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Research Article

THE PREVALENCE AND ASSOCIATED RISK FACTORS OF HOSPITAL ACQUIRED INFECTIONS (HAI) IN SALMANIYAH MEDICAL COMPLEX, IN BAHRAIN

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A B S T R A C T

The aim of this study is to provide basic data that will contribute to preventive measures to reduce the spread of hospital acquired infection (HAI) in Salmaniyah Medical Complex (SMC). The objectives of this study are to find out the prevalence of HAI and associated risk factors. The study was conducted in Salmaniyah Medical Complex in the year 2014. It is a cross sectional study that was conducted on patients who were admitted in SMC for more than 48 hours. Basic information like gender, age, duration of hospitalisation and associated risk factors were gathered from the patients' files. A database of patients was obtained and associated risk factors were identified. The main results were that the prevalence of HAI is 10.7 % and highest among patients above 60 years old. As age increases the length of stay increases. Mechanical ventilation was by far the highest risk factor of HAI. Preventive measures and management planes are highly recommended.

INTRODUCTION

Hospital-acquired infections (HAI) are a major public health problem all over the World, but particularly in developing nations.[8]

Nosocomial infection defined as an infection originated from the hospital, was neither present nor incubated at the time of admission to the hospital and appeared 48-72 hours or more after admission.[4]

In the United States, there are an estimated 2 million cases of health associated infections annually affecting about 10% of American hospital patients. In Europe there are 6.1% in Norway and 4.9% in Italy. In the Middle East, the United Arab Emirates gave a rate of 4.7%, prevalence survey in King Fahd National Guard Hospital in Riyadh, Saudi Arabia on 562 patients revealed 8% rate. In Bahrain Defence Force Hospital, Four health-care associated infections were recorded – a prevalence of 0.87% [3]

Hospital-acquired infections have several impacts on health such as disability and emotional stress of the patient and their families leading to reduced quality of life. Nosocomial infections are also one of the leading causes of death. They also have an eminent burden on economy.

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The greater the age of patients admitted to a hospital, the greater the prevalence of chronic diseases among hospitalised patients and the greater the use of diagnostic and therapeutic procedures which affect the host immunity. This will provide ac greater risk factor for developing nosocomial infections.

Organisms causing nosocomial infections can be transmitted to the community through discharged patients, staff, and visitors. If organisms are multi-resistant, they may cause significant disease in the community [1]. Based on these studies we want to determine the prevalence of hospital acquired infections and determine the associated risk factors.

LITERATURE REVIEW

Nosocomial infection also called "hospital acquired infection": can be defined as an infection acquired in a hospital by a patient who was admitted for a reason other than that infection (1)(10). It also can be defined as an infection occurring within 48 hours of hospital admission, three days of discharge or 30 days of an operation..(2) Other studies differentiate nosocomial infections from community acquired infections as any infection obtained more than 48 hours after being admitted to a hospital; whereas community acquired infections are defined as any infection obtained within 48 hours of being admitted to a hospital (6).

A study conducted in BDF hospital in Bahrain shows that health care associated infections can be subdivided into 3 categories: iatrogenic (pathogens that are present on medical

personnel, invasive procedures and antibiotic abuse), organisational (contaminated air-conditioning or water systems, staffing and physical layout of the facility)and patient related (severity of illness, underlying immunocompromised state and length of stay).

In this study, the prevalence of four health-care associated infections were recorded - a prevalence of 0.87% .Two of the infections were surgical site infections while the other two were skin infections (3)

A study done in King Fahad National Guard Hospital in Riyadh showed that the overall rate of hospital acquired infection is 8% (5).InUniversity Medical Centre of Rabat, Morocco, out of 1195 patients involved, occupancy rate was 51%. The prevalence of HAI was 10.3%(4).

An oxford study revealed that nosocomial infections are related to several risk factors which can be related to underlying health status (advanced age, malnutrition, alcoholism, heavy smoking, chronic lung disease, diabetes) or to acute disease processes (such as surgery, trauma and burns) or to invasive procedures (endotracheal or nasal intubation, central venous catheterization, surgical drains, nasogastric tubes, tracheostomy, urinary catheter) or finally they could be related to treatment (blood transfusion, recent antimicrobial therapy, immunosuppressive treatments, stress ulcer prophylaxis, recumbent position, parental nutrition, length stay) (2). A study done in Al-Hada Armed Forces Hospital, Taif, Saudi Arabia during the year 2004 on 1382 patients showed that 668 of them (48.3%) had nosocomial infection and 714 (51.7%) had community-acquired infection. Among those who developed nosocomial infections, 216 (32.3%), 172 (25.7%) and 124 (18.6%) had respiratory tract (RTI), urinary tract (UTI) and blood infections (BI) respectively. Surgical site infection (SSI) was reported in 86 cases (12.9%). Gram-positive organisms were reported in 31.8%. MRSA (Methicillin-resistant S. aureus) was the commonest pathogens (10.2%), followed by coagulase negative staphylococci (8.5%) and MSSA (Methicillin-susceptible S. aureus, 7.4%). While Gram-negative organisms were reported in 66.2%, E. coli was the commonest (22.3%), followed by Pseudomonas aeruginosa (17.6%) and Klebsiella pneumoniae (9.9%). Acinetobacter spp. and MRSA were highly sensitive to Imipenem (88.6%) and Vancomycin (98.5%) respectively. E. coli were highly sensitive to most of the antimicrobial agents except ampicillin (26.6%) [7] [8].

A one-day point prevalence survey was conducted on May 19, 2003 at the King Fahad National Guard Hospital in Riyadh, showed that the risk of developing a hospital acquired infection was 9.1 times higher among patients who were admitted to the ICU in comparison to those admitted to non-ICU wards . Also this study showed that the chance of developing nosocomial infections was equal among males and females or among the different age groups (5). Despite a study done on 495 patients with diagnosed infectious disorders at King Abdulaziz University Hospital during a five- year study; one in eleven admissions were for an infectious disease. Of these patients 53.9% were males. The age group, 26-45 years had the highest prevalence (39.8%), followed by the age groups 13-25 years (23.3%) and 46-65 years (22.7%). The least age group affected was above 65 years (14.3%)(6).

Hospital-acquired infections have several impacts on health and economical burden and related to several risk factors. The increased length of stay of infected patients is the greatest contributor to cost. One study showed that the overall increase in the duration of hospitalisation for patients with surgical wound infections was 8.2 days, ranging from 3 days for gynaecology ward to 9.9 for general surgery department and 19.8 for orthopaedic surgery department. Prolonged stay not only increases the financial burden on patients or health insurance companies, but also negatively affects their financial status due to work loss.

The increased use of drugs, the need for isolation and the use of additional laboratory and other diagnostic studies also contribute to increased costs.

There are national and hospital programs in order to prevent developing hospital acquired infections .The major preventive effort should be focused on hospitals and other health care facilities. Risk prevention for patients and staff is a concern of everyone in the facility, and must be supported at the level of senior administration. A yearly work plan to assess and enhance good health care, appropriate isolation, sterilisation, and other practices, staff training, and epidemiological surveillance should be developed.

Hospitals must provide sufficient resources to support the prevention of developing hospital-acquired infections (HAI)[1].

Study aim and objective

Aims

To prevent the spread of hospital acquired infections in Salmaniyah Medical Complex in Bahrain.

Objectives

1. To access the Prevalence of hospital acquired infection.
2. To identify the associated risk factors for hospitalacquired infection.

MATERIAL AND METHODS

Data sources/collection

It was decided to conduct the study on a sample of hospitalised patients in Salmaniyah Medical Complex. It was chosen for our study implementation in this research because it is the major representative of hospitals in Bahrain, admitting patients of all nationalities.

Type of study

A cross-sectional study was conducted during August 2014 on 300 patients who stayed in Salmaniyah Medical Complex for more than 48 hours.

The sampling technique

For data collection, a convenient sampling technique was used dividing the group into smaller groups and each group responsible for the collection of information from specific wards. The sample size which is 300 patients was taken randomly and the data was collected during 3 weeks.

Study instruments

A checklist was obtained from WHO with some modifications. We deleted a few questions that were not relevant to our aim. And this is based on information obtained from the literature review, which served the aims and objectives of this study.

The checklists were distributed among most of Salmaniyah departments.

The following are the various parts of the checklist

- Demographic characteristics of patients (age, gender)
- Date of administration and duration of hospitalisation.
- Questions related to risk factors, types of nosocomial infection and symptoms.

The checklist
Unit:
Unit Specialty:

Patient

Age:
Gender: Male Female
Date of admission:
Date of filling the checklist:
Patients Exposure
Surgical procedure (during the last month) yes No
Urinary catheters yes
No
Mechanical Ventilation yes
No
Intravenous catheters yes
No
Antibiotics yes
No
If yes, prescription for:
Prophylaxis Therapy Other_____
Nosocomial infections
Do you have any of these symptoms
Fever – Cough – Expectoraion – Malaise – Tachycardia – Any discharge

Have you been diagnosed with a nosocomial infection yes
No
If yes, fill the following:
Surgical site infection yes No
Urinary tract infection yes No
Pneumonia yes No
Other respiratory infection yes No
Blood stream infection yes No
Other _____

Ethical consideration

Prior to the implementation of the study and to ensure the confidentiality and the privacy of the information, ethical approvals were seek from

1. Study approval was granted from CMMS research committee in AGU.
2. A request was sent to the Ministry of Health research committee in Bahrain to get access to the patients' files.
3. Since the study was conducted in Salmaniyah Medical Complex, an official letter was shown to the head of nurses for granting permission in order to implement the study.
4. It was decided among the group members that all the information should be dealt with securely with a high level of confidentiality and secrecy.

Pilot Study

A pilot study conducted on 10 patients who stayed >48 hours in internal medicine, surgery and urology departments. It was aimed to test the checklist with regards to its clarity, relevancy to our objectives, easiness of filling, and time taken by us to complete it.

Depending on the results obtained from the pilot study we were assured that the checklist was relevant to our aim.
The results from the pilot study were not included in the final result.

Data entry and statistical analysis

After collection of data from Salmaniyah Medical Complex, the checklist papers were double checked to find out the uncompleted ones and if there were any missing answers.

The data were entered in the PC using the Statistical Package for Social Science (SPSS) version 21. Guidance in this process was provided by a statistician and IT specialist. Data were analyzed to include

1. Mean and standard deviation which was computed for the age of the patients.
2. Cross-tabulations were done between nosocomial infection and each of unit specialty, age, and gender for the patients.
3. Cross-tabulation was also done between age and length of stay for the patients with nosocomial infection.
4. Chi-Square test was used to decide whether there is a significant relationship between nosocomial infection and each of age and gender.
5. Binary logistic regression was used to identify the risk factors of nosocomial infection.
6. A P-value ≤ 0.05 was considered significant.

WHO. 2002

RESULTS

The data was analyzed using statistical package for social sciences (SPSS, version 21).

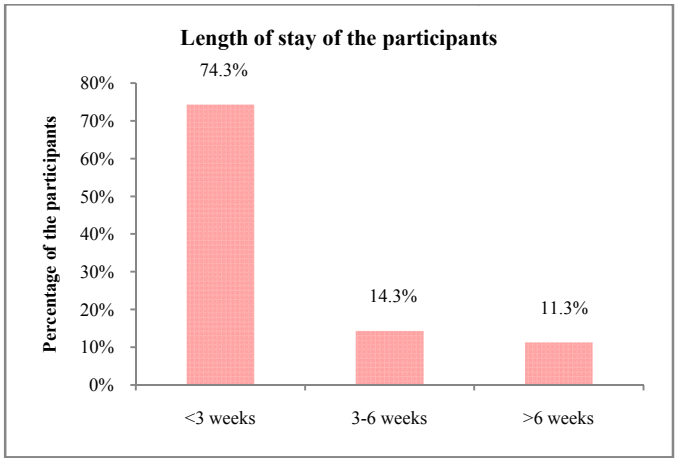
A total of 300 patients of all ages were collected from Salmaniyah Medical Complex, who were hospitalized for 72 hours and more, covering all departments.

Table 1 shows the highest number of patients (a total of 74) were taken from the surgery department while only one patient was taken from the ophthalmology department.

Unit specialty		
	n	**%**
Oncology	15	5.00%
Nephrology	12	4.00%
Neurology	10	3.30%
Cardiology	9	3.00%
ENT	8	2.70%
Peadiatrics	18	6.00%
Urology	9	3.00%
Ophthalmology	1	0.30%
Medicine	21	7.00%
Hematology	29	9.70%
Surgery	74	24.70%
Obstetric & Gynecology	31	10.30%
Respiratory	20	6.70%
Orthopedics	27	9.00%
GI	16	5.30%
Total	300	100.00%

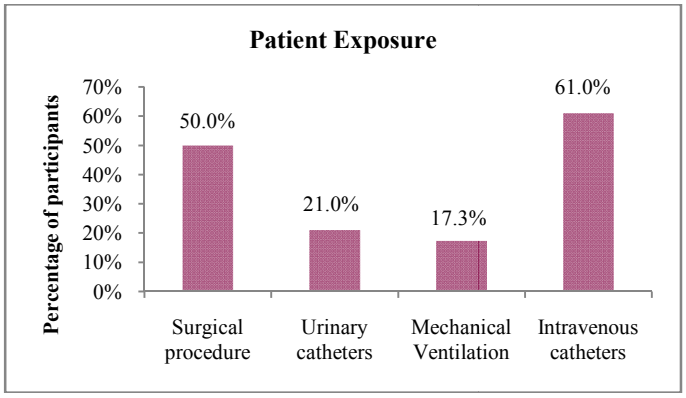
Table 2 shows the mean age of the sample of patients admitted > 48 hours is 42.7 ± 20.8

	Mean	SD
Age (in years)	42.7	20.8



Graph 1 shows that 74.3 % of the data was collected from patients admitted < 3 weeks.

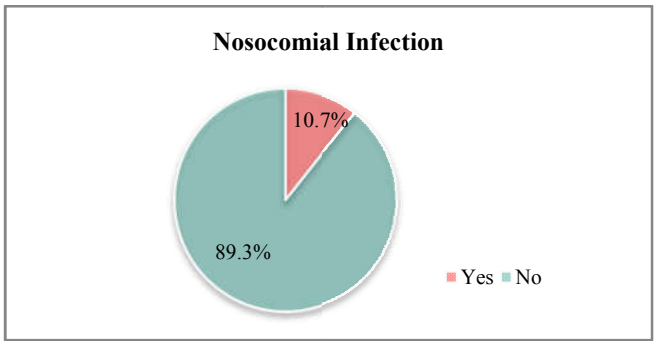
Patient Exposure			
		n	%
Surgical procedure	Yes	150	50.00%
	No	150	50.00%
Urinary catheters	Yes	63	21.00%
	No	237	79.00%
Mechanical Ventilation	Yes	52	17.30%
	No	248	82.70%
Intravenous catheters	Yes	183	61.00%
	No	117	39.00%



Graph 2 and table 3 reveals that 61% of the patients (around 183) in our sample were on intravenous catheters, also half of our sample had surgery.

Table 4 shows that 189 of the patients were taking antibiotics and 68.3% of them were taking the antibiotics for therapy.

Taking antibiotics and prescription			
		n	%
Antibiotics	Yes	189	63.00%
	No	111	37.00%
Prescription	Prophylaxis	60	31.70%
	Therapy	129	68.30%



Graph 3 reveals a prevalence of 10.7 % of nosocomial infection detected by our study.

Table 5 shows that out of 32 patients (which presents 10.7%) with a nosocomial infection, 10 had pneumonia while 9 had other respiratory infections.

Nosocomial infection			
		n	%
Nosocomial infection	Yes	32	10.70%
	No	268	89.30%
Surgical site infection	Yes	3	9.40%
	No	29	90.60%
Urinary tract infection	Yes	7	21.90%
	No	25	78.10%
Pneumonia	Yes	10	31.30%
	No	22	68.80%
Other respiratory infection	Yes	9	28.10%
	No	23	71.90%
Blood stream infection	Yes	5	15.60%
	No	27	84.40%

Table 6 reveals that the prevalence of nosocomial infection within the neurology department alone is 60%. While within the respiratory department, it is 50%.

Nosocomial infection & Unit specialty					
		Nosocomial infection			
		Yes		No	
		n	%	N5	%
Unit specialty	Oncology	1	6.70%	14	93.30%
	Nephrology	2	16.70%	10	83.30%
	Neurology	6	60.00%	4	40.00%
	Cardiology	1	11.10%	8	88.90%
	ENT	1	12.50%	7	87.50%
	Pediatrics	1	5.60%	17	94.40%
	Urology	2	22.20%	7	77.80%
	Ophthalmology	0	0.00%	1	100.00%
	Medicine	3	14.30%	18	85.70%
	Hematology	0	0.00%	29	100.00%
	Surgery	3	4.10%	71	95.90%
	Obstetric & Gynecology	0	0.00%	31	100.00%
	Respiratory	10	50.00%	10	50.00%
	Orthopedics	0	0.00%	27	100.00%
	GI	2	12.50%	14	87.50%

Table 7 shows that there a difference in the prevalence of nosocomial infection between age groups; and as age increases, the prevalence increases; but this difference is not significant because the p-value of the chi square test is equal to 0.169 which is more than 0.05.

Age and Gender & Nosocomial infection						
		Nosocomial infection				Chi-Square P-value
		Yes		No		
		n	%	n	%	
Age (in years)	<15	1	3.80%	25	96.20%	0.169
	16-30	5	7.10%	65	92.90%	
	31-45	5	7.90%	58	92.10%	
	46-60	10	12.50%	70	87.50%	
	>60	11	18.00%	50	82.00%	
Gender	Male	21	13.50%	135	86.50%	0.103
	Female	11	7.60%	133	92.40%	

The difference is also not significant between males and females (p-value 0.103).

Table 8 shows that as age increases, the length of stay increases, which is apparent in patients above 60 years old (out of 11 patients, 9 stayed more than 6 weeks). In contrast, all patients less than 15 years old stayed less than 3 weeks.

Age & Length of stay (for who has nosocomial infection)

		Length of stay					
		<3 weeks		3-6 weeks		>6 weeks	
		N	%	n	%	n	%
Age (in years)	<15	1	100.00%	0	0.00%	0	0.00%
	16-30	2	40.00%	0	0.00%	3	60.00%
	31-45	3	60.00%	0	0.00%	2	40.00%
	46-60	2	20.00%	4	40.00%	4	40.00%
	>60	2	18.20%	0	0.00%	9	81.80%

Table 9 reveals that according to the p-value and odd ratio only mechanical ventilation is a risk factor.

Logistic Regression of Nosocomial infection and Risk Factors

	P-value	OR	95% C.I. for OR	
			Lower	Upper
Surgical procedure	0.538	1.307	0.558	3.063
Urinary catheters	0.129	2.238	0.791	6.332
Mechanical Ventilation	0	10.371	3.74	28.759
Intravenous catheters	0	0.164	0.064	0.424

DISCUSSION

A study of health care associated infection rates done by RCSI in Bahrain Defense hospital on 500 medical records revealed a prevalence of 0.87 % which is lower than recorded in most published studies [3]. A prevalence survey in King Fahd National Guard Hospital in Riyadh, Saudi Arabia on 562 patients revealed 8% rate [5]; however in our study the point prevalence of nosocomial infection was 10.7%, which is comparably a high prevalence.

The higher prevalence in SMC compared to BDF could be the result of the fact that SMC is the main governmental hospital in Bahrain and most health centers around the kingdom refer patients to it, most expatriate workers are admitted into SMC and hygienic practices are carried out more precisely in BDF . Our results showed the highest prevalence of nosocomial infection was among those above 60 years old, which is predictable and reasonable due to several factors such as deteriorated immunity and the presence of many disease.

The results also showed that as age increases, the length of stay increases which is supported by a study done in King Fahd National Guard Hospital in Riyadh [5]. Most of the patients with nosocomial infection were found to have respiratory infections primarily pneumonia (31.3% had pneumonia while 28.1% had other respiratory infections) which maybe due to crowding, inappropriate disinfection and contaminated tubes, no routine changes in respirator tubing and infected medical staff [1].

The prevalence of nosocomial infection was found to be the highest within the neurology department (60% of the patients inside the neurological ward) which may have been caused by underlying diseases. The prevalence within the respiratory ward was also high (50%).

Logistic Regression was used to identify the risk factors for nosocomial infection. The P-value in the table 9 shows that the only risk factor is mechanical ventilation (P-value = 0.00, OR= 10.37). Which is supported by a study done in King Fahad Hospital which showed that there is a definitive relation between mechanical ventilation and nosocomial infection.

Surgical procedures and urinary catheters are not risk factors because their P-values are greater than 0.05. Also, intravenous catheters are not a risk factors although their P-value is less than 0.05 because their OR = 0.164, which is less than 1.

Table 9 shows that the OR for mechanical ventilation is 10.371. This means that a patient with mechanical ventilation is 10.371 times more likely to get a nosocomial infection than a patient without mechanical ventilation.

The 95% confidence interval for OR of mechanical ventilation is (3.74, 28.459) and this means that we are 95% confident that this interval contains the odd ratio.

CONCLUSION AND RECOMMENDATION

As a conclusion, the hospital acquired infection prevalence is high in this study, that's why a future prevention program in this hospital "Salmaniyah Medical Hospital" should focus on patients with longer length of stay, mechanical ventilation, and overprescribing antibiotics because of their highest risk factors detected in this study.

And on the other hand Salmaniyah Medical Hospital should focus on preventing such infections not only through the risk factors we assumed they had but also by Sterilization, which goes further than just sanitizing. Killing all microorganisms on equipments and surfaces through exposure to chemicals, ionizing radiation, dry heat, or steam under pressure. Since an estimated 40 percent of nosocomial infections are caused by poor hand hygiene (WHO). Hand-washing which frequently is called the single most important measure to reduce the risks of transmitting skin microorganisms from one person to another or from one site to another on the same patient. The best way for workers to overcome this problem they should wear protective garments and gloves when working with patients and the use of antibiotics is also a vital component of prevention as well.

Furthermore, as implementation of patient care practices for infection control is the role of the nursing staff. Nurses should be familiar with practices to prevent the occurrence of infection also a special program should be trained for the admitted patient throughout the duration of their hospital sta
Finally as a recommendation, nosocomial infection is the responsibility of all individuals and services providing health care. Everyone must work cooperatively to reduce the risk of infection for patients in this hospital by providing the proper hygiene. This includes personnel providing direct patient care, management, provision of materials and products, training of health workers, and there must be an effective support at the national and regional levels.

And finally we believe that Salmaniyah Medical Hospital can overcome this issue, which easily could be managed by using the modern techniques to prevent such cases from spreading here in Bahrain.

Limitations and difficulties

The methodology used in ourstudy is new and might need some correction therefore it might be the subject of criticism and doubt. In addition the data collected from the patient's records were not so clear thus we had to put aside some cases

and we didn't include them in our study .We also think that our checklist has to be scrutinized and tried again to be sure about it's validity. The number of patients we found were not equal in each department which made it difficult for us to compare the percentage of nosocomial infection between the wards. Also the handwriting of patients' files were difficult to read and the hospital staff were uncooperative.

Furthermore, the hospital is too big and our group were not familiar with it so we could not reach our destination easily which was time consuming.

References

1. WHO/CDS/CSR/EPH/2002.12
2. Inweregbu, Dr Ken, Dr Jayshree Dave and Dr Alison Pittard. "Nosocomial infections." *Oxford Journals* 5 (2005): 14-17. pdf.
3. Kelechi Austin Ofurum, M.Sc, B.Sc, David Leonard Whitford, MD, MB BS. "Health-Care Associated Infection Rates among Adult Patients in Bahrain Military Hospital: A Cross Sectional Survey." *Bahrain Medical Bulletin,* 32 (2010): 7
4. Razine *et al*.: Prevalence of hospital-acquired infections in the university medical center of Rabat, Morocco. International Archives of Medicine 2012 5:26. Available from: http://www.intarchmed.com/content/5/1/26.
5. Balkhy HH, Cunningham G, Chew FK, Francis C, Al Nakhli DJ, Almuneef MA, MemishZA. Department of Infection Prevention & Control, King Abdulaziz Medical City, King Fahad National Guard Hospital, Riyadh 11426, Saudi Arabia. *International Journal of Infectious Diseases:* IJID: Official Publication of the International Society for Infectious Diseases [2006, 10(4):326-333].
6. Alghamdi AA, Alamoudi OS, Tawfik M. Al-Kassimi G, Pattern of Infectious Diseases in the Western Region of Saudi Arabia; A Study of 495 Hospitalized Patients .2009 April; 15.
7. Abdel-Fattah MM. Surveillance of nosocomial infections at a Saudi Arabian military hospital for a one-year period. *Ger Med Sci*. 2005 Sep 1; 3:Doc06.
8. Department of Biological Sciences, Yarmouk University, Irbid, Jordan. *Journal of Hospital Infection* (Impact Factor: 2.86). 04/1991; 17(3):235-8. DOI:10.1016/0195-6701(91)90236-2 Source: PubMed
9. Khan, S.A. "Nosocomial Infection: General principles & The Consequences, Importance of It's Control And An Outline of The Control Policy - A Review ARTICLE." *Bangladesh Medical Journal* (2009): 60-64. pdf.
10. Nosocomial Infection Department, Center for Communicable Disease Control, Tehran, Iran, Islamic Republic Of Antimicrobial Resistance and Infection Control 2013, 2(Suppl1):P210 doi:10.1186/2047-2994-2-S1-P210

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