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Nosocomial infections in a pediatric residential care facility

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Abstract

Background—Nosocomial infections have rarely been characterized in pediatric residential care facilities. The purpose of this study is to assess the frequency of and risk factors for infectious diseases in pediatric residential care facilities over a 1-year period and to contrast them with other pediatric extended care facilities.

Methods—A retrospective chart review was performed at a pediatric residential care facility dedicated exclusively to children with severe physical and mental disabilities. Incidence rates of infection were collected on a census of 109 residents from January 1 through December 31, 2009. Infectious diseases were classified using ICD-9-CM codes. PubMed, Web of Science and CINAHL databases were searched to identify similar studies.

Results—In 2009, the overall incidence rate of infection was 6.21 per 1,000 resident-days of care, with the most frequent being streptococcal or staphylococcal skin infections (1.11 per 1,000 resident-days) and the least frequent being conjunctivitis (0.16 per 1,000 resident-days). Extensive literature reviews yielded two published studies that evaluated infections in pediatric extended care facilities; these studies exhibited distinct prevalences of infectious diseases when compared to the current study.

Conclusions—Studies examining nosocomial infections should not consider pediatric extended care facilities as one single entity given the heterogeneity among these facilities.

Keywords

infectious diseases; infection control; disability; residential home; pediatrics

Introduction

For decades, nosocomial infections, or infections that are acquired and detected in a healthcare facility, have been an area of concern in most acute and non-acute care facilities in the U.S. and worldwide. Not only do these infections impact health and quality of life, but they result in a substantial economic burden. In 2007, the estimated direct medical costs associated with nosocomial infections ranged between \$5.7 and \$6.8 billion in the U.S. alone.¹ These economic pressures on the nation's healthcare system are due to the prolonged

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Declaration of interest:

All authors report no conflicts of interest relevant to this article.

stay at a healthcare facility and additional diagnostics and interventions that often accompany nosocomial infections.² Within the last few decades, several identified changes within the healthcare delivery system have resulted in an increase of services being delivered in non-acute care settings. These changes include earlier discharge of patients from acute care hospitals due to caps set by insurance companies, and increased scope of care provided in the non-hospital setting due to technological advances in medicine.³ These changes in the way care is provided have spurred infection control practitioners and researchers to focus on infections acquired in extended care facilities, particularly nursing homes, in an effort to develop effective infection control policies and procedures for these chronically ill populations.⁴ While these guidelines have been widely accepted and implemented by all types of extended and residential care facilities regardless of the age of residents⁵, several studies have shown disparities in infection rates between adult and pediatric populations.⁵⁻⁷ Specifically related to susceptibility and response to infection, these differences raise questions as to the generalizability of guidelines originally created for older populations to pediatric populations.^{6,8} Morbidity and mortality rates among patients with impaired immune response and greater susceptibility to life-threatening infections, which differ with age and institutional placement, are matters of public health importance within U.S. healthcare facilities that must be dealt with for each population individually.

Considerable knowledge exists on the epidemiology of nosocomial infections in adult acute and non-acute care settings and in pediatric acute care settings. However, information on nosocomial infections is limited in extended care facilities among the pediatric population. There are numerous anecdotal reports of infections within healthcare facilities themselves, but to our knowledge, only two published studies^{9, 10} exist on infection rates in pediatric extended care facilities and none in pediatric residential care facilities. As a result of this brevity of information on pediatric residential care homes, focus in these institutions has been on those infections that are more prevalent in acute care settings and other long-term care facilities such as nursing homes for the elderly and long-term care hospitals.

Previous studies have used the term 'pediatric extended care facilities' to describe multiple types of facilities, including residential and long-term care facilities, skilled nursing and rehabilitation facilities, chronic disease and specialty hospitals as well as schools.⁵ Extended care facilities consist of 4 major types of facilities: long-term and residential care facilities, rehabilitation hospitals, and nursing homes. Long-term care facilities provide care to people of all ages with chronic illness or disability, and generally include rehabilitative, restorative, and/or skilled nursing care to individuals who need assistance with activities of daily living. Residential care facilities are for people of all ages who are unable to live by themselves, those with lifelong disabilities, and/or those whose caretakers are unable to provide for them in their own home. These facilities provide access to around the clock nursing care and are considered home for their residents due to the home-like environment they provide. Rehabilitation hospitals mostly focus on the treatment of disabling conditions; patients are generally discharged once they are able to perform daily living activities with little or no assistance. Nursing homes provide residence to the elderly population who are unable to live by themselves, are of a burden to family members, and/or need around the clock nursing care. All 4 types of facilities have similarities and differences in the type of care they provide and amenities they offer.

The purpose of this descriptive study is to examine and characterize infectious diseases in one of approximately 100 pediatric residential care facilities that exist throughout the U.S., and add to the limited knowledge that exists in this vulnerable population. The study provides evidence needed to support a distinction in infectious disease patterns among pediatric residential care facilities and other pediatric extended care facilities.

Materials and Methods

Setting

The Commonwealth of Virginia, a Mid-Atlantic state with an estimated population of 7882590 persons in 2009¹¹, houses one of approximately 100 state-of-the-art residential care facilities for children with severe physical and mental disabilities in the U.S. Pediatric residential care facilities, such as St. Mary's Home for Disabled Children (SMHDC) located in Norfolk, Virginia, house children from newborns through 22 years of age. Occupants of these facilities are generally known as residents and live in a room either by themselves or shared with one, two, or three other residents. At SMHDC, most medical care is performed in separate treatment rooms in the facility in order to maintain a normalized lifestyle by fostering a home-like environment. Common areas are typical of residential care homes where residents can interact and participate in learning activities. Unlike many other extended care facilities, SMHDC has outdoor courtyards with adaptive play equipment and a hydrotherapy pool and fountain. Eight educational classrooms, physician offices, a dentist office, and a barber and beauty shop are also on site at this facility. The facility is split into four units with similar resident profiles including comparable gender and age distributions. Therefore, analyses were done facility-wide and not stratified by unit. SMHDC is a private, not-for-profit, non-sectarian organization that housed 109 residents at the beginning of 2009.

Design and Procedures

A retrospective chart review was performed for all residents who resided at SMHDC on January 1, 2009; all residents were followed through December 31, 2009 or until discharge date (n=109). To maintain resident anonymity, only medical record staff and the chief nursing officer accessed medical records to provide information for this study. Each resident was assigned a unique identification number (IDN). If further information was needed on a subject, they were referred to by their IDN. Demographic variables obtained included age, sex, race, unit of residence, and date of discharge if discharged in 2009. International Classification of Diseases ninth clinical modification (ICD-9-CM) codes were used to characterize all clinical diagnoses and infectious diseases that occurred and were diagnosed in 2009 at SMHDC. Table 1 gives the diagnostic coding that was used to classify each facility-acquired infection.¹² Most infections were treated with antibiotics and/or topical ointment, per facility protocol, and all infections were treated on site. The month of onset for each new infection in 2009 was also recorded. Clinical diagnoses of chronic diseases were based on broad categories of ICD-9-CM diagnostic criteria.¹³

Incident cases of each infection of unique etiology were only counted once per resident although more susceptible residents may have experienced a relapse or recurrence of the same infection. Incidence was calculated for each new infection among the total population and within five stratified age groups: 0–4 years, 5–9 years, 10–14 years, 15–19 years, and 20–22 years. Incidence rates for each infection and total incidence rate were calculated by dividing the number of new infections by total resident-days of care during 2009. Resident-days only include the days in 2009 in which the resident was checked in at the facility and does not include days in which the resident was transferred to an acute care facility for emergency care or time spent at home with family, although these were rare instances.

For comparison with published studies, prevalence rates were also calculated for infections of the respiratory tract, urinary tract, skin, gastrointestinal system, bloodstream and eyes. Upper respiratory tract infections (URI) included diagnoses of URI, sinusitis and influenza, while lower respiratory tract infections (LRI) included bronchitis and pneumonia. Skin infections included those of streptococcal/staphylococcal and fungal etiology. Gastrointestinal infections included gastroenteritis and gastritis. Eye infections included

conjunctivitis, dacryocystitis, and hordeolum. Cases with incidence of more than one condition classified under certain categories (i.e. URI, LRI, gastrointestinal, skin, and eyes) were only classified as one case when calculating 1-year period prevalence (number of cases over the population at risk).

Existing comparative studies were identified by searches of PubMed, Web of Science (Science Citation Index), CINAHL, and references from relevant articles using different combinations of the search terms and MeSH headers “pediatric”, “pediatric nursing”, “infant”, “adolescent”, “child”, “disabled children”, “child, institutionalized”, “long-term care”, “skilled nursing facilities”, “residential facilities”, “extended care”, “infection”, “cross infection”, “nosocomial infection”, “hospital acquired infection”, “infection control”, and “infectious diseases”. We reviewed all articles in the English language with no restrictions on publication date.

Data were managed using Microsoft Office Excel 2007 and stored in a password protected file. The Eastern Virginia Medical School Institutional Review Board approved the exemption of this study from review.

Statistical Analysis

Statistical Analysis Software (SAS) version 9.2 (SAS Institute, Inc., Cary, NC) was used for all statistical procedures. Two-sided p-values for the relationship between specific infections and age strata were calculated using Fisher’s exact test in PROC FREQ since a majority of cells had expected counts less than 5. The average number of infections for each age strata was calculated using PROC MEANS, and PROC ANOVA was performed to test the null hypothesis that the means were equal. Chi-square tests were used for comparing prevalence rates of infection from the current study with those of other published studies. A 95% confidence interval based on the binomial distribution was calculated for the proportion of residents developing an infection in 2009.

Results

This study includes 109 residents at SMHDC identified on January 1, 2009 and followed through December 31, 2009. The total cumulative census for the study period was 37,819 resident-days of care, ranging from 37 to 365 days per person. The mean age ($\pm$ SD) of residents was 13.6 ± 5.85 years (no difference in age between males and females) with a male to female ratio of 1.06. The resident population had substantial levels of debilitating conditions including history of seizures (89.0%), incontinence of feces (85.3%), urinary incontinence (84.4%), cerebral palsy (83.5%), severe/profound mental retardation (79.8%), severe/profound gastrostomy (75.2%), spasticity (74.3%), osteopenia (68.8%), dysphagia (55.0%), and constipation (53.2%). Table 2 describes more specific demographic information, including gender, race, and diagnostic characteristics of the total study population and of each age stratum.

In 2009, 235 incident infections (0–8 specific infection types per person) developed in 90 (82.6%; 95% CI: 74.8%–90.4%) residents, resulting in an overall infection rate of 6.21 per 1,000 resident-days of care (Table 3). The highest incidence of infection seen was streptococcal/staphylococcal skin infections (1.11 per 1,000 resident-days) and the lowest being conjunctivitis (0.16 per 1,000 resident-days). Infection rates were calculated for each age stratum. Rate of infection was not significantly different across age groups ($p = 0.253$); the mean number of infections (SD) with increasing age strata were 1.70 (1.83), 2.72 (1.99), 2.48 (1.67), 2.00 (1.52), and 1.71 (1.65), respectively. Among the specific types of infection, significant differences in the number of UTI infections were observed for different age strata ($p = 0.01$), with a particularly high rate (.77 per 1000 resident-days) occurring among

children aged 5–9. No other differences in types of infection were detected across age groups.

Discussion

To our knowledge, this is the first study to examine nosocomial infection rates in a pediatric residential care facility, and the first among pediatric extended care facilities to calculate incidence rates. The lack of such information makes it difficult for extended care facilities to make external comparisons and judge whether its endemic rate exceeds that of other comparable facilities.

For extended care facilities that predominantly serve the adult population, rates of nosocomial infections have been seen to vary extensively depending on the type of facility, the demographics of the population served, and how nosocomial infections were characterized and reported.^{3, 14} Based on our extensive literature review, only two studies^{9, 10} were found citing period prevalence of infection in pediatric extended care facilities (Table 4). Vermaat and coworkers conducted a one-year study in a pediatric long-term care facility and reported similar prevalence of URI and eye infections as the current study. Statistically significant differences were observed for UTI, skin, gastrointestinal and lower respiratory infections ($P < 0.05$). Prevalence of UTI was 73% lower in the current study, while prevalences of skin, gastrointestinal, and lower respiratory infections were 188%, 163%, 359% greater, respectively. Harris and co-workers conducted a two-year study of infection prevalence rates in a pediatric rehabilitation hospital. For comparative purposes, we divided prevalence in half, assuming a uniform distribution of infections over the two-year study period and that infections were quickly resolved. Compared to the current study, statistically significant differences were observed for URI, LRI, skin and gastrointestinal infections ($P < 0.05$). Prevalence of UTI was 31% lower in the current study, while prevalence's of skin, gastrointestinal, URI and LRI were 900%, 207%, 53% and 164% greater, respectively.

Based on our results comparing infection rates in a residential care facility to those in a long-term⁹ and rehabilitation¹⁰ facility, we can conclude that significant differences in rates exist among different pediatric extended care facilities. LRIs, skin infections and gastrointestinal infections were all higher in the residential care facility, while eye infections were only slightly higher in this study compared to the long-term care facility. URI was lowest in the rehabilitation hospital and highest in the long-term care facility. UTI was much lower in this study compared to the long-term care facility, but similar to that observed in the rehabilitation hospital. Although it can be suggested that pediatric residential care facilities, such as SMHDC, vary in characteristics of patient population, structure, and scope of practice from other extended care facilities, thus having a different infectious disease burden, these conclusions should be taken cautiously due to the evolution in infection control practices, development of new drugs, and the detection of new organisms. Because of the dearth of data on infection rates in pediatric residential care facilities, it is difficult to discern whether or not SMHDC's infection rates are standard for this type of facility. Therefore, more studies are needed to examine and validate these distinctions between facility types and investigate the potential factors associated with these disparities in infection profiles.

Current infection prevention and control strategies in pediatric extended care facilities have mostly been derived from acute care hospitals that predominantly serve the adult population, failing to conform to unique child-specific needs. Methods used to control infections in acute and other non-acute care facilities may not be applicable to this or other similar facilities due to the differences in host factors, sources of infection, routes of transmission,

and distribution of pathogens.¹⁵ A national surveillance system for hospitals, the National Nosocomial Infections Surveillance (NNIS) system, provides acute care facilities with a standardized method of reporting nosocomial infections and provides hospitals with an external benchmark for comparison.¹⁶ This system, only exclusive to participating acute care hospitals, analyzes data from hospital-wide, intensive care unit, high-risk nursery, and surgical patient surveillance components that is voluntarily reported to the Center for Disease Control and Prevention.¹⁷ National surveillance systems, similar to the NNIS, would be beneficial for pediatric extended care facilities and should not be exclusive to acute care facilities. Infection control policies and procedures should be developed that are specific to each institution based on infection rates, severity of illness of residents, level of care provided to residents, and the structure of the facility. A panel of members from the Centers for Disease Control and Prevention, the American Practitioners of Infection Control, the Society for Hospital Epidemiology of America, the Joint Commission on Accreditation of Healthcare Organizations, and the Pediatric Infectious Diseases Society developed the fundamental structure of an infection control program in a long-term care facility to include surveillance, policy development, adequate employee health and continuing education.¹⁸ Although these elements were developed for all extended care facilities, they provide a good foundation which can be built upon to develop infection control protocols for the pediatric population and for specific facilities. Pediatric residential care facilities, like SMHDC, can develop an ongoing surveillance system to monitor the incidence of infections, and use this data to inform clinicians and to implement new procedures to eliminate suspected causes of infections. Informing clinicians via continuing education is particularly useful in this setting because infections and their etiology can vary by season.

Existing infection control measures implemented at the study facility include an emphasis on good hand hygiene using soap and water or antiseptic hand gel by the display of placards at each wash station, isolation precautions for patients with an infection, encouraged sick time for employees with symptoms, and restricted access to the play area and pool for certain infections, although the compliance rates are not known. Standard precautions, such as the use of gloves, gown, and hand hygiene are known to help keep infection rates down. In addition, we suggest that medical devices such as stethoscopes and thermometers be sanitized after each use. Personal items such as toys should be kept away from other children to eliminate the spread of pathogens. We also encourage active surveillance and continuing education for clinicians on the current infectious trends at the facility on a regular basis.

This study has several limitations. Only one residential care facility was examined for this analysis and hence sample size is small and the data are not generalizable to all extended care facilities. The reliance on a retrospective minimal dataset did not allow for the characterization of credentials for health professionals who made the various diagnoses. Inconsistent availability of laboratory data also precluded the validation of ICD-9-CM codes.

Our data indicate that the prevalence of nosocomial infections in this pediatric residential care facility located in Virginia differs from other pediatric extended care facilities. The brevity of published data on pediatric residential care facility infection rates and the descriptive nature of this study limit the amount of comparative analyses that can be done. Based on these study findings, we would recommend that future studies examining trends in infection rates should not characterize extended care facilities as one entity, given the observed heterogeneity among these facilities suggested by our results. In addition, infectious disease surveillance results should be shared with each facility's infection control department and clinical employees to further educate them on the importance of primary prevention techniques and implementation of appropriate strategies. This study was intended

to serve as a baseline for future studies on pediatric residential care facilities. Further research is needed to expand our knowledge on infections that occur in pediatric residential care facilities in order to develop targeted strategies that can reduce infections.

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References

1. Scott, RD. The direct medical costs of healthcare-associated infections in US hospitals and the benefits of prevention. Center for Disease Control and Prevention; Mar. 2009 Available at: http://www.cdc.gov/ncidod/dhqp/pdf/Scott_CostPaper.pdf
2. Graves N. Economics and preventing hospital-acquired infection. *Emerging Infectious Diseases*. 2004; 10(4):561–6. [PubMed: 15200842]
3. Stausbaugh, LJ.; Joseph, CL. Epidemiology and prevention of infections in residents of long term care facilities. In: Mayhall, CG., editor. *Hospital Epidemiology and Infection Control*. 2. Philadelphia: Lippincott Williams & Wilkins; 1999. p. 1461-1482.
4. Smith PW. Nursing home infection control: a status report. *Infection Control and Hospital Epidemiology*. 1998; 19:366–369. [PubMed: 9613700]
5. Harris JS. Infection control in pediatric extended care facilities. *Infection Control and Hospital Epidemiology*. 2006; 27:598–603. [PubMed: 16755480]
6. Harris JS. Pediatric nosocomial infections: children are not little adults. *Infection Control and Hospital Epidemiology*. 1997; 18:739–742. [PubMed: 9397366]
7. Donowitz L. Hospital-acquired infections in children. *New England Journal of Medicine*. 1990; 323:1836–1837. [PubMed: 2247123]
8. Stausbaugh, LJ.; Joseph, CL. Epidemiology and prevention of infections in residents of long term care facilities. In: Mayhall, CG., editor. *Hospital Epidemiology and Infection Control*. 2. Philadelphia, PA: Lippincott Williams & Wilkins; 1999. p. 1461-1482.
9. Vermaat JH, Rosebrugh E, Ford-Jones EL, Ciano J, Kobayashi J, Miller G. An epidemiologic study of nosocomial infections in a pediatric long-term care facility. *American Journal of Infection Control*. 1993; 21:183–188. [PubMed: 8239048]
10. Harris, J.; Hogan, M.; Kagel, S. Nosocomial infections in a pediatric rehabilitation hospital. Abstracts of the Fifth Annual Meeting of the Society for Healthcare Epidemiology of America; San Diego, CA. April 2–4, 1995; p. Abstract S29
11. U.S. Department of Commerce. [Accessed June 14, 2010] US Census Bureau Web site. Available at: <http://quickfacts.census.gov/qfd/states/51000.html>
12. Buck, CJ. 2010 ICD-9-CM for Physicians. Vol. 1–2. Portland, OR: Book News Inc; 2010. Professional ed
13. Centers for Disease Control and Prevention (CDC). International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM). Classification of Diseases, Functioning, and Disability. Sep 21. 2010 Retrieved December 10, 2010, from <http://www.cdc.gov/nchs/icd/icd9cm.htm>
14. Nicolle LE, Garibaldi RA. Infection control in long-term-care facilities. *Infection Control and Hospital Epidemiology*. 1995; 16:348–53. [PubMed: 7657988]
15. Donowitz L. Hospital-acquired infections in children. *New England Journal of Medicine*. 1990; 323:1836–1837. [PubMed: 2247123]
16. Archibald LK, Gaynes RP. Hospital-acquired infections in the United States. The importance of interhospital comparisons. *Infectious Disease Clinics of North America*. 1997; 11:245–55. [PubMed: 9187945]
17. Emori TG, Culver DH, Horan TC, et al. National nosocomial infections surveillance system (NNIS): description of surveillance methods. *Am J Infect Control*. 1991; 19(1):19–35. [PubMed: 1850582]

18. Friedman C, Barnette M, Buck AS, et al. Requirements for infrastructure and essential activities of infection control and epidemiology in out-of-hospital settings: a consensus panel report. *American Journal of Infection Control*. 1999; 27:418–430. [PubMed: 10511489]

Table 1

International Classification of Disease Code Classes for Infections

Infection	ICD-9-CM Coding
Bronchitis	466, 490 – 491
Candidiasis	112
Conjunctivitis	372
Dacryocystitis	375
Ear	381 – 382
Gastritis	535
Gastroenteritis	009, 558
Hordeolum	373
Influenza	487 – 488
MRSA	041, V09
Odontogenic Abscess	526
Ostomyelitis	730
Strep Pharyngitis	462
Pneumonia	480 – 486
Sinusitis	461, 473
Skin	050 – 059, 680 – 686
Tracheitis	464
Upper Respiratory	465, 478
Urinary Tract	599
Vaginitis	616

MRSA=Methicillin Resistant Staphylococcus Aureus.

Table 2

Demographic features of the study population

Variable	Age (years)					
	0-4 (n = 10)	5-9 (n = 18)	10-14 (n = 27)	15-19 (n = 33)	20-22 (n = 21)	Total (n = 109)
Gender, n (%)						
Male	5 (50.0)	6 (33.3)	16 (59.3)	18 (54.5)	11 (52.4)	56 (51.4)
Female	5 (50.0)	12 (66.7)	11 (40.7)	15 (45.5)	10 (47.6)	53 (48.6)
Race, n (%)						
Caucasian	4 (40.0)	7 (38.9)	17 (63.0)	18 (54.5)	12 (57.1)	58 (53.2)
African-American	5 (50.0)	10 (55.6)	9 (33.3)	14 (42.4)	7 (33.3)	45 (41.3)
Other	1 (10.0)	1 (5.6)	1 (3.7)	1 (3.0)	2 (9.5)	6 (5.5)
Conditions, n (%)						
Infectious And Parasitic Diseases	2 (20.0)	6 (33.3)	11 (40.7)	16 (48.5)	5 (23.8)	40 (36.7)
Endocrine, Nutritional And Metabolic Diseases, and Immunity Disorders	2 (20.0)	1 (5.6)	6 (22.2)	6 (18.2)	2 (9.5)	17 (15.6)
Diseases Of The Blood And Blood-Forming Organs	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.0)	0 (0.0)	1 (0.9)
Mental Disorders	10 (100.0)	18 (100.0)	27 (100.0)	33 (100.0)	21 (100.0)	109 (100.0)
Diseases Of The Nervous System And Sensory Organs	9 (90.0)	18 (100.0)	27 (100.0)	32 (97.0)	21 (100.0)	107 (98.2)
Diseases Of The Circulatory System	1 (10.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.9)
Diseases Of The Respiratory System	1 (10.0)	3 (16.7)	3 (11.1)	4 (12.1)	5 (23.8)	16 (14.7)
Diseases Of The Digestive System	7 (70.0)	12 (66.7)	22 (81.5)	25 (75.8)	17 (81.0)	83 (76.1)
Diseases Of The Genitourinary System	0 (0.0)	0 (0.0)	3 (11.1)	2 (6.1)	0 (0.0)	5 (4.6)
Diseases Of The Skin and Subcutaneous Tissue	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (4.8)	1 (0.9)
Diseases Of The Musculoskeletal System and Connective Tissue	5 (50.0)	15 (83.3)	25 (92.6)	30 (90.9)	20 (95.2)	95 (87.2)
Congenital Anomalies	3 (30.0)	8 (44.4)	10 (37.0)	14 (42.4)	11 (52.4)	46 (42.2)
Certain Conditions Originating in the Perinatal Period	0 (0.0)	1 (5.6)	3 (11.1)	0 (0.0)	1 (4.8)	5 (4.6)
Symptoms, Signs, And Ill-Defined Conditions	5 (50.0)	16 (88.9)	27 (100.0)	33 (100.0)	21 (100.0)	102 (93.6)
Injury And Poisoning	0 (0.0)	1 (5.6)	5 (18.5)	9 (27.3)	8 (38.1)	23 (21.1)
Supplementary Classification Of Factors Influencing Health Status And Contact With Health Services	6 (60.0)	15 (83.3)	23 (85.2)	26 (78.8)	16 (76.2)	86 (78.9)
Supplementary Classification Of External Causes Of Injury And Poisoning	1 (10.0)	1 (5.6)	4 (14.8)	3 (9.1)	1 (4.8)	10 (9.2)
Total resident-days of care	3366	6496	9855	11590	6512	37819

Table 3

Number (incidence rate) of infections stratified by age

Infection	Age (years)						P-value for heterogeneity
	0-4	5-9	10-14	15-19	20-22	Total	
Influenza	1 (0.30)	1 (0.15)	3 (0.30)	2 (0.17)	0 (0.00)	7 (0.19)	0.54
Tracheitis	1 (0.30)	0 (0.00)	3 (0.30)	2 (0.17)	2 (0.31)	8 (0.21)	0.65
Bronchitis	1 (0.30)	3 (0.46)	4 (0.41)	5 (0.43)	2 (0.31)	15 (0.40)	0.98
Sinusitis	2 (0.59)	8 (1.23)	7 (0.71)	5 (0.43)	3 (0.46)	25 (0.66)	0.17
Ear	3 (0.89)	6 (0.92)	8 (0.81)	7 (0.60)	4 (0.61)	28 (0.74)	0.78
Gastroenteritis	0 (0.00)	1 (0.15)	3 (0.30)	6 (0.52)	0 (0.00)	10 (0.26)	0.19
Strep/Staph Skin	1 (0.30)	5 (0.77)	12 (1.22)	16 (1.38)	8 (1.23)	42 (1.11)	0.19
Fungal Skin	2 (0.59)	3 (0.46)	5 (0.51)	3 (0.26)	3 (0.46)	16 (0.42)	0.81
Pneumonia	0 (0.00)	3 (0.46)	6 (0.61)	2 (0.17)	3 (0.46)	14 (0.37)	0.29
URI	3 (0.89)	4 (0.62)	2 (0.20)	3 (0.26)	1 (0.15)	13 (0.34)	0.16
Strep Pharyngitis	1 (0.30)	4 (0.62)	8 (0.81)	11 (0.95)	6 (0.92)	30 (0.79)	0.70
UTI	1 (0.30)	5 (0.77)	0 (0.00)	1 (0.09)	2 (0.31)	9 (0.24)	0.01
Conjunctivitis	0 (0.00)	3 (0.46)	1 (0.10)	2 (0.17)	0 (0.00)	6 (0.16)	0.27
Other*	1 (0.30)	3 (0.46)	5 (0.51)	1 (0.09)	2 (0.31)	12 (0.32)	0.32
Total	17 (5.05)	49 (7.54)	67 (6.80)	66 (5.69)	36 (5.53)	235 (6.21)	--

URI=upper respiratory tract infection; UTI=urinary tract infection. All rates are expressed as the number of new infections per 1000 resident-days of care for the study period. P-values were calculated using Fisher's Exact Test for the relationship between each infection and age strata.

* Includes Methicillin Resistant Staphylococcus Aureus, gastritis, dacryocystitis, odontogenic abscess, bacterial vaginosis, chronic osteomyelitis, systemic herpes, hordeolum, and candidiasis.

Table 4

Studies reporting nosocomial infection prevalence in pediatric extended care facilities compared to current study

Author, Year (Country)	Type	Period	N	Nosocomial Infection Prevalence (%)					
				Respiratory Tract (URI, LRI)	UTI	Skin	Gastro-intestinal	Eyes	
Current Study	Pediatric residential care facility	Jan 2009–Dec 2009	109	53.2 (32.1, 21.1)	8.3	45.0	9.2	7.3	
Harris et al., 1995 (USA)	Pediatric rehabilitation hospital	Jan 1993–Dec 1994	1053	58.0* (42.0*, 16.0*)	24.0	9.0*	6.0*	NR	
Vermaat et al., 1993 (Canada)	Pediatric long-term care facility	May 1988–April 1989	1137	41.6* (37.0, 4.6*)	31*	15.6*	3.5*	6.4	

NR= Not Reported in study.

* P<0.05 when compared to current study using a chi-squared test.