Original Article

Epidemiology of Four Main Nosocomial Infections in Iran during March 2007 – March 2008 based on the Findings of a Routine Surveillance System

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Abstract

Background: Annually, around six million patients are admitted to hospitals in Iran. Information about the prevalence of nosocomial infections (NIs) is necessary for both appropriate management and establishment of preventative measures in hospitals. This article is based on the findings of the Nosocomial Infection Surveillance System (NISS) which has been providing information on NIs in Iran since March 2007.

Methods: NISS covers 95 hospitals throughout Iran, each with over 200 beds. There are four main infections: urinary tract infection (UTI), surgical site infection (SSI), bloodstream infection (BSI) and pneumonia (PNEU) included in NISS. Reports are completed on forms that have been provided based on national guidelines. In all selected hospitals there is one designated nurse who conducts infection control activities and is trained in the detection and reporting of NIs based on NISS guidelines.

Results: During March 2007 – March 2008, a total of 1,879,356 patients were admitted to the selected hospitals. The total detected NIs were 10557 with a prevalence of 0.57%. Of these, UTI was the most prevalent infection (32.2%) and BSI was the least (16.3%). Based on gender, females had more UTI, whereas PNEU was the highest in males. Of reported NIs, 9% were detected in children less than five years of age and included BSI (45%), PNEU (20%), SSI (19%) and UTI (16%). There were 26% reported NIs in the age group over 65 years, of which the most prevalent infections were UTI (42%) followed by PNEU (31%), SSI (15%) and BSI (12%). NIs were most often detected in intensive care units (ICUs; 26.7%), followed by surgery wards (12.8%).

Conclusion: In comparison with other studies and the World Health Organization (WHO) estimates, the rate of NIs appears to be less according to NISS. NISS has the capability to provide basic information for efficient management and control measures, in addition to indicating variations in NIs based on gender, age and location (hospital ward). In order to have a more realistic estimate of NIs and strengthen NISS, it is advisable to conduct a point prevalence study.

Keywords: Iran, nosocomial infections, prevalence

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Introduction

Nosocomial infections (NIs) are important in terms of their potential for high mortality, morbidity and elevated hospital costs.[1–3] In the pediatric intensive care unit (ICU) alone, the mean cost of bloodstream hospital-acquired infections is approximately $39000 to $50000 per year.[4–6] The prevalence of hospital-acquired infections varies from 5% in Europe and North America to 40% in Sub-Saharan Africa, Latin America and parts of Asia.[7] According to a survey by the World Health Organization (WHO) that has been conducted in 14 countries, 8.7% of hospital inpatients suffer from NIs.[8] In Iran there are over 100,000 hospital beds in 830 hospitals and approximately 6 million patients admitted annually (unpublished data).

In order to control hospital-acquired infections, effective programs are needed; however without information about the prevalence of NIs the burden of estimation and effective programming for NIs is almost impossible.[8,9] There were limited studies about NIs in Iran, which supposed 8%–10% prevalence rate,[10,16,17] however additional information is needed to determine the country-wide presence of NIs. According to regulations proposed by the Ministry of Health and Medical Education, each hospital must have an active hospital infection control committee. In this regard the Nosocomial Infection Surveillance System (NISS) was initiated in March 2007. NISS is based on a guideline prepared by the Iranian Center of Disease Control (ICDC). The aim of this paper is to report an overview of the results of NISS and discuss details regarding reported NIs by gender, age group and location (hospital wards).

Materials and Methods

This was a prospective surveillance study, the results of which were reported according to NISS guidelines from the ICDC. All hospitals with more than 200 beds were included in the surveillance system regardless to the type of them (governmental or private) and it means that all large hospitals at the country are covered by NISS. Participation of the hospitals in NISS was mandatory. In Iran, 95 out of 830 hospitals (non-random sample) were considered sentinel sites and required to report their NIs cases to ICDC. As such, all provinces are involved in NISS.

All patients diagnosed with NIs are registered, their information recorded and reported to district health centers and then to the ICDC at the end of each month. Each hospital in the NISS sends a NIs reporting form to the district health center for data review and analysis by the public health authorities. At the district level, all data are entered into the ICDC portal site.

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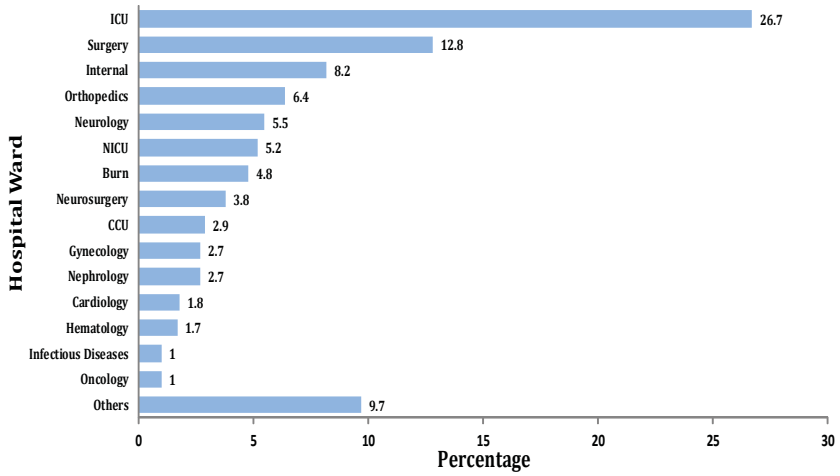

Figure 1. Relative frequencies of four selected nosocomial infections (NIs) according to hospital ward.

Table 1. Frequency of different types of nosocomial infections (NIs) in different age groups.

	n (%)				
Age group (years)	**BSI***	**PNEU***	**SSI***	**UTI***	**Total**
0–4	433 (46)	180 (19)	177 (19)	150 (16)	**940 (100)**
5–14	91 (20)	84 (19)	144 (33)	125 (28)	**444 (100)**
16–64	681 (11)	1470 (24)	2095 (33)	1972 (32)	**6398 (100)**
65+	336 (12)	863 (31)	424 (15)	1152 (42)	**2775 (100)**
Total	**1721**	**2597**	**2840**	**3399**	**10557**

*BSI = bloodstream infection; PNEU = pneumonia; SSI = surgical site infection; UTI = urinary tract infection.

The definition of NIs according to NISS is a patient hospitalized longer than 48 hours with a confirmed infection (clinical and/or laboratory) not present or incubating at the time of admission.[10] Definitions are the same as standard definitions that have been published by the Centers for Disease Control and Prevention.[11]

For the beginning phase of the surveillance in order to have ease of reporting there are only four NIs selected, which comprise more than 70% of all NIs.[10] Cases are registered according to the site of infection so that the following four main types of infections are reported: urinary tract infection (UTI), pneumonia (PNEU), bloodstream infection (BSI) and surgical site infection (SSI). Data pertaining to patients' sex and age along with location (ward of admission) are also recorded in the forms by trained, selected nurses.

We have used central and distributional measures for data analysis in this study. In order to show the difference in measures among the different groups we used the Mann-Whitney tests. All differences were considered statistically significant with $P < 0.05$. We used SPSS (version 16) for data analyses. Confidentiality of the gathered data was maintained and there was no patient identifying information recorded.

Results

During March 2007 – March 2008, a total of 1,879,356 patients were admitted to the selected hospitals. At the same time, there were approximately 10557 reported NIs cases from 95 hospitals across different provinces of Iran. According to the results of 10557 questionnaires, 10105 (96.8%) were from hospitals affiliated with the Ministry of Health, 7 (0.1%) were private hospitals, and 146 (1.4%) were Ministry of Welfare hospitals. There was no type of hospital reported in approximately 299 (2.8%) questionnaires. NIs cases were reported from 1,879,356 patients hospitalized in the above mentioned hospitals (about 5.67 per 1000 hospitalizations). There were 4592 (43.5%) female patients and 5965 (56.5%) males. The mean age of female was 44.84 (SD = 24.67) years and for males it was 42.67 (SD = 24.69; $P = 0.001$). Out of 10557 NIs patients, there were 3399 (32.2%) with UTI, most of whom (2456) were symptomatic. Other types of NIs resulted from SSI (n = 2840; 26.9%), PNEU (n = 2597; 24.6%), and BSI (n = 1721; 16.3%).

The frequency of NI types differed between females and males. In females the numbers of NIs were: UTI (n = 1795; 39%), SSI (n = 1194; 26%), PNEU (n = 884; 19%), and BSI (n = 719; 16%). In males it was: PNEU (n = 1704; 28%), SSI (n = 1649; 28%), UTI (n = 1600; 27%), and SSI (n = 1012; 17%). The relative frequency of detected NIs during the study period according to hospital ward is shown in Figure 1. ICUs (26.7%) had the most NIs, followed by surgery wards (12.8%). The relative frequency of NIs by age group and type of infection is shown in Table 1. The most common type of NIs in patients under the age of 5 years was BSI, in 5 to 64 years it was SSI, whereas UTI was the most common in those over the age of 65 years (Table 1). The most prevalent type of infection in ICUs was PNEU (51%), followed by UTI (25%), BSI (14%), and SSI (10%). In Neonatal ICUs, BSIs (47%) were the most common type of infections followed by PNEU (31%), UTI (15%), and SSI (7%).

Discussion

The advantage of NISS is its countrywide coverage such that in every province there are at least two or three hospitals involved in the surveillance system, which provides an overview of NIs in Iran. However there are some limitations to the NISS. First, the NISS includes only four main NIs, second there is no tracking system for the follow up of discharged patients, and finally the data of hospitalized patients, with the exception of those categorized with NIs, are not gathered. As a result, NISS is able to provide the frequency but not the rate of NIs with regards to gender, age and hospital wards.

According to results from the first year of NIs surveillance in Iran the reported rate of hospital-associated infections was low compared to estimates from other studies. Although the prevalence of NIs reported in several studies ranged from 6% to 28% (USA: 6%, Belgium: 7.1%, Italy: 6.7%, Uganda: 28%, and Shiraz, Iran: 10%), the findings from NISS reported 0.57% for hospital-associated infections in Iran.[12–16] However, this low estimation has been possibly attributed to the weakness of the surveillance system in following up patients after discharge. Follow up is very important for SSI patients, particularly taking into consideration the rapid discharge of elective surgery patients at less than 48–72 hours after admission. These patients are not usually followed. Additionally NISS does not include all NIs therefore under the best of circumstances we could only find a 70% real prevalence of NIs. Finally, The NISS is a routine surveillance system not a scientific survey hence underreporting is common.

The results of our study showed that most reported NIs cases were from the ICU. In two another studies performed in Shiraz (Iran) in 2001 and 2005, most cases were reported from ICUs and burn units,[16,17] which were similar to other studies.[18,19] This was possibly due to more susceptible cases and the longer duration of hospitalizations in these units.

According to our study the most prevalent NIs was UTI. Lyytikäinen et al. in a nationwide study reported the most prevalent hospital-acquired infection was SSI followed by UTI.[9] This difference in results might be due to underreporting of SSI and the difference in selecting hospitals between these studies. In the current study, the only inclusion criterion for hospital selection was the number of beds. However, similarities existed between our findings and those of other studies. For example Reilly et al. conducted a point prevalence study in Scotland in 2005-6 which showed that UTI was the most common NIs, followed by SSI.[20] The main infection in all age groups was UTI, followed by SSI, PNEU and BSI. However the frequency of infections in children less than five years of age differed. In this age group the main infection was BSI followed by PNEU, SSI, and UTI which supported the findings by Rutledge-Taylor et al. in Canada in 2009.[21]

Based on our findings, young children and the elderly might be more affected with NIs than other age groups. However, since we did not have access to the exact numbers of admissions by age we could not confirm this observation. Among the elderly, those with chronic diseases, the immunocompromised, and those with extended hospitalizations in addition to overall higher hospital admission rates could account for increased NIs seen in this population.

Conclusion

According to the results of our study it seems that the sensitivity of NISS compared with studies from other countries[18–22] is low in Iran. We need to conduct a validation study such as a point-prevalence study in order to get more accurately estimate the extent of hospital-acquired infections which would result in better prioritization of allocated resources.[22] Due to the continuity of NISS these findings could be very important in presenting the trend of infections. It can provide important indicators to the responsible authorities to enable planning and evaluation of the infection control activities in hospitals. In addition, NISS is a recently established system and needs strengthening to produce more appropriate results.

Conflict of interest

The authors state that they have no conflict of interest.

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