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RESEARCH ARTICLE

NOSOCOMIAL INFECTIONS IN CRITICALLY ILL PATIENTS

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ABSTRACT

All hospitalized patients specially those who are critically ill are susceptible to have Nosocomial Infection.

Aim: To conduct a detailed study of various types of nosocomial infections, related factors and control measures for the purpose of preparing a descriptive report on evidence of nosocomial infections in critically ill patients.

Setting and Design: Critical Care Areas through quantitative research approach and non interventional descriptive research design was used for the present study based on Chain of Infection Model (Centers for Disease Control and Prevention, 2005).

Material and Method: A Structured Checklist and Nosocomial Infection Assessment Proforma was developed and used to collect data from purposively selected sample of sixty critically ill patients who became febrile after 48 hours of hospital admission. The collected data was organized, tabulated and analyzed and interpreted using descriptive and inferential statistics to assess Nosocomial Infection evidence.

Results: Findings of the study revealed that maximum number of patients i.e. 32 (53.33%) had fever with one manifestation. Culture/serology report was positive in 26 CIP. Acinetobacter baumannii was the found in 12 (46.15%) patients. Most of the patients had only one type of NI, 26 (63.42%) developed respiratory tract infection followed by those with other localized/wound infection 15 (36.59%) then urinary tract 5 (12.19%) and GI tract 2 (4.88%). Measures for control of NI according to structure and process standards were not met. Item analysis revealed several deficits in control measures.

Conclusion: Majority of the Critically ill patients do have manifestations of Nosocomial Infections, supporting the assumption. Therefore, descriptive report was prepared and planned to be shared with local TNAI member and Infection control team

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INTRODUCTION

A considerable proportion of critically ill patients acquire an infection during their stay in an intensive care unit (ICU) and the frequency of these infections varies considerably in different populations and clinical settings. The highest frequencies of nosocomial infections 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 (Mayon-White *et al*., 1988). Nosocomial infections not only affect patient health and safety, but also the health care system as a whole. It is estimated that nosocomial infections increase the cost of health care between $4.5 and $5.7 billion in patient care.

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In addition to monetary resources, nosocomial infections increase the number of days a patient spends in the hospital, requiring additional medical care and hours spent providing patient care. These costly infections divert funding and precious staff and nursing time from possible implementation of patient safety and infection control measures to protect patients (Safdar and Abad, 2008). Recent systematic reviews have estimated hospital-wide prevalence of HAIs in high-income countries at 7.6% and in low and middle-income countries at 10.1% (http://www.who.int/en/ / reviewed on 22/08/2013). Infection control for preventing nosocomial infections may play an important role in reducing medical costs, hospital stay, and mortality in hospitalized patients (Shen *et al*., 2005). To ensure that all healthcare workers understand and adhere to recommended practices, principles of infection control and aseptic technique need to be reinforced in training programs and incorporated into institutional polices that are

monitored for adherence (http://www.cdc.gov/reviewed on 3/2/2014).

MATERIALS AND METHODS

Research approach & Research design: For the present study, quantitative research approach and non interventional descriptive research design was used.

Target population: The target population of the study included all afebrile adult critically ill patients admitted in selected medical and surgical areas (wards, units) of Christian Medical College and Hospital Ludhiana.

Sample and Sampling technique: Eighty adult critically ill patients with apparently no evidence of infection were selected from adult critical care areas using non-probability purposive sampling technique for the study.

Description of the Research tool

Title of the tool: Structured Checklist and Nosocomial Infection Assessment Proforma. The tool had two sections. Section A comprised of patient related information, section B had various items related to Nosocomial Infections, related factors and control measures for NI.

Section B was further organized into parts

Part –I consists of 10 items related to assessment of NI. It includes fever after 48 hrs. of hospital admission, urinary tract infection related manifestations i.e. urgency, frequency, dysuria and burning micturition, respiratory tract infection related manifestations i.e. cough, breathing difficulty, purulent sputum and new chest X-ray findings indicative of inflammation, GI tract infection related manifestations i.e. loose stool and abdominal pain, Other skin/localized/wound infection related manifestations pain, tenderness at the site of infection, redness, warmth, drainage and bad odour from wounds.

Part- II consisted of 49 items on related factors according to links in chain of infection and control measures for NI. Related Factors include host related, agent related, reservoir related, portal of entry/exit related and mode of transmission related. Control measures for NI were based on structure, process and outcome standards.

Criteria	Weightage Score
Fever after 48 hrs.	1
One manifestation with fever	1
Two manifestations with fever	1
>2 manifestations with fever	1
Culture/serology positive	1

Levels of NI evidence	Nosocomial Infection Manifestation Score (NIMS)
Weak evidence of NI	≤2
Strong evidence of NI	>2

Data collection procedure

After getting approval from Research and Ethical Committee, written permission was obtained from Principal, CON, Nursing Superintendent, Medical Superintendent and H.O.Ds of critical care areas, Christian Medical College and Hospital, Ludiana, Punjab, data was collected. Data was collected by using non participatory method from critical care areas of Christian Medical College and Hospital, Ludhiana from 9th of December 2013 to 31st of December, 2013. The researcher introduced and explained the purpose of study to the nurse incharges of the areas and audit was carried out by using observations (O_1 & O_2), asking and assessment of patient charts. The investigator took 30-35 minutes to observe, ask and audit patient's medical records and charts and to get information from staff nurses.

RESULTS

Findings related to personal and illness related characteristics of CIP (Critically ill patients)

Majority of the patients i.e. 40 (66.66%) were in age group of ≥51 yrs.and 20 (33.33%) patients were below 51 yrs. of age. Most of them (n=41) were males (68.33%) and 19 (31.67%) were females. Regarding hospital areas, majority of the patients i.e. 36 (60%) patients were selected from medical critical care areas and 24 (40%) from surgical critical care areas and 36 (60%) patients were admitted with medical conditions and whereas 24 (40%) patients had surgical conditions (Table 1a).

Findings related to assessment of NI (Nosocomoial infections)

Out of 60 CIP febrile (100%), majority of the NI i.e. 32 (53.33%) patients had one manifestation followed by 26 (43.33%) patients who showed evidence of Nosocomial Infections with culture/serology positive and 2 (3.33%) patients had two manifestations (Table 1c and Figure 1). Hence, it is concluded that maximum number of patients i.e. 32 (53.33%) had fever with one manifestation.

Culture/serology report was positive in 26 CIP. Majority of the CIP i.e. 38 (63.33%) showed weak evidence of NI with NIMS (Nosocomial infection manifestation score) ≤2 whereas 22 (36.67%) patients showed strong evidence of NI with NIMS >2(Table 1b). Out of these 26 CIP, Pseudomonas aeruginosa was found in 8 (30.77%) CIP, E.coli was found in 6 (23.07%) CIP, Acinetobacter baumannii was found in 12 (46.15%) CIP, MRSA was found in 3 (11.54%) patients, Enterococcus was found in 2 CIP and Klebsiella was found in 9 (34.62%) CIP.

There were 10 CIP who had more than one organism. Only 1 (3.84%) CIP had Candida albicans infection. There were 15 (57.69%) CIP with more than two organisms.Majority of the critically ill patients i.e. 41 (68.33%) had localized or specific infection followed by systemic or generalized infections 19 (31.67%). Out of 41 critically ill patients with localized infection, most of the patients, 26 (63.42%) had respiratory tract infection followed by other skin/localized/wound infection (36.59%) then urinary tract (8.33%) and GI tract (3.33%).

Table 1(a). Frequency distribution of critically ill patients (CIP) in the sample according to personal and illness related characteristics

N=60

	CIP	
Personal and illness related characteristics	n	%
Age (in years)		
a.<51	20	33.34
b.≥51	40	66.66
Gender		
a.Male	41	68.33
b.Female	19	31.67
Conditions		
a.Medical	36	60
b.Surgical	24	40

Table 1(b). Frequency and percentage distribution of critically ill patients (CIP) according to Nosocomial Infection (NI) manifestation Evidence

N =60

	CIP	
NI manifestation evidence	n	%
• Weak evidence (Nosocomial Infection Manifestation Score (NIMS≤2)	38	63.33
• Strong evidence (NIMS >2)	22	36.67

Table 1(c). Frequency and percentage of critically ill patients (CIP) according to Nosocomial Infection (NI) manifestations

N =60

		CIP	
NI manifestations	Weightage	n	%
• Fever >48 hrs of admission	1	60	100
• one manifestation with fever	1	32	53.33
• two manifestations with fever	1	2	3.34
• > two manifestations with fever	1	0	0
• Culture / Serology positive	1	26	43.33

Maximum score = 5
Minimum score = 1

Table 1(d). Frequency and percentage distribution of Critically Ill Patients (CIP) according to type of causative organism

N=60

	CIP	
	n	%
Culture/serology positive	26	43.33
Culture/serology negative	19	31.67
Culture/serology not done	15	25
Type of causative organism	8	30.77
Bacterial		
Pseudomonas aeruginosa		
E.coli	6	23.07
Acinetobacter baumannii	12	46.15
MRSA	3	11.54
Enterococci	2	7.69
Klebsiella	9	34.62
Mycobacterium tuberculosis	0	0
Clostridium difficile	0	0
Fungal	1	3.84
Candida albicans	1	3.84
Viral	0	0
Culture showing > 1 organisms	10	38.46
Culture showing > 2 organisms	15	57.69

Table 1(e). Mean, SD and Z value of Nosocomial Infection Manifestation Score (NIMS) according to Related factors

N = 60

Related factors	NIMS				
	n	Mean	SD	df	Z
Resistance to antibiotics (Agent related factor)					
a.Not resistant	34	1.97	0.30	40	8.47*
b.Resistance	26	2.85	0.46		
Used Fomites at bedside (Reservoir related factor)					
a.Lying	19	2.11	0.46	58	2.28*
b.Not lying	41	2.46	0.59		
Open wounds/ ulcers / impaired Skin integrity (Portal of entry and exit related factor)					
a.Present	32	2.53	0.57	58	2.75*
b.Absent	28	2.14	0.52		
Non invasive procedures (Mode of transmission related factor)					
a.Without aseptic techniques	48	2.46	0.54	58	2.08*
b.With aseptic techniques	12	2.08	0.67		

Maximum score =5 * Significant at p< 0.05 level
Minimum score = 1

Table 1(f). Association of Nosocomial Infection Manifestation Score (NIMS) according to Link II agent related factors as links in chain of infection

N=60

	NIMS					
Related factors	n	Score ≤2 F	Score >2 f	df	χ^2	p
Resistance to antibiotics (Agent related factor)						
a.Not resistant	34	33	1	1	2.72*	0.10
b.Resistant	26	21	5			
Fomites at bedside (Reservoir related factor)						
a.Lying	19	16	3	1	3.98*	0.05
b.Not lying	41	22	19			

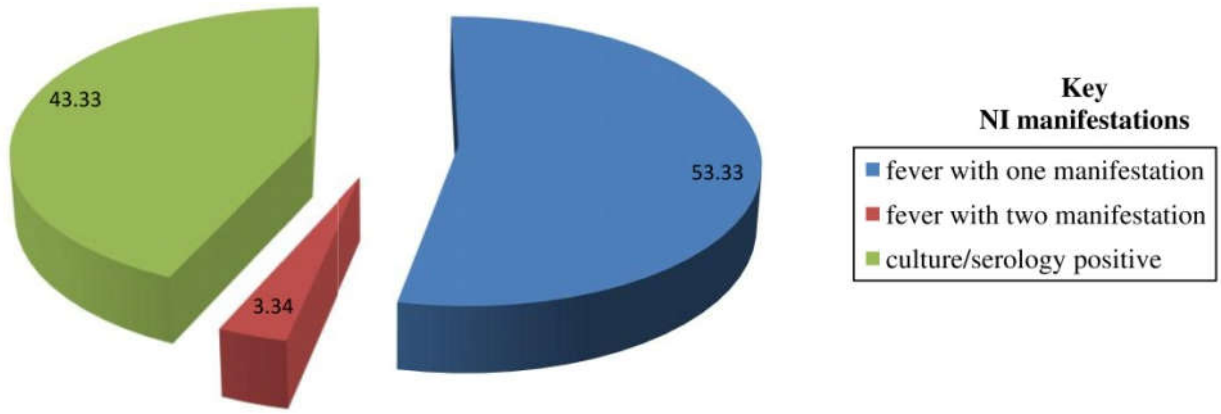

Fig. 1 Frequency and percentage of Critically Ill Patients according to Nosocomial infection manifestation

Out of these 41 patients, 1(2.44%) patient had both respiratory tract and urinary tract infection and 6 (14.63%)patients had both respiratory tract and other skin/ localized/ wound infection. Only 1CIP (2.44%) had both respiratory and urinary tract infection and 6 CIP (14.63%) had respiratory and other skin/localized/wound infection (Table 1d and Figure 2).

Findings related to related factors and control measures associated with NI

Among 60 critically ill patients, host related factors, such as aging (≥51yrs.) of age, hospital admission of >48hrs., h/o immunization from patient's chart, relatives, low immunity

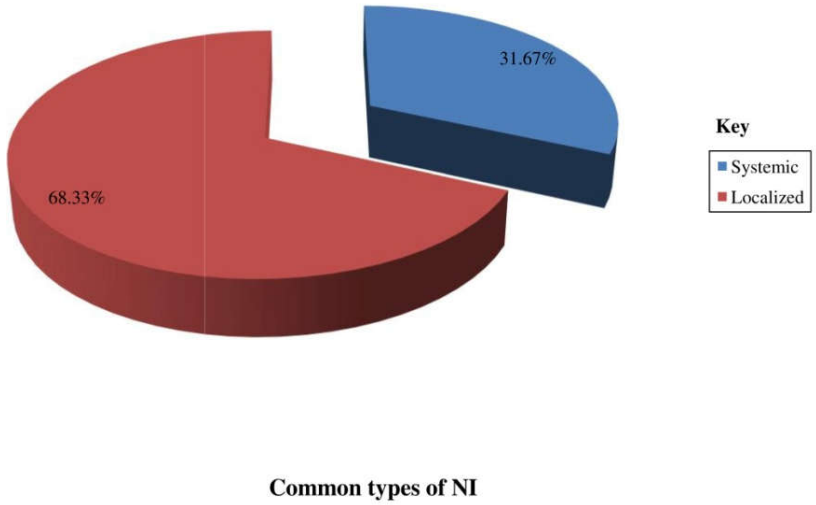

Fig. 2. Frequency and percentage distribution of critically Ill patients (CIP) according to common types of Nosocomial infections

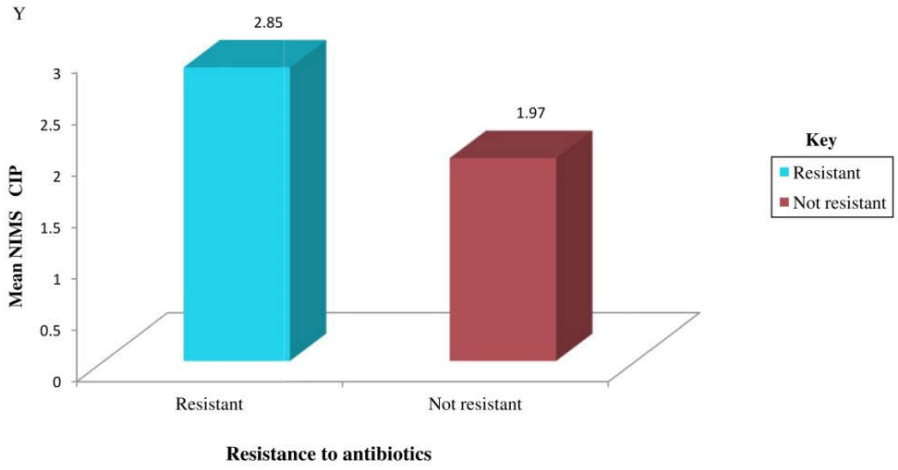

Fig. 3. Mean nosocomial infection manifestation score (NIMS) according to link II agent related factor (Resistance to antibiotics)

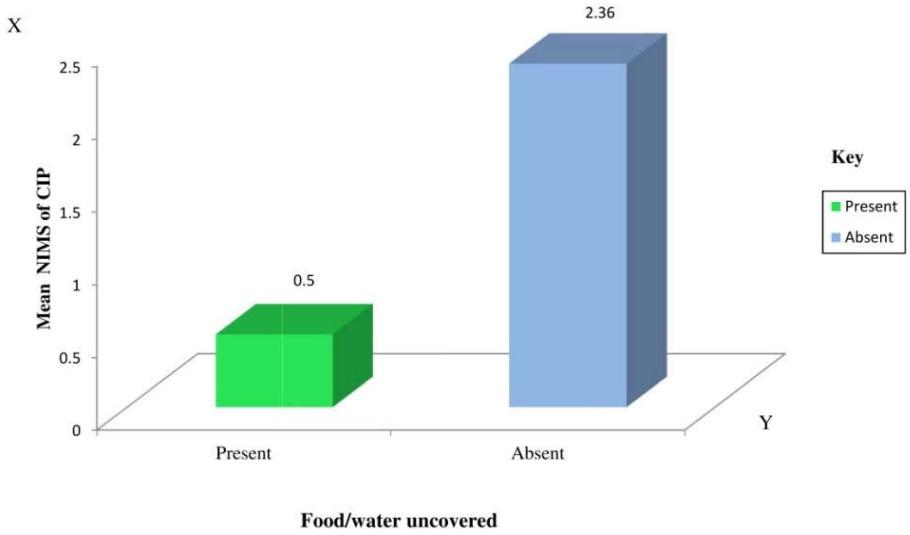

Fig. 4. Mean nosocomial infection manifestation score (NIMS) according to link III reservoir related factor (food/water uncovered)

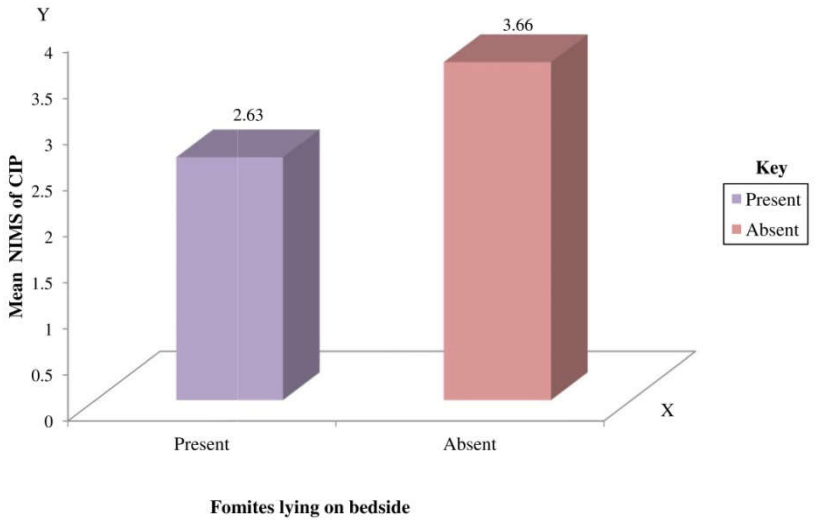

Fig. 5. Mean nosocomial infection manifestation score (NIMS) according to link III reservoir related factor (fomites lying on bedside)

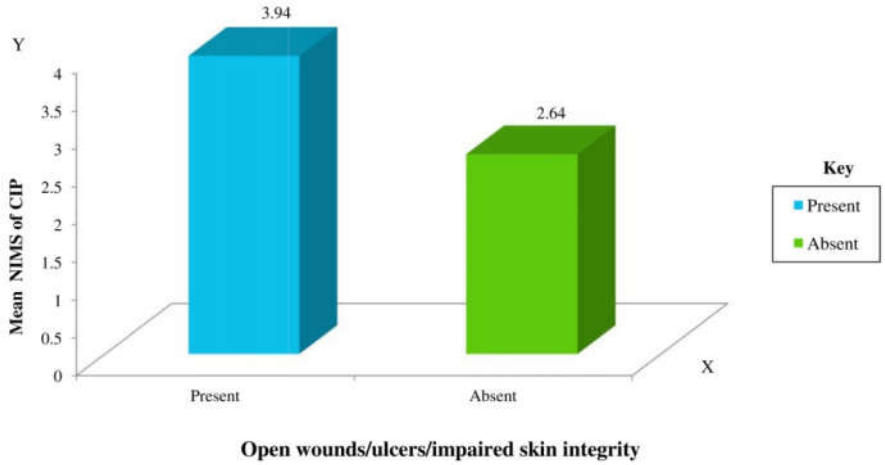

Fig.6. Mean Nosocomail infection manifestation score (NIMS) according to link IV portal of entry and exit related factors (open wounds/ulcers/impaired skin integrity)

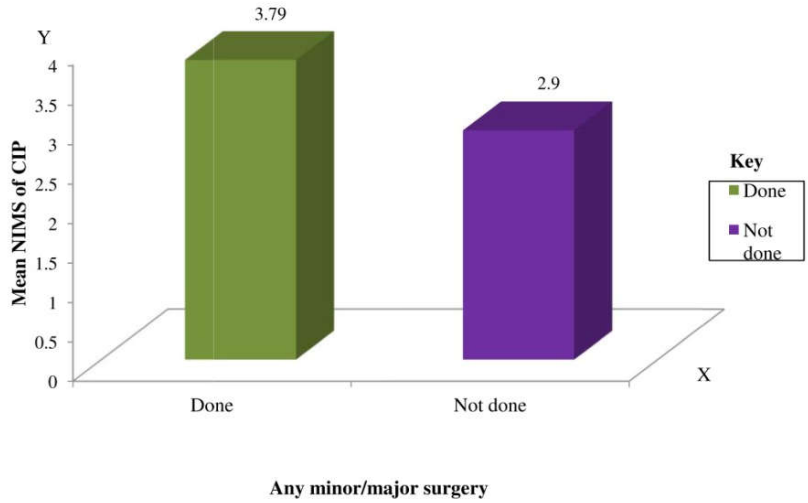

Fig.7. Mean Nosocomail infection manifestation score (NIMS) according to link V mode of transmission related factor (any minor/major surgery done)

due to neutropenia, HIV, HCV, HBsAg or patient is on immunosuppressive drugs, antibiotic prophylaxis not used, ranked first by obtaining highest mean related factor score (4.75). Host related factors and agent related factors had no significant impact on NI whereas resistance to antibiotics, uncovered food water, fomites at the bedside of the patient (reservoir), open wounds/ulcers/impaired skin integrity (portal of entry/exit) and non invasive procedures (mode of transmission) were significantly related to NI at $p<0.05$ level of significance (Figure 3-7). Further test of association was applied which showed that there was significant association of resistance to antibiotics and fomites lying at the bedside of the patient with NI (Table e and f). None of the structure, process and outcome standards were met. Therefore, descriptive report was prepared and planned to be shared with local TNAI member and Infection control team.

DISCUSSION

Findings in the present study revealed that out of 60 CIP examined during two weeks, 41 critically ill patients had localized (specific) infection, out of these 41 patients most of the patients, 26 (63.42%) had respiratory tract infection followed by other skin/localized/wound infection (36.59%) then urinary tract (8.33%) and GI tract (3.33%). The findings were supported by Baghei *et al*. (2011) who reported that the most common type of infections were pneumonia 59.5%, UTI 21.3%, and both 19.1% respectively. The present study showed that Acinetobacter baumannii is the organism which was found in most (46.15%) of the patients. The findings were similar to Patwardhan *et al*. (2008) who reported that Acinetobacter isolates displayed high level of antibiotic resistance to most of antibiotics.

In the present study, it was found that the mean Nosocomial Infection Manifestation Score was higher (2.85) in patients who were resistant to antibiotics and 1.97 in those who were not resistant to antibiotics. The difference between their means was statistically significant. The above findings were similar to Hilmar *et al*. (2004) who reported that the proportion of nosocomial blood stream infections due to antibiotic-resistant organisms is increasing in US hospitals. The present study reveals that Nosocomial Infection have significant relationship with surgical procedures done on the patients. These findings were similar to Ak O *et al*. (2011) who reported that length of ICU stay, central venous catheterisation, mechanical ventilation and tracheostomy were statistically significant risk factors for NI. It was found in the present study that lack of Nosocomial Infection control standards is one of the factor leading to Nosocomial Infection occurrence. Above finding was supported by (Raka, 2010) who reported that Lack of financial funds, inadequate infrastructure and management, improper use of antimicrobials and shortage of trained staff are key constraints for effective infection control in the hospitals of low income countries.

In the present study, the percentage of patients with respiratory tract infection was highest (63.42%) and none of the standards were met which showed poor quality of structure, process and outcome standards. The findings were supported by Patricia *et al*. (2013).

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