

Knowledge and Attitude towards Hand Hygiene and Study of Bacterial Flora on Hands of Health Care Workers at a Teaching Hospital in Silvassa, UT of Dadra and Nagar Haveli

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Abstract

Introduction: The hospital atmosphere can harbour a large variety of microbial flora which can potentially constitute a risk of infection in patients, visitors and healthcare workers. Contaminated hands act as a vehicle for transmission of microorganisms. Poor hand hygiene practices are a significant cause of rise in healthcare associated infections which increases morbidity, mortality, and healthcare costs among hospitalised patients worldwide. So, hand hygiene of HCWs plays a crucial role in the prevention of healthcare associated infections.

Material and Methods: A questionnaire based cross-sectional study, conducted at 600 bedded teaching hospital for eight months. All the data was collected in the principal investigator's google drive, Kruskal-Wallis non-parametric test applying on correct and not correct answers of the respondents.

Result: The study showed 52.1% HCWs had Moderate knowledge, 88% had a good attitude, and 84% had good practice. There was no significant difference ($p > 0.05$) in the knowledge of HCWs. Hand drying practice (27%) were found poor. CONS (27.5%) were the major bacterial flora found on the hands of HCWs. Alcohol-based hand rub is effective to remove transient flora of hands.

Conclusion: The findings of this study shows that most healthcare workers had moderate knowledge, displayed a positive attitude and good hand hygiene practice. Continuous education on hand hygiene and administrative orders can improve the knowledge and attitude towards the hand hygiene.

Keywords: Hand Hygiene, Healthcare Workers, Knowledge, Attitude, Practice, Bacterial flora.

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Introduction

Hospital-acquired infections or hospital-associated infections (HAI) also called Nosocomial infections are defined as infections acquired in the hospital that are not present or incubating at the time of admission. Infections that occur after 48 hours of admission are often considered hospital-acquired [1]. The rate of HAI could indicate the quality of care given by the hospital. The factors that contribute to the frequency of HAIs are many and could include patients admitted to hospitals who are often immunocompromised, who often undergo many invasive tests or procedures and treatments, and the patient care practices and the hospital environment may increase the risk of transmission of microorganisms among patients.

Infections have a variety of effects on patients including an extended stay in the hospital, infection would increase treatment costs, and increase the number of laboratory and diagnostic investigations resultant increase in the financial burden of families as well as the healthcare systems [2]. Another complication is that infections are difficult to treat with antibiotics; now a day drug resistance is becoming more common, particularly among Gram-negative bacteria [3,4].

The hospital environment can harbour a large variety of microbial flora which can potentially constitute an infection risk to patients as well as visitors and healthcare workers. Transmission of microbes from the environment to the patients and healthcare workers through direct and indirect contact with the environment has been well documented. Environmental contamination has been significantly associated with the transmission of multi-drug resistant organisms (MDRO) like methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE), *Clostridioides difficile*, and *Acinetobacter*

baumannii. Contaminated hands or gloves spread microorganisms around the hospital environment.

Most healthcare-associated infections (HAI) are thought to be transmitted by the hands of Healthcare workers (HCWs) through direct contact during patient care and their hands can become gradually colonized by bacteria. Poor hand hygiene (Hand rub & Hand wash) practices are a significant cause of rise in healthcare associated infections which increases morbidity, mortality, and healthcare costs among hospitalised patients worldwide. So hand hygiene of HCWs plays a crucial role in the prevention of healthcare associated infections [5].

The World Health Organisation (WHO) has issued guidelines for procedural hand hygiene in order to reduce the prevalence of hospital-acquired infections but a lack of knowledge among healthcare workers is associated with poor compliance [6]. Even though the relative simplicity of this procedure, adherence to hand hygiene is unacceptably low. Some of the reasons for lack of adherence or compliance to hand hygiene include lack of appropriate material, low staff-to-patient ratios, allergies to hand washing products, insufficient knowledge among HCWs about risk and procedures, the time required and casual attitudes among HCWs towards hand hygiene [7,8,9].

There are two types of microbes colonizing hands (i) The resident flora: Which consists of microorganisms residing under the superficial cells of the stratum corneum, (ii) Transient flora: Which colonizes the superficial layers of the skin. Transient microorganisms survive, but do not usually multiply on the skin. They are often acquired by health care workers (HCWs) during direct contact with patients or their nearby contaminated environmental surfaces [10,11]. Keeping the above factors in mind, the present study was done to evaluate

knowledge & attitude toward hand hygiene and bacterial load of hands of HCWs.

Material and Methods

Setting:

The present study is a questionnaire based cross-sectional study, conducted at 600 bedded teaching hospital in Silvassa, UT of Dadra and Nagar Haveli, from February 2022 to September 2022.

Inclusion criteria: All participants worked at the teaching hospital.

Study population and participants:

Each participant taking part in the study was demonstrated with the correct steps of hand hygiene as per WHO guidelines [12]. All the health care workers (Clinicians, faculties, nurses, technicians) and 2nd-year medical students were included in the present study. A total of 309 HCWs and medical students participated in the study.

Data collection instruments and data collection:

Informed consent was obtained from respondents prior to the administration of the questionnaire. Google form was given to accumulate data which was kept in access control with the principal investigator only. The questionnaires were filled anonymously and no information was collected about the identity of HCWs.

The questionnaire was designed as per WHO Guidelines on Hand Hygiene in Health care. [1], and some questions were added as per infection control specialist's & microbiologist's requirements of teaching hospitals and related literature [13].

Questionnaire comprise of total 32 question divided in four parts:

1. Demographic information – 6 questions
2. Assessment of knowledge – 12 questions
3. Assessment of attitudes – 6 questions
4. Assessment of practices – 8 questions

Only knowledge-based questions were assessed on the basis of a scoring system, 1 point was given to correct answer. Attitudes questions based on agree, strongly agree, disagree, and strongly disagree. Assessment of practice questions were based on participant's opinion.

After training case-based questions on hand hygiene techniques were given. Students have to select the option either Hand Rub or Hand Wash. Assessment of questionnaire based on the scoring system. For correct answer 1 point given.

For analysis of microbial flora on the hands of HCWs, a total of 80 swabs were collected. Sterile cotton swabs were pre-moistened in sterile normal saline and rubbed over interdigital spaces of hands and fingers dorsally and ventrally. Swabs were inoculated on blood agar plate without any delay [14].

Out of 80 healthcare worker, 40 HCWS were chosen randomly for flora of hands pre & post hand rub. All the swab sample were cultured on Soya Casein Digest agar (SCDA) plates for isolates identification.

Statistical Analysis

All the data was collected in the principal investigator's google drive. Data was tabulated in Microsoft Excel. For p-value: Kruskal-Wallis non-parametric test applying on correct and wrong answers of the respondents.

Results

A total of 309 HCWs participated in this study. The age range of HCWs is 20-57 years. 67.3% HCWs were Female. Most of the HCWs had working experience (0-5 years). Concerning ward activity, the majority of HCWs were working in wards, ICU and other departments.

Table 1: Demographic information.

Demographic information	Distribution	Frequency	Percentage
Age	20-30 Years	231	74.7%
	31-40 Years	61	19.7%
	41-50ears	15	4.8
	>50 years	2	0.6%
Gender	Male	101	32.6%
	Female	208	67.3%
Occupation	Doctor	40	12.9%
	Nurse	114	36.9%
	Others	4	1.2%
	Student	141	45.6%
	Technician	10	3.2%
Experience in this Hospital	0-5 years	91(46 nurse)	29.4%
	5-10 years	32	10.9%
	10-15 years	23	7.44%
	15 years and above	14	4.5%
	NIL	148(141 students)	47.9%
Encircle your work place	Casualty	7	2.2%
	ICU	31	10.3%
	Laboratories	17	5.5%
	NICU	21	6.7%
	OPD	37	11.9%
	Others	108	34.6%
	PICU	2	0.6%
	Wards	85	27.5%
	OT	1	0.3%
Source of information	Friends/ relative	8	2.5%
	Health worker	85	27.5%
	Lecture	191	61.8%
	Media	25	8.09%

Table 2: Correct response of knowledge of healthcare workers toward hand hygiene.

Knowledge of healthcare workers toward hand hygiene.	Correct Answer	% Of Population Answer Correctly	% Of Population Answer Incorrectly
1. In which of the following situations, hand hygiene should be performed?	5 moments of hand hygiene.	87.3% n=270	12.6% n= 39
2. How much time do you take for washing hands?	60 seconds	75.4% N=233	24.5% N=76
3. In case of visibly not contaminated hands	Perform hand rub	61.1% N=189	39% N= 120
4. How spread of infection most commonly occur from one	Through Airborne, contaminated hands of staff,	87% N=269	13% N=40

patient to another in health care settings?	contaminated equipment, improper environmental cleaning (all of above)		
5. Which is the most common infection acquired by patient from health care provider in case of improper hand hygiene.	Colonization or infection with methicillin-resistant staphylococcus aureus	30% N=93	70% N=216
6. Clostridium difficile (the cause of antibiotic-associated diarrhea) is readily killed by alcohol-based hand hygiene products	False	41.1% N=127	58.8% N=182
7. Minimum Time needed for Alcohol based Hand Rub to kill most germs	20 seconds	62.4% N=193	37.5% N=116
8. Hand rubbing is more effective against germs than hand washing	False	64.7% N= 200	35.3% N=109
9. Is wearing accessories associated with increased colonization of hands?	True	80.9% N=250	19% N=59
10. What is the most frequent source of contamination responsible for healthcare associated infections?	Germs present on the hand of Health care workers.	62.7% N=194	37.2% N=115
11. Contaminated hands are a vehicle for transmitting infection	Yes	95.7% N=296	4.2% N= 13
12. Can Hand washing prevent the Nosocomial infection	Yes	91.2% N=282	8.7% N=27

Moderate knowledge seen towards hand hygiene.

Table 3: Comparison of knowledge of nurses, doctors, students and others (technician)

Knowledge of healthcare workers toward hand hygiene.	Correct Answer	Nurses (n=114) N %	Doctors (n=40) N %	Students (n=141) N %	Others (n=14) N %	P value
1. In which of the following situations, hand hygiene should be performed?	5 Movement of hand hygiene.	105 92.1%	36 90%	117 83%	12 85%	0.168

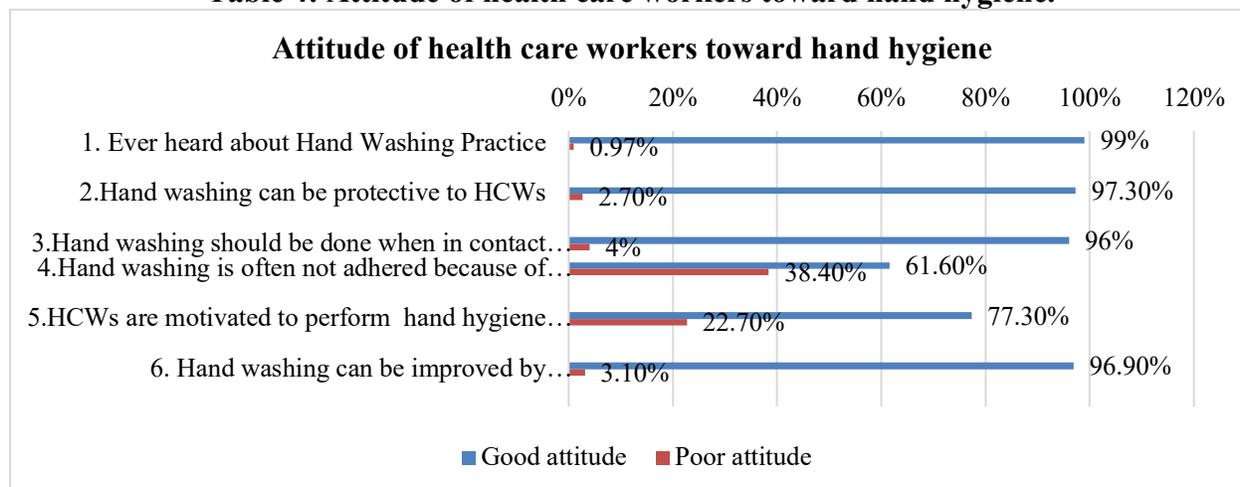
2. How much time do you take for washing hands?	60 seconds	100 87.7%	24 60%	96 68%	12 85%	0.000
3. In case of visibly not contaminated hands	Perform hand rub	73 64%	24 60%	83 59%	11 78.5%	0.481
4. How spread of infection most commonly occur from one patient to another in health care settings?	Through Airborne, contaminated hands of staff, contaminated equipment, improper environmental cleaning (all of above)	90 79%	32 80%	107 75%	13 92.8%	0.509
5. Which is the most common infection acquired by patient from health care provider in case of improper hand hygiene.	Colonization or infection with methicillin-resistant staphylococcus aureus	22 19.2%	23 57.5%	41 29%	7 50%	0.000
6. Clostridium difficile (the cause of antibiotic-associated diarrhea) is readily killed by alcohol-based hand hygiene products	False	54 47.3%	21 52.5%	44 31.2%	9 64.2%	0.005
7. Minimum Time needed for Alcohol based Hand Rub to kill most germs	20 seconds	60 52.6%	29 72.5%	93 66%	10 71.4%	0.056
8. Hand rubbing is more effective against germs than hand washing	False	70 61.4%	22 55%	97 68.7%	10 71.4%	0.325

9. Is wearing accessories associated with increased colonization of hands?	True	90 79%	33 82.5%	115 81.5%	12 85.7%	0.897
10. What is the most frequent source of contamination responsible for healthcare associated infections?	Germs present on the hand of Health care workers.	80 70.1%	29 72.5%	77 54.6%	8 57.1%	0.037
11. Contaminated hands are a vehicle for transmitting infection	Yes	104 91.2%	39 97.5%	140 99.2%	14 100%	0.008
12. Can Hand washing prevent the Nosocomial infection	Yes	104 91.2%	36 90%	129 91.4%	14 100%	0.698
Total knowledge score		Poor: 2 (1.7%) Moderate :48 (42.1%) Good:64 (56.1%)	Poor: 3 (7.5%) Moderate :18 (45%) Good:19 (47.5%)	Poor: 4 (2.8%) Moderate : 9 (48.9%) Good: 68 (48.2%)	Poor: 0 (0%) Moderate: 4 (28.5%) Good:10 71.4%)	0.207

p-value: Kruskal-Wallis non-parametric test applying on correct and not correct answers of the respondents.

From the above table, it show that there was no significant difference($p > 0.05$) between the responses of the nurses, doctors, students and others (technicians) regarding the knowledge of healthcare workers towards hand hygiene .

Table 4: Attitude of health care workers toward hand hygiene.



Positive attitude seen in HCWs towards Hand Hygiene.

Table 5: Practice of healthcare workers towards hand hygiene.

Practice of healthcare workers toward hand hygiene.	Good practice	Poor practice
1. Why do you perform your Hand hygiene at your work place?	Total 100% - 67% HW perform hand hygiene to prevent the spread of infection between patients. 33% HW perform for self-protection.	0%
2. When was the last training attended for hand hygiene?	100%. All participant had attempted training.	0%
3. How often you practiced Hand Hygiene at your work places?	77.3% HW perform hand hygiene several times Several times/ days	22.7 %
4. Which material do you use for Hand Hygiene at your hospital work?	63% HW using liquid soap and water, 37% HW using alcohol-based hand rub.	NA
5. Do you wash your hands before and after work?	96.7% HW wash their hands	3.3% do not wash their hands
6. How do you dry your hand after washing?	44% HW air dry, 17.4% use new towel, 6.1% use paper towel	7.7% use used towel to dry their hands, 20.7 % use their handkerchief.
7. Which step frequently missed by you while hand hygiene?		7.4% H.W missed finger tips while washing hand. 29.7 % missed Inner border of hand, 31% missed nails. 14.8% missed

		thumbs, 16.8% missed webs between the finger.
8. Which is the most common reason you skip hand hygiene?		37.2% H.W skip hand hygiene because of over burden by work. 24.5 % H.W Don't remember that they have to perform hand hygiene. 20% H.W prefer to wear glove. 9.3% H.W sink is far away.8.7% H.W has allergies to hand hygiene products.

Good hand hygiene practice was found.

Table 6: Case Based Question Assessment – Students

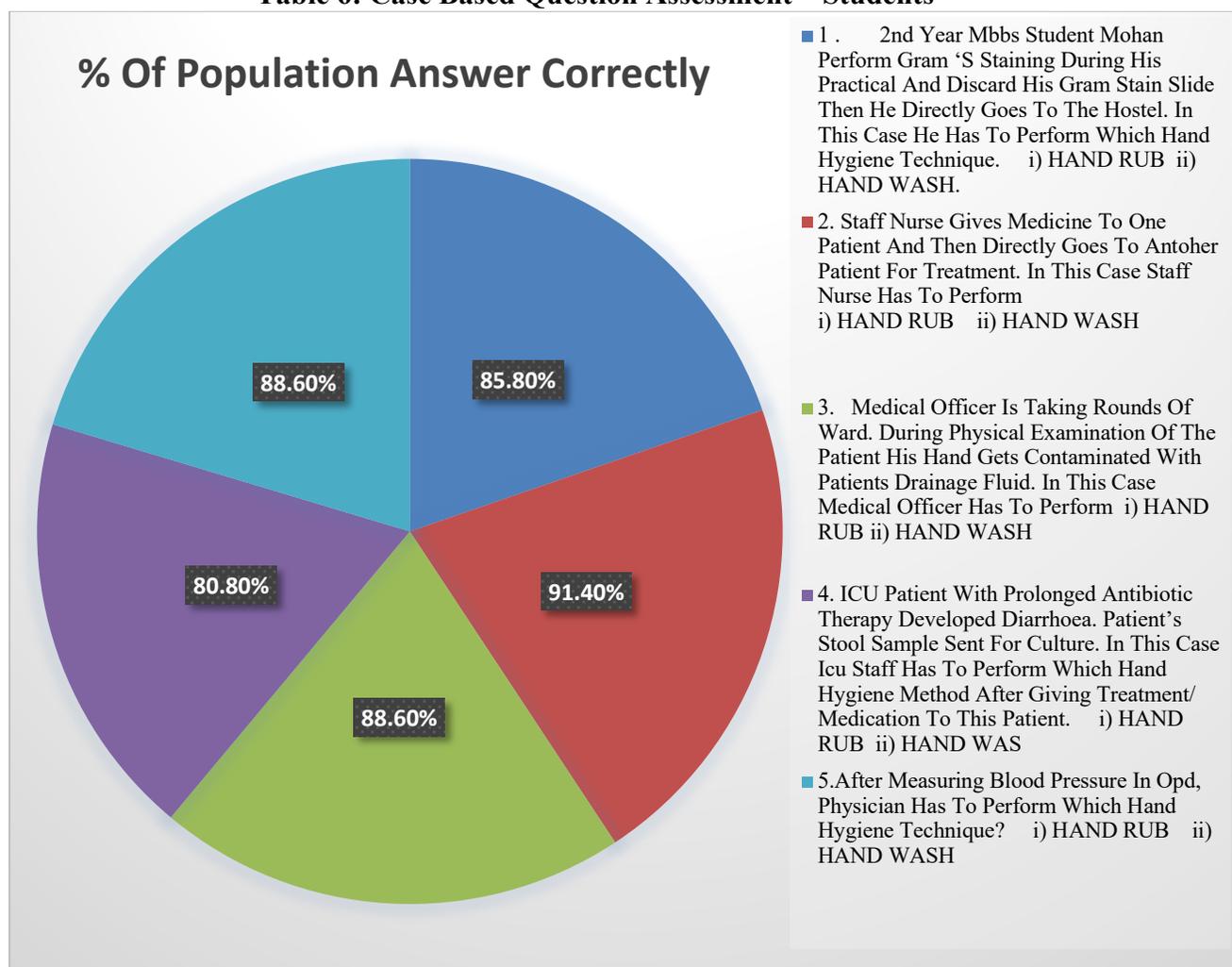


Table 7: Microorganism isolates from hands of healthcare workers. (randomly collected from critical care unit)

Sr. no	Organism	Swab from palm and inter digit space	Finger print	Total	
1	MSSA	1.25% n=1	0% n=0	0.6% n=1	
2	MRSA	0% n=0	0% n=0	0% n=0	
3	Coagulase negative staphylococcus	13.7% N=11	13.7% n=22	33(20.6%) n=33	Total CONS-27.5% n= 44
4	MR- cons	7.5% n= 6	6.25% n= 5	6.8% n= 11	
5	Klebsiella pneumoniae	1.25% n= 1	0% n=0	0.6% n=1	
6	No Growth	7.5% n=6	1.25% n=1	4.3% n=7	
7	Gram positive bacilli	68.7% n=55	65% n=52	66.8% n=107	
	Total	80	80	160	

33.1 % bacterial flora was found on hands of critical care unit HCWs.

Table 8: Hand transient flora load of health care workers beforehand sanitization

S. N.	HCWs		1	2	3	4	5	6	7	8	9	10	No of Positive colonies
1	Doctors	7	+	-	+	+	-	+	+				5
2	Staff Nurse	10	+	+	+	+	+	+	+	-	+	+	9
3	OT assistant	2	-	+									1
4	Students	10	+	+	+	+	+	+	+	+	+	+	10
5	Laboratory Technician	4	+	-	-	+							2
6	Sweeper	2	+	+									2
7	Dresser	2	+	+									2
8	Peon	1	+										1
9	servant	2	+	+									2
	Total	40											34 (85%)

85% of the participants were positive for transient hand flora before hand hygiene.

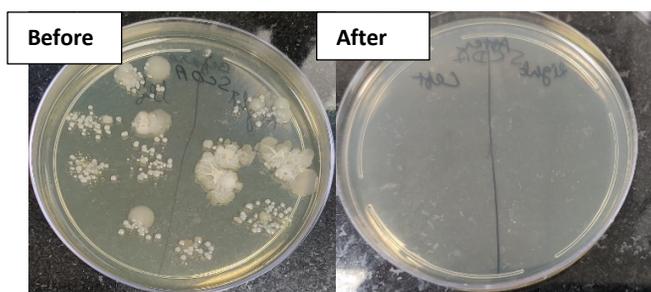


Table 9: Hand transient flora load of health care workers after hand sanitization

Sr. no	HCWs		1	2	3	4	5	6	7	8	9	10	No of Positive colonies
1	Doctors	7	-	-	-	-	-	-	-				0
2	Staff Nurse	10	-	-	-	+	-	-	+	-	-	-	2
3	OT assistant	2	-	+									1
4	Students	10	+	-	-	-	-	-	+	+	-	-	3
5	Laboratory Technician	4	-	-	-	-							0
6	Sweeper	2	-	+									1
7	Dresser	2	-	-									0
8	Peon	1	-										0
9	Servant	2	-	-									0
	Total	40											7(17.5%)

17.5% participants were positive for transient hand flora after hand hygiene.

Discussion

Hand hygiene plays a vital role in the prevention of healthcare-associated infections. The data collected in this study shows moderate knowledge, good attitude and sub-optimal hand hygiene practices. Some of the studies done around the world show similar results to our study [17]. But some of the studies show good results of all the three aspects like knowledge, attitude and hand hygiene practices [15,16]. Most of the healthcare workers had good knowledge about the 5 moment of hand hygiene, they also knew the timing of hand washing and hand rubbing [17].

Most of the participants had good knowledge about the mode of transmission of nosocomial infection. They also believed that wearing accessories and contaminated hands are the vehicle for the transmission of infection [12].

It was observed that there was a decline in the level of knowledge in infectious agent related questionnaire of our study, only 30% HCWs knew that MRSA is most common infection acquired by patients from health care workers in the scenario of improper hand hygiene. Only 41.1% of participants knew how to prevent the spread of *Clostridium difficile*-related infections by using proper

hand washing practices rather than hand rub [18]. 61% of participants also knew when their hands are visibly not soiled or dirty and to use hand rub to remove the infectious agent from their hands to prevent the spread of infection.

No significant difference was seen in knowledge towards hand hygiene in doctors, nurses, students and other HCWs. A study conducted on hand hygiene shows doctors have significantly better knowledge than other HCWs [19]. Some studies report a better knowledge among nurses than doctors and some studies found that HCWs had insufficient knowledge towards hand hygiene [20-22].

HCW's positive attitude towards hand hygiene seen in our study has also been seen in other studies also [23]. They all know about the importance of hand washing practices in healthcare settings. Almost all healthcare workers follow hand hygiene practices when they come in contact with patients and patient's surroundings. The majority of health care workers adhere to hand-washing practices in spite of their busy work schedules. HCWs strongly agree that regular training and administrative orders to follow strict hand hygiene practices

improved hand hygiene compliance and the same has been agreed in other studies also [15].

Good hand hygiene practices seen in HCWs in our study has also been seen in other studies while some studies reported low compliance rate [15,24-26]. All HCWs attend trainings regarding Infection Prevention and Control (IPC) and follow the same during their work. The reason behind good hand hygiene practice in our study was regular training attended by HCWs, and continuous education which increases the compliance level of hand hygiene practices. HCWs involved in patient care must be given hand hygiene training immediately after their joining so that good compliance can be achieved for patient care.

Hand drying is also an important step in hand hygiene practices. Moist hands are the vehicle for transmission of nosocomial infection [27]. For hand drying practices - 44% of HCWs allowed their hands to air dry, 17.4% used new towels, and 6.1% used single-use paper towels - which are good practices to prevent the spread of infection. Few HCWs dried their hands with used towels and a handkerchief which is improper, because the used towels and handkerchiefs may contaminate with infectious agent which may act as a reservoir of organisms and easily transmit nosocomial infections. Studies conducted on hand drying also agree that poor hand drying techniques like using cloth towels repeatedly contaminated with infective agents spread nosocomial infections [28,29]. Electric warm-air dryers for drying hands are not recommended in health facilities, as forced air can result in the spread of the pathogen through water droplets. The major reason behind skipping hand hygiene in this study was being overburdened by work, and the low patient-to-staff ratio - HCWs have to attend to a large number of patients. This finding has also been reported in others studies [15]. Some HCWs accept

that they don't remember that they have to perform hand hygiene which is unacceptable. Some HCWs prefer to wear gloves because gloves protect them from infection. Only a few HCWs had allergies to hand hygiene products.

Training improves the knowledge of students [30]. Almost all students gave the right answers to case-based questions i.e., when to use hand rub and hand wash, when hands are visibly dirty or soiled, when there is exposure to potential spore forming organism e.g., *Clostridium difficile*, to perform hand wash after using the washroom. To use alcohol-based hand rub and when hands do not have visible dirt, blood or body fluids [6].

In our study, 160 samples were randomly collected from critical care units to test for bacterial flora on hands, to check the compliance of hand hygiene. Patients admitted in critical care units are immunocompromised, and improper hand hygiene practice in this area increases the transmission of nosocomial infections, which leads to an increased hospital stay, morbidity and mortality. Bacterial flora was found in the hands of critical care HCWs. Growth was seen in 53 (33.1%) samples. The maximum sample showed growth of coagulase negative *Staphylococcus* (27.5%), out of them 6.8% were methicillin resistant CONS (MR-CONS), only one *Staphylococcus aureus* (1.25%) and *Klebsiella pneumoniae* (1.25%) were isolated. Our findings match with other studies. 107 (66.8%) samples showed No growth. Concordant results were seen in other studies [31-33].

To check the transient flora on hands of HCWs 40 samples were collected before and after hand rub. 34 (85%) HCWs showed growth for transient hand flora beforehand rub, which were significantly reduced after proper hand rub steps practice, only 7 (17.5%) showed growth after hand rubbing. Similar findings were seen in reference study

[34]. Hands of HCWs are likely to be colonised while working in the hospital which can be removed by using hand rub at different interval. Advantage of hand rub is its use at point of care, less time required, effective to remove pathogen from hands, no drying material required.

Conclusion

We conclude that moderate knowledge, good attitude and practice towards hand hygiene were found in our institute's HCWs. There was no significant difference in the knowledge among HCWs. Hand drying practices were poor in spite of regular training attended by HCWs. CONS were the major bacterial flora found on the hands of HCWs most likely due to faulty hand drying technique. Alcohol-based hand rub is effective to remove transient flora of hands. Continuous training on hand hygiene and administrative orders can improve the knowledge and attitude towards the hand hygiene.

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