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KNOWLEDGE, ATTITUDE AND COMPLIANCE OF HAND HYGIENE AMONG HEALTH CARE WORKERS AT A TERTIARY CARE HOSPITAL OF DHAKA CITY.

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1. ABSTRACT

Introduction: Proper hand hygiene is an important means of preventing hospital-acquired infections. This study aimed to provide information on knowledge, attitude and compliance of hand hygiene among health workers in a tertiary care hospital of Dhaka city. **Methodology:** A cross-sectional study was carried out during the period 1st November 2014 to April 2015 to assess knowledge, attitude and compliance regarding hand hygiene among health care workers in a tertiary care hospital, Dhaka. A total of 12 units/wards of the hospital were selected for data collection, doctors and nurses of these units were taken as the study population. The researcher visited both the groups and explained the nature of the study. Verbal consent was obtained from those who volunteered to participate. Knowledge and attitude towards hand hygiene was assessed using self-administered questionnaires and the hand hygiene was observed directly for compliance. **Results:** Among the 336 study participants only 5.1% had poor knowledge whereas the vast majority (81.3%) had moderate knowledge regarding hand hygiene. Most of the respondents (59.20 %) were found to have moderate attitude towards hand hygiene**.** It was also found that significantly higher proportion of nurses (74.90%) had undergone through hand hygiene training compared to doctors (19.7%). The overall compliance was found to be 62.32%, and it was higher among nurses than among doctors (63.24% versus 55.96%). Highest compliance (90.09%) was found for moment two; i.e., "before doing any clean/aseptic procedure", and least compliance (23.07%) was found for moment five; i.e., "after touching patient's surroundings" of hand hygiene opportunities. Significant association was found between level of knowledge and hand hygiene compliance rate of healthcare workers. Also, hand hygiene training was found to be significantly associated with level of knowledge, attitude and compliance among the healthcare workers**. Conclusion:** Present study highlights the need of multi disciplinary, multifaceted approach with special attention to repeated training with evaluation and feedback regarding hand hygiene practices among the health care workers to increase the knowledge and attitude which may play a very important role in increasing hand hygiene compliance and reducing cross transmission of hospital-acquired infections. Further study is also needed to explore the reasons for non-compliance at institutional and national level.

2. INTRODUCTION

Hospital-acquired infection (HAI), are infections acquired during hospital care which are not present or incubating at admission. Infections occurring more than 48 hours after admission are usually considered hospital acquired.[1]

Hospital-acquired infection is a burning global issue occurring worldwide and affects both developed and resource-poor countries. Infections acquired in health care settings are among the major causes of death and increased morbidity among hospitalized patients resulting in an estimated 20,000 deaths a year.[2]

Of every 100 hospitalized patients at any given time, 7 in developed countries and 10 in developing countries will acquire at least one HAI. [3] The prevalence of HAI in developed countries varies between 5%-15% and it varies between 6%-19% in low and middle -income countries.[3] In one study[4] it has been found that the prevalence of HAIs in hospitals of East Asia Regions is 10%.

HAIs are a significant burden for the patient and for public health. A high frequency of hospital-acquired infections is evidence of a poor quality of health service delivery, and leads to avoidable costs and illnesses. HAI's are considered an undesirable outcome, as they are preventable; they are considered an indicator of the quality of patient care, and a patient safety issue.

Transmission of health care-associated pathogens takes place through direct and indirect contact, droplets, air and a common vehicle Transmission through contaminated hands of healthcare workers (HCW) is the most common pattern in most settings and about 50% of health care associated infection occurs due to hands of health care workers.[5]

To address this problem, continuous efforts are being made worldwide to identify effective and sustainable strategies. One of such efforts is the introduction of an evidence-based concept of "My five moments for hand hygiene" by World Health Organization (WHO). These five moments that call for the use of hand hygiene include the moment before touching a patient, before performing aseptic and clean procedures, after being at risk of exposure to body fluids, after touching a patient, and after touching patient surroundings. Despite the relative simplicity of this procedure, compliance by health care worker with recommended hand hygiene procedures has remained unacceptably low, with compliance rates generally below 50% of hand hygiene opportunities.[6]

There are many factors contributing to poor hand hygiene compliance among health care workers particularly in developing countries, like Bangladesh where basic infection control measures are usually lacking or non-existent in most health facilities, including a lack of knowledge about the importance of hand hygiene in reducing the spread of infection, lack of understanding of correct hand hygiene technique, poor attitudes among the health care workers towards hand hygiene, lack of institutional commitment such as understaffing, poor hygiene and sanitation, lack of shortage of basic equipment and inadequate structures and overcrowding, etc.[7] A study carried out in a tertiary care hospital in India[8], showed that the knowledge on hand hygiene was moderate among the healthcare workers and the majority of the respondents had poor attitude with regard to hand hygiene.

In Bangladesh, a national hand hygiene guideline based upon WHO's "Clean Care is Safer Care" a strategy has been established to promote effective hand hygiene programme in all health care settings and the ministry of Health and Family Welfare of the Govt. of the People's Republic of Bangladesh signed an agreement with WHO for implementing the pilot activities on WHO Guidelines on Hand Hygiene in Bangladesh in the year 2005-2006. Hence pilot activities have started in Chittagong Medical College Hospital in five wards. The pilot activities motivate the HCWs and create awareness on "Clean Care is Safer Care" which creates a tremendous impact on the overall patient care in health care facilities.[9]

Any intervention needs baseline surveillance for evaluating the current situation. While hospital-acquired infection surveillance is already a challenging task in developed countries, paucity of data and other factors add to this challenge and make it imperative to our region. Published literature was not found on hand hygiene among health care workers in Bangladesh. Thus the current study was designed to assess the knowledge, attitude and compliance of hand hygiene among health care workers in a tertiary care hospital of Dhaka city. And also to draw attention of the health sector policy makers to recognize this emerging public health problem for appropriate interventions.

3. RESEARCH QUESTION

- **General objective**

To assess the knowledge, attitude and compliance of hand hygiene among health care workers in a tertiary care hospital of Dhaka city.

- **Specific objectives**

1. To find out the level of knowledge among health care workers of a tertiary level regarding hand hygiene.
2. To detect the level of attitude towards hand hygiene among health care workers of tertiary level.
3. To evaluate the compliance rate of hand hygiene among health care workers of tertiary level.

4. METHODOLOGY

Study type

Cross sectional study

Study location

The study was carried out in one of the tertiary care hospital, Dhaka.

A total of 12 wards of the hospital were selected for the study- Adult intensive care unit, Neonatal intensive care unit, Coronary cardiac unit , Cardiovascular surgical intensive care unit, General high dependency unit, Cardiac high dependency unit, Emergency ward, Dialysis Unit, Neuro ward, Oncology ward, General ward and OBGYN ward. These wards were selected because of usual occurrences of relatively high density of patient care activities so that the data collector can gather a greater number of hand hygiene opportunities more quickly. Alcohol based hand sanitizer-to-bed ratio in all of these wards were1: 1. On the other hands, the ICU's had private rooms with a sink located inside the every patient room and in non-ICU wards; there were averages of two hand washing sinks placed in different places of the ward. In addition, the WHO posters of hand hygiene showing hand hygiene technique and a model describing

5 moments of hand hygiene were displayed in each of these wards for reminder of the health care workers.

Study period: 1st November'14 to 30th April'15.

Study population: Doctors and nurses.

Eligibility criteria
Inclusion criteria

- Doctors and Nurses who were willing to participate in this study.

Exclusion criteria

- Doctors and/or nurses who worked as a member of infection control committee or infection control team.

Sampling technique
Incidental sampling was done.

Sample size
In one study Kudavidnange BP et al[10] reported that 74% of healthcare workers of a teaching hospital, Srilanka had moderate knowledge and 47.5% had good attitudes towards hand hygiene**.** In another study Syed Z et al[11] reported that the compliance rate of hand hygiene among health care workers of a general hospital, KSA was 50.3%.

Using the above information and following formula we can calculate the sample size.
$n=Z^2p\ (1-p)/d^2$

The sample size for proportion of population having moderate knowledge (PK=0.74), would be, n=294.8.
The sample size for proportion of population having good attitude (PA=0.47), would be, n=382.
and the sample size for compliance rate (PC=0.50), would be, n=384

For this study, we could take the sample size of 336 (61 doctors and 275 nurses) who were willing to participate in the study.

Data Collection
Knowledge was assessed by using a questionnaire based on WHO's hand hygiene knowledge questionnaire for health care workers.[12] This questionnaire consists of 24 questions including multiple choice and "yes' or "no" questions. Attitude was measured using a self-structured questionnaire that consists of 10 statements and the respondents were given the option to select on a 1 to 7 point Likert scale between strongly agree and strongly disagree.

For compliance, the 5 moments/indications of hand hygiene practices recommended by WHO were observed directly among the health care workers. These 5 moments are as follows.

- **Moment-1**: "Before touching a patient." It includes the following situations.

a) Before shaking hands, before stroking a child's forehead.
b) Before assisting a patient in personal care activities: to move, to take a bath, to eat, to get dressed, etc.
c) Before delivering care and other non-invasive treatment: applying oxygen mask, giving a massage.
c) Before performing a physical non-invasive examination: taking pulse, blood pressure, chest auscultation, recording ECG.

- **Moment-2:** "Before clean/aseptic procedure." It includes the following situations.

a) Before brushing the patient's teeth, instilling eye drops, performing a digital vaginal or rectal examination, examining mouth, nose, ear with or without an instrument, inserting a suppository / pessary, suctioning mucous.
b) Before dressing a wound with or without instrument, applying ointment on vesicle, making a percutaneous injection / puncture.
c) Before inserting an invasive medical device (nasal cannula, nasogastric tube, endotracheal tube, urinary probe, percutaneous catheter, drainage), disrupting / opening any circuit of an invasive medical device (for food, medication, draining, suctioning, and monitoring purposes).
d) Before preparing food, medications, pharmaceutical products, sterile material.

- **Moment-3**: "After body fluid exposure risk." It includes the following situations.

a) When the contact with a mucous membrane and with non-intact skin ends.
b) After a percutaneous injection or puncture; after inserting an invasive medical device (vascular access, catheter, tube, drain, etc); after disrupting and opening an invasive circuit.
c) After removing an invasive medical device.
d) After removing any form of material offering protection (napkin, dressing, gauze, sanitary towel, etc).
e) After handling a sample containing organic matter, after clearing excreta and any other body fluid, after cleaning any contaminated surface and soiled material (soiled bed linen, dentures, instruments, urinal, bedpan, lavatories, etc).

- **Moment-4**: "After touching a patient." It includes the following situations if they correspond to the last contact with the patient before leaving him / her:

a) After shaking hands, stroking a child's forehead.
b) After you have assisted the patient in personal care activities: to move, to bath, to eat, to dress, etc.
c) After delivering care and other non-invasive treatment: changing bed linen as the patient is in, applying oxygen mask, giving a massage.
d) After performing a physical non-invasive examination: taking pulse, blood pressure, and chest auscultation, recording ECG.

- **Moment-5**: "After touching patient surroundings." It includes the following situations if they correspond to the last contact with the patient surroundings, without having touched the patient:

a) After an activity involving physical contact with the patients immediate environment: changing bed linen with the patient out of the bed, holding a bed trail, clearing a bedside table.
b) After a care activity: adjusting perfusion speed, clearing a monitoring alarm.
c) After other contacts with surfaces or inanimate objects: leaning against a bed, leaning against a night table / bedside table.

Eight observers who had prior training and experience in infection prevention procedures collected the data. These observers included the principal nursing officer in charge of infection control in the hospital, one infection control junior nurse and six-infection control linked nurses. All of these observers were given repeated training regarding the observation method. The presence of the observers during data collection did not influence or interrupt the schedules of the health care workers as they provided care for patients. The observations were taken in different times of the day for a two and half month period of time. The data collection form was based on W.H.O hand hygiene compliance observation form.

Data management and analysis
Data was entered into the SPSS software version 20 and cross checking was done for any correction. Recoding was done for knowledge, attitude and compliance variable and new variable was created. Age of the respondents was categorized into two categories; less than 30 years and over 30 years. Working experience of the respondents was categorized into four categories; Less than twelve months of working experience, working experience in between thirteen to twenty four months, working experience in between twenty five to thirty six months and more than thirty six months of working experience. Knowledge and attitude was categorized into three categories and scoring was done on the basis of a previous study.[13] i.e., a score of more than 75% had considered as "good", 50-74% "moderate", and less than 50% had taken as "poor". On the other hand, the compliance was expressed in percentages and calculated as follows.

$$\text{Compliance (\%)} = \frac{\text{Actions}}{\text{Opportunities}} \times 100$$

Where

- **Opportunity**: defined by indication (reasons that motivate(s) hand hygiene action) of doing hand hygiene. The indications were the 5 moments of doing hand hygiene that was described earlier.
- **HH action**: response to the hand hygiene indication(s); it can be either a positive action by performing handrub or handwash, or a negative action by missing handrub or handwash.

Finally data was analyzed using descriptive statistics and inferential statistics including Chi Square test. The level of significance was set at 5% ($p<0.05$).

Ethical Issues
Permission for data collection was obtained from the Ethical committee of the hospital and the committee decided that the confidentiality of the hospital and the respondents should be maintained and the data for this study should not be personalized. Verbal consent was obtained from all of the respondents for data collection.

5. RESULTS

i. Findings

Demographic variables
The age of the study participants ranged from 21.00 to 44.00 years and the mean age was 26.3±4.4years. Majority (86.3%) were 30 years of age or younger (table -1), and were mostly (83.90%) female (figure-1). In figure-2, it was found that, 82% of the study participants were nurses group and only 18% were doctors.

The participants had been in their profession for 32.997±30.32years (29.96±24.08 yrs for nurses and 46.67±47.47 yrs for doctors). Nearly one-third of the respondents had worked less than 12 months and 29% had more than 36 months of work experience as shown in table-2. In figure-3, it was found that, highest number (38) of respondents were from the Obs and Gynae ward.

Hand hygiene training
Majority (64.90%) of the study participants had received formal training on hand hygiene (figure-4). majority of the nurses (74.90%) had gone through hand hygiene training (figure-5), on the contrary only 19.7% doctors had received formal hand hygiene training and the observed difference was found to be statistically significant (χ^2=66.853, df 1; $p<0.001$).

Knowledge on hand hygiene
The knowledge score of study participants varied from 9 to21 and the mean score was 14.94±2.27. It was found that 13.7% of healthcare workers had good knowledge and 5.1% had poor knowledge of hand hygiene (figure-6). Though almost equal proportions of doctors (82%)) and nurses (81.2%) had moderate level of knowledge of hand hygiene (figure-7), the proportion of doctors (4.9%) with good knowledge was lower than the proportion for nurses (15.6%). And the differences in the level of knowledge of hand hygiene between doctors and nurses was found to be statistically significant (χ^2= 13.752, df 2; p=0.001).

Also significant association was found between level of knowledge and hand hygiene training (table-3) among the health care workers (χ^2= 9.137, df 2; p=0.01).

Attitude towards hand hygiene

In figure-8, it was found that, 80.30% of doctors and 54.50% of nurses had moderate attitude towards hand hygiene whereas in figure-9, it was shown that 42.90% of nurses and 19.70% of doctors had good attitude towards hand hygiene that was found statistically significant (P value=0.001). Also significant association was found between attitude of health care workers towards hand hygiene and hand hygiene training (P value=0.004) as shown in table-4.

Hand hygiene compliance

There was a total of 860 hand hygiene opportunities observed, and a total of 536 hand hygiene actions were taken and the overall compliance rate was found to be 62.32% (table-5). The compliance rate among nurses was 63.24% and that for doctors was 55.96% (figure-10). The compliance rate for hand hygiene (figure-11) was found highest (86.04%) in NICU and lowest (49.48%) in Dialysis ward. Compared to Nurses, Doctors were more compliant in NICU (Doctors-89.47%, Nurse-85.07%) and in GICU (Doctors-71.42%, Nurse-68.88%) only, and in the other areas nurses were more compliant in regards to hand hygiene than doctors (figure-12).

The hand hygiene compliance rate for different moments appears in figure-13. For moment-2 of hand hygiene the compliance rate was found to be 90.09%, while that for moment-4, moment-3, moment-1 and moment-5 were found to be 76.19%, 75.59%, 55.91% and 23.07% respectively.

It was found that, the health care workers who had good level of knowledge had compliance rate of 75.60%, those having moderate level of knowledge had a compliance rate of 60.17% and those having poor level of knowledge had a compliance rate of 58.97% (table-6). Moreover, a statistically significant association was found between the level of knowledge and compliance rate of health care workers (χ^2= 10.744, df 2; p<0.05). Compliance rate was also found to be significantly associated (p<0.05) with hand hygiene training (table-7). The healthcare workers who underwent hand hygiene training were found more compliant for doing hand hygiene actions in comparison to those who didn't undergo training. The compliance rate was found 67.41% for the health care workers who underwent hand hygiene training and compliance rate of 51.78% was found for the health care workers who did not undergo the training.

ii. Tables and Figures

Table-1: Age of the respondents.

Age (Years)	Frequency	Percent
=<30	290	86.3%
>30	46	13.7%

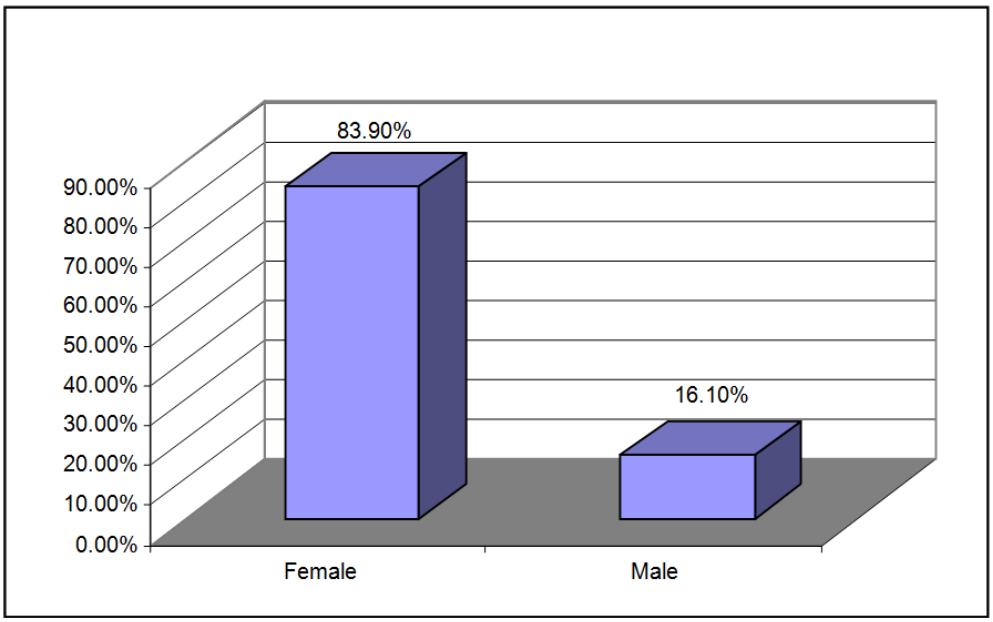


Figure 1: Sex of health care workers.

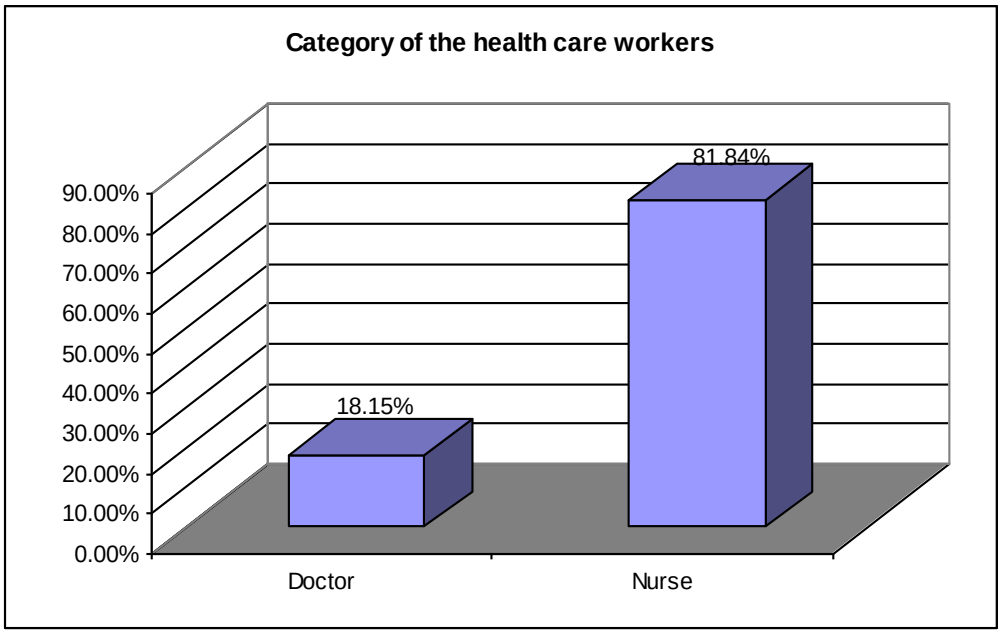


Figure 2: Category of the health care workers.

Table 2: Duration of working experience of the respondents in months.

Work experience (months)	Frequency	Percent
=<12	105	31.3%
13-24	88	26.2%
25-36	43	12.8%
>36	100	29.8%

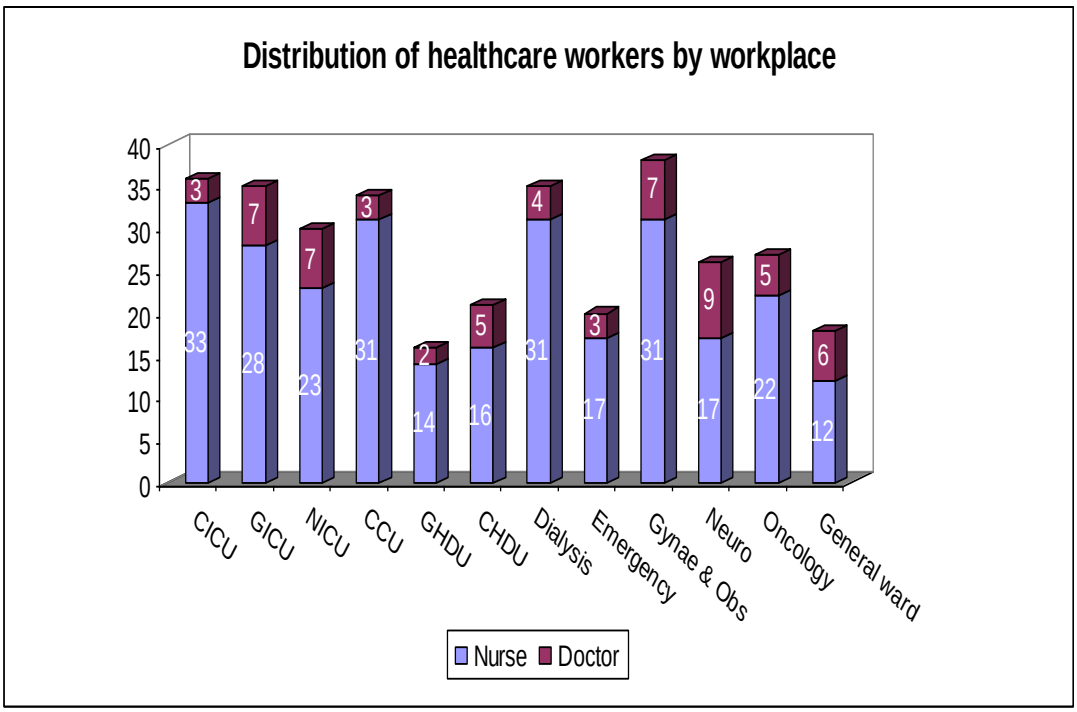


Figure 3: Distribution of health care workers in by workplace.

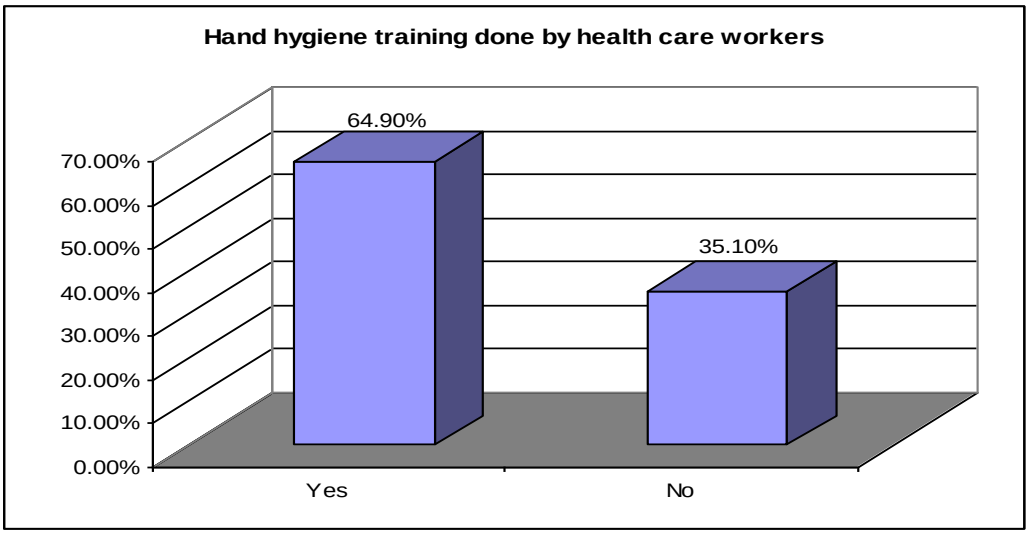


Figure 4: Hand hygiene training done by health care workers.

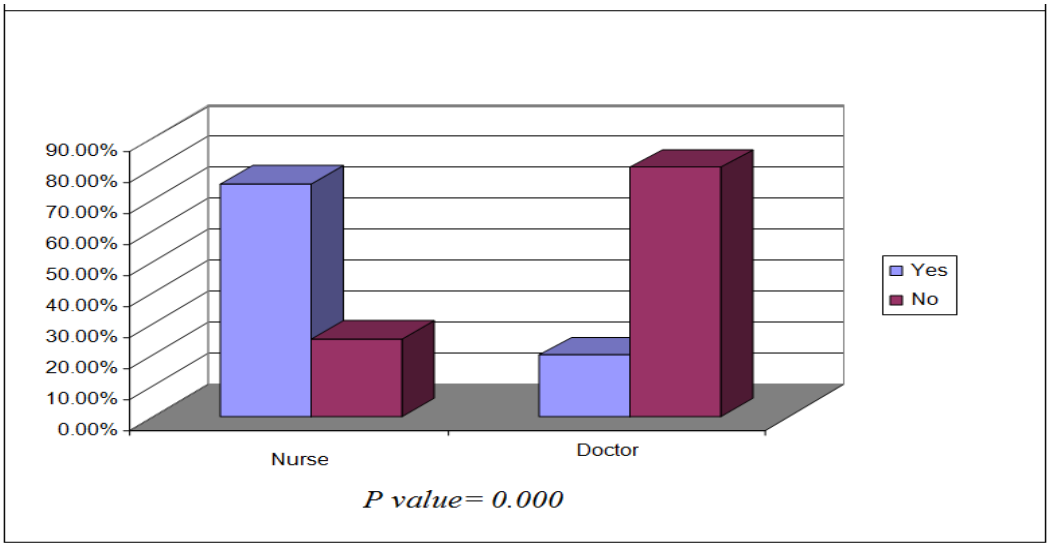


Figure 5: Hand hygiene training done by different categories of health care workers.

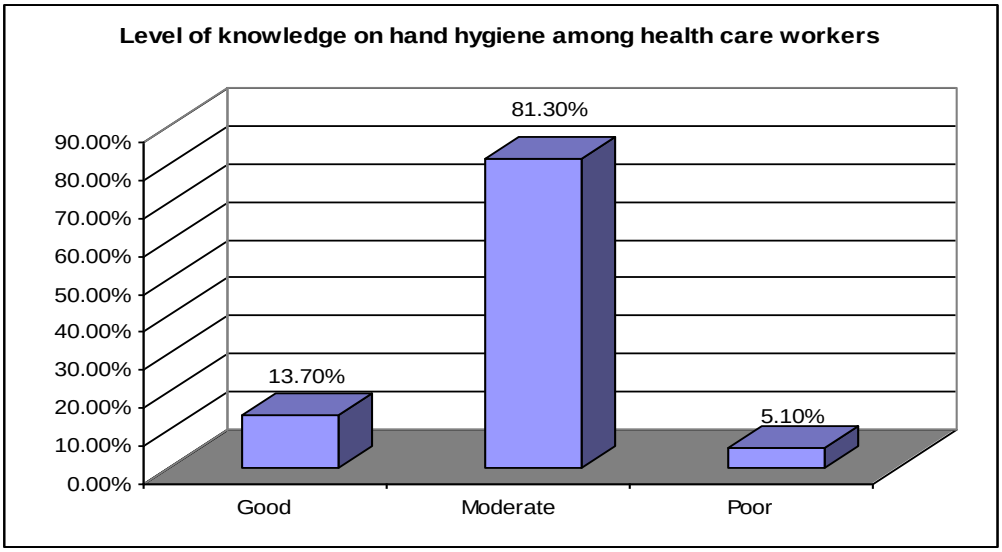
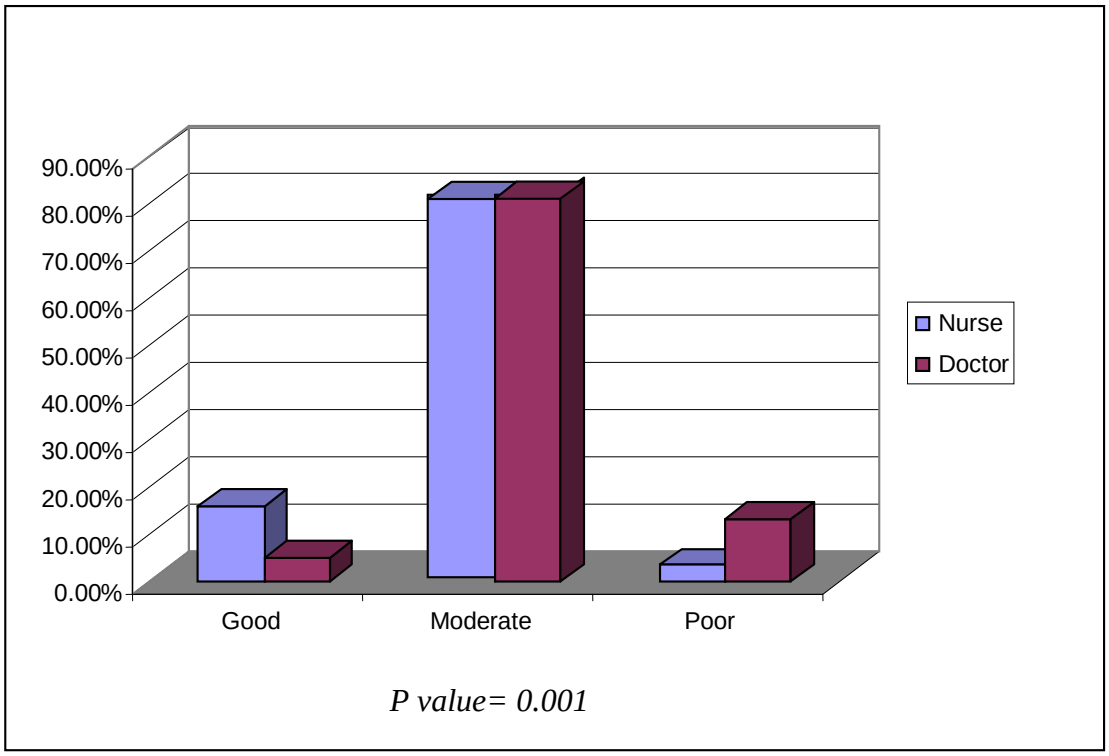


Figure 6: Knowledge on hand hygiene among healthcare workers.



Chi square: 13.753, df=2, P=0.001

Figure 7: Level of knowledge on hand hygiene among different categories of healthcare workers.

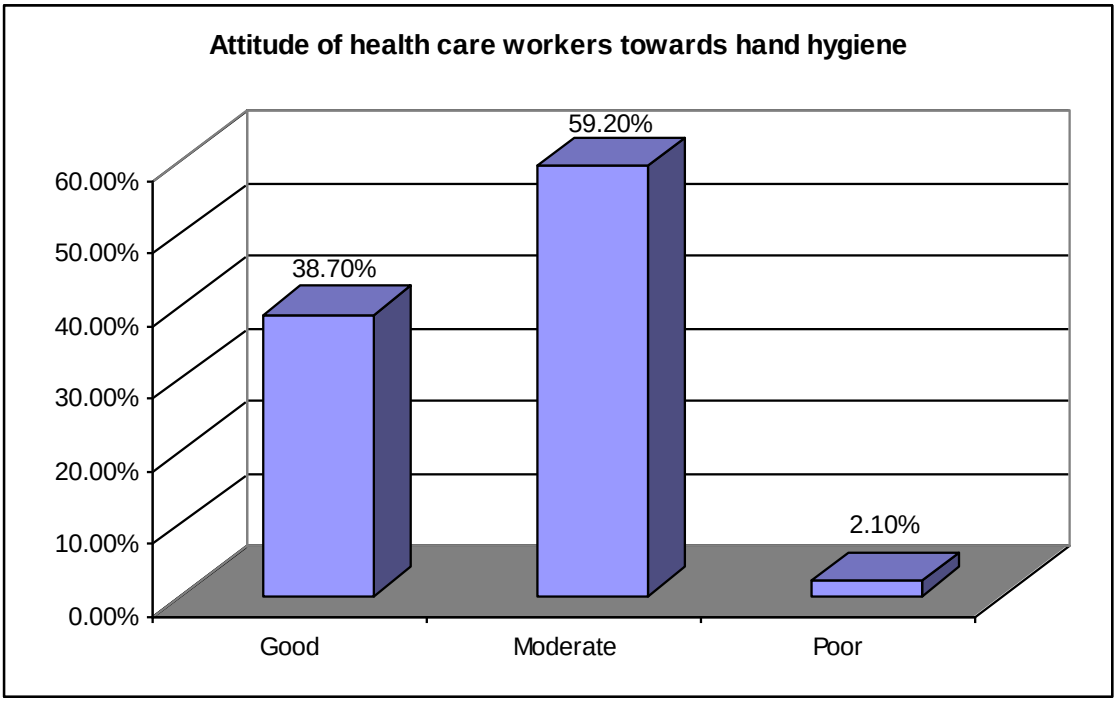
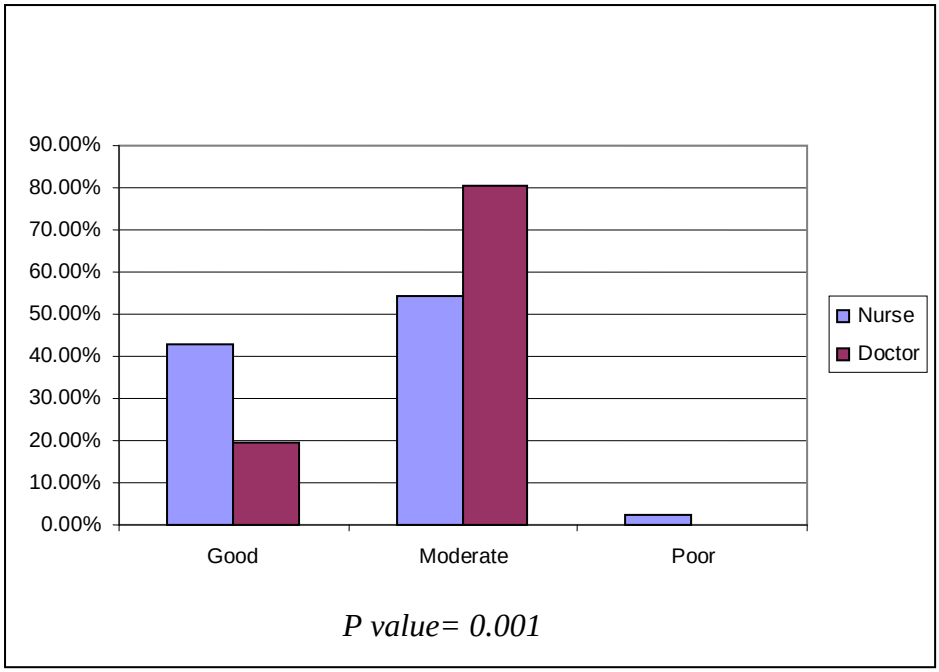


Figure 8: Attitude of healthcare workers towards hand hygiene.



Chi square: 14.124, df=2, P=0.001

Figure 9: Hand hygiene attitude among different categories of healthcare workers.

Table 3: Association between level of knowledge and hand hygiene training among the health care workers.

Knowledge level	HH training		P value
	Yes	No	
Good	38(17.4%)	8(6.8%)	0.010 (Chi square:9.137 df=2)
Moderate	172(78.9%)	101(85.6%)	
Poor	8(3.7%)	9(7.6%)	

Table 4: Association between attitude and hand hygiene training among the health care workers.

Attitude	HH training		P value
	Yes	No	
Good	94(43.1%)	36(30.5%)	0.004 (Fisher's exact: 10.120)
Moderate	117(53.7%)	82(69.5%)	
Poor	7(3.2%)	0(0%)	

Table 5: Overall hand hygiene compliance rate among healthcare workers.

Total hand hygiene opportunity observed	Total hand hygiene actions taken	Compliance (%)
860	536	62.32%

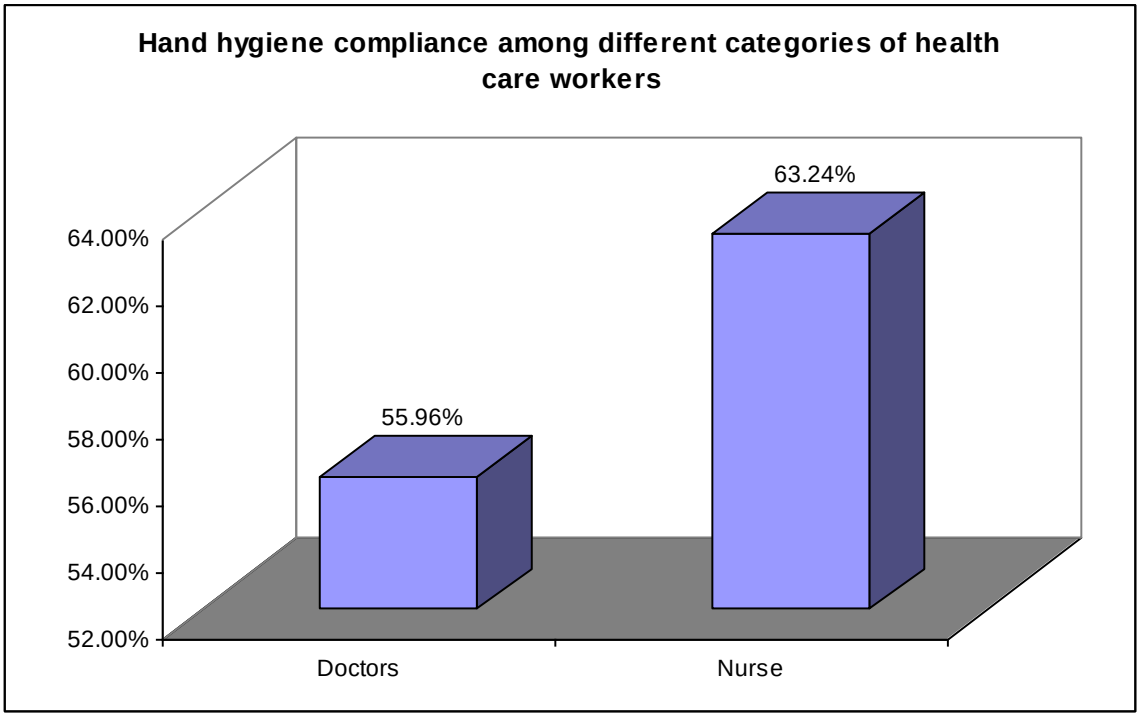
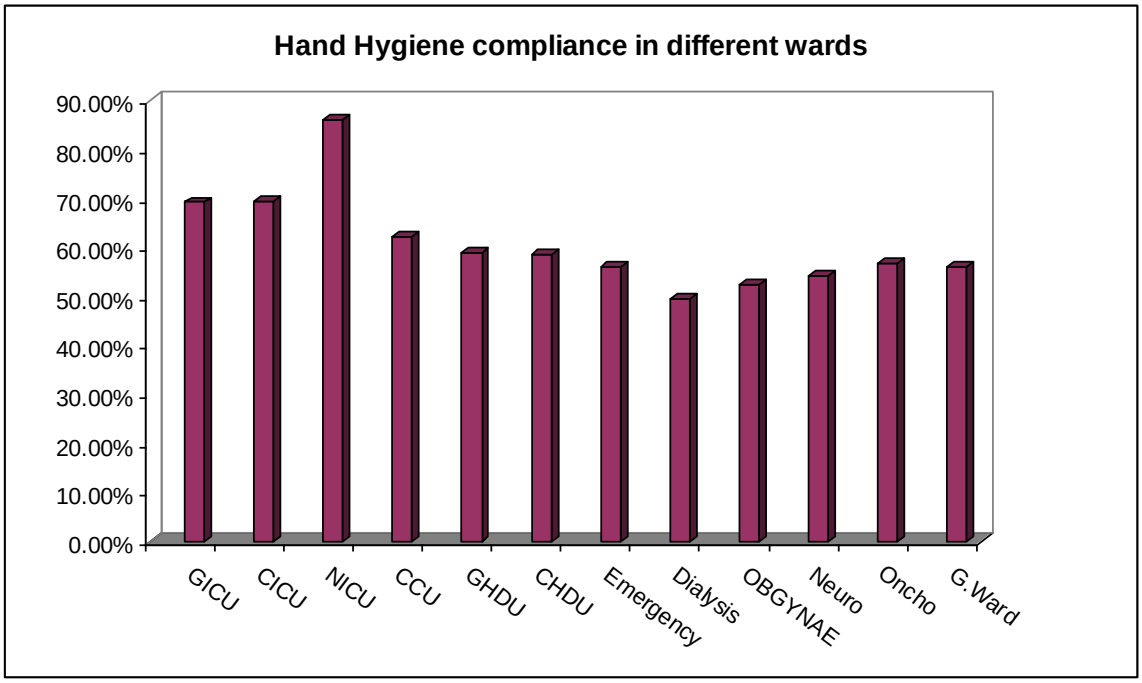


Figure 10: Hand Hygiene Compliance rate of health care workers in accordance to different Category.



Figur 11: Hand Hygiene Compliance rate of health care workers in accordance to different department.

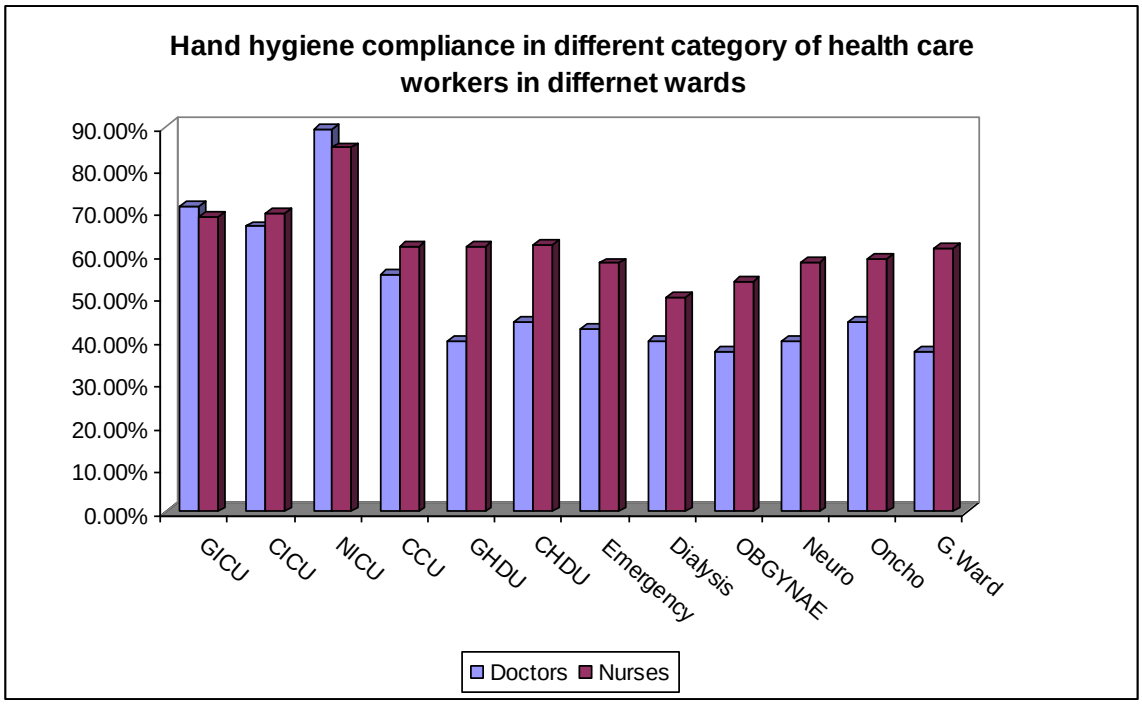


Figure 12: Hand hygiene compliance in different categories of health care workers in different wards.

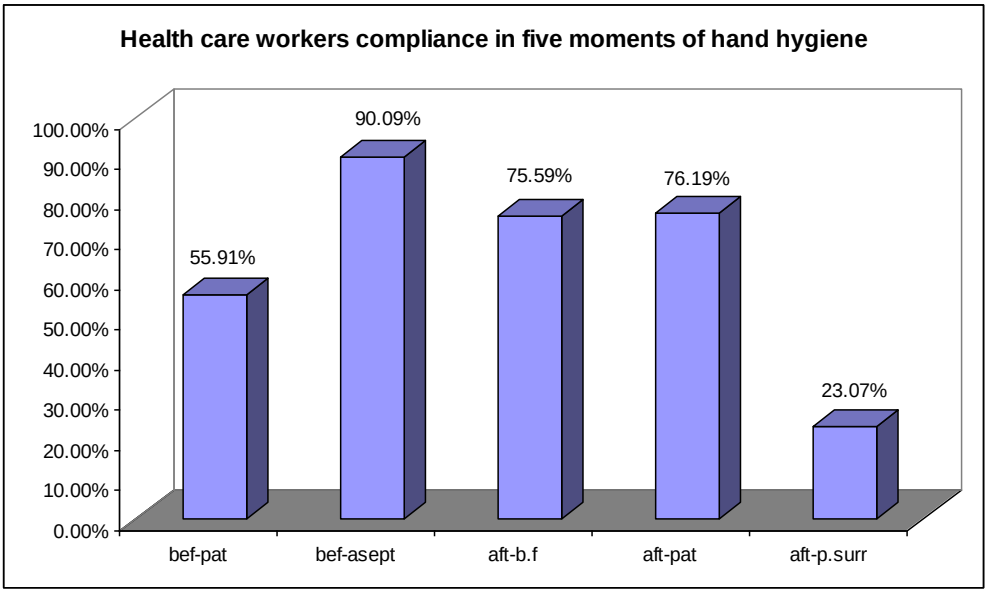


Figure 13: Hand hygiene compliance in five moments.

Table 06: Association of hand hygiene compliance rate with level of knowledge among health care workers.

Level of knowledge	Compliance rate	P value
Good (=>75%)	75.60%	<0.05 (Chi square: 10.744, df=2)
Moderate (50-74%)	60.17%	
Poor (<50%)	58.97%	

Table 7: Association of hand hygiene training with hand hygiene compliance rate.

HH training	Compliance rate	P value
Yes	67.41%	<0.05 (Chi square: 19.642, df=1)
No	51.78%	

6. DISCUSSION

Hand hygiene is a simple procedure, which is instrumental in reducing hospital-acquired infections and cross transmission of pathogens in the hospital. The present study showed that majority of the healthcare workers (81.30%) had moderate knowledge on hand hygiene. Our study is comparable with other studies[10], which reported that 72.5% had moderate knowledge on hand hygiene. Also in a study[14] of a tertiary health care setting, Bhopal city, India it was found that most of the respondents had moderate knowledge on hand hygiene. In our study, number of nurses (15.63%) having good level of knowledge was more in comparison to doctors (4.91%) and more doctors having poor knowledge than nurses whereas moderate level of knowledge was seen almost similar percentages of both groups (Figure-7), all of which was found statistically significant. This result differs from the study[15] of a tertiary hospital of South West Nigeria, where doctors had non-significant better knowledge (83.5%) of hand hygiene than nurses (82.5%) and none of the doctors had poor knowledge unlike 5% of nurses. Timothy A Ekware et al. also found in their study[15] that there was statistically significant association between attending hand hygiene training session and knowledge of hand hygiene (Fisher's exact $p<0.001$), which was found similar to our study (Chi square $p=0.010$, Table-3) also.

Our study showed, majority 59.20% of the respondents had moderate attitude, 38.70% had good attitude and 2.10% had poor attitude toward hand hygiene, which differs from another study[10], which took place in a tertiary hospital of Sri Lanka where majority 47.5% of respondents had good attitude towards hand hygiene. Also in a study[15] Timothy A Ekware et al. found that the majority 97.6% of respondents had good attitude towards hand hygiene. In our study it was found that 42.90% of nurses and 19.70% of doctors had good attitude towards hand hygiene that was found statistically significant (P value=0.001). Also significant association was found between attitude of health care workers towards hand hygiene and hand hygiene training (P value=0.004) as shown in table-4.

Many studies[6,16,17] on the practice of hand hygiene by health care workers have reported low compliance rate. In a study[11] of Kingdom of Saudi Arabia, the overall compliance rate among the health care workers was found 50.3%. In a similar study[15] among health care workers in ICU in a tertiary care hospital in Nigeria, hand hygiene compliance rate was found 53%. Also in a study[16] placed in Ain Shams University hospitals, Cairo, the overall compliance rate among the health care workers were found 34%. These figures are lower than the 62.32% of compliance rate of this present study. Though it differs from the other studies[18] where health care workers hand hygiene compliance rate was found 78% and 94%.

In our study nurses had showed better compliance than the doctors group (63.24% versus 55.96%) which is similar to the study[11] which also showed better compliance among nurses than the doctors (52.2% versus 49.1%). Erasmas V. et al. also found in his study[19] that nurses had 48% compliance whereas doctors showed 32% compliance. In another study, Ayse karaaslan also found better hand hygiene compliance among nurses (41.4%), than the doctors 931.9%) in his study.[20] Though one study[16] differs from all these results where Abd Elaziz KM. et al. was found that doctors showed a significantly higher compliance (37.5%) than other category of health care workers ($p=0.000$) in Ain Shams University, Cairo.

We found in our study the highest hand hygiene compliance in Neonatal ICU among the healthcare workers as similar to a previous study[21] where the healthcare workers in the NICU of Korle-Bu Teaching hospital, Ghana had a relatively higher percentage of Hand hygiene compliance than other departments. It indicates that NICU health care staffs were found very careful to the patients in performing hand hygiene as compared to other departments. The lowest compliance was found in dialysis unit, which can be explained due to rapid turnover of the patient (around 100 patients go through dialysis within16 hours of time by 35 dialysis machines in the study place).

The nurses were found more compliant in almost all the wards except general ICU and Neonatal ICU where doctors showed better hand hygiene practice than the nurses which is similar to some other studies[11, 22] also.

During observation of the five moments of hand hygiene practices it was found in this study that the most frequent hand hygiene practices was done for moment two; i.e., before doing any clean/aseptic procedure (90.09%) which differs with a previous study[23] done by Siddharth Chavali et al. in Aditya Birla Memorial Hospital, Pune, India where only 39% compliance was found for moment two. Moment four (After contact with a patient) and moment three (after body fluid exposure risk) was higher than moment one; i.e., before contact with a patient (76.19% and 75.59% versus 55.91% respectively) which was found similar to other studies[15,24] also. The lowest compliance was found for moment five (After touching patients surroundings) which was 23.07% and was found similar to a previous study[23] where the hand hygiene compliance for moment five was poor across all study population done by Siddharth Chavali et al. in Aditya Birla Memorial Hospital, Pune, India. In our study, statistically significant association was found between the level of knowledge and compliance rate of health care workers ($P<0.05$). It was found that, the health care workers who had good level of knowledge having compliance rate of 75.60%, 60.17% for moderate level of knowledge and 58.97% compliance rate was found for the poor level of knowledge. Also significant association was found between hand hygiene training

and compliance rate of the health care workers (P<0.05) in our study. The healthcare workers who underwent hand hygiene training were found more compliant for doing hand hygiene actions in comparison to those who didn't undergo training (67.41% versus 51.78%). The result is similar to other study[33] where health care workers of Gondar University Hospital, North West Ethiopia showed significant association between training and compliance regarding hand hygiene. In a study by Mathai *et al*[34], they have emphasized the importance of multimodal technique in improving hand hygiene compliance. They saw a large and significant difference between pre and post multimodal interventions. In another study by Lam *et al*[35] they found the multimodal interventions like educational sessions, posters, performance feedback and verbal reminders have improved their hand hygiene rates

7. CONCLUSION

Hand hygiene training was found significantly associated with the level of knowledge and attitude. In spite of having moderate knowledge and attitude level, the compliance rate was found suboptimal. Hand hygiene compliance was relatively lower among doctors than among nurses. Hand hygiene compliance rate was highest for the moment-2 of hand hygiene opportunities, i.e., hand hygiene before doing any clean/aseptic procedure, indicating failure on part of the healthcare worker in recognizing that hand hygiene practices were equally important in activities relating to patient care as it was for clean/aseptic procedures. Training and retraining of healthcare workers on hand hygiene could be undertaken to further enhance knowledge and create positive attitude regarding the issue and thus contribute in reducing HAIs and reinforcement of safety of healthcare workers.

8. RECOMMENDATIONS

- Implementation of multifaceted interventional hand hygiene program with continuous monitoring and performance feedback is necessary in the institution.
- More research is required to investigate problems associated with hand hygiene, to identify the reasons for non-compliance and to design interventions to improve the condition.
- Registering all healthcare centers in the country to develop national hand hygiene compliance rate that can be used as a benchmark of any individual hospital.

9. LIMITATIONS

- The study was carried out in a single institution. A nation- wide study would have been more instructive.
- Only doctors and nurses were included in this study and other category of health care workers (Housekeeping, ward boy, laboratory technicians, OT assistants etc) were not included.
- Relatively small sample size could be taken for the doctor group, as fewer numbers of doctors were willing to participate in the study.
- There may have some change in the behavior of the respondents in respect to hand hygiene practice as they were aware of being observed, though the respondents were not informed about the exact date and time of observation.
- There were chances of inter observer variability among eight observers in recording hand hygiene opportunities and actions by health care workers.

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