

# Epidemiology of nosocomial infections in pediatric patients in an Iranian referral hospital

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## Key words

Nosocomial infection • Epidemiology • Pediatric

## Summary

*Nosocomial infections (NI) are important causes of morbidity and mortality in pediatric hospitals. Different surveillance methods for detecting hospital-acquired infection have been developed. The selection of which varies according to specific surveillance objectives and the resources are available. The aim of this study was to determine the epidemiology of nosocomial infections in medical wards of a tertiary-levels teaching pediatric hospital in Tehran, Iran. We performed a prospective cross-sectional study and NI was identified by daily review of medical charts of patients hospitalized for at least 48 hours. We evaluated 1497 patients. The overall patient NI rate was 3.34*

*per 100 patients and the infection rate per 1000 patient-days was 5.27. The most common site of infection was the respiratory tract (36%) followed by the gastrointestinal tract (32%). *S. aureus*, *P. aeruginosa* and *Salmonella* species were the most frequent pathogen isolates. The lethality rate associated with NI was 10%. Describing the epidemiology of NI in this hospital enable us to estimate infection occurrence, distribution and expected incidence, as well as recognizing trends and keeping track of possible outbreaks.*

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## Introduction

Nosocomial infections (NI) are a major complication of hospital care in adults and children. These infections can be caused by bacteria, fungi, and viruses and can occur in the bloodstream, urinary, respiratory, digestive tracts and soft tissues. The recent medical developments, including the increased use of broad spectrum antibiotics, urinary and central venous catheterizations as well as endotracheal intubations put patients at an increased risk of contracting NI undergo longer hospital stays and treatment costs [1-3].

Although NI occurs universally, its frequency varies greatly among regions [4]. In developed countries NI rates in infants and children are lower than those reported for adults and occur mainly in Intensive Care Units (ICUs); in contrast, in developing countries pediatric hospital-acquired infection is frequent and the incidence of infant NI reaches higher [4, 5].

Awareness of NI rates is essential to implement preventive measures and to establish appropriate intrahospital and interhospital comparisons. Surveillance activities are the first step in developing infection control programs and may help in decreasing the incidence of infections and reducing costs [6]. Different surveillance methods for detecting hospital-acquired infection have been developed. The selection of which varies according to specific surveillance objectives and the resources are available [7]. The aim of this study was to determine the epidemiology of nosocomial infections in

medical wards of a tertiary-levels teaching pediatric hospital in Tehran, Iran.

## Methods

This prospective cross-sectional study was carried out between Aug 23, 2002 to Feb 20, 2003, at the Children Medical Center Hospital, a teaching children's hospital and a tertiary care referral unit, in Tehran, Iran. During the study months surveillance consisted of daily review by a pediatric resident of the medical charts of patients that stay in hospital at least 48 hours and then follow up of patients who presented with suspicious signs or symptoms of infection such as fever, sputum, coughing or diarrhea, pertinent physical examination and laboratory data. If an infection met the definition of nosocomial [7, 8], a data entry sheet was completed by the pediatric resident. In this study, no post discharge surveillance was performed.

## Results

Of 1814 children, 317 were excluded from the study because they were hospitalized for short duration; therefore data on 1497 patients with 9476 patient-days were submitted. In this study 50 patients with NI were found. The overall patient NI rate was 3.34 per 100 patients and the infection rate per 1000 patient-days was 5.27. The

**Tab. I.** Frequency (%) of pathogens according to type of infection.

	Blood stream	UTI	GI	IPC	Cellulitis	All
<b>Gram positive cocci</b>						
<i>S. aureus</i>	3 (42.85%)					3 (15.7%)
<i>Coagollase Negative Staphylococci</i>		1 (14.28%)				1 (5.2%)
<i>Pneumococcus</i>				1 (100%)		1 (5.2%)
<b>Gram negative bacilli</b>						
<i>Salmonella</i> spp.			3 (100%)			3 (15.7%)
<i>Klebsiella</i> spp.	1 (14.28%)	1 (14.28%)				2 (10.5%)
<i>Enterobacter</i> spp.	1 (14.28%)					1 (5.2%)
<i>E. coli</i>		1 (14.28%)				1 (5.2%)
<i>P. aeruginosa</i>	1 (14.28%)	2 (28.5%)				3 (15.7%)
<i>Enterococcus</i>	1 (14.28%)					1 (5.2%)
<i>Acenitobacter</i> spp.					1 (100%)	1 (5.2%)
<i>Candida albicans</i>		2 (28.5%)				2 (10.5%)
<b>Total</b>	<b>7</b>	<b>7</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>19</b>

UTI: urinary tract infection, GI: gastrointestinal, IPC: Intraperitoneal cavity.

most common site of infection was the respiratory tract (18 cases, 36%) followed by the gastrointestinal tract (16 cases, 32%) and the infections of bloodstream and urinary tract which occurred with equal frequency (7 cases, 14%), miscellaneous infections included intraperitoneal cavity infection and cellulitis, represented only 4% of infections. The distribution of NI by age showed 24 (48%) infections in children > 1 month but < 1 year, 16 (32%) in children of 1 year up to 6 years, and 10 (20%) in children 6 years and older. Nineteen pathogens were isolated (38%). Enterobacteriaceae were the most frequent pathogens isolated (36.8%), in this family *Salmonella* species had the higher frequency (15.7%) (Tab. I). Sixteen cases of the 50 NI (32%) had underlying disease and the most common underlying disease was immunodeficiency (18.7%). The overall rate of device-associated NI was 18% while the rate of catheter-associated urinary tract infection was the highest (67%). The lethality rate associated with NI was 10%. The mean length of hospital stay was 6.33. In our study the mean hospital stay for patients who were infected was 14 days and 6.06 for patients who were uninfected by NI. Therefore, the mean excess length of hospitalization due to NI was 7.94 days.

## Discussion

Although there are abundant data from epidemiological studies about nosocomial infections. Most of the reports has not come from developing countries such as Iran. The predominant site of infection differ by the population studied, the type of surveillance performed and also the season in which the study is conducted [5]. The studies which were not conducted in fall or winter, respiratory and gastrointestinal tract infections had low rates and the most frequent type of NI in these studies were bloodstream infections [5]. In children, nosoco-

mial urinary tract infections (NUTI) account for 6 to 18% of hospital-acquired infection on pediatric services in small and large teaching hospitals [9]. NUTI rate in our hospital (14%) lies within this range. More than half of the NUTI in this study and about 50% of children in other larger studies occurred without prior urinary tract instrumentation [10]. Therefore instrumentation of the urinary tract is an established external risk factor for infection but it clearly does not account for all risk in children [10]. In addition to the presence of an invasive device, severity of the underlying disease, use of antibiotics and longer time of hospitalization can be considered as major risk factors for the acquisition of NI in pediatric patients [11]. Consistent with earlier findings, the frequency of NI was highest among infants and *S. aureus* is the most frequently reported pathogen in our hospital [5, 12, 13]. In our study similar to the previous studies in developing countries, Gram-negative bacilli are reported as the most frequent pathogens in these infections [14-15]. An outbreak of *P. aeruginosa* in this year in our hospital is the cause of higher proportion of *P. aeruginosa* than reported in the Canadian study (15.7% vs. 5.3%) [13]. Viruses cause 14% to 22% of all NI in pediatric patients [13]. In our study, NI incidence may have been underestimated because widespread applications require for viral diagnostic. NI-associated mortality over the study period was 10%, as same as the mortality rate reported by the European study group [1]. Extra hospital stay is a key indicator of the impact of NI [16]. Therefore, we should consider the impotence of NI and establish scientific policies to prevent the loss of patients, time and money.

Finally, this study highlights the importance of NIs in children in our country. Surveillance of NIs plays a fundamental role in infection control in hospitals and serves as a guide for measures to reduce NI rates.

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