

Original Article

Prevention of Nosocomial Infection & role of Hand Hygiene Compliance in a Private Hospital of Bangladesh

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Abstract

Background: Nosocomial infection (NI) is a major cause of morbidity and mortality of patients attending the healthcare facilities all over the world. Only a few studies regarding this issue have been conducted in Bangladesh.

Objective: To describe the load of NI and to assess role of hand hygiene compliance of doctors and nurses regarding its prevention.

Method: In this cross-sectional study, medical records of all patients admitted from January 2014 to June 2014 were reviewed and data were collected from patients who had diagnosis of NI. Collected data includes month wise number of NI patients, types of NI, organism responsible for NI and hand hygiene compliance of doctors and nurses. Regarding hand hygiene compliance only critical care areas were considered.

Results: During the study period, a total of 8769 patients were admitted in all inpatient departments and critical care areas (cardiac intensive care unit, neonatal intensive care unit, general intensive care unit, coronary care unit, general high dependency unit and cardiac high dependency unit) of the hospital and number of NI was 201 (2.29%). The highest NI was respiratory tract infection (63%) and the lowest was skin & soft tissue infection (2%). Predominant organisms responsible were *E. coli* (16%), *acinetobacter* species (15%), *Pseudomonas* species (14%), *Klebsiella* species (13%), *Serratia* species (13%) and *Candida* species (13%). The highest average hand hygiene compliance (67.67%) and lowest NI (1.14%) was observed in June 2014.

Conclusion: In this study, NI rate was the lowest when the hand hygiene compliance was the highest. So, it is obvious that implementation of hand hygiene may be one of the important measures to prevent NI. So, hospitals should have strict guidelines and review measures to prevent this man made phenomenon. All these efforts will not only reduce patient morbidity, but will also reduce the use of antibiotics and healthcare costs of the country.

Key Words: Nosocomial infection (NI), Hand Hygiene Compliance.

Introduction:

Nosocomial infection is an infection occurring in a patient during the process of care in a hospital or other health care facility which was not present or incubating at the time of admission.¹ NI can affect patients in any type of setting where

they receive care and even may appear after discharge. However, an asymptomatic patient may be considered infected if pathogenic microorganisms are found in a body fluid or at a body site that is normally sterile, such as cerebro-spinal fluid or blood.² Infections acquired by staff or visitors to the hospital or other healthcare setting and neonatal infection that result from passage through the birth canal may also be considered nosocomial infections.³

The highest frequencies of NIs were reported from hospitals in the Eastern Mediterranean and South-East Asia Regions (11.8 and 10.0% respectively), with a prevalence of 7.7 and 9.0% respectively in the European and Western Pacific Regions.⁴ Annually, this results in 5000 deaths with a cost to the National Health Service of a billion pounds in United Kingdom. On average, a patient with NI spent 2.5 times longer in hospital, incurring additional costs of £3000 more than an uninfected patient. A few studies have been conducted in Bangladesh to measure the load of NI. In a study conducted in general surgery and burn unit of Dhaka Medical College Hospital revealed that burden of NI was 46.2%.⁵ Pneumonia and surgical-site infection are most common NI followed by gastrointestinal infection, urinary tract infection, and primary bloodstream infection.

Pathogens that cause such infections are termed nosocomial pathogens. People become infected with bacteria, viruses, fungi and parasites when these micro-organisms spread through the air, through direct or indirect contact or when

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infected blood or body fluids enter the body. The risk of infection is higher in places where people gather, and the impact is magnified in hospitals and long-term care facilities because patients are already ill and at particular risk of infection due to medical interventions and “hands-on” care. The severity is greatest among those who are elderly, very young, have weakened immune systems or have one or more chronic conditions. Of greatest concern are the bacteria that

are resistant to multiple types of antibiotics. More than 50% of NI are caused by bacteria that are resistant to at least one type of antibiotic.⁶ Infection can easily spread from patient to patient through the hands of healthcare workers during treatment or personal care or by touching contaminated shared surfaces, such as bathrooms, toilets or equipments. Even the simple act of holding a loved one’s hand can risk spreading infection if hands haven’t been correctly washed. While direct person-to-person touch is the primary pathway, the healthcare environment itself can be a route of transmission. Bacteria can exist on many objects in the patient environment (e.g. bedrails, telephones, call buttons, taps, door handles, mattresses, chairs). Some of those bacteria can survive for a long time—in some cases for many weeks and even months. Methicillin-resistant *Staphylococcus aureus* (MRSA) and *Clostridium difficile* (*C. difficile*) are two of the most well-known bacteria that are able to adapt and survive in the healthcare environment long enough to cause infection.⁷

In 1985, the Centers for Disease Control and Prevention’s (CDC’s) Study on the efficacy of NI control reported that hospitals with four key infection control components—an effective hospital epidemiologist, one infection control practitioner for every 250 beds, active surveillance mechanisms, and ongoing control efforts, can reduce NI rates by approximately one third.⁸ Infection control programs are cost-effective, but their implementation is often hindered by a lack of support from administrators and poor compliance by doctors, nurses, and other health workers. Hand hygiene is the single most important measure for prevention and control of NI and can significantly reduce the burden of disease, particularly in developing countries. Unfortunately, compliance with recommended hand hygiene procedures has been unacceptably poor, with mean baseline rates of 5% to 81%.⁹

Objective:

To describe the load of NI and to assess role of hand hygiene compliance of doctors and nurses regarding its prevention.

Method:

This is a cross-sectional study which is conducted in United Hospital Limited, Dhaka, Bangladesh. Medical records of all patients admitted in all inpatient departments and critical care areas from January 2014 to June 2014 were reviewed. Patients having diagnosis of NI with culture positive materials where sample were taken 48 hours after admission were considered. Patients with incomplete information, NI patients with culture negative materials and those who left the hospital against medical advice were excluded from the study. An infection control team was formed which included an infection control doctor and an infection control nurse. At the same time an

infection control committee was also formed which comprises consultants from all specialties of hospital, chaired by senior consultant of microbiology. To prevent nosocomial infection two measures were taken, 1) a guideline of antibiotic therapy which was based on infection site, possible organisms responsible for infection and local resistance pattern were supplied to all departments and were advised to follow it strictly and 2) implementation of hand hygiene practice (Hand washing and hand disinfecting with alcohol based hand rub). Effective hand washing was described as the application of a plain (non-antimicrobial) or antiseptic (antimicrobial) soap onto wet hands; then vigorous rubbing together of both hands to form a lather, covering all the surface of the palms, tops of the hands, base of the fingers, between the fingers, back of the fingers, fingers tips, fingernails, thumb and wrists for one minute. Alcohol hand-rub uses alcohol instead of water. The process of alcohol hand-rub starts by applying a sufficient amount of the alcohol based hand-rub product (liquid, gel or foam) according to the manufacturer’s recommendation (usually between 3 to 5 ml), and spreading it all over the hands, especially the areas between fingers, thumbs and finger nails. To see the compliance, a vigilance team was also formed. For study purpose, emphasis was given on hand hygiene practice only and regarding this hand hygiene practice, only critical care areas (cardiac intensive care unit, neonatal intensive care unit, general intensive care unit, coronary care unit, general high dependency unit and cardiac high dependency unit) were considered.

Collected data included month wise number of NI patients, types of NI, organism responsible for NI and hand hygiene compliance of doctors and nurses in critical care areas from January 2014 to June 2014. Statistical analysis was done using SPSS version 16 (SPSS Inc., Chicago, USA) and results are presented as frequency and percentage with charts and tables.

Results:

Distribution of NI patients

During study period a total 8769 patients were admitted in the hospital among which 2.29% patients were diagnosed as NI [Table 1]. The highest (3.5%) NI occurred in January 2014 and the lowest (1.14%) in June 2014.

Types of NI

In this study the highest NI was respiratory tract infection (63%) followed by urinary tract infection (21%), blood stream infection (10%) surgical site infection (4%) and skin & soft tissue infection (2%) [Figure 1].

Microbial organism causing NI

The predominant organisms responsible for NI were *E.coli* (16%), *Acinetobacter* species (15%), *Pseudomonas* species (14%), *Klebsiella* species (13%), *Serratia* species (13%) and *Candida* species (13%) [Table 2].

Hand hygiene compliance

The highest average hand hygiene compliance was observed in June 2014 (67.67%). Among doctors, the highest hand hygiene compliance (94%) was noted in neonatal intensive

care unit in March 2014 and June 2014 and the lowest (37%) was noted in general high dependency unit in January 2014. Among nurses, the highest hand hygiene compliance (86%) was also noted in neonatal intensive care unit in March 2014 and the lowest (39%) was noted in cardiac high dependency unit in February 2014 [Figure 2].

Discussion:

In this study, month wise distribution of NI from January 2014 to June 2014, types of NI, organisms responsible for NI and hand hygiene compliance of doctors and nurses as a prevention strategy in the United Hospital Limited, Bangladesh was described. This study showed NI rate was 2.29% which is similar to the result of a survey (2.4%) conducted by infection control unit of BIRDEM hospital in 2004.¹⁰ On the contrary, findings from two other studies conducted in Dhaka Medical College Hospital revealed that NI rate were much higher (46.2% and 38%).^{5, 11} Similarity of results between United Hospital and BIRDEM Hospital was probably due to similarity of infection control policy of these institutes. But the rate of NI was much higher in Dhaka Medical Hospital possibly because the study was conducted in surgery unit of this institute where chance of wound infection is common. Louis et al. conducted a study in Europe and the prevalence of NI was 20.6% which is also much higher than our study probably because that study was conducted to see the NI among patients of intensive care units only where chance of cross infection rate is very high as a result of use of mechanical ventilation, other invasive procedures, long hospital stay and finally less immunity of the patients.¹²

Majority of NI in this study was respiratory tract infection but two other studies conducted in Dhaka Medical College Hospital showed wound infection was the predominant NI.^{5, 11} In United Hospital, patients from all departments were included but studies conducted in Dhaka Medical College Hospital, patients from surgery units and burn unit were included and possibly this is the main reason of this disparity. In EPIC study conducted by Louis et al. majority of infection was pneumonia that is similar to our study.¹² This is because majority of patients included in both studies were from critical care units.

Predominant organisms in this study were *E. coli*, *Acinetobacter species*, *pseudomonas species*, *Klebsiella species*, *Serratia species* and *candida species*. Two other studies conducted in Bangladesh by Zaman et al. and Mohiuddin et al. in 1992 and 2008 respectively showed that the predominant organism was *E. coli* followed by *Pseudomonas* and *Staphylococcus aureus*.^{13, 14} This reflects the changing pattern of organism responsible for NI as a result of changing pattern of drug resistance.

The importance of hands in transmission of hospital infections has been well demonstrated and can be minimized with appropriate hand hygiene practice. Compliance with

hand washing however is frequently suboptimal. This is due to a variety of reasons including: lack of appropriate accessible equipment, high staff to patient ratios, allergy to hand washing products, insufficient knowledge of staff about risk and procedures, long duration recommended for washing and the time required.^{15, 16} This study showed that among doctors, the highest hand hygiene compliance (94%) was noted in neonatal intensive care unit and the lowest (37%) was noted in the general high dependency unit and among nurses, the highest hand hygiene compliance (86%) was also noted in neonatal intensive care unit and the lowest (39%) was noted in cardiac high dependency unit. Hand hygiene compliance rates in different developed countries rarely exceed 50% and in the USA it is 50%, 42% in the Switzerland and 32% in the UK.¹⁷ It is noted in this study that in the month of June 2014 hand hygiene compliance rate was highest and NI rate was lowest at that time. In a study conducted by Chen et al. in Taiwan showed that an increase in hand hygiene compliance from 43.3 to 95.6 percent was directly related with an 8.9 percent decrease in NI with a net benefit of more than \$5.2 million.¹⁸ In another study conducted in Argentina by Rosenthal et al showed that improvement in hand washing in ICUs from 23.1% to 64.5% were associated with reduction in NI 47.55 per 1000 patient-days to 27.93 per 1000 patient-days.¹⁹ So, it is obvious that hand hygiene is an important strategy for prevention of NI.

Conclusion:

NI is a global threat and its impact on health and economy is considerable but certainly it is preventable. In this study it was noted that in the month of June 2014 when hand hygiene compliance was the highest and NI was the lowest. So, it is obvious that hand hygiene practice is the cornerstone in the prevention of NI. In Bangladesh, infection control program in hospitals has been recognized only in early 2000. Only few hospitals of the country have designated infection control programs and only a few has an antibiotic policy of its own. So, our recommendation is to introduce NI and its prevention in the undergraduate and post graduate medical curriculum to aware our future doctors of this man made phenomenon. We also recommend establishing infection control policy and surveillance system in all government and private hospital in our country. These efforts will not only reduce patient morbidity, but also reduce the use of antibiotics and health care costs of the country.

Limitations:

Only culture positive cases were included in this study and many patients with actual NI having culture negative specimen and NI acquired from other health care facilities were not taken into consideration. So, true burden of NI in our context might not be reflected in this study. Hand hygiene compliance in this study could not be evaluated in general wards and in the cabin due to lack of vigilance team in these areas. Besides this, nosocomial infection in hospital staffs was not calculated in this study.

Tables:

Table 1: Month wise distribution of NI patients.

Month	Number of admitted patients	Number of NI patients (%)	p value
January 2014	1285	45 (3.50)	
February 2014	1360	34 (2.50)	0.142
January 2014	1285	45 (3.50)	
March 2014	1620	47 (2.90)	0.373
January 2014	1285	45 (3.50)	
April 2014	1489	35 (2.35)	0.079
January 2014	1285	45 (3.50)	
May 2014	1447	22 (1.52)	0.001
January 2014	1285	45 (3.50)	
June 2014	1568	18 (1.14)	0.001
Total	8769	201 (2.29)	-----

Table 2: Hand hygiene compliance in different departments.(CICU - Cardiac Intensive Care Unit, NICU - Neonatal Intensive Care Unit, GICU - General Intensive Care Unit, CCU - Coronary Care Unit, GHDU - General High Dependency Unit, CHDU-Cardiac High Dependency Unit)

Unit	January 2014				February 2014				March 2014				April 2014				May 2014				June 2014			
	Doctor (%)	Nurse (%)	P value	Average	Doctor (%)	Nurse (%)	P value	Average	Doctor (%)	Nurse (%)	P value	Average	Doctor (%)	Nurse (%)	P value	Average	Doctor (%)	Nurse (%)	P value	Average	Doctor (%)	Nurse (%)	P value	Average
CICU	59	52	0.319	60.15	73	67	0.354	60.24	64	66	0.769	67	70	71	0.876	61.03	83	78	0.372	60.06	67	71	0.540	67.57
NICU	87	81	0.247		90	82	0.103		94	86	0.059		93	77	0.001		56	70	0.040		94	81	0.005	
GICU	44	62	0.010		56	58	0.775		63	67	0.553		53	53	1.000		45	60	0.033		74	57	0.001	
CCU	48	56	0.257		45	64	0.007		46	68	0.002		60	54	0.113		45	53	0.257		65	55	0.148	
GHDU	37	43	0.386		45	40	0.474		56	64	0.248		52	61	0.199		50	55	0.479		58	66	0.243	
CHDU	39	43	0.565		48	39	0.199		59	59	1.000		43	46	0.669		83	78	0.372		48	59	0.118	

Figures:

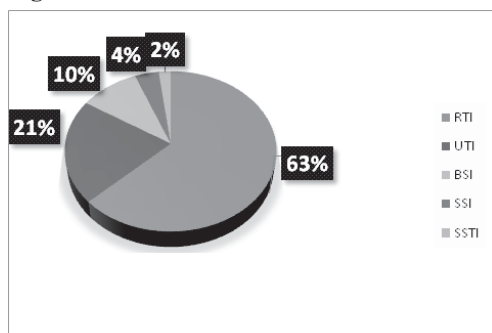


Figure 1: Types of NI. (RTI – Respiratory tract infection, UTI – Urinary tract infection, BSI – Blood stream infection, SSI – Surgical site infection, SSTI – Skin & soft tissue infection)

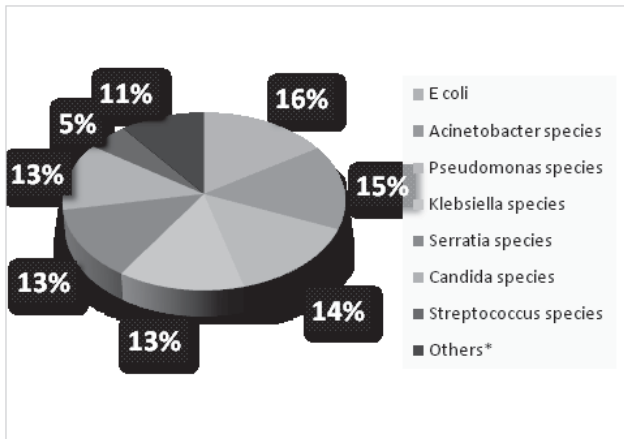


Figure 2: Microbial organisms causing NI. (*Others = *Staphylococcus* spp, *Citrobacter*, *Providencia* spp, *Enterobacter* spp, *Proteus* spp)

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