



## Brief report

## Health care–associated infection and hospital readmission in a home care service for children

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## Key Words:

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Multidrug resistance

The number of children in home health care services is increasing, and there is a need for infection control regulation in this environment. We describe the main causes of infection and hospitalization in children assisted by a pediatric home health care service in Rio de Janeiro, Brazil.

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Home health care services (HHCSs) are increasing in number in Brazil and other countries. Infection control in HHCS settings is necessary to prevent home health care–associated infections (HHAIs) and hospitalization. The types and etiology of infections and reasons for hospitalization in children in HHCS settings are unknown. Such information would help in defining strategies for infection control and prevention, and in optimizing diagnosis and treatment of HHAI.

Cerebral palsy and pulmonary disorders are the main causes for admission to an HHCS in children in Rio de Janeiro, Brazil (written communication, André Ricardo Araujo da Silva, unpublished data, 2008). Here we describe clinical outcomes and causes of hospitalization in children admitted to a pediatric HHCS, and present the epidemiologic profile for colonization/infection with multidrug-resistant (MDR) bacteria.

## METHODS

We prospectively followed all patients admitted for more than 24 hours to the HHCS of Prontobaby Hospital da Criança, Rio de Janeiro, between January 2008 and June 2009. Prontobaby Hospital

is a 104-bed private children's hospital. The HHCS was defined as health care assistance provided at least 12 hours per day by a multidisciplinary team (nurse, physiotherapist, and physician), including a weekly home visit by a physician. All patients admitted to the HHCS came from the hospital's intensive care unit (ICU) or semi-intensive care unit (SICU). We used the methodology established by the National Healthcare Safety Network for surveillance of HHAI,<sup>1</sup> and the criteria for HHAI recommended by Association for Professionals in Infection Control and Epidemiology–Healthcare Infection Control Practices Advisory Committee.<sup>2</sup> Patients' medical records and laboratory data were investigated for the acquisition of MDR bacteria before admission (during ICU or SICU stay) and during HHCS stay. MDR bacteria was defined as proposed by Siegel et al.<sup>3</sup>

A descriptive analysis of patient data was performed using the  $\chi^2$  test or Student *t* test as appropriate. Level of significance was defined as  $P < .05$ . The study was approved by FIOCRUZ's (Fundação Oswaldo Cruz) Ethics Committee.

## RESULTS

The study included 31 children with a mean age at admission of 55.1 months (range, 4–231 months; median, 39 months). The mean length of HHCS stay was 878 days (range, 6–1,539 days; median, 506 days). Causes of admission to the HHCS and required procedures involving invasive devices are listed in Table 1. Central venous or vesical catheters were not required.

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**Table 1**  
Epidemiologic and clinical data for 31 patients admitted to the pediatric HHCS

Data	n (%)
Male sex	16 (52)
Underlying disease	
Cerebral palsy	15 (48)
Bronchopulmonary dysplasia	5 (16)
Genetic syndromes	4 (13)
Neuromuscular disorders	4 (13)
Inborn errors of metabolism	1 (3)
Seizures	1 (3)
Congenital heart defects	1 (3)
Invasive device	
Tracheostomy	23 (74)
Gastrostomy	25 (81)
Invasive ventilation	9 (29)

A total of 46 strains of MDR bacteria were isolated in 9 patients (29%) before HHCS admission. All of these patients acquired at least one MDR bacteria during the ICU or SICU stay. Gram-negative bacteria composed 91% of the MDR isolates. Extended-spectrum  $\beta$ -lactamase (ESBL)-producing *Klebsiella pneumoniae* and carbapenem-resistant *Pseudomonas aeruginosa* were the most prevalent MDR acquired agents, detected in 9 samples (rectal swab, blood, urine, or catheter tip; 20%). ESBL-producing *Escherichia coli* was isolated in 6 clinical samples (13%). No MDR bacteria were isolated from patients' clinical cultures during the HHCS stay. However, routine surveillance cultures performed at the time of hospital readmission detected MDR bacteria (methicillin-resistant *Staphylococcus aureus* [nasal swab] and ESBL-producing *Proteus* spp, *Escherichia coli*, and *K pneumoniae* [rectal swabs]) in 3 children who were in HHCS for more than 6 days (1 patient) or 1,500 days (2 patients).

All patients had at least 1 infection and 129 HHAs were detected, including 55 (43%) episodes of pneumonia, 19 (15%) influenza-like illnesses, 18 (14%) skin infections, 15 (12%) urinary tract infections, and 8 (6%) cases of conjunctivitis. There were 39 hospital readmissions, 27 of which (69%) were due to HHA (Table 2). The annual rate of hospitalization per child due to home health care-associated pneumonia was 0.38, twice that for any other HHA. Four (41%) children with previous MDR bacterial colonization/infection were readmitted, compared with 12 (59%) of those without colonization/infection ( $P = .50$ ). Eight of the 9 patients (89%) with invasive ventilation were hospitalized, compared with 13 of the 22 (59%) without invasive ventilation ( $P = .23$ ). Three children died, two due to HHA (nonventilator-associated pneumonia or urinary sepsis) and the third death was the result of progressive neuromuscular disorder.

## DISCUSSION

Although an estimated 1.2 million infections occur annually in approximately 8 million adults and children seen in HHCS settings in the United States,<sup>4</sup> there are few published studies on infection control and clinical outcomes in pediatric HHCS.<sup>5,6</sup> This is the first study to characterize HHAs and causes of hospitalization in children enrolled in HHCS in Brazil. Pneumonia was the leading cause of HHAs and hospitalization in this study, similar to the finding of Bertrand et al<sup>5</sup> in a study of a home ventilation service for children in Chile.

Patients have several chances to acquire MDR bacteria in HHCS settings because they generally have invasive devices, are under the

**Table 2**  
Causes of hospitalization in children in a pediatric HHCS

Cause	2008 (n = 27), n (%)	2009 (n = 12), n (%)	Total period (n = 39), n (%)	P value
Infectious diseases	17 (63)	10 (83)	27 (69)	.37
Pneumonia	10 (37)	8 (67)	18 (46)	.48
Cholecystitis	2 (7)	0	2 (5)	
Cutaneous infection/ cellulitis	2 (7)	0	2 (5)	
Urinary tract infection	0	2 (17)	2 (5)	
Sinusitis	1 (4)	0	1 (3)	
Coagulase-negative staphylococcal bacteremia	1 (4)	0	1 (3)	
Bacterial sepsis (other causes)	1 (4)	0	1 (3)	
Noninfectious diseases	10 (37)	2 (17)	12 (31)	.37

care of health care professionals who usually work in other clinical settings, and often are treated with broad-spectrum antibiotics. In an adult home care program, Gonzalez-Moro et al<sup>6</sup> found bacterial contamination in 15% of ventilation equipment and colonization by potentially pathogenic bacteria in 25% of patients. ESBL-producing enterobacteria and MDR *P aeruginosa* have become increasingly important causes of health care associated infections, and are problematic in terms of the development of effective antibiotics.<sup>7</sup> Strategies to prevent and control cross-transmission of these pathogens in HHCS settings are not well established, and studies are needed to determine whether contact precautions and similar measures need to be adopted in HHCSs.<sup>8</sup>

This study has some limitations. Surveillance of HHAs was done only weekly in patients' homes by the infection control practitioner. Although data were collected daily by health care workers, short-term infections might have been missed. Moreover, the criteria used for diagnosis of HHA were not specific for children and were based mainly on clinical assessment,<sup>2</sup> which might have resulted in inaccurate diagnoses.

The development of written protocols for infection control and prevention of respiratory infections, considering the occurrence of MDR bacteria, should be priorities in pediatric HHCSs. Efforts also should be made to improve the etiologic diagnosis of HHAs in children.

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