ORIGINAL ARTICLE

Healthcare Providers' Knowledge and Frequency of Healthcare-associated Infections in Secondary Level Hospitals of Karachi

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Abstract

Background
Healthcare Acquired Infections (HAIs) are significant public health challenge in world. HAIs are acquired during the course of treatment in a healthcare setting. Infection control measures can decrease HAIs by more than 50%.

Methods
A cross sectional study was carried out in five secondary level hospital supervised by a Karachi based NGO. Data was collected in two months March-April 2017.A total of 350 healthcare workers were randomly selected from the 5 hospitals and analyzed in the final data. Data was analyzed using IBM SPSS Version 21.

Association between categorical variables were assessed through the application of Chi square and difference in knowledge scores among different hospitals employees identified through their numbers of beds and was taken out by the application of ANOVA. Significant valueis less than 0.05.

A total of 400 questionnaires were distributed out of which a total of 350 were answered, giving the response rate of 87.5%. Significant difference was observed among the hospitals (F 2.698 P Value 0.03) when preparedness against infection was assessed. 22 bedded hospital was found to have a higher preparedness score among all the hospitals. Maximum frequency of nosocomial infections was seen in hospital with maximum number of beds.

Conclusion
This study indicated that the current status of nurse knowledge related to Nosocomial infections was poor. Policies on infection control and training and re-training of HCW are highly recommended.

Key words
HAI, Nosocomial infection, Healthcare worker, Infection control measure, Secondary level hospital.

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Introduction
Nosocomial or Healthcare-associated infections (HAIs) are a serious public health challenge worldwide affecting both developed and developing countries.[1] Healthcare-associated infections are systemic or localized condition that results from adverse reaction of an infectious agent or its toxin that was present 48 hours or more after admission in a hospital and not incubating at admission time.[2] Nosocomial infections are one of important causes of serious illness and even death in critically ill patients. Out of every 100 hospital admissions 7 patients in developed and 10 in developing countries are victim of Hospital Acquired Infections. Healthcare-associated infections imposes high cost on individuals, societies, states and health care institutions.[3] Large proportion of Nosocomial infections can be prevented and they are considered as an indicator of quality of health care system.[4] Infection control practices can reduces HAI by more than 50 %.[2] These infections are usually spread by health care workers that have poor compliance with infection control measures especially poor hand hygiene.[5] These infections account for an estimated 90,000 preventable deaths per year.[5] Large number of Healthcare-associated infections result in prolongs stays in hospitals, delayed patient recovery and may results in patient's death. The additionalcosts of disease arebearded primarily by patients and their families, hospitals and by society as a whole.[7-9]

The prevalence of Nosocomial infections is now increasing in world and becoming a challenge for health care professional. In developing countries like Pakistan, these infections cause financial burden overpatients and health care institutions. Health care system of Pakistan is not well developed, health budget is very low and nurse to patient's ratio is not according to standard. Medical insurance system is not existed in Pakistan and most of patients pay expenses by themselves or by state in government run hospital. Prevention and control of HAIs requires the presence of policy and organization, health care worker training, defined protocol for cleaning of operation room, delivery rooms and hand hygiene, proper sterilization of medical equipment and linen, proper waste disposal, proper use of antibiotics, presence of systems for isolation of patients with infectious diseases and existence of a vaccination program for staff.[10]

Methodology

A cross sectional survey was carried out in five secondary level hospitals supervised by a Karachi based NGO. Data was collected in two month period from March-April 2017. The target population comprised of healthcare providers of five hospital men and women aged 20 or older with more than 6 month of work experience excluding administrative staff. The participant fall into any of following educational categories: Physician includes residents (2 years' experience in respective field). Consultants (Post-graduation in respective field). Nursing staff included Aid Nurse (two years working experience), Midwife (certified midwifery), NICU, OT, Lab, blood bank Technicians (certified technician in respective field), Registered Nurse holding an active RN license. Housekeeping staff i.e. Ward boys and maids (Non Matric but can read and write). Sanitary staff (sweeper and sweepers) illiterate. 400 employees (n=400) were randomly selected from the hospitals roster. Out of 400 employees 350 responded. Employees less than 6 months experience and who did not complete the questionnaire were not included in the study.

Survey tool is a validated questionnaire. The questionnaire was constructed from emergent theme reviewed in literature by following authors De-Oliviera *et al.*[11] ; Edwards *et al* 2009.[12]; Ribby *et al* 2005.[13]; Pittet *et al* 2009.[14]; Pessoa-Silva *et al* 2007.[15]; Sex *et al* 2007.[16] Participant respond were rated on a Likert scale.[17]

The questionnaire consists of three sections, namely demographic features, Health facilities preparedness on infection control and Knowledge of infection control.

Three data collectors and one nurse from each health facility were selected and trained. Illiterate employee who could not read the questionnaire, were facilitated by translator. The data was analyzed using SPSS version 21. Ethical clearance taken from ethical review committee of Health services of NGO. The respondents were informed about purpose of study. Verbal consent was also obtained from study participants. All information gained during data collection was confidential. Data was analyzed using IBM SPSS Version 21. Association between categorical variable were assessed through application of Chi square and difference in knowledge score among different hospital identified through their beds was taken out through the application of ANOVA. P value less than 0.05 was taken as significant.

Results

This cross-sectional study investigated Knowledge of health care providers with regard to spread of Hospital Associated infections. The predictive relationship exists between organizational support and the level of healthcare providers' knowledge.

Demographics Features

350 out of 400 questionnaires were responded, giving the response rate of 87.5%. Proportions of female were n=201 (57.4%) and n=149 (42.6%) are male. Most of the participant lies between the age 21-30 years (35. 1%). 13.1 % participants were greater than 50 years and 6.3% were less than 20 years age.

Regarding the education of participant n=97 (27.7%) were midwifes with one and half year education and only n=31(8.9%) are Registered Nurse with 3 years education. Among the doctors 10.6% were resident and 9.15 % are consultant physician. In term of field experience of participant 62.6 % (n=219) have more than 3 years of experience in fields. In term of employment, majority of participant 32.0% work in maternity ward and 60% work for 6 hours. As far as interest in education of infection control is concerned, 83.4 % of participants have attended workshops and only 12.6% not attended any workshop.

Knowledge of the healthcare employees regarding hospital preparedness for Infection control was assessed on different parameters (Table 1). Regarding hospital Infection Control team, 15 bedded hospital employees n=38 (28%) affirmed that they have an Infection Control team. In 22 bedded hospital n=29(22%) confirmed the presence of team whereas others hospitals employees were found to be less aware of the presence of such team.

60 beds hospital employees n=21(27%) showed that Infection control practitioner is present during every shift while n=19 (24%) HCW of 22 beds hospital was also aware of Infection Control practitioner presence in hospital.

n=31(26%) HCW of 22 bedded hospitals think that improvement of hand hygiene adherence is institutional priority. Equal number of HCW of 25 beds and 10 beds hospital n=27(22%) were also think so.

n=41(26%) health provider of 10 beds hospitals said that their facility had hand disinfectants for patients in ward and in patient's room whereas n=38(24%) healthcare providers of 60 beds gave the same response.

Regarding the availability of disinfectant outside patient's rooms and in corridors n=37(25%) of 22 beds hospital health care worker were agreed with this whereas n=33(22%) of 10 beds employees affirmed that they have hand disinfectant outside patient's rooms and in corridors.

n=36(30%) health care workers of 22 beds hospital affirmed that they are provided with disposable paper towel for staff whereas n=23(19%) employees of 25 beds hospital responded that they are provided with such facility. When enquire about the availability of disposable paper towel. n=30(30%) employees of 15 beds hospital affirmed whereas n=27(27%) health workers of 25 beds hospital have such knowledge. Other hospitals have lesser knowledge of this.

Table 1: Hospital preparedness regarding control of Nosocomial

#	Hospital preparedness	Response	60 Bed n (%)	25 Bed n (%)	20 Bed n (%)	15 Bed n (%)	10 Bed n (%)	P Value
1.	My hospital has an infection Control team.	Yes	20(15)	27(20)	29(22)	38(28)	20(15)	0.056
		No	48(22)	42(19)	45(29)	34(16)	47(22)	
2.	The infection control Practitioner is physically present/ on call during every shift.	Yes	21 (27)	15(19)	19(24)	10(13)	12(16)	0.243
		No	47(17)	54(20)	55(20)	62(23)	55(20)	
3.	Hospital has made Improve HH adherence an institutional priority	Yes	21(17)	27(22)	31(26)	15(21)	27(22)	0.146
		No	47(31)	42(18)	43(20)	57(25)	40(17)	
4.	Hospital provides hand disinfectant in every ward and patient's room.	Yes	38(24)	23(15)	33(21)	21(13)	41(26)	0.006
		No	30(15)	46(23)	41(21)	51(26)	26(13)	
5.	Hospital provides Suitable hand disinfectant in patient 'room and in corridors.	Yes	30(20)	27(18)	37(25)	21(14)	33(22)	0.192
		No	38(19)	42(21)	37(18)	51(25)	34(17)	
6.	Hospital has no multiple use towelsfor staff use.	Yes	22(18)	23(19)	36(30)	18(15)	22(18)	0.046
		No	46(20)	46(20)	38(17)	54(24)	45(20)	
7.	My hospital provides disposable paper towels for hand disinfection	Yes	15(12)	27(27)	30(23)	38(30)	21(16)	0.004
		No	53(24)	42(19)	44(20)	34(16)	46(21)	
8.	Facility has conspicuous written material on transmission, of nosocomial infection	Yes	12(11)	20(18)	27(24)	31(27)	23(20)	0.021
		No	56(24)	49(21)	47(20)	41(17)	44(19)	
9.	Hospital provides disposable thermometer for patients in isolation.	Yes	8(12)	13(20)	14(21)	22(33)	9(14)	0.041
		No	60(21)	56(20)	60(21)	50(18)	58(20)	
10.	Patient's family members question HCW if they determine that the HCW intends to examine patients without hand washing.	Yes	19(31)	27(19)	33(23)	34(24)	31(21)	0.030
		No	49(24)	42(20)	41(18)	38(18)	36(17)	
11.	The administration provides workers with incentives to participate in educational courses on transmissionof HAIs.	Yes	8(10)	16(19)	22(27)	13(16)	23(28)	0.023
		No	60(22)	53(20)	52(19)	59(22)	44(16)	
12.	The administration in facility mandates HCW participation in c educational courses on prevention of HAIs.	Yes	7(6)	28(22)	28(22)	25(20)	39(31)	0.000
		No	61(27)	41(18)	46(21)	47(21)	28(13)	

Regarding the availability of literature for awareness of nosocomial infection for staff in health facility, n=31(27%) health workers of 15 beds hospital and n=27(24%) of 22 beds hospital HCW have responded positively. When employees ask about the availability of disposable non-critical medical device (Thermometer) for patients in isolation facility n=22(33%) workers of 15 beds hospital responded positively followed by n=14 (21%) staff members of 22 beds hospital.

Regarding patient's family question about the hand washing practice of HCW, the respondents belonging to 60 beds hospital n=19 (31%) give positive response flowed by 15 beds hospital n=34(24%).

15 beds hospital n=23(28%) and 22 beds hospital is n=22(27%) respondents affirmed that their hospitals facilitate them to participate in educational activities on infection control.

Regarding the role of administration in CME, n=39(31%) HCW of 10 beds hospital and n=22(25%) HCW of 15 beds hospital affirmed that it is mandatory to participate in CME oninfection control.

The questions which were related to hospital preparedness regarding infection control practices were converted to numeric data and all practices with a YES was given a score of 1 and NO was given 0. The scores were than computed and after fulfilling the assumptions ANOVA was applied for finding difference in preparedness among different hospitals categorized on number of beds. Significant difference was observed among the hospitals (F 2.698, P value 0.03). Table 2. When pairwise comparison was performed through application of Post hoc Tukey, significant difference was only found between 22 bedded and 60 bedded hospitals (p value 0.029).

Frequency of nosocomial infection

Hospital Acquired Infections data taken from the medical record of patients from July 2016 to Dec 2016, from 5 healthcare facilities. HAIs includes were,surgical site infections, Catheter-associated Urinary Tract Infections and Blood Stream Infection. Frequency of HAIs increases with increase in hospital bed Occupancy (Figure 1). Highest in 60 beds hospital and lowest in 10 beds hospital.

Overall infection control knowledge among HCWs was poor 23%. However, n=266 (76%) of HCW knew safety precaution for safe disposal of used medical supplies like needles, syringes, and catheters which transfer Nosocomial Infection to healthcare workers. n=230 (65%) of HCW have knowledge that hospitals harbor microorganism that could be transmitted by HCW. Only n=266 (23%) know mode of transmission of HAIs. n=172 (22%) knew that they are supervised while washing hand. Knowledge of hand hygiene after removing sterile or non-sterile gloves was only n=162 (21%) among HCW. Awareness about hand washing guideline was only n=249 (20%) among HCW. Only n=244 (18%) knew that an alcohol-based hand

Table 2: **Difference in mean preparedness scores among the hospitals**

				95% Confidence Interval for Mean			
# of Beds	**N**	**Mean Std.**	**Deviation**	**Lower Bound**	**Upper Bound**	**F**	**P value**
10	67	4.4925	2.65360	3.8453	5.1398		
15	72	3.9722	2.39114	3.4103	4.5341		
22	74	4.5811	2.81389	3.9292	5.2330	2.698	0.031
25	69	3.9565	3.26043	3.1733	4.7398		
60	68	3.2500	2.24855	2.7057	3.7943		

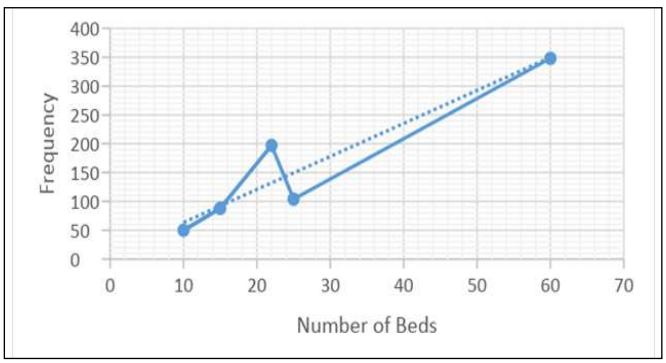

Fig 1. Frequency of nosocomial infection and hospital bed occupancy

sanitizer was effective.

Discussion

The purpose of this study was to determine the frequency of nosocomial infections and to assess the knowledge of health care workers (HCWs) with regard the spread of HAIs (Table 3).

Among the respondents n= 201 (57.4%) are female and n=149 (42.6%) are male. These finding are similar to those documented in the study of Sessa *et al*.[18]

Most of the participant n=123 (35.1%) lies between the age 21-30 years, this was same to study conducted by Johnson *et al*. 2013; Janjua *et al*., 2007, Reda *et al*., 2010.[19-21]

Regarding the education, n =97 (27.7) participants has only 1-year education in their respective field while only 8.9% (n=31) are Registered Nurse with 3 years diploma. Similar views were found in study conducted in Baghdad.[22]

In term of field experience of participant n=219 (62.6 %) have more than 3 years of experience in fields. This finding is similar to the study conducted by Taheri and Jokar, 2007[23] which indicate that most of sample has less than 5 years of employment in the hospital.

Majority of the respondents of study 292 (83.4 %) said that they participated in training dedicated to infection control and n=135(38.6%) of the respondents had attended educational

Table 3: Healthcare provider's perception regarding Nosocomial Infection

#	Knowledge	Response	Nurses n (%) n=128	Pharmacists n (%) n=22	Doctors n (%) n=69	Ward boys n(%) n=72	Sweepers n (%) n=59	P Value
1.	I am aware of hand washing guideline.	Yes	88 (35)	13(4)	61(27)	52(19)	35(16)	0.005
		No	40(9)	9(9)	8(6)	20(18)	24(21)	
2.	I have been supervised during hand washing activity.	Yes	70(42)	9(8)	28(17)	42(21)	23(20)	0.018
		No	58(36)	13(5)	41(20)	30(17)	36(20)	
3.	Health facility harbor microorganism that could be transmitted by HCW.	Yes	81(31)	10(7)	56(27)	48(62)	35(47)	0.000
		No	47(48)	12(7)	13(10)	24(16)	24(16)	
4.	I know how to use biohazards bags/containers.	Yes	75(34)	13(5)	46(24)	46(21)	36(14)	0.514
		No	53(43)	9(5)	23(14)	26(21)	23(16)	
5.	I know how and where the contents in biohazards bag/container are disposed.	Yes	76(35)	14(7)	42(18)	46(25)	33(14)	0.331
		No	52(37)	8(16)	27(16)	26(20)	26(19)	
6.	I know safety precaution for disposal of needles ect.	Yes	91(35)	15(19)	60(64)	58(21)	42(14)	0.066
		No	37(47)	7(7)	9(8)	14(10)	17(16)	
7.	Nosocomial infection may be transmitted via medical equipment.	Yes	95(35)	16(19)	65(64)	58(21)	17(14)	0.001
		No	33(47)	6(8)	4(5)	14(27)	42(12)	
8.	Hand hygiene should be performed after using sterile or non-sterile glove.	Yes	85(36)	12(4)	54(23)	48(25)	43(17)	0.098
		No	43(43)	10(8)	15(11)	24(17)	16(19)	
9.	I am aware of guideline for hand hygiene with alcohol based handsanitizer.	Yes	85(34)	14(5)	52(25)	53(18)	40(10)	0.158
		No	43(44)	8(7)	17(15)	19(14)	19(18)	

workshops 6 months to 1 year ago. Among 350 health professionals only 57 (16.3%) had ever participated in any training program about infection prevention. Angelillo *et al*.[24] recommended that educational courses about HAIs had a positive effect on infection control procedures and compliance.

Most of the respondents 62.3% of this study showed that management of healthcare facilities did not arrange continuing education courses on hospital infections control. Angelillo *et al*.[24] study demonstrated that continuous education courses on HAIs control had improve health care providers'adherence to infection control measures. But in this study however 87.7% of participants have attended educational workshops on infection control but overall knowledge on infection control was poor. This may be due to poor presentation or language barriers. This needs further research on effectiveness of educational workshops on infection control measures. In present study, total score for knowledge was 23%. Many studies have reported level of knowledge regarding infection control in health care providers and it ranges 16% to 75%. A research conducted in Nepal showed 16% of HCWs had such knowledge.[25] While Study in Jordon reported that 46% of HCW had infection control knowledge.[26]

In this study n=212(60,6%) of respondent showed that their facility has no Infection Control Committee. The Infection

Control Committee is an important part of infection control program as committee supervises infection control practice in hospital. It also recommends and implements appropriate policies, and frequently reviews these policies.[27]

The awareness to hand washing guideline was evaluated by asking leading question like when should you wash hands and how should you wash your hand? Knowledge about the steps of hand washing. What should you do if you don't have soap and clean water? Out of 350 respondents, 228 (65.1%) of HCWs thinks that promotion of hand hygiene adherence is not their hospital priority. Hand hygiene practices rate remain low in hospitals generally despite the documented guidelines. An average adherence rate is 40% as it reported in 34 studies from 1981 to 2000.[28]

n=194 (55.4%) of the respondents stated that administration not provide hand hygiene disinfectant in facility. WHO recommends alcohol-based hand formulations as disinfectant, at the point of care. Dispensers' location at the point of care makes hand hygiene easier by overcoming barriers such as inconvenient dispenser locations or lack of disinfectant agents.[29,30]

In this study only n=88(35%) nurses and n=61(27 %) doctors 19% of janitorial staff and 16% of sanitary staff were aware guideline of hand hygiene. Hand washing is key to the prevention of spread of micro-organisms responsible for nosocomial infections, but frequently, this is not adequately recognized by HCWs.[3,32]

In this study 35% of nurses and 27% of doctors have knowledge about hand washing. This is in contrast to study conducted by Manishaat *at al*.[33] where doctors' knowledge was 92.9% while nurses' knowledge was 88.4%.

In this study only 19.6% of HCW responded said that they had a sharp disposal system in various working stations. This needed to be improved by hospital quality improvement program, HCWs education and regular audits.[34]

In this study only 35% of nurse, 21% of supporting staff and only 14% of sanitary staff has knowledge of safe disposal of used syringes/needles and other sharps. As shown in this research nurses had relatively better knowledge of infection control as compare to other HCWs like technician ect. Study by Taneja *et al*. reported that 75.5% of staff nurses at a tertiary care hospital had knowledge of infection control.[35]

n=162 (21%) of respondents used to wash hand after removing sterile /non-sterile gloves. Gloves may be torn during use or may have small, unapparent defects, so during removal of gloves hands can become contaminated.[36] Hand hygiene is thus essential before changing another pair of gloves. In present study only 34 % of nurses aware of guideline for hand hygiene with alcohol-based formulation. Alcohol-based disinfectants found to have superior activity in reducing bacterial counts in hospitals.[37,38]

This study showed that frequency of HAIs increased with increase of hospital occupancy. Increase nursing workload is one of the main risk factor for HAIs.[39,40] If the nursing staff is not proportionally increase with high bed occupancy, HAIs increases. The highest prevalence of HAI was reportedin large and teaching hospitals (6.7% and 7.4%, respectively).[41] Studies have shown that overcrowding and understaffing leads to failure of patient safety programs as it decreases healthcare worker adherence to hand hygiene and overburden the screening and isolation facilities.[42]

Conclusion and Recommendation

The result of this research showed that the present state of healthcare provider's knowledge related to Nosocomial infection was not satisfactory. Policies on infection control and training andre-training of HCW are highly recommended. Hospital administration should provide resources and support in the form of educationand training opportunities to health care personals. There is urgent need of Infection Control guidelines in every hospital for HCWs. It is also recommend displaying written guidelines in every health care facility. Monitoring system for infection rates is needed in every hospital. There is urgent need of Infection Control Committee in each institution. Continuous training program of health care providers, implementation of policies about infection control and adherence to practicesof infection control are effective in control of HAIs. Further study required to compare effect of knowledge of HCWs on infection control practices.

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