Tabari Biomedical Student Research Journal

OPEN ACCESS

ORIGINAL: Epidemiological Examination of Hospital Infections in Different Hospital Departments

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ARTICLE INFO

Submitted: 08 Sep 2023
Accepted: 15 Nov 2023
Published: 02 Dec 2023

Keywords:
Epidemiology;
Hospital infections;
E.coli;
Klebsiella

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Citation:
Omraninava M, Khosronejad S, Yekani R, Ari Tabarestani M, Akbari Neserkani F, Mohammadzadeh K. Epidemiological Examination of Hospital Infections in Different Hospital Departments. Tabari Biomed Stu Res J. 2023;5(4):46-54.

10.22034/5.4.46

ABSTRACT

Introduction: The prevalence of hospital infections is a matter of great importance that necessitates the identification of contributing factors and a comprehensive understanding of their epidemiology. Thus, the objective of this investigation was to analyze the epidemiology of hospital infections in various departments of Qaemshahr Valiasr Hospital from 2013 to 2017.

Material and Methods: In order to achieve this, a total of 625 patients admitted to different departments of the hospital were included in the study, and after recording their demographic data, the prevalence of hospital infections was documented. The data was then compared using the Kai Squire and man Whitney tests.

Results: The findings of this study revealed that the prevalence of hospital infection was determined to be 4.5%, and this was found to have a direct and statistically significant correlation with factors such as age, length of hospitalization, diabetes, urinary catheter, and ventilation ($P<0.05$). Additionally, the study identified the lung as the most commonly affected organ, and the bacteria cultured most frequently were E.coli and Klebsiella.

Conclusion: In light of the prevalence of hospital-acquired infections in hospitalized patients, particularly those with prolonged hospitalization, diabetes, urinary catheterization, mechanical ventilation, and advanced age, it is strongly recommended that adequate training be provided to hospital staff and that preventive measures be implemented in high-risk individuals to effectively reduce the occurrence of hospital-acquired infections and their associated complications.

Introduction

Hospital infections, also known as nosocomial infections, pose a significant global challenge (1). These infections are particularly prevalent in developing countries, making them a crucial health issue (2). Hospital infections refer to infections that occur in the hospital setting and are not present during the patient's incubation period upon admission. These infections can be localized or disseminated and are caused by pathogenic reactions associated with the infectious agent or its toxins (3). Global

statistics indicate that over 2 million people suffer from hospital infections annually, with nearly 100,000 deaths attributed to these infections (4). The incidence of hospital infections varies depending on the level of industrial development in a country, ranging from approximately 5% to 10% in developed countries, to 20% to 25% in underdeveloped countries (3). Various studies conducted worldwide have reported hospital infection rates ranging from 4% to 47% (5-7). The incidence of these infections also varies across different countries. For instance, in the United States and Europe, the reported rates range from 3.58% to 11.1% and from 1.6% to 13.2%, respectively. In Brazil, the incidence ranges from 18.9% to 50.7%, while in Colombia, it is reported to be 8.4% (8-13). In England and Ireland, one in every five to ten hospital admissions is associated with hospital infections, with surgical departments and intensive care units being the most affected (14).

A study conducted in hospitals across the country from 2007 to 2008 found that the most common hospital infections were urinary tract infections (32.2%) and blood infections (16.3%), with the highest infection rate observed in the intensive care unit and surgical department (15). Durando et al (16) reported the highest prevalence of hospital acquired infections in Italy, with 30% of urinary tract infections, 26% of respiratory tract infections, 14/8% of blood flow, 11/6% of surgical site, and 6/5% of gastrointestinal tract infections. Another study conducted in Ahvaz (17) found a 41% prevalence of urinary infections, 28% prevalence of respiratory infections, 20/5% prevalence of surgical site infections, and 10/5% prevalence of blood infections.

The most common microorganisms that contribute to hospital infections are enterococci, Escherichia coli, Pseudomonas, and staphylococci, resulting in infections such as mechanical ventilation, arterial catheter, urinary tract, venous catheter, intracranial pressure device, bronchoscopy, and tracheostomy (18). Epidemiological studies have identified several factors associated with an increased risk of hospital infections, including patient age, presence of underlying diseases, length of stay, weakened immune system, and aggressive diagnostic and therapeutic measures. These risk factors can be mitigated through appropriate measures, reducing the risk of hospital infections (19). Hospital infections not only pose a significant threat to patient health, but also result in worse complications, higher mortality rates, and longer hospital stays. According to the United States Department of Health, these infections cause 99,000 deaths annually and impose a significant financial burden, with healthcare costs ranging from 5-10 billion dollars (20,21). Given the importance of hospital infections, it is crucial to identify the underlying causes and develop effective control strategies. By controlling and addressing hospital infections, we can reduce mortality rates, complications, medical interactions, and the average length of hospitalization. Additionally, this can lead to a decrease in hospital costs and an improvement in the overall health and satisfaction of individuals within the community. Therefore, we conducted an epidemiological survey of hospital infections in different departments of the Qaemshahr Valiasr Hospital from 2013 to 2017.

Methods

Research implementation

The study was conducted descriptively and analytically between 2013 and 2017 at the Qaemshahr Valiasr Hospital. All inpatients during the study period were included, and their demographic information (age, gender, cause of hospitalization, inpatient ward, length of hospitalization, pathogen type in patients with a diagnosis of hospital infection, risk factors, type of treatment) was recorded in a designed questionnaire. Information regarding the signs and symptoms of hospital infection was collected according to the NNIS standard for the main types of hospital infections (respiratory, urinary, blood, surgical site, and burns, digestive).

The statistical community

conducted a study on patients admitted to

various departments of the hospital who were diagnosed with hospital infections based on specified codes. The study included patients who showed no signs of infection upon admission and were not in the incubation period of the disease. Patients with fever prior to 48 hours and those with infectious diseases were excluded from the study. The sampling method used was non-financial targeted sampling. The checklist used in the study comprised two parts: patient demographic information and hospital infection information, which were created by the researcher.

Sample size

The required sample size for the study was determined based on a hospital infection prevalence of 7% in hospitalized patients, a confidence level of 95%, and an accuracy level of 2%. Therefore, a minimum of 625 samples were needed for this study.

Method of data analysis

The data analysis was conducted in two parts: descriptive and analytical statistics. The descriptive section involved reporting the abundance and percentage for qualitative variables, as well as the mean and standard deviation for quantitative variables. In the data analysis, the normality of the data was first assessed using the clomogrouph-Smirnoff sample test with the modification of the li li Ferris. If the data followed a normal distribution, parametric methods such as the student's t-test were used. If the data did not follow a normal distribution, the Mann-Whitney test was employed. The K-two test was used for analyzing nominal-scale data, and the Fisher exact test was used when more than 20% of the expected abundance in the tables was less than 5 (Cochran). The software used for this research was IBM-SPSS v. 20, and the significance level was set at less than 5%.

Results

The objective of this study was to investigate the epidemiology of hospital infections in different departments of the Valiyasar Samet City Hospital from 2013 to 2017. A total of 625 patients participated in the study, out of which 28 patients (4.5%) tested positive for hospital infections. Among the participants, 293 (46.9%) were males and 332 (53.1%) were females. The average age of the subjects was 41.85 ± 27.06 years. The prevalence of hospital infections was significantly higher in individuals above the age of 50 compared to those below the age of 50 (6.9% versus 1.9%) (P=0.003). There was no statistically significant difference in the prevalence of hospital infections between genders (P>0.05).

As observed in the aforementioned ***table1***, there was no statistically significant difference in the occurrence of hospital infections when considering the individuals' medical background of blood pressure and heart disease (P>0.05). Nevertheless, it was revealed that among individuals diagnosed with diabetes, the prevalence of hospital infections showed a significant increase (16/8 % vs. 1%) (P<0.001).

Table 1. prevalence of hospital infections by background disease history

infection	Sickness		negative	Positive	Total	P-value
blood pressure	No	Number	463	۱8	48۱	0/103
		Percent	96/3%	3/7%	100/0%	
	Yes	Number	134	10	144	
		Percent	93/1%	6/9%	100/0%	
diabetes	No	Number	483	5	488	<0/001
		Percent	99/0%	1/0%	100/0%	
	Yes	Number	114	23	137	
		Percent	83/2%	16/8%	100/0%	
heart problems	No	Number	496	21	517	0/269
		Percent	95/9%	4/1%	100/0%	
	Yes	Number	101	7	108	
		Percent	93/5%	6/5%	100/0%	

Table 2. prevalence of hospital infections by inpatient ward.

infection		Variable	negative	Positive	Total	P-value
the part	intensive care	Number	26	14	40	<0/001
		Percent	65/0%	35/0%	100/0%	
	Internal	Number	159	3	162	
		Percent	98/1%	1/9%	100/0%	
	surgery	Number	186	6	192	
		Percent	96/9%	3/1%	100/0%	
	Women	Number	102	3	105	
		Percent	97/1%	2/9%	100/0%	
	children	Number	124	2	126	
		Percent	98/4%	1/6%	100/0%	

The ***table2*** displayed above demonstrates that the occurrence of hospital infections was most prevalent in the intensive care unit, with a rate of 35%. Conversely, the pediatric unit exhibited the lowest prevalence at 1/6%, which was found to be statistically significant with a p-value of less than 0.001.

Based on the aforementioned ***table1***, there was no statistically significant difference observed in the prevalence of hospital infections related to venous catheters (P>0.05). However, it was discovered that patients with urinary catheters exhibited a significantly higher prevalence (17/9% versus 1/4%) (P<0.001). Moreover, a substantial increase in prevalence was observed amongst patients who were subjected to ventilation (52% versus 2/5%) (P<0.001).

As seen in the ***table4*** above, the prevalence is significantly increased in patients who were hospitalized for more than 7 days (11/8% versus 0/5 %) (P<0.001).

As depicted in the illustration, the prevailing microorganisms consisted primarily of E.coli (25%), followed by Klebsiella (21/4%) and sodomonas (17/9%). The most commonly affected areas were respiratory infections (42.9%), succeeded by urinary infections (28.6%), surgical site wound infections (17.9%), and blood infections (10.7%)(***Figure1***).

Table 3. Prevalence of hospital infections based on hospital interventions

infection		Variable	negative	Positive	Total	P-value
Urinary catheter	No	Number	501	7	508	<0/001
		Percent	98/6%	1/4%	100/0%	
	Yes	Number	96	21	117	
		Percent	82/1%	17/9%	100/0%	
venous catheter	No	Number	74	1	75	0/235
		Percent	98/7%	1/3%	100/0%	
	Yes	Number	523	27	550	
		Percent	95/1%	4/9%	100/0%	
ventilation	No	Number	585	15	600	<0/001
		Percent	97/5%	2/5%	100/0%	
	Yes	Number	12	13	25	
		Percent	48/0%	52/0%	100/0%	

Table 4. prevalence of hospital infections by length of stay.

infection		Variable	negative	Positive	Total	P-value
Hospitalization period	Less than 7 days	Number	403	2	405	<0/001
		Percent	99/5%	0/5%	100/0%	
	7 days and more	Number	194	26	220	
		Percent	88/2%	11/8%	100/0%	

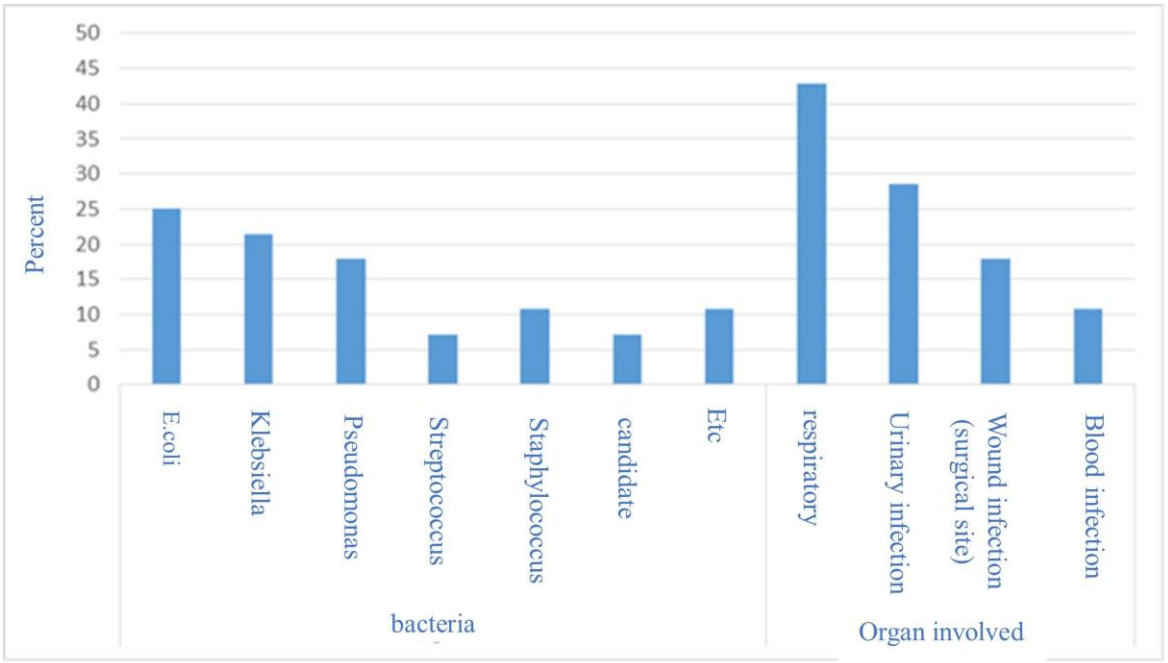

Figure 1. frequency of bacterial and organ types involved in patients with hospital infection

Discussion

A total of 625 patients were enrolled in the study, out of whom 28 patients (4.5%) were ultimately identified as having positive cultures. The predominant bacterial species were Escherichia coli (25%), followed by Klebsiella (21.4%) and sodomonas (17.9%). The most commonly affected infection types were respiratory infections (42.9%), urinary infections (28.6%), surgical site wound infections (17.9%), and blood infections (10.7%). Our investigation revealed a direct and significant association between hospital-acquired infections and factors such as age, length of stay, diabetes, urinary catheterization, and mechanical ventilation. However, the prevalence of hospital-acquired infections did not show any statistically significant correlation with gender, history of blood pressure, heart disease, venous catheterization, or the season of hospitalization.

In the study conducted by Kołpa et al, the objective was to investigate the occurrence, microbiological factors, and Risk Factors of hospital infections in the intensive care unit over a span of 10 years (from 2007 to 2016) in Poland. A total of 1,849 patients were admitted to the hospital during this period, for a cumulative duration of 17,599 days in the intensive care unit. Out of these cases, 510 (27.6%) resulted in hospital infections, with a rate of 29% per 1,000 days of hospitalization. The most prevalent type of infection was pneumonia associated with tubing, with an incidence rate of 15.2 cases per 1,000 days of ventilation. This was followed by catheterization-induced infections, with a ratio of 8 cases per 1,000 catheterizations, and urinary tract infections due to ulceration, with a ratio of 3 cases per 1,000 catheterizations. Among the isolated microorganisms, 25% were Acinetobacter, 9% were Escherichia coli, 15% were coagulase-negative Staphylococcus, 8% were Pseudomonas, 7% were Klebsiella pneumoniae, 6% were Candida albicans, and 87% of Acinetobacter were Acinetobacter baumannii, which displayed higher resistance to drug treatments. The study findings revealed that pneumonia had the highest frequency as a hospital infection (22).

However, it should be noted that the findings of the study on hospital infections were significantly higher than our own study due to differences in the study population. While our study included all hospital departments, the aforementioned study focused solely on intensive care departments. Similar to our study, respiratory infections were the most common type of infection. However, in our

study, Acinetobacter was the most frequently isolated microorganism, followed by Pseudomonas, whereas in the aforementioned study, Pseudomonas was the predominant microorganism. This discrepancy can be attributed to variations in the study location and the specific department under investigation.

In a separate investigation carried out by Zhao et al. in China, the objective was to examine the risk factors and prevention methods for hospital infections in hospitalized children between the years 2015 and 2017. The study included a total of 1526 children (892 boys and 634 girls) who were admitted to the hospital. Through multivariate logistics analysis, 54 cases (accounting for 3.53% of the total) of hospital infections were identified. The independent risk factors for hospital infections included the age of children under 3 years, improper feeding, hospitalization exceeding 5 days, and aggressive acts towards children. The most commonly identified infections were upper respiratory system infections (16 cases), digestive infections (15 cases), lower respiratory system infections (12 cases), urinary infections (3 cases), blood culture infections (5 cases), and other infections (3 cases). These findings are consistent with the prevalence of infections observed in our own study. Furthermore, lung infections were found to be the most commonly acquired infections in the hospital setting(23).

Similarly, in the study conducted by Shojaei et al. in one of the hospitals in Qom during 2011, a total of 12,668 hospitalized patients were examined. Out of these patients, 97 cases (with an average prevalence of 0.76%) were found to have hospital infections. The highest infection rates were observed in surgical site infections (53.9%) and respiratory infections (35%), whereas the lowest rates were observed in urinary infections (6%), burns (5.1%), and blood infections (no reported cases). The highest infection rate was observed in the ICU ward (56.56% or 42 cases) followed by the burn ward (5.65% or 17 cases). The prevalence of infection in this study was significantly lower than in our own study, which could be attributed to differences in sample size, demographic indicators of patients, entry and intensive care criteria, and various other factors.

In another study conducted in Pune, India in 2014, a total of 1,815 patients were surveyed, with each patient staying for a total of 1,815 days. The study found a high number of withdrawals and differences in sampling, control of distortion effects, and the location and timing of the study. Thus, it is evident that there are noticeable differences in the prevalence of hospital infections between different studies(24).

In the study conducted by Nair and colleagues, the main objective was to identify and assess the risk factors associated with hospital infections in patients who underwent surgery for a period of 7-3 days. The findings revealed that the prevalence of hospital infections was 76/3%. Specifically, the surgical ICU had a prevalence of 25%, the medical ICU had a prevalence of 20%, and the pediatric sector had a prevalence of 17/12%. The study established a direct correlation between long-term patient residency, mechanical ventilation, the use of urinary catheters, and exposure to the central air conditioning system, and the high incidence of hospital infections. Furthermore, it is worth noting that the prevalence of infection in this study was similar to our own study, albeit slightly lower. This variation can be attributed to the larger sample size of patients in intensive care in our study, which subsequently increased the prevalence of hospital infections in our findings. In contrast, other departments had a prevalence rate of less than 5%. However, similar to the aforementioned study, our own investigation also demonstrated a direct link between long hospital stays, mechanical ventilation, and urinary catheters to the high incidence of hospital infections(25).

In the study conducted by Bijari and colleagues, the primary aim was to determine the occurrence of hospital infections and the associated factors in hospitals located in South Khorasan. The research involved an examination of patient demographic information, inpatient ward data, pathogen type, and risk factors among all patients diagnosed with hospital infections in hospitals

with over 100 beds. The analysis revealed that a total of 358 patients were diagnosed with hospital infections, resulting in an incidence rate of 9/0% in provincial hospitals. The ICU department had the highest incidence rate at 3/17%. Pneumonia infection was the most common, accounting for 43% of cases, followed by urinary infections at 1/15%. In 5/33% of cases, the cultivation result was negative. Among the pathogens causing infections, Klebsiella species accounted for 8/12% of cases, while sodomonas aeroginosa accounted for 8/9%. The most prevalent risk factors associated with hospital infections were urinary catheterization (4/70%), suction (8/66%), and the use of a chip tube (2/54%). Notably, 24% of patients succumbed to the infections. It is important to highlight that the prevalence of infection in this study was significantly lower than our own findings. This discrepancy can be attributed to differences in sample size, demographic indicators of patients, entry and exit criteria, sampling techniques, control of confounding variables, and variations in location and time of the study(26).

Conclusion

The findings of the current study indicated that the incidence of nosocomial infections was recorded at 4.5%, a figure that displayed a substantial and direct correlation with age, length of stay in the hospital, diabetes, urinary catheterization, and ventilation. Our study further revealed that the lungs were the most frequently affected organ, and the predominant bacterial species cultured were aclaia and Klebsiella. Consequently, given the prevalence of nosocomial infections among hospitalized individuals, particularly those with prolonged hospital stays, diabetes, urinary catheterization, ventilation, and advanced age, it is strongly advised that hospital staff receive appropriate training and that preventive measures be implemented for high-risk individuals in order to mitigate the occurrence of nosocomial infections and minimize associated complications.

Acknowledgments

We express our gratitude to Islamic Azad University – Sari Branch for their valuable contribution to this study.

Conflicts of interest

The authors declare no conflict of interest.

Authors' contributions

All authors were involved in the conception and design, analysis and interpretation of the data, drafting of the manuscript and revising it critically for intellectual content, approved the final version for submission, and agreed to be accountable for all aspects of the work.

Funding

This research received no external funding.

References

1. Ahoyo TA, Bankole HS, Adeoti FM, Gbohoun AA, Assavedo S, Amoussou-Guenou M, et al. Prevalence of nosocomial infections and antiinfective therapy in Benin: results of the first nationwide survey in 2012. Antimicrob Resist Infect Control. 2014;3(1):17.
2. Askarian M, Mahmoud H, Assadian O. Incidence of Nosocomial Infections in a Big University Affiliated Hospital in Shiraz, Iran: A Six-month Experience. Int J Prev Med. 2013;4(3):366–372.
3. Masoomi asl H, Zahraiee SM, Majidpoor A, Nateghian AR, Afhami SH, Rahbar AR, et al. National guideline of nosocomial infections surveillance. 2nd ed. Tehran: Center for Communicable Disease Control, Ministry of Health. 2007.
4. Reed D, Kemmerly SA. Infection control and prevention: a review of hospital-acquired infections and the economic implications. Ochsner J. 2009;9(1):27-31.
5. Lee MK, Chiu CS, Chow VC, Lam RK, Lai RW. Prevalence of hospital infection and antibiotic use at a university medical center in Hong Kong. J Hosp Infect.

2007;65(4):341-7.
6. Danchaivijitr S, Judaeng T, Sripalakij S, Naksawas K, Plipat T. Prevalence of Nosocomial Infection in Thailand 2006. J Med Assoc Thai. 2007;90(8):1524–29.
7. Kallel H, Bahoul M, Ksibi H, Dammak H, Chelly H, Hamida CB, et al. Prevalence of hospital-acquired infection in a Tunisian hospital. J Hosp Infect. 2005;59(4):343-7.
8. Stoll BJ. Infections of the neonatal infant. In: Behrman RE, Kliegman RM, Jenson HB, editors. Nelson textbook of pediatrics. 17th ed. Philadelphia: WB Saunders.2004: 623-40.
9. Raymond J, Aujard Y. Nosocomial infections in pediatric patients: A European, multicenter prospective study. European Study Group. Infect Control Hosp Epidemiol. 2000;21(4):260-3.
10. Urrea M, Iriondo M, Thio M, Krauel X, Serra M, et al. A prospective incidence study of nosocomial infections in a neonatal care unit. Am J Infect Control. 2003;31(8):505-7.
11. Orsi GB, Ettorre G, Panero A, Chiarini F, Vullo V, Venditti M. Hospital acquired infection surveillance in a neonatal intensive care unit. Am J Infect Control. 2009;37(3):201-3.
12. Nagata E, Brito AS, Matsuo T. Nosocomial infections in a neonatal intensive care unit: Incidence and risk factors. Am J Infect Control.2002; 30(1):26-31.
13. Efird MM, Rojas MA, Lozano JM, Bose CL, Rojas MX, Rondón MA, et al. Epidemiology of nosocomial infections in selected neonatal intensive care units in Colombia, South America. J Perinatol. 2005;25(8):531-6.
14. Smyth ET, McIlvenny G, Enstone JE, Emmerson AM, Humphreys H, Fitzpatrick F, et al. Four country healthcare-associated infection prevalence survey 2006: Overview of the results. J Hosp Infect. 2008;69(3):230-48.
15. Zahraei SM, Eshrati B, Masoumi Asl H, Pezeshki Z. Epidemiology of four main nosocomial infections in Iran during March 2007 - March 2008 based on the findings of a routine surveillance system. Arch Iran Med. 2012;15(12):764-6.
16. Durando P, Icardi G, Ansaldi F, Crimi P, Sticchi C, Compagnino F, et al. Surveillance of hospital-acquired infections in Liguria, Italy: Results from a regional prevalence study in adult and pediatric acute-care hospitals. J Hosp Infect.2009;71(1):81-7.
17. Ghorbani Birgani A, Asadpoor S. Nosocomial infections in the intensive care unit of Ahvaz Arya hospital (2008-2009). Modern Care J. 2011;8(2):85-93.
18. Brunner LS, Smeltzer SC. Brunner & Suddarth's textbook of medical surgical nursing. 12th ed. Philadelphia: Wolters Kluwer/Lippincott Williams & Wilkins. 2010.
19. Sheng WH, Wang JT, Lin MS, Chang SC. Risk factors affecting in-hospital mortality in patients with nosocomial infections. J Formos Med Assoc. 2007;106(2):110-118.
20. Stone PW, Hedblom EC, Murphy DM, Miller SB. The economic impact of infection control: Making the business case for increased infection control resources. Am J Infect Control.2005;33(9):542-7.
21. Klevens RM, Edwards JR, Richards CL Jr, Horan TC, Gaynes RP, Pollock DA, et al. Estimating health care-associated infections and deaths in U.S. hospitals, 2002. Public Health Rep. 2007;122(2):160-6.
22. Kołpa M, Wałaszek M, Agnieszka Gniadek A, Wolak Z. Incidence, Microbiological Profile and Risk Factors of Healthcare-Associated Infections in Intensive Care Units: A 10 Year Observation in a Provincial Hospital in Southern Poland.Int J Environ Res Public Health.2018;15:112.
23. Zhao X, Feng L, Wang J. Risk factors and prevention countermeasures of nosocomial infection in hospitalized children. Biomed Res. 2017;28(21): 9429-33.
24. Shojai S, Rahimi T, Amini M, Shams S. Investigation of hospital-

acquired infections in Nikooyi Hospital, Qom city, 2011. Qom Univ Med Sci J. 2015;9(4):64.

25. Nair V, Sahni AK, Sharma D, Grover N, Shankar S, Chakravarty A. Point prevalence & risk factor assessment for hospital-acquired infections in a tertiary care hospital in Pune, India. Indian J Med Res. 2017;145:824-32.

26. Beijari B, Abbasi A, Hemati M, Karabi K. Hospital-acquired infections and associated factors in hospitals of South Khorasan province. Iran J Med Microbiol. 2014;8(4).