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Hand hygiene and its implications in health care associated infections in a tertiary care facility - a questionnaire-based survey

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Abstract

Background: Health care associated infections (HCAI) pose a serious threat, especially in developing countries. Hand washing is a proven and easily practiced technique for reducing HCAI. **Aim:** To measure the knowledge, attitude and practices of students and faculty in medical and paramedical fields in a tertiary care facility. **Method:** This cross sectional study was conducted using a Knowledge, Attitude and Practice (KAP) questionnaire constituting of 18 questions. The questionnaire was distributed to students and faculty of health care related colleges via online form resulting in 799 responses. Study population was divided into medical students, paramedical students and faculty subgroups. **Result:** Regarding attitude, it was revealed that 525 (67.5%) of the total respondents were aware HCAI was a serious issue as compared to 72 (67.9%) members of faculty. Furthermore, 627 (78.4%) learned World Health Organization (WHO) recommended techniques for hand washing, while only 405 (50.69%) report practicing it routinely. Under knowledge, 9 (8.49%) members of faculty were able to identify all patients at risk of developing antibiotic resistant infections, compared to 6 (1.62%) respondents of medical and 6 (1.86%) members of paramedical (nursing and allied health science) subgroups. 12.26% (n=106) of faculty identified most common HCAI. Regarding practice, over half of faculty (53.77%; n=106) reported practicing as WHO recommended hand washing practices in particular while medical and paramedical scored below 38.92% (n=370) and 42.77% (n=323), respectively. None of the faculty reported practicing recommended techniques in given sanitation scenarios. **Conclusion:** Knowledge and practice of sanitation techniques is poor amongst health care workers. Better education and training could potentially reduce spread of infection and antibiotic resistance rates.

Key words: Health care workers, health care associated infection, hand hygiene

Introduction

Health care associated infection (HCAI) is a serious concern worldwide. HCAI prolong hospital stays, increase resistance to antimicrobials, increase financial burdens and even cause deaths. As many as

15.5 patients per 100 suffer from HCAI in developing countries.¹ A study conducted in a tertiary care centre in India concluded that HCAI dramatically drive up treatment costs and add an unnecessary burden to hospitals.² It is difficult to estimate the economic cost of HCAI worldwide due to lack of proper data, however the WHO guidelines on hand hygiene in health care reports that the annual economic impact of HCAI in the United States alone is approximately \$6.5 billion in 2004.³ Further, they report that the endemic burden of HCAI is much higher in lower income countries, than in higher income countries – particularly for patients admitted to ICU or NICU. Given that India is still a developing country with a substantial population of low income persons, it is important to address the cause of these issues.

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The problem of HCAI is compounded when the involved pathogen is antibiotic resistant. One of the greatest challenges facing the world today is the problem of antibiotic resistant bacteria. Infection by antibiotic resistant bacteria further complicates the issue by increasing fatalities and financial burdens on patients and on health care systems worldwide. Health care facilities are breeding grounds for such antibiotic resistant bacteria. When a person takes unneeded antibiotics, they increase their risk of contracting an antibiotic resistant infection in the future.³ There are now many strains of bacteria that are resistant to multiple drugs and drug classes. In a CDC report, there are about 14,000 deaths annually due to *Clostridium difficile* infections in the United States alone.⁴ Methicillin-resistant *Staphylococcus aureus* (MRSA) infections are one of the most common types of antibiotic resistant infections in the United States, which kills more people than HIV/AIDS, Parkinson's disease, emphysema and homicide combined.⁵ These are just two examples of the many antibiotic resistant bacteria that cause problems across the world. Recent studies in Europe report rates of patients affected by HCAI is ranging from 4.6% to 9.3%.³ In developing countries the rates are even more extreme. The WHO reports that in some settings in Brazil and Indonesia, more than half of neonates admitted to the NICU acquire a HCAI with fatality rates ranging from 12% to 52%.³ These statistics underscore the serious problem of health care infections across the world. The cause of HCAI can be traced to improper hand washing and sanitization practices in the health care environment.⁶ These patients can develop surgical site infections which are the most frequently surveyed type of HCAI in developing countries.² Another source of infection is device-associated infections, such as those from catheters and ventilators. It is important to note that the victims of HCAI are not only the patients receiving treatment, but also health care workers (HCW). According to the WHO, transmission of viral and bacterial illnesses including tuberculosis to health care workers is well established.³

The WHO notes that reduced compliance with hand hygiene will lead to preventable HCAI.³ Therefore it is important to enforce and practice hand hygiene

as a simple and important preventive measure to combat the problem of HCAI.

Methods

Study site

The survey was conducted at five constituent institutions related to health care practices under a tertiary care hospital in Southern India.

Survey design

The survey was a cross sectional study which used a KAP questionnaire, gathering information about the knowledge and attitude of the participants as regards HCAI and their hand sanitation practices. Created using Google forms, the questionnaire contained a total of 18 questions.

The nature of the questionnaire was generalized as it targeted a wide group of participants over different fields under health care, rather than a specialization. The first six questions were for demographic data collection.

Questions 7-10 were to assess the attitude of HCW towards hand hygiene.

Questions 11-15 were to assess their knowledge regarding HCAI and related aspects.

Questions 16-18 were to assess their practices in routine hand antisepsis.

The questionnaire was evaluated and validated by five experts from the grade of senior lecturer to professors, from the departments of Medicine, Microbiology, Community medicine and Nursing. Corrections and/or suggestions made by the above mentioned evaluators were incorporated into the questionnaire.

Participants in the survey

The target population for the survey was the health care workers at a tertiary care hospital in southern India which included students of various colleges who interact with patients regularly.

Students from different health care associated institutions participated in the survey were: Medical, Dental, Nursing and Allied health sciences.

In addition, the faculty from a few of the departments of Anatomy, Biochemistry, Community

Medicine, Medicine, Microbiology, Obstetrics and Gynaecology, Orthopaedics, Paediatrics, Pathology, Physiology, Surgery and Urology responded to the survey as well.

Data collection

After procuring permission from the deans of the respective institutions, the Google link for the survey questionnaire (Figure 1) was circulated via e-mail and in various student groups on WhatsApp messenger to ensure it reached as many candidates as possible. They were contacted through the respective college offices which had contact information on file. As for the hospital departments, surveys were sent via e-mail through the medical college office which already had their contact information on file.

Participant responses were automatically saved anonymously to the cloud on Google forms. All the responses were downloaded and converted to a spreadsheet format to enable compiling and analysis.

Data analysis

The data collected in the spreadsheet was scored based on the number of correct answers as applicable and then compiled. Categorical variables were summarized by frequency and percentage. Some of the questions had multiple correct answers. The goal was to see how many correct options the respondents would be able to select.

In questions 7-10 and 18, the participant could choose only one answer. For these options were scored from 0-3 depending on the acceptability of the option according to the sources used to create the questions. In question 11, there was only one correct option and the remaining three were incorrect. Questions 12-16 were structured to have multiple correct options and graded according to the number of correct options selected. In question 17, there was only correct option per row.

Results

Although 637 (79.75%) of the respondents were Indians, the remaining participants in the survey included individuals mostly from Sri Lanka, United States, Canada and Malaysia. Education background was divided as follows:

- Reportedly 370 (46.31%) had a medical background (students from two medical colleges and one dental college)
- Reportedly 323 (40.43%) had a paramedical background (students of nursing and allied health sciences)
- Reportedly 106 (13.26%) were faculty members which included general physicians, surgeons, postgraduates as well as professors of the teaching and treating departments.

There were 282 (35.3%) first year undergraduate students (preclinical) that participated. Another 386 (48.4%) students were involved in health care for 1 to 5 years while only 81 (10.2%) had over 10 years of exposure in the health care setting. Of the total population, 717 (89.8%) of the respondents were undergraduate students while the rest were faculty members composed of general physicians, surgeons and resident doctors.

The vast majority, 737 (92.3%) responded that doctors should wash their hands after encountering every patient either with hand sanitizers or with soap and water.

A majority, 626 (78.4%) of the participants were familiar with the sequence of steps as recommended by the WHO for washing hands, but only 405 (50.69%) actually used it in routine hand sanitation. Knowledge about two particular topics was relatively poor with 529 (66.21%) participants scoring 2 or less out of 5 on the topic of patients most at the risk of developing antibiotic resistance and 598 (74.96%) scoring 1 or less out of 3 on the topic of most common micro-organisms responsible for HCAI. Only 339 (42.43%) of the respondents were compliant with the five moments of hand hygiene as recommended by WHO.

The study population's opinion about the severity of HCAI in India was divided among 539 (67.5%) people who considered it a serious problem and 204 (25.6%) people who consider it a moderately serious problem. Only 48 (6.1%) people in the study population were unaware of HCAI. Out of the 106 faculty members, 71 (67.9%) of faculty regarded HCAI as a serious problem. In our study 638 (79.9%) responded that

doctors should wash their hands with hand sanitizers in between patients, while 157 (19.7%) opted for soap and water. Unsurprisingly, 737 (92.3%) participants opined that doctors should exercise hand hygiene after every patient while 51 (6.38%) chose that it was okay to do it after 2-5 patients. A surprising minority of 9 (1.11%) individuals thought that doctors should rarely wash their hands after making contact with a hospital patient.

When asked about how to approach a patient, 536 (67.2%) opined that they follow the proper disinfection procedure before moving on to the next patient while 172 (21.6%) were in favour of calling for another doctor to attend to the second patient. A minority, 90 (11.2%) thought it okay for the doctor to go on to the next patient without washing hands as long as he/she used gloves.

Since questions 12-15 have multiple correct answers, knowledge scores have been calculated by adding one mark for every correct option selected. The knowledge scores of the participants are presented in Table 1, wherein a higher grade corresponds to better knowledge.

The practice scores for questions 16-18 have been put up in Table 2. Question 16 has multiple correct options and has been graded in the same way as for Table 1. In question 17, the participant could choose only one option per row.

Discussion

Knowledge, attitudes and practices (KAP) regarding health care associated infections still require improvement. Our study aimed to measure the KAPs of the medical and paramedical fields on a large scale in India. The study findings were found to be similar to findings from other hospitals in India and in fact, in hospitals worldwide. In 2012, the WHO noted that at least 35% of more than 2000 health care facilities surveyed in 69 countries have basic or inadequate hand hygiene control.⁷

The expectation was that faculty would have the highest score in all three categories relative to medical students and paramedical students. It was also expected that attitude scores would be high among health care students and faculty especially

given the frequency of HCAI especially in developing countries. A similar study with Italian medical and nursing students revealed that knowledge among both student groups was poor.⁸ In the Middle East, a hospital in Palestine found that knowledge, attitude and practices were comparable between both nurses and physicians.⁹ Further more poor hand hygiene practices were reported among nurses in a Saudi hospital¹⁰ and KAPs among fourth year medical students in a medical college in Riyadh was found to be worse than the nursing students.¹¹ What this serves to highlight is the systemic problem of hand hygiene among both students and practicing health care workers globally.

Our study's findings tend to recapitulate similar results as recorded from other institutions both nationally and internationally. Our results show that the percentage of faculty that feel that HCAI is a serious concern is same as the overall percentage of the study population. This elucidates a serious lack of awareness and sensitivity among the study population. It is interesting to note that in study conducted in a tertiary care centre in Bhopal it was found that 70% of nurses felt guilty for not following proper hand hygiene practices as compared to only 56% of residents.¹² This further serves to highlight the poor attitudes of health care workers when it comes to basic infection control methods.

It is established fact that hand sanitation with alcohol based hand rubs also prevent the spread of many infections.^{13, 14} Although many members of faculty did not consider HCAI to be a serious concern, it should be noted that in the remaining attitude questions the faculty has scored very well. Their scores were much higher than the average scores of the study population which indicated that the faculty has a much better attitude towards HCAI even though only 72 (67.9%) members of the faculty considered it to be a serious concern. Overall the study indicated that faculty recognizes the importance of sanitation better than other subgroups and practicing health care professionals would benefit from an awareness program to highlight the importance of HCAI.

The 11th question was the only knowledge based question in which faculty fared better than medical and paramedical subgroups. The remaining knowledge based questions, however, revealed that faculty was either equally or less knowledgeable when compared to other subgroups. This was the most significant finding and also interesting to note that similar results were found in other studies. In one study conducted in a tertiary care hospital, it was found that only 55.3% of the doctors and nurses studied had suboptimal knowledge regarding standard precautions.¹⁵ Research from university hospitals in Cairo also find that study groups of nurses have better knowledge regarding hand washing, an important method for infection control, than doctors.¹⁶ All the three subgroups in our study demonstrated a lack of knowledge regarding active hand sanitizer agents, patients at risk of developing HCAI, common HCAI and pathogens most commonly implicated in HCAI. The poor knowledge amongst medical and paramedical groups can be explained by their majority student status. Additionally, in another survey conducted on dental students in central India, it was found that knowledge was poor among the student population, even though attitude was regarded as good.¹⁷ The most startling result however, was the low score in the faculty subgroup. The relatively small increase in knowledge between student and faculty in our study suggests that there is a systemic lack of awareness in the study population. Poor knowledge will undoubtedly lead to poor compliance in future. The results also show that although the majority of faculty know why and how sanitation should be practiced many may not be aware of the proper situations in which to take precaution. The overall population also revealed poor knowledge of causative agents which is an important step when prescribing antibiotics. This gap in knowledge is a potential cause of the widespread antibiotic resistance plaguing third world countries like India. Hand hygiene is the easiest method for reducing HCAI and spread of infection. The practice questions asked how often WHO recommended techniques¹⁸ were used and in which scenarios hand washing practices are performed as well as the type of sanitizer used according to the WHO, every

option should have been marked in the survey. Yet, only 57 (53.77%) reported practicing hand washing practices in all of the WHO recommended moments (i.e. before entering patient setting, after touching bodily fluids, etc.). When given various scenarios, all medical subgroups were able to answer at least one scenario correctly. Furthermore, the majority of faculty population scored only one or two options correctly. Notably, none in the faculty population marked the correct WHO recommended answer for every scenario. Given that the faculty understands the need for aseptic procedure, the survey once again found that many have poor adherence or understanding of recommended protocol.

Medical and paramedical subgroups demonstrated poor hand washing and sanitization practices. The medical subgroup was particularly poor. The results indicated that twice as many in the paramedical subgroup practiced hand sanitation techniques daily as compared to the medical subgroup. About 15% of faculty report that they either do not practice the technique or do not practice it often while washing hands. In a study conducted in 2009 in Cairo, it was found that though doctors were more compliant with hygiene protocols than other subgroups, only 11.6% of the opportunities were done correctly.¹⁶ This data reveals persistent gaps in our practices and HCAI control measures. Compliance with protocol should be improved to help decrease infection spread in hospitals. Greater oversight and management of students and staff could be implemented in health care setups to reduce the infection burden and improve patient outcomes. A cross sectional study concerning ICU health care workers showed that rates of compliance were inversely related to the intensity of activity.¹⁹ This offers an explanation for low compliance rates and suggests that reduced workloads or increased staff could potentially increase overall hygiene compliance.

Attitude amongst the overall population is poor regarding the importance of HCAI. The faculty has much better knowledge than medical and paramedical subgroups; however, practice of proper techniques is lower than expected. This is not new. Some studies report that 61.4% of doctors were aware of proper cleaning protocol as compared to

82.7% of nurses in the same hospital.¹⁵ Some studies have found that less than half of doctors practice the proper hand washing techniques.⁶ Yet another study from University of Sri Jayewardenepura found that final year medical students were far less knowledgeable and compliant regarding hand hygiene practices as compared to nursing students.²⁰ This appears to be a trend among other studies as well.²¹ Although medical subgroup in our study reported to have better practice of proper hand sanitation technique, very few practice it during the proper moments. According to findings, only 57 (53.77%) of faculty report practicing in each of the WHO recommended moments which was considered to be suboptimal.

In light of these findings it is imperative that we improve hand sanitation compliance. In the Indian scenario, alcohol based rubs are the easiest and cheapest ways to practice sanitation techniques.²² We recommend supplying alcohol based rubs near points of contact. This recommendation has been found to be effective in preventing infection in one study.²³ In fact, hospital wide action can dramatically reduce instances of MRSA and other HCAI.²⁴ We recommend multi-modal frequent training sessions to fill gaps in knowledge of health care workers to improve compliance and attitudes as recommended by multiple studies.^{25, 26}

Limitations

Due to the self-reported nature of the survey, the population size was limited to those who willingly took time to participate in the study. The survey was also generalized in order to target a wider audience rather than a specific group. Finally, the study subgroups were uneven in size due to the voluntary nature of the survey.

Conclusions

Among students, the link between sanitation and HCAI should be emphasized along with the risk of serious injury or death. This could be done by inclusion of topics about HCAI in medical curriculum and enforced in practical exams. Easily preventable infections should not be the cause for patient deaths in any health care setup.

In conclusion, the study finds that the attitude of the

study population towards HCAI should be changed. Although knowledge amongst faculty is generally better than the study’s non-faculty population, their knowledge has room for improvement. Practices of proper hand sanitation techniques are minimal and proper WHO standards are not practiced. To further improve the outcome of HCAI in the hospital, all three aspects (knowledge, attitude, and practice) should be improved amongst both faculty and the student populations. The study population would benefit from an awareness campaign aimed at improving knowledge and practice. The study population should also be made aware of the serious nature of the HCAI crisis.

Appendix

Table 1: Assessment of knowledge questions of n=799 participants. Grading based on number of correct answers per question

Question	Score	Medical students	Paramedical students	Faculty
12. Active ingredients in hand sanitizers		n (%)	n (%)	n (%)
	0	12 (3.24)	18 (5.57)	5 (4.71)
	1	221 (59.73)	212 (65.63)	68 (64.15)
	2	137 (37.03)	93 (28.79)	33 (31.13)
	Total	370 (46.31)	323 (40.43)	106 (13.27)
13. Patients at risk of developing antibiotic resistance	0	19 (5.14)	21 (6.5)	1 (0.94)
	1	132 (35.68)	141 (43.65)	28 (26.42)
	2	99 (26.76)	74 (22.91)	14 (13.21)
	3	81 (21.9)	49 (15.17)	30 (28.3)
	4	33 (8.92)	32 (9.9)	24 (22.64)
	5	6 (1.62)	6 (1.86)	9 (8.49)
	Total	370 (46.31)	323 (40.43)	106 (13.27)
14. Most common forms of hcai	0	31 (8.38)	36 (11.15)	1 (0.94)
	1	115 (31.08)	121 (37.46)	40 (37.74)
	2	192 (51.9)	147 (45.51)	52 (49.06)
	3	32 (8.65)	19 (5.88)	13 (12.26)

	Total	370 (46.31)	323 (40.43)	106 (13.27)
15. Causative agents of hcai	0	112 (30.27)	144 (44.58)	32 (30.19)
	1	162 (43.78)	118 (36.53)	31 (29.25)
	2	84 (22.7)	49 (15.17)	28 (26.41)
	3	12 (3.24)	12 (3.72)	15 (14.15)
	Total	370 (46.31)	323 (40.43)	106 (13.27)

Table 2: Assessment of practice questions of n=799 participants. Grading based on number of correct answers per question

Question	Score	Medical students n (%)	Paramedical students n (%)	Faculty n (%)
16. Moments hand hygiene is practiced	1	51 (13.78)	58 (17.96)	7 (6.6)
	2	43 (11.62)	53 (16.1)	9 (8.49)
	3	65 (17.57)	42 (13)	13 (12.26)
	4	67 (18.11)	32 (9.91)	20 (18.87)
	5	144 (38.92)	138 (42.72)	57 (53.77)
	Total	370 (46.31)	323 (40.43)	106 (13.27)
17. Situations hand hygiene is practiced	1	0 (0)	0 (0)	38 (35.89)
	2	37 (10.00)	60 (18.58)	63 (59.43)
	3	62 (16.76)	170 (52.63)	5 (4.72)
	4	271 (73.24)	93 (28.79)	0 (0)
	Total	370 (46.31)	323 (40.43)	106 (13.27)
18. Use of WHO recommended practices	0	24 (6.49)	8 (2.48)	5 (4.72)
	1	60 (16.22)	41 (12.69)	11 (10.38)
	2	157 (42.43)	59 (18.27)	29 (27.36)
	3	129 (34.86)	215 (66.56)	61 (57.55)
	Total	370 (46.31)	323 (40.43)	106 (13.27)

Survey on hand sanitation awareness

Your participation in the survey is voluntary and your responses will be kept confidential. There is no risk involved in participating in this form. By filling out this form and clicking the submit button at the end, you are giving us your consent to use the data for analysis and future publishing.

* Required

1. Age: *
(in years)

2. Gender: *
• Male
• Female

3. Nationality: *

4. Educational Background *

[highest level of education and your field of study]
(For eg.: If you are a 3rd year MBBS student of KMC, write 3rd year; MBBS, KMC / If you are a professor of Microbiology Dept. of KMC, write Professor, Dept. of Microbiology, KMC)

5. Have you participated in the 'Hand Sanitizing Relay' on 15th October 2016 for Guinness Book of World Record?

- Yes
- No
- Was not aware of this event

6. How long have you been involved in health care? *

- < 1 year
- 1 - 5 years
- 6-10 years
- 10 years

7. What is your opinion about Health Care Associated Infection (HCAI) in India? *

- Not a serious problem
- A moderately serious problem
- A very serious problem
- I am unaware of health care acquired infections

8. After a doctor has attended a patient, he should: *

- Wash his hands with sanitizers available at the hospital.
- Wipe his hands using a handkerchief
- Wash his hands with soap and water
- Go home and wash with soap and water

9. On an average, how often should a doctor wash his hands after encountering a patient in the hospital? *

- After every patient
- After 2-5 patients
- Rarely after making contact with a hospital patient
- At the end of his day's work

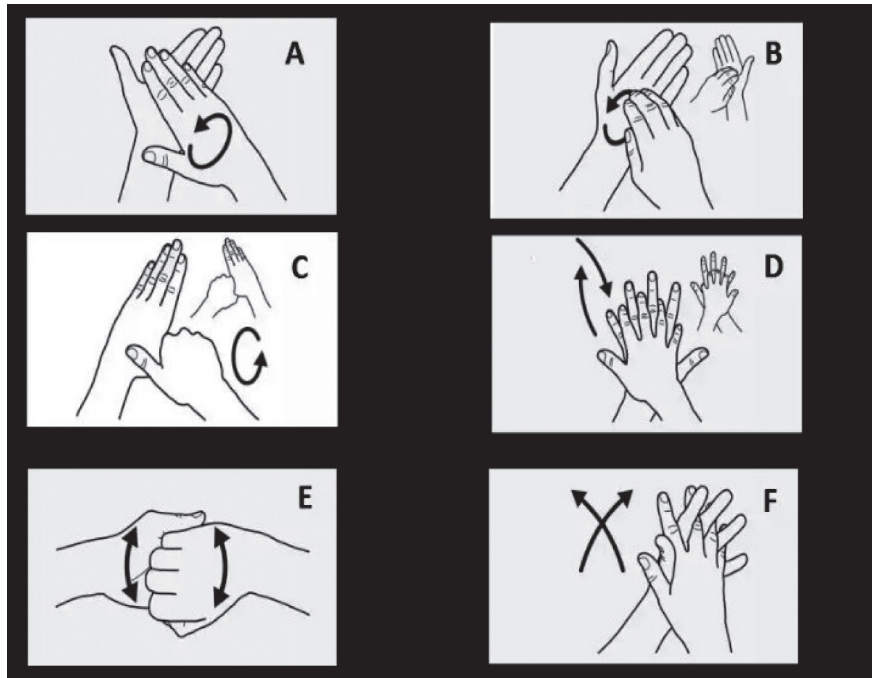


Figure 1: Survey questions used in the study by all n=799 participants

10. In case of an emergency, when a doctor is taking care of a patient with communicable infection, but another patient requires immediate medical attention, he should: *

- Follow the proper disinfection procedure and then move on to the emergency patient
- Wear gloves without washing hands, then go out to the next patient
- Go on directly to the next patient without washing hands
- Immediately call for another doctor to attend the second patient

11. Which option shows the correct order of the WHO recommended method of hand washing? *

- A, F, C, E, D, B
- A, D, F, E, C, B
- D, E, B, C, F, A
- B, D, F, E, C, A

12. Which of the following are active ingredients of hand sanitizers? *

(one or more correct options)

- Ethanol
- Isopropanol
- Hydrogen peroxide

- Phthalates
- Ethyl methyl ketone

13. Patients who are mostly at risk for developing antibiotic resistance are those undergoing/suffering from: *

(one or more correct options)

- Chemotherapy
- Bleeding disorders
- Complex Surgeries
- Psychiatric disorders
- Rheumatoid arthritis
- Cirrhosis of liver
- Dialysis for end stage renal disease
- Organ and Bone Marrow Transplant

14. The top three Health Care Associated Infections at Kasturba Hospital, Manipal is: *

(Select any three options)

- SSI (Surgical Site Infections)
- ICU acquired
- CRBSI (Catheter related blood stream infection)
- CRUTI (Catheter related urinary tract infection)
- VAP (Ventilator acquired pneumonia)

15. The pathogens usually responsible for health care associated infection is/are: *

(one or more correct options)

- Streptococcus pneumoniae
- Norovirus
- Clostridium difficile
- Cryptococcus
- Acinetobacter
- Candida

16. In which of the following situations do you perform hand hygiene? *

(one or more correct options)

- Before touching the patient
- Before performing aseptic procedures on patient
- After body fluid exposure/risk
- After touching the patient
- After touching the patient's surroundings

17. In the given scenarios, what would you use to wash your hands? *

	Anti-microbial soap and water	Alcohol based hand sanitizer	Any one is fine in this scenario
When hands are visibly dirty (proteinaceous material/blood/body fluids)			
When hands are not visibly			
Before eating			
When exposure to potential spore forming pathogens is strongly suspected/proven			

18. After learning the WHO recommended technique of hand washing, how often do you use this technique daily? *

- Every time I wash my hands
- Whenever I remember to follow the technique
- I wash my hands but I don't follow the technique
- I don't practice it often

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