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2309. Promoting Healthcare Worker (HCW) Use of Personal Protective Equipment in Pediatric Ambulatory Settings

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Background. Existing Centers for Disease Control (CDC) and American Academy of Pediatrics (AAP) guidelines promote HCW personal protective equipment (PPE) use to prevent respiratory virus transmission in pediatric clinics; however, adherence to recommendations is inconsistent. We evaluated the effectiveness of two strategies designed to cue HCW use of PPE in a pediatric primary care clinic.

Methods. We implemented two HCW-focused interventions: (1) prompt for front desk respiratory symptom screen with placement of droplet signs on examination room door for symptomatic patients and (2) universal masking of healthcare workers during all patient encounters. Each intervention was implemented over a 2-week period and preceded by a washout period. We obtained caregiver report of HCW hand hygiene and mask use during patient encounters and measured differences in the proportion of behavior observed compared with washout periods.

Results. We obtained 217 caregiver reports of clinician handwashing and mask use before, during and after the patient encounter. There was no difference in nurse pre- or post-encounter hand hygiene behavior before and after each intervention (Baseline 65.9%; Droplet: 73.3%, $P = 0.34$; Universal masking: 77.5%, $P = 0.16$ and Baseline 53.3%; Droplet: 66.6%, $P = 0.14$; Universal masking: 55%, $P = 0.85$, respectively). There was also no difference in pre- or post-encounter MD hand hygiene behavior before and after each intervention: (Baseline 86.9%; Droplet: 77.8, $P = 0.17$; Universal masking: 87.5%, $P = 0.92$ and Baseline 75%; Droplet: 71.1%, $P = 0.62$; Universal masking: 80.0%; $P = 0.53$, respectively). However, there was a significant difference in observed mask use during encounters among both RNs and MDs before and after each intervention: (Baseline: 17.4%; Droplet: 44.4%, $P < 0.05$; Universal masking: 42.5%, $P < 0.05$ and Baseline: 20.6%; Droplet: 51.1%, $P < 0.05$; Universal masking: 62.5%, $P < 0.05$, respectively).

Conclusion. Respiratory symptom screening with visual prompts to use PPE and universal masking may not significantly impact hand hygiene behavior in a setting with high hand hygiene use but may increase mask use. Such interventions could provide a useful and low cost tool to help prevent the spread of respiratory viruses in primary care settings.

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2310. Reasons Pediatric Providers Obtain Endotracheal Aspirate Cultures and How Results Inform Patient Management

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Background. Endotracheal aspirate cultures (EACs) are commonly obtained in many PICUs. However, EACs cannot distinguish between bacterial colonization and infection, and may promote antibiotic overuse if collected in patients without clinical signs and symptoms of ventilator-associated infections (VAIs). We examined clinician's reasons to obtain EACs and whether the results informed clinical management.

Methods. We conducted a structured survey of nurse practitioners and physicians caring for ventilated children to inform a quality improvement initiative to optimize the use of EACs in the PICU at a tertiary care children's hospital. We assessed EACs

obtained from patients mechanically ventilated for at least 24 hours from November 2017 to February 2018. This was a 2-part survey: part 1 conducted within 1–2 days after obtaining an EAC, part 2 conducted after EACs results were reported.

Results. 25 surveys were completed. Nearly half (44%) of EACs were obtained for isolated clinical signs of fever, hypotension, laboratory abnormalities, or ventilator increases, while the remainder were obtained for a combination of reasons. Most EACs (60%) were collected as a "pan culture" with urine and blood cultures, and 92% of EACs had a previous EAC. At the time of ordering, providers thought the EAC would help with diagnosis of VAI (68%), antibiotic selection (80%), and believed it was very important for the patient's management (60%). After results were available, 40% of patients were given a diagnosis of VAI. Antibiotic therapy was discontinued in 12% and modified in 16% based on the EAC results. Antibiotics were changed based on a different test in 52%, or unchanged in 20%. Of the patients with a prior EAC, 72% of EACs resulted the same or fewer bacteria. On follow-up, 56% of the providers reported the EAC provided little to no value for the patient's management.

Conclusion. A large proportion of EACs were obtained due to isolated changes in a patient's clinical status and most EACs were obtained from patients who had prior EACs. Results were often similar to prior EAC results, infrequently led to changes in antibiotic selection and many providers did not find the results helpful. These findings suggest there is opportunity to standardize and reduce the use of EACs in the PICU.

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2311. Atypical Cat Scratch Disease Presentations

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Background. Cat scratch disease (CSD) is caused by *B. henselae*, a Gram-negative intracellular bacilli which is transmitted to humans via cat bite/scratch. Typical CSD presents as regional lymphadenopathy and fever. However, there are multiple atypical presentations of cat scratch disease that have been reported including prolonged fever, absence of lymphadenopathy and systemic complications such as hepatosplenic disease, osteomyelitis, Parinaud oculoglandular syndrome, neuroretinitis, encephalitis, and bacillary angiomatosis among other rare presentations. The aim of this study was to review the frequency, presentation, and treatment outcomes of atypical CSD presentations at Nationwide Children's Hospital (Columbus OH).

Methods. This was a retrospective study performed at Nationwide Children's Hospital, Columbus, OH. EMR of patients were reviewed between January 2010 and March 2017 using ICD9 or ICD 10 codes for CSD. Patients were identified on the basis of compatible clinical presentation and confirmatory serological test or PCR results for *B. henselae*. Clinical, radiological, and histopathological findings were collected

Results. A total of 204 patients were serologically diagnosed as having cat scratch disease between January 2010 and July 2017. Of the 204 cases, 166 (81%) had typical CSD and 38 (18.6%) had atypical CSD. Of the atypical manifestations, 20 (52%) patients had no lymphadenopathy, 12 (31%) had osteomyelitis, 12 (31%) patients had hepatic and/or splenic microabscesses, 4 (10.5%) had osteomyelitis and hepatic/splenic involvement, 3 (1.5%) had encephalitis, 2 (5.2%) had neuroretinitis, and there was one case each (2.6%) of Parinaud oculoglandular syndrome, uveitis, pulmonary cavity lesion, myocarditis, and endocarditis. Fever of unknown origin was present in 28 (75.6%) of the atypical CSD cases. The median duration of antibiotic treatment was 25 days (IQR 31) and median duration of illness in patients with atypical CSD was 51 days (IQR 56). The majority of patients were treated with dual antibiotic therapy that included rifampin.

Conclusion. In children with fever of unknown origin, serologic testing for CSD should be performed even in the absence of lymphadenopathy and a search for underlying systemic complications is recommended for prompt diagnosis and appropriate treatment.

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2312. Bordetella holmesii Bacteremia in Pediatric Patients: A Single-Center Experience

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Background. *Bordetella holmesii* is a respiratory pathogen, known to cause bacteremia predominantly among patients with functional or anatomical asplenia. Currently, there is no consensus on optimal treatment for *B. holmesii* infection nor are there established interpretative criteria. This study aims to describe treatment of pediatric patients diagnosed with *B. holmesii* bacteremia, and treatment outcomes, in order to help establish an optimal therapeutic strategy.

Methods. We conducted a retrospective chart review of pediatric patients with microbiologically confirmed *B. holmesii* bacteremia at Children's Healthcare of Atlanta, 2011–2018. We extracted demographic and clinical information of the identified patients from the medical record, and evaluated antimicrobial choice, hospital days, and treatment outcomes.

Results. Seven patients were identified; all had sickle cell disease and five had moderate to severe asthma requiring controller medications. They presented to the emergency department with mild respiratory illness with fevers, but had hemodynamic stability. Peripheral blood cultures were obtained and intravenous ceftriaxone was administered as the empiric antibiotic therapy. Six patients were discharged home after evaluation, and one patient was admitted for treatment for acute chest syndrome with venoocclusive crisis (see figure). When the blood cultures grew *B. holmesii*, previously discharged patients were called back for follow-up; three were admitted, and only one patient had a subsequent blood culture growing *B. holmesii*. Hospitalization days ranged from 3 to 5 days, and two patients went home with oral ciprofloxacin at the time of discharge. Total antibiotic days ranged from 1 to 15 days among the seven patients. No one required an intensive level care, and all were asymptomatic without recurrence of *B. holmesii* infections at the post-discharge follow-up.

Conclusion. In our pediatric patients with *B. holmesii* bacteremia, clinical recovery was favorable with no severe illness, despite widely different treatment regimens and length of therapy. The questions still remain regarding pathogenicity of *B. holmesii* infection and efficacy of antibiotic use.

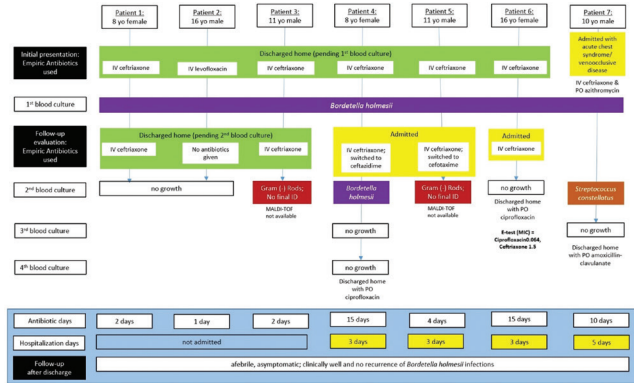


Figure. Summary of treatment course and follow-up for the patients with *Bordetella holmesii*

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2313. Risk of Relapsed or Persistent Infection Caused by Enterobacter Species in Children

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Background. *Enterobacter* species are a major cause of infections in hospitalized children. Treatment is complicated by the presence of a chromosomal AmpC β -lactamase, capable of inactivating certain antibiotics, including third-generation cephalosporins (3GC). Previous studies in adults have reported a 3–19% risk of relapsed bacteremia with 3GC therapy. Data in children regarding risk factors predicting relapse or persistence of infection are lacking. We sought to determine the frequency of and risk factors for relapse or persistence of *Enterobacter* infection in children.

Methods. Retrospective study of patients <21 years old admitted to Texas Children's Hospital during 2012, 2015 and 2016 with bacteremia due to *Enterobacter* species. Risk factors for relapse or persistence of bacteremia 72 hours and up to 30 days after initial positive blood culture were evaluated; relapsed infection at secondary sites also was evaluated.

Results. 58 individual patients with bacteremia due to *Enterobacter* species were identified; most (58%) were immunosuppressed and 19 (32.8%) were critically ill. The majority (75.9%) had primary bacteremia; 82.8% had a central line. An intra-abdominal source was identified in 6 (10.3%) patients. Seventeen (29.3%) patients had initial *Enterobacter* isolates resistant to 3GCs. Of the 41 patients with 3GC-susceptible isolates, 5 (12.2%) had relapse or persistence of infection; 2 of these developed relapse with an isolate resistant to 3GCs. Among the relapsed cases, those who developed resistant isolates had uncontrolled intra-abdominal or biliary sources of infection. Treatment with a 3GC was not associated with increased risk of relapse or persistence of infection (OR 2.1; 95% CI, 0.3–14.2, $P = 0.45$). Source control was inadequate in all cases of relapsed bacteremia. Relapsed cases with primary bacteremia cleared their bacteremia with central line removal. One patient with relapsed infection died.

Conclusion. The incidence of relapsed or persistent *Enterobacter* infection after initial bacteremia is comparable to previous adult studies. However, treatment of 3GC-susceptible isolates with 3GCs did not result in higher rates of treatment failure. Source control is important in preventing relapse or persistence of infection.

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2314. Invasive Haemophilus influenzae Infections in Children: A 10-Year Study

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Background. The rate of *Haemophilus influenzae* type b (HIB) infections has decreased dramatically since the use of HIB vaccines in infants and children. The current prevalence of invasive HIB infections and those due to non-type b *H. influenzae* is not fully known. The objective was to describe the cases of all invasive *H. influenzae* infections and describe the spectrum and severity of clinical disease.

Methods. Retrospective study of all hospitalized patients with culture-proven invasive *Haemophilus influenzae* infections at Nationwide Children's Hospital, Columbus, Ohio, from 2009 to 2018. The electronic health records were reviewed for pertinent demographic, clinical, laboratory data, and outcomes.

Results. There were a total of 59 culture-proven *H. influenzae* infections of which 12 were excluded due to insufficient patient data. The remaining 47 patients (32 [68%] male; 30 [64%] white, 8 [17%] African-American) and their culture results are provided in Table:

Haemophilus influenzae Infections in 47 Patients: Culture Results

	Type a N = 1 (%)	Type b N = 3(%)	Encapsulated non-b N = 11(%)	Not typeable N = 30(%)	Not typed N = 2(%)	Total N = 47(%)
<6 months	0	0	0	7(23)	1(50)	8(17)
≥6–12 months	1(100)	2(67)	7(64)	7(23)	0	17(36)
>1–5 years	0	1(33)	4(36)	6(20)	1(50)	12(25)
>5–8 years	0	0	0	8(26)	0	8(17)
>8–17 years	0	0	0	0	0	0
≥18 years	0	0	0	2(6)	0	2(4)
Blood only	1(100)	1(33)	4(36)	27(90)	2(100)	35(75)
CSF only	0	1(33)	0	0	0	1(2)
Both Blood and CSF	0	1(33)	5(45)	0	0	6(13)
Both CSF and Peritoneal Fluid	0	0	0	1(3)	0	1(2)
Both Blood and Synovial Fluid	0	0	2(18)	0	0	2(4)
Both Blood and Eye Discharge	0	0	0	2(6)	0	2(4)
Virus Coinfection	1(100)	3(100)	3(27)	14(46)	1(50)	22(47)
Bacteria Coinfection	0	1(33)	0	5(16)	2(100)	8(17)
Death	0	0	0	1(3)	0	1(2)

There were 14 (30%) patients with pneumonia and bacteremia, 6 (13%) with meningitis and bacteremia, 2 (4%) with only meningitis, 1 (2%) with bacteremia/meningitis and septic hip, 2 (4%) septic arthritis with bacteremia, 1 (2%) with periorbital cellulitis and bacteremia, and 21 (45%) with only bacteremia. Of the 3 cases of *H. influenzae* type b, 2 had not been vaccinated while 1 received only 1 dose of HIB vaccine.

Conclusion. Invasive *H. influenzae* infections were associated with substantial morbidity and a 2% case-fatality rate.

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2315. Neisseria meningitidis Oro-Pharyngeal Carriage, Serogroups and Clonal Complex in Children and Adolescents in Argentina

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Background. *Neisseria meningitidis* (Nm) pharyngeal carriage is a necessary condition for invasive meningococcal disease. In 2017, Argentina introduced a tetravalent meningococcal conjugated vaccine (MenACYW) to the National Immunization Program for children. We present the first carriage study in children in the prevaccine era. Aims: 1) to assess the rate of Nm carriage in healthy children and adolescents attending a public hospital in Buenos Aires city; 2) to determine serogroup and clonal complex distribution; 3) to determine carriage risk factors by age.

Methods. Cross-sectional study including children 1–17 years, stratified in two age groups (1–9 years and 10–17 years) assisted at Ricardo Gutiérrez Children Hospital between March–December 2017. Oro-pharyngeal swabs were plated and meningococci identified by conventional microbiology methods. Serogroup was determined by PCR. Clonal complex was determined by MLST.

Results. A total of 1751 children were included. Group aged 1–9 years: 38 Nm were isolated from 943 samples collected: overall carriage 4.0%. Serogroups distribution: B 26.3%, Y 2.6%, W 5.3%, Z 5.3%, non-groupable 7.9% and non-capsulated 52.6%. Clonal complex was determined for 25 isolates. Attendance at social venues was the only independent predictor of Nm carriage (adjusted OR: 2.02, CI 95% = 1.01–4.03; $P = 0.04$). Group aged 10–17 years: 76 Nm were isolated from 808 samples: overall carriage 9.4%. Serogroups distribution: B 19.7%, C 5.3%, W 7.9%, Y 9.2%, Z 5.3%,