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Hand Hygiene Practices in Health Care Personnel in Tertiary Care Hospital of Kancheepuram District, Tamil Nadu

Sankararaman Kandasamy^{1*}, Jeyakumari, D², KandasamyChitresh Shankar³, Vijayalakshmi Kandasamy⁴, Priestly Vivekkumar, S⁵, Suresh Pichandi⁶

¹Associate Professor, Department of Microbiology, Madha Medical College & Research Institute, Chennai 600128, India

²Department of Microbiology, JIPMER, Karaikal, 609602, India

³Department of General Medicine, SudharsanDiabetology Clinic, Chennai, India

⁴Department of obstetrics & Gynaecology, Chettinad Medical College & Research Institute, Chennai 603103, India

⁵Panimalar Medical College Hospital and Research Institute, Chennai 600123, India

⁶Department of Biochemistry, Sri Venkateshwara Medical College Hospital and Research Centre, Puducherry 605102, India

Corresponding Author- **Dr. Sankararaman Kandasamy***

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Abstract: **Abstract:** **Background:** Health care-associated infections (HCAI) represent one of the greatest risks associated with health care. Hand hygiene (HH) is singled out as the most effective measure for preventing infections related to health care. **Aim and Objectives:** The study aims to assess the hand hygiene practices in health care personnel. **Material and Methods:** Knowledge, attitude and practices of hand hygiene were used as per WHO's hand hygiene questionnaire among health care workers. Attitudes and practices were also assessed by the questionnaires. The real time assessment of hand hygiene technique by bacteriological methods was carried out. **Results:** The Healthcare workers of our hospital have moderate knowledge in hand hygiene (68%), good scorers are only 5.5% and 27% have poor knowledge in Hand hygiene practices. The knowledge of moments of HH among them is 29%. **Conclusion:** Hand hygiene is important for healthcare workers to control nosocomial infection. Implementation of multifaceted interventional behavioral hand hygiene program is important for improving the compliance of hand hygiene practices. **Keywords:** Hand hygiene, Health care-associated infections, intensive care units, antimicrobial resistance, Health care worker.

INTRODUCTION

Health care-associated infection (HCAI), also known as nosocomial infection is a significant cause of morbidity and mortality in hospitalized patients [1]. At any point in time more than 1.4 million patients around the world experience healthcare associated infections [2]. An estimated 5-15% of hospitalized patients and 9-37% of those admitted to intensive care units (ICUs) acquire HCAI during hospital stay in developed countries [3]. This results in about 1,35,000 deaths per year in Europe and around 99,000 deaths per year in USA in 2004 [4]. In developing countries, the HCAI impact is far greater, with the risk being two to twenty-folds higher than those in the developed world and the proportion of patients infected may exceed 25% [5].

Risk of obtaining HCAI depends on the infectious agent factors (e.g., antimicrobial resistance, virulence); the host (e.g. old age, low birth weight, underlying diseases, immune suppression, and malnutrition) environment (e.g. ICU

admission, invasive procedures and devices, prolonged hospital stay and antimicrobial therapy) [6].

Transmission of pathogens through direct and indirect contact, air and droplets. Transmission via contaminated hands of HCWs' is the commonest pattern in most of the settings and this require five types of sequential steps for infection to occur: (i) the patient's skin organisms, (ii) organism transferred from hands of HCWs; (iii) organisms surviving in several minutes on HCWs' hands; (iv) the HCWs using hand washing could be inadequate or omitted entirely, or the agent used for hand hygiene inappropriate; and (v) the contaminated hand could come of direct contact from another patient [7]. It is easy to understand that the hands of staff can become contaminated even after apparently 'clean' procedures like: pulse monitoring, checking blood pressure, recording a temperature, Touching of a patient's hand, groin or shoulder. Failure to perform appropriate hand hygiene is considered to be the leading cause of HCAI and the spread of multi drug resistant organisms, and has been recognized as a significant contributor to outbreaks [6].

Hand hygiene has been singled out as the most effective measure for preventing infections related to health care. While hand hygiene is not the only measure to counter HCAI, compliance with it alone can dramatically enhance patient safety. The multimodal implementation methods of hand hygiene reduces HCAI rates [8]. This study comprises of assessment of knowledge and awareness on hand hygiene among the health care workers by a WHO standardized questionnaire and "identification of the bacteria" contaminated in the hands of health care workers working in various departments of the hospital.

Therefore this method of study aims at providing this baseline information on hand hygiene compliances which is essential, in order to develop appropriate and targeted interventions aimed at improving hand hygiene practices and ultimately reducing the high rates of HCAI in developing countries like India.

AIM

The overall aim of the study is to assess the hand hygiene practices in health care personnel in a tertiary care hospital of Kancheepuram district, Tamil Nadu.

OBJECTIVES

1. To assess the hand hygiene practices in health care personnel in a tertiary care hospital.
2. To find their awareness on WHO's 5 moments of hand hygiene and WHO's 6-step hand hygiene technique.
3. To observe the hand washing techniques and see whether it is in accordance with WHO criteria.
4. Real time assessment of hand hygiene technique by various bacteriological methods.

MATERIALS AND METHODS

Study type: An institution-based observational, descriptive, Cross-sectional study.

Place of study: A tertiary care hospital, Kancheepuram, Tamil Nadu.

Period of study: A period of two months between June and July 2016.

Sample size: A group of n = 200 health care workers of a tertiary care hospital were included.

Study group: Doctors, Nurses, Operation theatre technicians, (OT) and Laboratory technicians (LT).

Inclusion Criteria: The health care workers of all ages and who has given willingness to participate in the study and gave informed consent, as mentioned in the study group.

Exclusion Criteria: The health care workers who are known to have any bacterial infection and not willing for study participation.

Ethical Consideration: The study was approved by our Institute ethics committee. Informed written consent was obtained from all participants.

METHODS

Knowledge, attitude and practices of hand hygiene were measured using WHO's hand hygiene questionnaire among health care workers [9]. Knowledge assessment was done by using 21 questions. Each correct answer was given one point and an incorrect answer was given zero. The answers to their questions were multiple choices/ "Yes" or "No" options. The maximum obtainable for knowledge was 21. The scores were calculated and expressed in percentage. An overall score of more than 75% was considered good, 50-74% moderate and < 50 was taken as poor [10].

Attitudes and practices were also assessed by the questionnaires.

After evaluating the participants by the structured questions, the real time assessment of hand hygiene technique by bacteriological methods was carried out. The colonization of microorganisms in the hands of participants was tested by collecting samples during their peak working hours. Before washing their hands, direct finger print of both right and left hand on the surface of Blood agar and MacConkey agar plates was taken. The same was repeated after washing their hands. The participants were asked to wash their hands by soap. The steps of washing followed by the participants were also observed and noted.

The plates were transported immediately to the laboratory and incubated in 37°C for period of 48 hours. The colonies were perceived and identified by standard biochemical tests. Then the antibiotic sensitivity test was carried out by Kirby - Bauer disc diffusion technique to identify drug resistance like MRSA, ESBL and MBL. MRSA was detected by using Cefoxitin 30µg disc, ESBL was screened by double - disc synergy test and Imipenem resistance was also looked for detection MBL production.

Statistical Analysis

The collected data was collected and tabulated by using Microsoft Excel and Statistical Package for Social Sciences (SPSS version 20) software were used to analyze the data. The numerical data expressed as percentages, frequency for qualitative data. Student's t-test was used to compare the mean between the continuous variables and chi-square association test used. A value of p less than 0.05 was considered statistically significant.

RESULTS

A total of 200 health care workers (HCW) were enrolled in the study. The group includes Doctors (D) 72 (36%), Nurses (N) 108 (54%), Laboratory technicians (LT) 12 (6%), Operation theatre technicians (OT) 8 (4%) (Fig 1). Amongst them, female participants were 147 (74%) and male 53 (27%) (Fig 2). The participants from the various departments are as per given in Table 1.

The more number of participants (HCW) were from Anesthesia 27 (14%), General Medicine 23 (12%), Orthopedics 18 (9%), Pediatrics' 18 (9%), ENT 16 (8%), ICUs 14 (7%), Pathology 11 (5.8%), Dermatology 10 (5%), Pulmonary Medicine 9 (4.5%), OBG 9 (4.5%), Casualty 8 (4%), Biochemistry 6 (3%), and Blood bank 2 (1%). The response of the participants to the questionnaires and for sample collection was 100%.

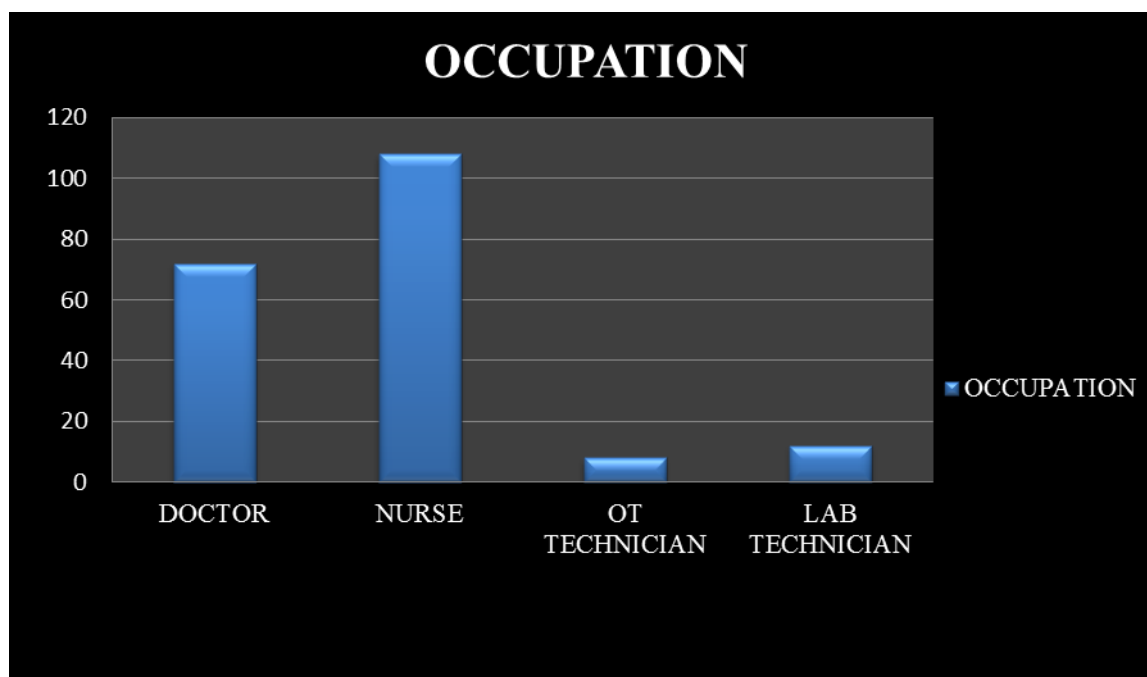


Fig 1: Participants included in the study

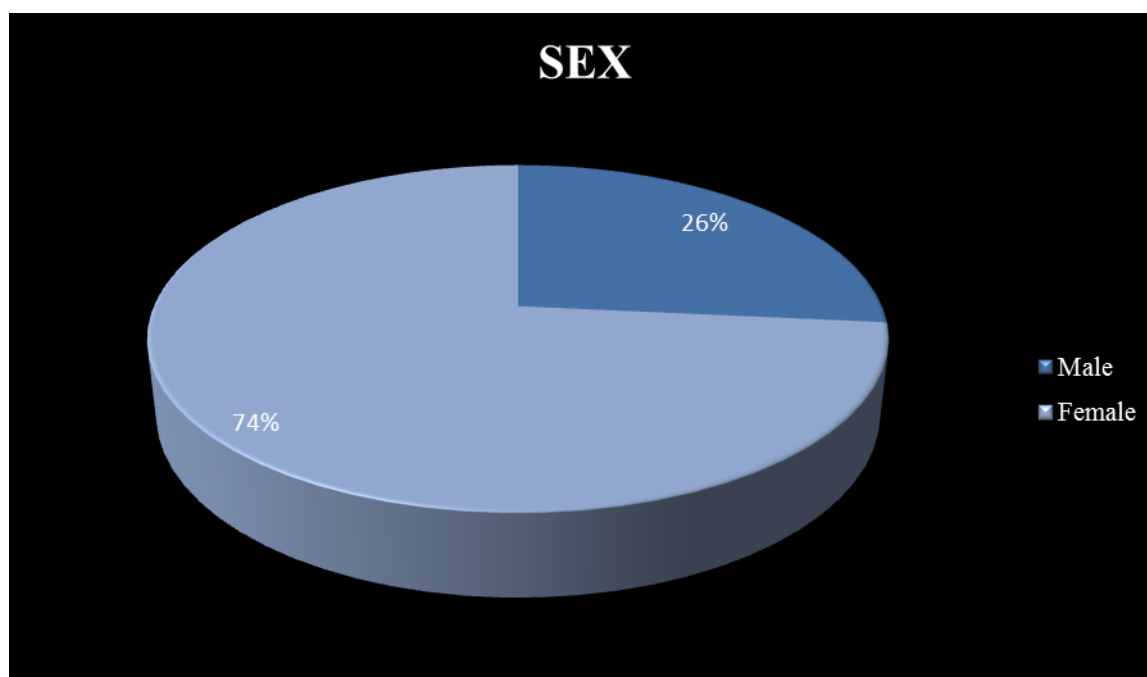


Fig 2: Sex of the participants

Table 1: Participants from the various departments

S. No	DEPARTMENT	Doctors	Nurse	Lab Tech	OT Tech
		n= 72 (36%)	n=108 (54%)	n=12 (6%)	n =8 (4%)
1.	DERMATOLOGY	3 (30%)	7 (70%)	NIL	NIL
2.	ENT	5 (31.2%)	11 (68.8%)	NIL	NIL
3.	PEDIATRICS	9 (50%)	9 (50%)	NIL	NIL
4.	GENERAL MEDICINE	10 (43.5%)	13 (56.5%)	NIL	NIL
5.	GENERAL SURGERY	3 (21.4%)	11 (78.6%)	NIL	NIL
6.	ORTHOPAEDICS	9 (50%)	9 (50%)	NIL	NIL
7.	RESPIRATORY MEDICINE	5 (55.6%)	4 (44.4%)	NIL	NIL
8.	OBSTETRICS AND GYNAECOLOGY	4 (44.4%)	5 (55.6%)	NIL	NIL
9.	OPHTHALMOLOGY	4 (26.7%)	11 (73.3%)	NIL	NIL
10.	PATHOLOGY	7 (63.6%)	NIL	4 (36.4%)	NIL
11.	BIO-CHEMISTRY	NIL	NIL	6 (100%)	NIL
12.	ANAESTHESIOLOGY	7 (25.9%)	13 (48.1%)	NIL	7 (25.9%)
13.	CASUALTY	5 (62.5%)	3 (37.5%)	NIL	NIL
14.	BLOOD BANK	NIL	NIL	2 (100%)	NIL
15.	ICU	NIL	4 (100%)	NIL	NIL
16.	MICU	1 (16.7%)	4 (66.7%)	NIL	1 (16.7%)
17.	ICCU	NIL	2 (100%)	NIL	NIL
18.	PICU	NIL	2 (100%)	NIL	NIL

Knowledge on hand hygiene

The overall knowledge on hand hygiene among the participants was moderate 68% (D -71%, N- 63.2%, LT 92.3% and OT 63%). On analyzing the results based on the scoring system only few participants 11 (5.5%) scored good whilst 136 (68%) scored moderate and 53 (27%) scored poor for knowledge based questions. The responses of the participants to the individual questions is given in Table 2 and scoring in Table 3.

Table 2: Assessment of knowledge among Health care workers

S. No	Knowledge based questions (answer)	Doctors n = 72	Nurse n = 108	Lab Tech n = 12	OT Tech n = 8	P Value
		n (%)	n (%)	n (%)	n (%)	
K1	Expected no. of deaths due to health care associated	17	25(23.1%)	4(30.8%)	1	>.05

	infections per year in developed countries like Europe (1,30,000 – 1,40,000)	(23.6%)			(14.3%)	
K2	Which of the following should be avoided, as associated with increased likelihood of colonisation of hands with harmfulgerms? a. Wearing jewellery(yes) b. Damaged skin (yes) c. Artificial fingernails (yes) d. Regular use of a hand cream (no)	53 (73.6%) 70 (97.2%) 65 (90.3%) 30 (41.7%)	84 (77.8%) 92 (85.2%) 71 (65.7%) 49 (45.4%)	12 (92.3%) 11 (84.6%) 10 (76.9%) 12 (92.3%)	7 (100%) 4 (57.1%) 5 (71.4%) 6 (85.7%)	>.05 <.05 <.05 <.05
K3	Do you know the moments of hand hygiene and steps of hand washing as prescribed by WHO? (yes) a. No. of moments (5) b. No. of steps (7)	49 (68.1%) 21 (29.2%) 14 (19.4%)	89 (82.4%) 25 (23.1%) 44 (40.7%)	11 (84.6%) 9 (69.2%) 1 (7.7%)	7 (100%) 3 (42.9%) 5 (71.4%)	>.05 <.05 <.05
K4	Which of the following hand hygiene actions prevents transmission of germs <u>to the patient</u> ? a. Before touching a patient (yes) b. Immediately after a risk of body fluid exposure (yes) c. After exposure to the immediate surroundings of a patient (no) d. Immediately before a clean/aseptic procedure (yes)	63 (87.5%) 58 (80.6%) 45 (62.5%) 57 (79.2%)	96 (88.9%) 93 (86.1%) 68 (63%) 77 (71.3%)	12 (92.3%) 11 (84.6%) 9 (69.2%) 10 (76.9%)	7 (100%) 7 (100%) 3 (42.9%) 7 (100%)	>.05 >.05 >.05 >.05
K5	Which of the following hand hygiene actions prevents transmission of germs <u>to the health-care worker</u> ? a. After touching a patient (yes) b. Immediately after a risk of body fluid exposure (yes) c. Immediately before a clean/aseptic procedure (no) d. After exposure to the immediate surroundings of a patient (yes)	66 (91.7%) 69 (95.8%) 49 (68.1%) 57 (79.2%)	83 (76.9%) 73 (67.6%) 81 (75%) 83 (76.9%)	11 (84.6%) 10 (76.9%) 11 (84.6%) 13 (100%)	7 (100%) 7 (100%) 6 (85.7%) 5 (71.4%)	<.05 <.05 >.05 >.05
K6	What is the minimal time required for alcohol based rubs? (20 seconds)	16 (22.2%)	17 (15.7%)	0 (0%)	3 (42.9%)	>.05
K7	What is the minimum time needed for liquid soap hand washing? (40 seconds)	12 (16.7%)	17 (15.7%)	3 (23.1%)	2 (28.6%)	>.05
K8	Are posters describing hand washing are displayed at washing areas? (yes)	50 (69.4%)	88 (81.5%)	11 (84.6%)	5 (71.4%)	>.05
K9	When is the “WORLD HAND HYGIENE DAY”? (May 5)	32 (44.4%)	31 (28.7%)	4 (30.8%)	2 (28.6%)	<.05
K10	When is the “WORLD HAND WASHING DAY”? (Oct 15)	29 (40.3%)	36 (33.3%)	11 (84.6%)	2 (28.6%)	<.05

Table 3: Scoring of knowledge based questions on HH

S. No	Knowledge based questions	Doctorsn = 72 (36%)	Nurse n = 108 (54%)	Lab Tech n = 12 (6%)	OT Tech n = 8 (4%)
1.	Good (> 75%)	4	5	0	2
2.	Moderate (50 – 74%)	51	68	11	5
3.	Poor (< 50%)	17	35	1	1

Moments and steps of hand hygiene

The results of analysis of moments of hand hygiene showed that the knowledge of the moments of the participants viz LT 9 (69.2%), OT technicians 3 (43%), D 21 (29.2%) and N 25 (23.1%). The knowledge of seven steps of hand washing was observed only in 64 (32%) participants. The knowledge in different groups is as OT 5 (71.4%), N 44 (41%), D 14 (19.4%), and LT 1 (8%) Table 2 & 4.

Table 4: Assessment of results of moments and steps of hand hygiene

If YES	NO. OF MOMENTS		NO. OF STEPS	
	Frequency	Percentage	Frequency	Percentage
4	16	8%	2	1%
5	58	29%	17	8.5%
6	44	22%	73	36.5%
7	38	19%	64	32%
NA	44	22%	44	22%

Attitudes in hand hygiene

The major participants had poor attitudes in regards to hand hygiene (28%). The correct responses percentage of the four groups of hand hygiene with attitudes are mentioned in Table 5.

Table 5: Comparison of responses to attitude among Health care workers

S. No	Attitude based questions	Doctors n = 72	Nurse n = 108	Lab Tech n = 12	OT Tech n = 8	P Value
		n (%)	n (%)	n (%)	n (%)	
A1	Hand hygiene refers to, washing with a. Water b. Alcohol rub c. Liquid soap d. Dettol	4 (5.6%) 15 (20.8%) 34 (47.2%) 19 (26.4%)	10 (9.3%) 11 (10.2%) 37 (34.3%) 50 (46.3%)	4 (30.8%) 2 (15.4%) 3 (23.1%) 4 (30.8%)	1 (14.3%) 0 (0%) 2 (28.6%) 4 (57.1%)	<.05
A2	The effectiveness of hand hygiene in preventing health care-associated infection. a. Very low b. Low c. High d. Very high	1 (1.4%) 5 (6.9%) 43 (59.7%) 23 (31.9%)	1 (.9%) 23 (21.3%) 63 (58.3%) 21 (19.4%)	0 (0%) 2 (15.4%) 3 (23.1%) 8 (61.5%)	0 (0%) 2 (28.6%) 4 (57.1%) 1 (14.3%)	<.05
A3	The importance of hand hygiene at our institution. a. Very low priority b. Moderate priority c. High priority d. Very high priority	4 (5.6%) 28 (38.9%) 28 (38.9%) 12 (16.7%)	7 (6.5%) 60 (55.6%) 27 (25%) 14 (13%)	0 (0%) 4 (30.8%) 4 (30.8%) 5 (38.5%)	0 (0%) 3 (42.9%) 4 (57.1%) 0 (0%)	>.05
A4	Hand rubbing is more effective against microbes when compared to hand washing.	36 (50%)	64 (59.3%)	7 (53.8%)	4 (57.1%)	>.05
	Average	27%	28%	27.2%	28%	

Practices of hand hygiene

The valuation for hand hygiene practices showed that doctors have good hand hygiene actions (86.1%) followed by nurses (72.2%) whereas LT and OT have (62%) & (43%) of HH actions respectively. The analysis of barriers interfering with their HH practices showed that doctors communicated that out of products (71%) and forgetfulness (60%) as their main barriers; Nurses stated that Problem with the products (70%), too busy (67%) and forgetfulness

(60.1%); Laboratory technicians revealed that out of products (77%), problem with the product (54%) as well as forgetfulness (54%) as their main barriers. OT technicians indicated that unaware of its importance (71.4%) and problem with the products (57.2%) as their major barriers. Also training in hand hygiene was undergone mainly by nurses than the other groups of participants. The responses of the participants to the individual questions are given in Table 6.

Table 6: Comparison of Hand hygiene practices among Health care workers

S. No	Practice based questions	Doctors n = 72	Nurse n = 108	Lab Tech n = 12	OT Tech n = 8	P Value
		n (%)	n (%)	n (%)	n (%)	
P1	I received formal training in hand hygiene in the last three years.	40 (55.6%)	85 (78.7%)	6 (46.2%)	5 (71.4%)	<.05
P2	Our hospital managers / senior officials promote hand washing on any basis.	56 (77.8%)	87 (80.6%)	11 (84.6%)	6 (85.7%)	>.05
P3	The following hand hygiene actions are performed. a) Before touching a patient b) Immediately after fluid exposure c) Before and after septic procedure d) After removing of gloves e) All the above	1 (1.4%) 0 (0 %) 5 (6.9%) 4 (5.6%) 62 (86.1%)	7 (6.5%) 5 (4.6%) 14 (13%) 4 (3.7%) 78 (72.2%)	0 (0%) 0 (0%) 2 (15.4%) 3 (23.1%) 8 (61.5%)	1 (14.3%) 0 (0%) 2 (28.6%) 1 (14.3%) 3 (42.9%)	<.05
P4	I routinely use a liquid soap for hand hygiene.	58 (80.6%)	84 (77.8%)	12 (92.3%)	6 (85.7%)	>.05
P5	I practice hand hygiene even in case of emergencies.	49 (68.1%)	63 (58.3%)	8 (61.5%)	4 (57.1%)	>.05
P6	The barriers interfering with my optimal hand hygiene practices. a) Not convenient b) Out of product c) Problem with product d) Too busy e) Forget f) Unaware of its importance	35 (48.6%) 21 (70.8%) 42 (58.3%) 40 (55.5%) 43 (59.7%) 17 (23.6%)	50 (46.3%) 57 (52.8%) 75 (69.5%) 72 (66.7%) 65 (60.1%) 63 (58.3%)	4 (30.8%) 10 (76.9%) 7 (53.9%) 6 (46.2%) 7 (53.9%) 4 (30.8%)	3 (42.9%) 2 (28.6%) 4 (57.2%) 2 (28.6%) 3 (42.9%) 5 (71.4%)	>.05 >.05 >.05 >.05 >.05 <.05
	Average	46.57%	49.94%	45.14%	44.77%	

Bacterial colonization on the hands of the participants

The bacteria isolated before washing are given in Fig 3 and Table 7.

Single organism was isolated from the hands of 108 (54%) participants, mixed growth in 35 (17.5%) and no growth in 57 (28.5%).

Both Gram positive and gram negative bacteria with heavy growth were observed. Amidst gram positive bacteria, Coagulase negative Staphylococcus aureus (CONS) 117 (58.5%), Staphylococcus aureus 10 (5%) in which MSSA 5 (2.5%) & MRSA 5 (2.5%) and Bacillus species 9 (4.5%) were grown.

The gram negative bacteria isolated were Pseudomonas species 25 (22.5%), Klebsiella species 10 (5%), Escherichia coli 6 (3%), Enterobacter species 2 (1%) and Acinetobacter species 1 (0.5%).

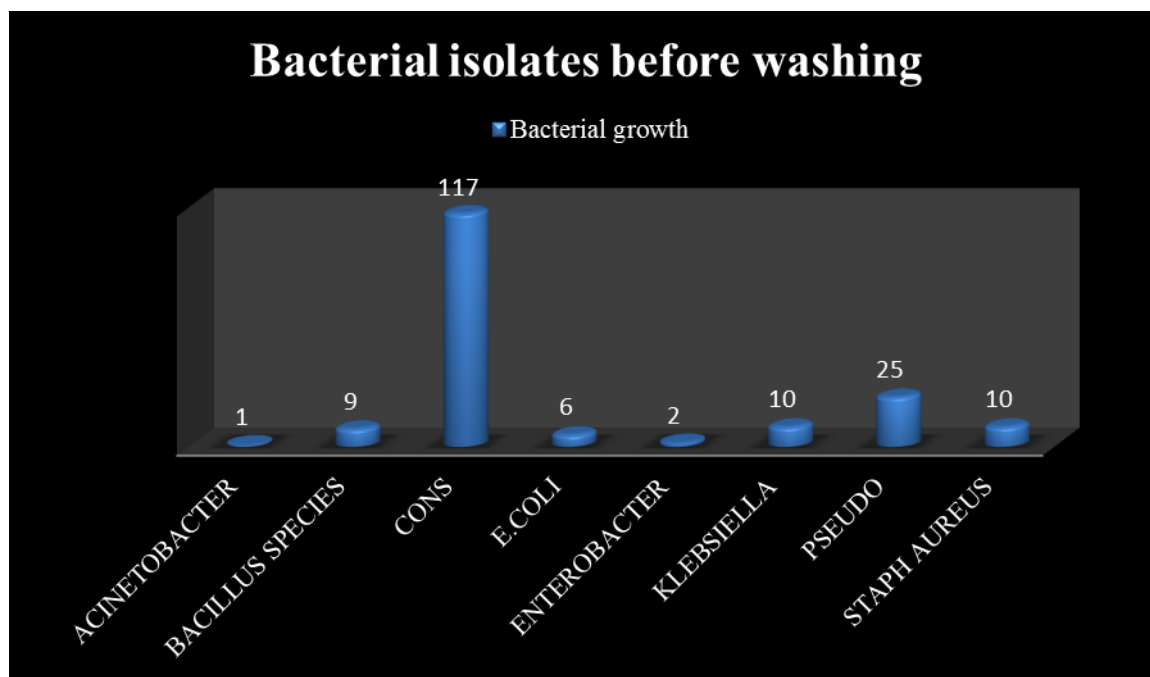


Fig 3: Bacteria isolated before washing

Table 7: Bacterial growth before and after washing

Observations	Bacterial Growth Before Washing		Bacterial Growth After Washing	
	Frequency	Percentage	Frequency	Percentage
Single growth	108	54%	33	16.5%
Mixed growth	35	17.5%	12	6%
No growth	57	28.5%	155	77.5%

The bacteria isolated after washing are given in Fig 4 and Table 7.

The single growth persist in 33 (16.5%), mixed growth in 12 (6%) and no growth in 155 (77.5%)

The colony count of the bacteria reduced after washing but still the significant numbers of pathogenic bacteria grown after washing. CONS 29 (14.5%), Staphylococcus aureus 8 (3%), Bacillus species 9 (4.5%), Klebsiella species 6 (3%), Pseudomonas species 5 (2.5%), E.coli 1 (0.5%) and Enterobacter species 1 (0.5%), were grown.

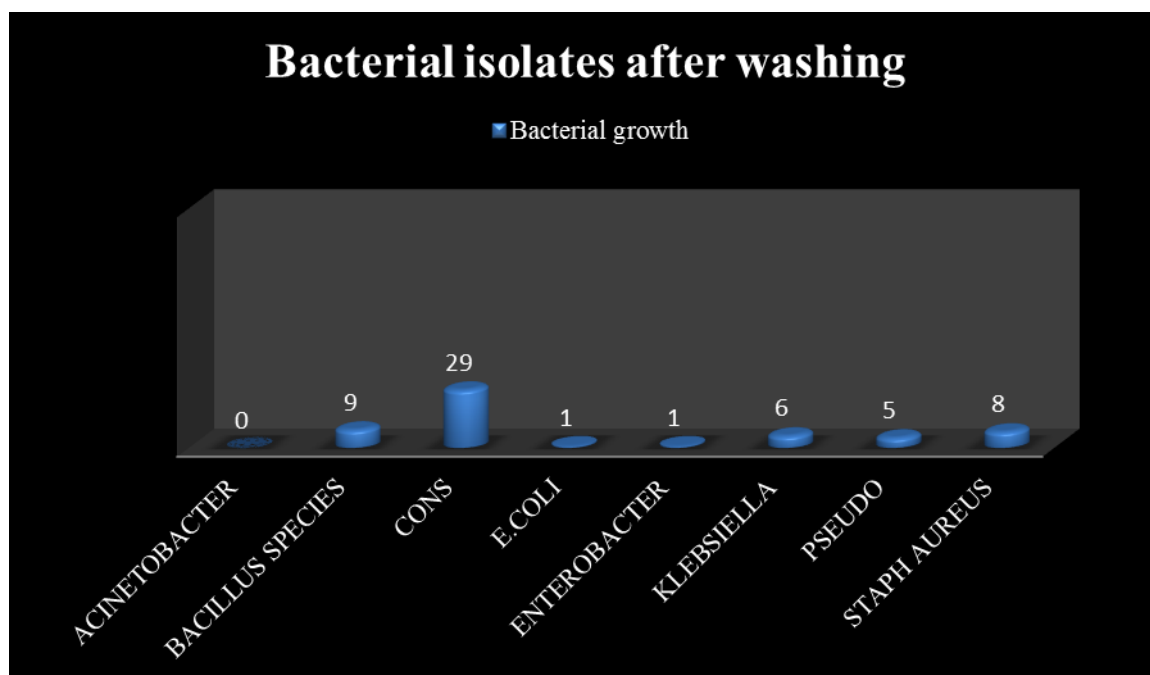


Fig 4: Bacteria isolated after washing**DISCUSSION**

Compliance of Health care workers to adhere to correct hand hygiene are found to be poor in most of the developing countries [11]. However hand hygiene is the single most effective preventive measure against HCAI and can contribute to shorter hospital stay, reduction in patient morbidity and health care costs [11].

Our study groups consisted of Doctors, Nurses, Laboratory technicians and Operation theatre technicians. In our study all the study groups had moderate knowledge of hand hygiene (68%), which is a positive findings which is comparable to the study conducted by

Sreejith SN *et al.*, and Arthiet *al.*, [12, 13] Though they have overall awareness about hand hygiene, the most important aspects like moment of hand hygiene and steps of hand washing are to be followed as prescribed by WHO for hand hygiene practices. The knowledge of moments in the four groups is as follows: doctors (29.2%) and nurses (23.1%) are less knowledgeable than the LT (69.2%) and OT technicians (43%). The seven steps hand washing were not followed by most of the participants though they aware of its importance viz; OT (71.4%), N (41%), D (19.4%) and LT (8%). This shows that compliance of the hand hygiene is poor in our study. This is in accordance with the most of the studies conducted in developing countries like India [12, 13]. In spite of being a very simple action, compliance with hand hygiene among health care providers is as low as than 40% [14].

The minimum time required for alcohol based rub is 20 seconds as per the WHO hygiene guidelines [6]. This knowledge is lacking in most of the participants of our study which is alike to the study done by Vaishnaviet *al.*, and Arthiet *al.*, [10, 13].

Sreejithetal, VandeMortelet *al.*, [12, 15] have documented that the nursing students had better hand hygiene knowledge than the medical students. The study conducted by Mu'taz MD *et al.*, [16] in Jordan declared that compliance and importance of HH had no significant differences between nurses and physicians. This is in contradiction to our study where LT (92%) had more knowledge followed by doctors (71%), nurses and OT (63%) and also contradict the study by Suresh kumar D *et al.*, [17] that compliance is better in doctors and nurses than ancillary staff.

A study conducted by Anargh V *et al.*, [18] observed that 81% considered that hand washing soap and water is superior to hand rubbing which is in constant to our study which showed that 80% of our participants considered liquid soap in their routine hand washing practices. But participants of 56 % affirmed that hand rubbing procedure is most effective than hand washing which is in consistent with the study done by Marta LC *et al.*, [19].

The attitude of the participants towards hand hygiene was overall poor (28%) whereas study conducted by Mu'taz MD *et al.*, [16] in Jordan showed a better score on attitude in HH. The practices of hand hygiene actions have been followed only by 76% of our participants. Though it is a good scoring, rest 24% of the health care workers need to be improved. This is similar to the findings in a study done by Sreejith SN *et al.*, and Arthiet *al.*, [12, 13].

The factors for non- compliance of our study are expressed by the participants of our study as follows (i) problem with the product (64%), too busy to maintain the HH (60%) forgetfulness (59%), unaware of its importance (47%), not convenient to every time (46%) and out of products (45%). Some of the study acknowledged that the barriers of HH is mainly the low availability of alcohol based rubs and in order to improve compliance as availability of there has been shown to be directly associated with improved compliance [18].

It is proven that organisms that cause nosocomial infections are most commonly transmitted by the hands of health care workers [20]. Transient microorganisms do not usually multiply on skin surfaces [21]. They are often acquired by HCWs during direct contact with patients or contaminated environmental surfaces adjacent to the patient and are the organisms most frequently associated with health care associated infections. The transient flora transmissibility is depends on species present, microorganisms numbers in skin moisture and surface. The few HCWs hands may get persistent colony of pathogenic flora such as *Staphylococcus aureus*, gram negative bacilli and yeasts [22].

Our study proved that both the normal flora as well pathogens like *Klebsiella* species, *Pseudomonas* species, *Acinetobacter* species, *Escherichia coli*, *Enterobacter* species, MRSA and MSSA were isolated in many participants before washing in their peak working hours. After washing with soap the organisms load completely eliminated in 76% of the participants however 24% still carriers those organisms with reduced count. This is similar to the study lead by Mónica Nogueras *et al.*, [23].

The reason for persistence of organisms even after washing their hands could be due to improper washing

techniques carried out by the participants. In our study the complete seven steps were carried out only by 32% of HCWS and rest of the participants were not passed the seven steps of washing techniques. This shows the poor compliance of hand hygiene in spite of moderate knowledge of hand hygiene.

LIMITATIONS

This study is hospital-based study, a detailed community based study is required. The proper frequent training sessions and assessment of hand hygiene is required for the improvement of hand washing practices in the hospital.

CONCLUSION

To conclude, hand hygiene is important for health care workers to control HCAs. It is important that all HCWs to stick on to and improve their practices, attitude and knowledge of HH. HH plays an important role in decreasing the cost of care for the patients and hospitals, contributes to shorter hospital stay, reduces mortality and morbidity rates and improves quality of care and life of patients. Implementation of multifaceted interventional behavioural hand hygiene program is important for improving the compliance in the hand hygiene practices. Also study shows that training sessions of hand hygiene is required more frequently and assessed for the improvement of hand washing practices in the hospital. Continuous monitoring along with performance feedback will encourage them to follow the correct hand hygiene practices.

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