



Original Article

Impact of Educational Intervention in the Frequency of Nosocomial Infection among Patients Admitted in ICU of Tertiary Care Hospital: Interventional Study

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ABSTRACT

Objectives: Infection is one of the leading causes of death in the world especially in low and lower-middle income countries. **Methods:** Patients (n=270) were included in a study that was conducted in ICU of a tertiary care public sector, Jinnah Hospital, Lahore for a period of 18 months. Patients were divided into two groups (pre and post educational intervention). During this period, information about patient's nosocomial infection rate, its distribution and patient's excess length of stay in hospital collected. **Results:** Total of 115 (42.6%) were males and 155 (57.4%) were females. Results showed 42 (15.9%) out of 270 participants suffered in Nosocomial Infection/Hospital Acquired Infection during treatment and stay in ICU. **Conclusion:** It was concluded that educational intervention played a significant role in controlling the nosocomial infection among patients admitted in the ICU.

INTRODUCTION

"Nosocomial infection or hospital acquired infection is defined as an infection that begins 48 hours after hospitalization or within 48 hours after being discharged that was not incubating at the time of admission at hospital"(1). Infection is one of the leading causes of death in the world (2). specially in low and lower-middle income countries (3). Although the global mortality rate due to infections has dropped over the past three decades;⁴ it still remains the leading cause of death and Pakistan is no exception, showing similar tendency (5,6). Intensive care units (ICUs) are often called the hubs" of infections.

Extremely vulnerable population group with reduced host defenses and deregulated immune responses, multiple procedures, and use of invasive devices such as endotracheal intubation (7). central venous cannulations (8) mechanical ventilation (9). and urinary catheterizations (10). which distorts the anatomical integrity-protective barriers of patients are more prone to infection. The rate of both primary infection (at the time of admission) and secondary infection (ICU-derived infection occurs during stay) is higher in the ICU (11). Many high-income countries have well-established surveillance system to report

hospital acquired infections (HAI). These systems include reporting the nature and site of the infection as well as programs of intermittent point prevalence survey studies. Hospital acquired infection is one of the world's greatest health burden. According to WHO, 4 million patients suffer from HAI in Europe each year. The prevalence is estimated at 7.1% in the United States (USA) and the annual nosocomial infection rate is estimated at 1.7 million patients with an average of 4 to 12 million cases with prevalence of 4% - 5% (12). Among the developing countries, only 23 of the 147 countries reported their national data. The prevalence rate in these countries ranged from 5.7% to 19% (12). The World Health Organization (WHO) estimates that hundreds of millions of patients in developed and developing countries suffer from the hospital acquired infections each year. The rate of health care associated infection in developing countries is higher as compared to developed countries (12). Data compiled by the European Center for Disease Prevention and Control (ECDC) between 1996 and 2007 showed that the frequency of nosocomial infections ranged from 3.5% to 10.5%, with mean 1 to 7% (4). European Centre for Disease Prevention and Control (ECDC) conducted a point prevalence study in acute care hospital to estimated HAIs from 2011 to 2012, the results showing a prevalence rate of 6% of all patients (13). ECDC also reported that the prevalence rate of HAI in tertiary care hospitals was 4-7% higher than specialized hospitals and secondary level hospital, where rate was 4.5-6.5% (13,14). The rate of hospital acquired pneumonia (HAP) was 8.1% in intensive care units (ICU) (12). The incidence of HAI in USA was estimated 4.5%.in 2002 (12). USA conducted a multistate point-prevalence survey of health care-associated infections in 183 acute care hospitals in 2011. The estimated value of health care-associated infections was 4.0% (15). Little information about HAI is available for low and middle-income countries. According to the World Health Organization (WHO) report on the "Burden of Endemic Health Care-Associated Infection Worldwide" a systematic review of literature in 2011, only 23 developing countries out of 147(16%) reported this problem and in 97 out of 147(66 %), there is no monitoring system as well as any published data.¹ A study from the intensive care unit of Al-Shifa International Hospital, Islamabad found that 88 out of 346 patients (25.4%) aged 16 to 82 with an average age of 46 had hospital-acquired pneumonia (HAP) (16). Due to its increasing prevalence and lack of local data on its management, we designed current study in-order to evaluate its prevalence in our setups. Data compiled by the European Center for Disease Prevention and Control (ECDC) between 1996 and 2007 showed that the frequency of nosocomial infections ranged from 3.5% to 10.5%, with

mean 1 to 7%.⁴ European Centre for Disease Prevention and Control (ECDC) conducted a point prevalence study in acute care hospital to estimated HAIs from 2011 to 2012, the results showing a prevalence rate of 6% of all patients.¹³ ECDC also reported that the prevalence rate of HAI in tertiary care hospitals was 4-7% higher than specialized hospitals and secondary level hospital, where rate was 4.5-6.5% (13,14). The rate of hospital acquired pneumonia (HAP) was 8.1% in intensive care units (ICU).¹² The incidence of HAI in USA was estimated 4.5%.in 2002.¹² USA conducted a multistate point-prevalence survey of health care-associated infections in 183 acute care hospitals in 2011. The estimated value of health care-associated infections was 4.0% (15). Little information about HAI is available for low and middle-income countries. According to the World Health Organization (WHO) report on the "Burden of Endemic Health Care-Associated Infection Worldwide" a systematic review of literature in 2011, only 23 developing countries out of 147(16%) reported this problem and in 97 out of 147 (66 %), there is no monitoring system as well as any published data.¹ A study from the intensive care unit of Al-Shifa International Hospital, Islamabad found that 88 out of 346 patients (25.4%) aged 16 to 82 with an average age of 46 had hospital-acquired pneumonia (HAP) (16). Due to its increasing prevalence and lack of local data on its management, we designed current study in-order to evaluate its prevalence in our setups.

METHODS

Patients (n=270) were included in a study that was conducted in ICU of a tertiary care public sector, Jinnah Hospital, Lahore for a period of 18 months. Patients were divided into two groups (pre and post educational intervention). Patients acquiring nosocomial infection after 48 hours of admission in the ICU identified during a 6-month period following Infection Prevention and Control training sessions and then compared with retrospective data of same duration. All the patients 16 years and above admitted in ICU for more than 48 hours included in the study according to the defined criteria. Immuno-compromised patients and those suffering from chronic infection before admission in ICU were excluded. Date and site of infection, patient demographic information and device use, collected for each infection. During this period, information about patient's nosocomial infection rate, its distribution and patient's excess length of stay in hospital collected by using following method: Patient's nosocomial infection rate calculated by dividing the total number of patients with nosocomial infections by the total number of patients in the ICU($\times 100$). Written consent was taken.

RESULTS

Total of 115 (42.6%) were males and 155 (57.4%) were females. According to table-1, 54 (40.0%) and 61 (45.2%) were in group I and group II respectively, while 81 (60.0%) and 74 (54.8%) were in these two groups respectively. Results showed insignificant difference between groups with p-value of 0.742.

		Group		Total	P-value
		Group I	Group II		
Gender	Male	54 (40.0%)	61 (45.2%)	115 (42.6%)	.742
	Female	81 (60.0%)	74 (54.8%)	155 (57.4%)	

Table 1: Comparison of Gender in Both Groups

Regarding length of stay of participants in ICU, study showed that 52 (19.3%) participants stayed in ICU for 3 days, followed by 35 (13%) and 34 (12.6%) stayed in ICU for 4 and 5 days respectively as shown in figure-1.

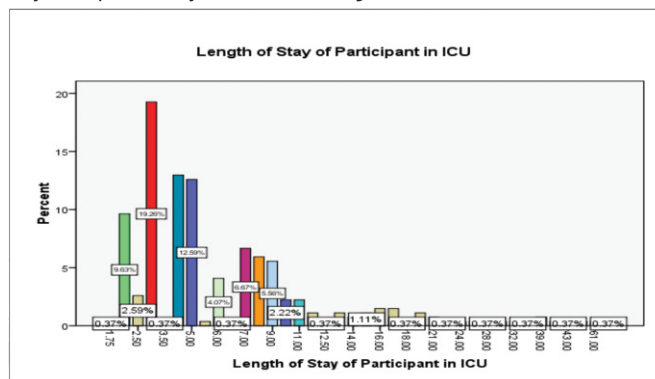


Figure 1: Length of stay of patients in ICU

Table-2 showed that 135 Group II patients belonged to pre and 135 post intervention groups. Regarding ventilator days mean was 7.7259 and 5.3870 respectively in pre and post intervention groups, with standard deviation (Std.) 11.15038 and 5.57854 in these two groups. Similarly mean and standard deviation of central line days pre and post intervention groups were 8.7481 and 6.3593 and standard error mean 0.98105 and 0.51821 respectively. Regarding urinary catheter days mean was 8.7815 and 8.7815 respectively in group I and Group II, while standard deviation (Std.) was 11.34970 and 6.30541 respectively

	Group	N	Mean	Std. Deviation	Std. Error Mean
Age	Group I	135	35.99263	17.51566	1.50751
	Group II	135	8.7407	17.98339	1.54776
ICU Adm. Days	Group I	135	8.8926	11.48042	.98808
	Group II	135	6.7241	6.33769	.54546
Vent. Days	Group I	135	7.7259	11.15038	.95967
	Group II	135	5.3870	5.57854	.48012
Cent. Line Days	Group I	135	8.7481	11.39879	.98105
	Group II	135	6.3593	6.02100	.51821
U Cath. Days	Group I	135	8.7815	11.34970	.97683
	Group II	135	6.5926	6.30541	.54268

Table 2: Information about Length of Patient's Stay in Different

Processes at Icu

Figure-2 showed death and survival rate of patients during stay in ICU. It showed that 54.07% patients died and 45.93% survived during study period.

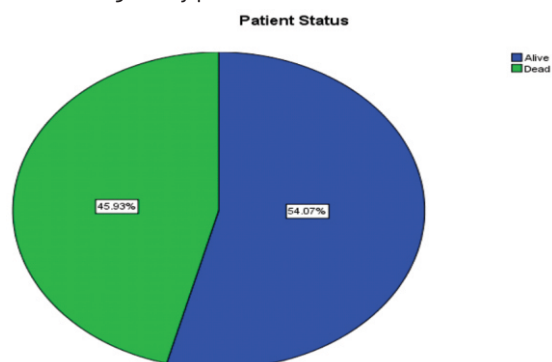


Figure 2: Frequency Distribution Of Participant's Survival And Death

Figure-3 showed that 42 (15.9%) out of 270 participants suffered in Nosocomial Infection/Hospital Acquired Infection during treatment and stay in ICU. Where 228 of 270 (84.44%) had no Hospital Acquired Infection.

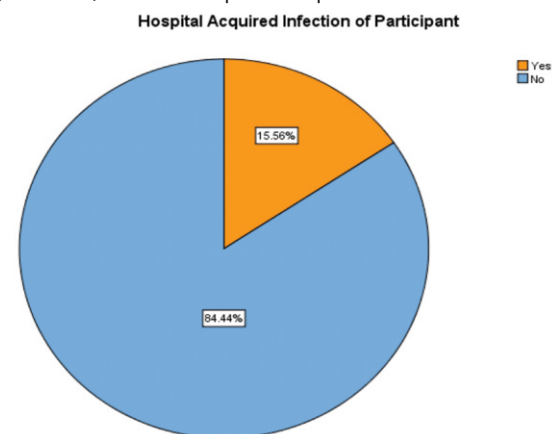


Figure 3: Frequency Distribution Of HAI at ICU

Table-3 showed that 27 (20.0%) patients in group I and 15 (11.1%) in group II had sign and symptoms of HAI, while 108 (11.1%) of group I and 120 (11.1%) patients in group II did not show any sign and symptoms of HAI. Results showed that the association of hospital acquired infection among groups was insignificant with p-value (0.064).

		Group		Total	P-value
		Group I	Group II		
HAI	Yes	27 (20.0%)	15 (11.1%)	42 (15.6%)	.064
	No	108 (80.0%)	120 (11.1%)	228 (84.4%)	
		135 (100.0%)	135 (100.0%)	270 (100.0%)	

Table 3: Comparison of HAI in Both Groups

DISCUSSION

As far as gender of the patients is concerned, study demonstrated that in both groups, most of the patients were females in Group-I Pre Educational intervention

(60.0%) and in Group-II Post Educational intervention (54.8%). However, no significant association was found ($P=0.742$). But the findings of a similar study carried out by Abramczyk and associates (2011) in a teaching health care facility of Brazil highlighted that in both groups majority of the patients were males. Study reported that in pre-interventional group, 51.4% patients were male and 48.6% were females while in post-interventional group, 60.3% patients were males and 39.7% were females. However, this study was also unable to provide significant results ($P=0.383$) (17). A study carried out at International Shifa Hospital Islamabad also reported that 25.4% patients aged 16-82 years with an average age of 36 years had hospital acquired pneumonia (16). It has been reported that gender related difference of nosocomial infection, reflecting potential confounders (18). A study carried out in a tertiary care health facility revealed that among patients who admitted in the intensive care unit from 1995 to 2004, 34% women developed nosocomial infection. While pneumonia was more frequent in men, whereas urinary tract infections (UTI) were predominant in women, during mechanical ventilation while stay in ICU did not differ between genders. This study concluded that female patients developed more nosocomial infections and were at increased risk of ICU mortality (18). Health care associated infections not only threaten the patient's health and life but also bring additional burden to patients and healthcare system, direct economic loss and prolong hospitalization. Information regarding the length of patient stay in different processes in ICU varies from 6.7 to 8.8 days. Similar results were reported by Huixiu Jia et.al who mentioned that length of stay due to hospital acquired infection increased from 9.7 to 10.7 days in different hospitals also and also revealed the intensity of hospital acquired infections increased with the increase in the length of stay (18). Similar results were also reported a study done in France (19), Iran (20) and Saudi Arabia (21). Several studies have shown the increased length of stay due to hospital acquired infections but had poor comparability, because most studies were limited to infections of single site or caused by a single organism, and the characteristics of patient were different (22-24). The effect of different infection on length of stay were analyzed, among them blood stream infection prolonged hospital stay for 6.3 to 8.7 days in comparison of multicenter study involved 69 tertiary care ICU of 37 cities in 11 counties revealed that the extra length of stay due to blood stream infection was 9.8 days (25). Through these studies, it can be said that the blood stream infection can cause longer stay of hospitalization. In ICU the mortality is associated with several risk factors of which nosocomial infection is the most significant. Critical ill patients are treated in intensive care units; death rate and treatment

success depend upon proper utilization of technological and human resources as well as ICU staff training. Among ICU patients, mortality is associated with duration of hospital stay, patients condition, sedation, immobility, coma, mechanic ventilation, intubation, neurological disease, vasopressors drugs usage, glycemic index and agitation. Prolonged stay in the ICU enhance the risk of mortality (26). Mortality rate in both groups was evaluated in the present study in which found that patients of both groups who stayed in the intensive care unit, death occurred more than half (54.1%) of the patients died while 45.93% survived during the study period. In Group-I, 58.5% and in Group-II, 49.6% patients survived while mortality was observed in 41.5% and 50.4% in Group-I and Group-II, respectively. It showed the impact of intervention as mortality rate among ICU patients reduced after the post educational intervention. However, no significant association was found between both groups ($P=2.148$). The findings of this study are comparable with a study performed by Mitsogianni and collaborators (2016), who confirmed the post intervention impact on the mortality rates, as mortality rate among ICU patients was 32.2% which reduced to 30.6% after educational intervention, however the result was found statistically insignificant ($P=0.789$) (27). Nosocomial infection is transmitted to the patients during hospital stay. WHO data showed that the most significant factors associated with incidence of HAI among high income countries are: age above 65 years, admission in ICU and stay >7 days etc. Hospital stay in ICU can reduce the probability of transmission of nosocomial infection (12).

CONCLUSION

It was concluded that nosocomial infection among patients admitted in the ICU is reliant on duration of hospital stay but educational intervention played a significant role in controlling the nosocomial infection among patients admitted in the ICU.

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