.8) | −5.8% (−9.1% to −2.5%) |

Data presented as Mann–Whitney *U* test for continuous variables and $\chi^2$ or Fisher's exact test for dichotomous variables. IQR, interquartile range; NA, not applicable (cannot be calculated).

[a] All patients who were admitted to the PICU were on mechanical ventilation.

[b] Follow-up data were missing in 28 patients (1 cross-infected patient and 27 non–cross-infected patients).

of viral infection to visitors of admitted patients with bronchiolitis or, respectively, medical personnel during subsequent winter epidemic seasons. Although the numbers were relatively small, the source of HAI appeared to be at least as common in personnel or visiting family members as in roommates.

We acknowledge the following limitations. Our study size was small, with only 218 patients included. Furthermore, although we used a highly sensitive multiplex PCR assay to assess the presence of the most commonly described causative respiratory viruses of bronchiolitis, we cannot exclude having missed detection of potentially pathogenic microorganisms because sensitivity was not 100% or because the pathogen was not represented in the assay (ie, enterovirus and parechovirus in the first season).[19,20] This accounts even more for the throat swabs we used in the patient's visitors and medical personnel. Although less sensitive, we purposely chose this method because oropharyngeal swabs are easier to obtain than nasopharyngeal aspirates, especially when not much mucus is available in asymptomatic persons. Furthermore, the rationale was that the risk of spread correlates with a detectable load and thus a sufficient amount of virus would be detectable with swabs instead of aspirates.[24]

In addition, the presence of 1 or more viruses does not constitute proof of these viruses being the causative agents of the bronchiolitis. This drawback, however, is shared with all other studies in which similar methodology is used.[25,26] Because viruses can frequently be found in asymptomatic children, one could have expected even more HAI in patients sharing a room, but this was not the case. Finally, although we tried thoroughly to record all roommates (and in the last seasons all visitors and personnel as well) by having a dedicated researcher available during the day throughout the 3 study periods, we cannot exclude that some possible vectors for HAI have been overlooked, such as the emergency department, the waiting rooms, or other areas where ill children may congregate.

Also, it is possible that the relatively low number of HAIs caused by room sharing in this study can be explained by the increased awareness of the importance of hygienic measures to prevent spreading of respiratory viruses as a result of the study being done and the information and education associated with it. Not only may the study have increased awareness of the importance of hygienic measures among medical personnel, parents, and visitors, but room sharing itself may also have increased social awareness and control in each room, potentially improving adherence to hand-washing and other hygienic measures. With hindsight, it is regrettable that we did not measure the compliance of the hygienic measures during the study period.

We realize that our hygienic measures do not follow the Centers for Disease Control and Prevention guidelines warranting masks in medical personnel taking care of patients with respiratory infections, as well as the placement of a mask on coughing patients[27]. The reason why we do not mandate the use of masks is because of the argument that the mask inhibits social contact with young children in covering facial expressions. Because there is no solid evidence other than hypothetical assumptions that wearing masks inhibits the transmission of respiratory viruses from 1 patient to another through medical personnel, we do not mandate a mask for our health care providers when taking care of children with respiratory infections, and we do not place masks on coughing pediatric patients admitted to our ward. Still, even without the use of masks, the occurrence of HAI through roommates was minimal.

## Clinical Implications

With our study results, we imply that cohorting patients who are RSV-positive separately from otherwise healthy patients with bronchiolitis who are RSV-negative and



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routinely performing virological tests for that purpose might not be necessary. Furthermore, studies have revealed varying degrees of bronchiolitis severity for a range of respiratory viruses,[3,4] and clinical differentiation between different viral agents is not possible because of comparable presenting signs and symptoms.[14,24] We excluded patients with significant comorbidities and thus, our results are not stringently generalizable to these patient categories; we assume these implications are applicable for all patients with bronchiolitis.

Because bronchiolitis is a clinical diagnosis,[1,2,15] and diagnosis of specific viruses or coinfection neither leads to specific therapy nor predicts severity or duration of disease, routine viral testing of children with typical bronchiolitis would thus not be cost-effective. Abolishing routine viral testing in children admitted for bronchiolitis will contribute to the reduction of high costs associated with this pediatric disease and would fit in well with the Choosing Wisely Initiative.[28,29,30] Moreover, it will contribute to the patient's well-being because sampling can be uncomfortable.

Although routine viral testing in bronchiolitis is discouraged in the results of our study, such testing may still be justified clinically in children with an atypical course of the disease, for research purposes, or for epidemiological monitoring.[14] Another argument for viral testing in children with airway infections would be implications for treatment (eg, to detect causes for which antiviral treatments are advised such as influenza); however, one may argue that reports on the effectiveness of treatment of influenza are inconsistent or to discontinue additional administration of palivizumab in infants.[31–33]

Prevention of the nosocomial spread of respiratory viruses is of utmost importance. The primary focus should not be on virological diagnosis but on encouraging and enforcing the use of standard infection control procedures, with hand sanitation being the most important.

## CONCLUSIONS

Room sharing is not an important cause of nosocomially acquired cross-infection in otherwise healthy children hospitalized for bronchiolitis with appropriate hygienic measures. Moreover, HAI was not associated with a more severe disease course. We suggest that room sharing of children with bronchiolitis is safe, irrespective of virological diagnosis, when standard hygienic measures are carefully employed. This implies that the cohorting of patients with bronchiolitis who are RSV-positive and -negative and routinely performing virological tests for that purpose may be no longer necessary. Because most HAIs were not acquired from roommates, standard hygienic measures such as hand-washing remain the most important in preventing nosocomial respiratory cross-infections in hospitalized children with bronchiolitis.

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# Room Sharing in Hospitalized Children With Bronchiolitis and the Occurrence of Hospital-Acquired Infections: A Prospective Cohort Study

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*Hospital Pediatrics* 2019;9;415
DOI: 10.1542/hpeds.2018-0222 originally published online May 28, 2019;

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