

Research Article

Aseptic-clinical hand hygiene knowledge survey amongst health care workers in a tertiary care hospital in Western India

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ABSTRACT

Background: Maintenance of hand hygiene among health care workers (HCWs) is the cornerstone of infection prevention and control programmes in a health care facility. Poor hand hygiene amongst HCWs is the single most common cause of cross-transmission of infections between patients and HCWs in the hospital. The objective of this study was to identify the risk factors for non-adherence and assess the knowledge regarding maintenance of hand hygiene amongst health care workers at a tertiary health care centre in Western India.

Methods: A descriptive, cross-sectional study was conducted on HCWs - doctors, undergraduate students and staff nurses at a tertiary care hospital and post-graduate institute in western India after ethical committee clearance. A self-report questionnaire by the World Health Organisation (WHO) for the Hand Hygiene Knowledge Survey (2009), which consisted of ten questions and "My 5 moments of hand hygiene", was answered by the study participants after their written/informed consent. Data was analysed using one-way Anova and Student's t-tests.

Results: 317 participants responded to the survey which included 131 doctors, 111 medical students and 75 staff nurses. 90.85% participants routinely used an alcohol-based hand rub (ABHR) but their overall hand hygiene knowledge score was only 61.04%. Prior formal training in hand hygiene significantly improved the knowledge of HCWs ($P < 0.001$). There was a significant difference between the knowledge and actual practice of "My 5 Moments of hand hygiene".

Conclusions: Hand hygiene knowledge remains unsatisfactory till date amongst HCWs. There is a need to educate HCWs through frequent training sessions right from the time of undergraduate medical study.

Keywords: Hand hygiene, HCW, ABHR, HCAI, My 5 moments of hand hygiene

INTRODUCTION

Health care workers' (HCWs) hands are the most common vehicle for transmission of hospital-acquired infections from patient to patient and from patient to the hospital environment. Maintenance of proper hand hygiene amongst treating doctors and nurses is one of the most important measures to curb health care associated infections (HCAI).¹⁻⁴ But knowledge about proper hand hygiene in clinical settings remains poor till date among HCWs. This is shown by a lack of even basic awareness about hand washing guidelines among hospital personnel especially in developing countries.⁵ Universal adoption of

alcohol-based hand rub (ABHR) by HCWs is a critical system change for making any hospital infection control strategy successful. The World Health Organization (WHO) had launched the First Global Patient Safety Challenge programme known as "clean care is safer care" in 2005. The main objective of this programme is to achieve an improvement in hand hygiene practices worldwide and promote a strong patient safety culture.³

Healthcare facilities in India are affected by multiple factors such as their geographic location, sociodemographic features of their surroundings and the patient population they cater to. Most hospitals follow

clean and hygienic practices but systematic guidelines and control measures including maintenance of proper hand hygiene to prevent HCAI are often lacking.

METHODS

Study design – Cross-sectional, descriptive survey

Place of study

A tertiary care hospital and medical college in Maharashtra, India. The study was conducted by the Department of Medicine.

Inclusion criteria

Doctors (including senior consultants and post graduate resident doctors), staff nurses and undergraduate medical students. Sample size was not formally decided and the participants were selected randomly from among personnel and students of various departments after their voluntary, written and informed consent. Ethics committee clearance from the University ethics committee was procured before beginning the study. Prior verbal approval was taken from various departmental heads to carry out the study.

Methodology

All participants were given two self-report questionnaires to fill. Questionnaire 1 - It was the questionnaire for hand hygiene knowledge assessment in HCWs (Table 1) from 2009 Global patient safety strategy initiative WHO guidelines⁶. It had 10 main questions and 22 sub-questions. The answers were multiple choices, Yes/No type or single choice type. One point was given for each correct answer and zero for each incorrect answer, starting from question number two. A maximum of 22 points could be scored. Questionnaire 2 – It comprised of five questions from the “My 5 moments of hand hygiene” by WHO for assessing the knowledge and practice of the 5 moments of hand hygiene during working hours for HCWs.

Statistical analysis

One-way Anova (at 99.99% confidence level), students t-test (at 99.99% confidence level) and results expressed as percentages were used to analyse the results.

The study sought to analyse the impact of formal training on hand hygiene on the HCWs’ knowledge of this subject. Within each group of health care workers (doctors, medical students and nurses), the students t-test was applied (at 95% confidence interval) to compare the scores of the group that received formal hand hygiene training with the group that did not.

RESULTS

Of the 317 participants in the study, 131 were doctors including post-graduate students (41.33%), 111 were undergraduate medical students (35.01%) and 75 were nurses (23.66%).

There were 145 (45.74%) male and 172 (54.26%) female participants. Amongst doctors, 74 (56.49%) were males and 57 (43.51%) were females. Amongst students, 66 (59.46%) were males and 45 (40.54%) were females. Amongst nurses, 5 (6.67%) were males and 70 (93.33%) were females.

Table 2 shows the WHO questionnaire on hand hygiene knowledge with correct answers and the study participants’ responses. Correct answers to the questionnaire have been taken from the WHO Data Summary Report Framework.⁷

A total of 59.3% participants were formally trained about hand hygiene in the three years prior to this study (Question 1 of Table 2). Nurses received training more frequently than others (74.6%). Routine use of ABHR (Question 2 of Table 2) was done by 90.85% subjects (93.1% doctors, 95.4% students and 80% nurses).

The main route of cross-transmission of potentially harmful germs between patients in a health-care facility is HCWs hands when not clean (Question 3 of Table 2). The correct option was selected by 68.45% of the study group.

The most frequent source of germs responsible for HCAs is germs already present on or within the patient (Question 4 of Table 2). Only 29.97% subjects could give this correct answer. The minimum time needed for ABHR to kill most germs on hands is 20 seconds (Question 8 of Table 2). Correct answer to this question was given by 64.35% participants.

Questions 5,6,7,9 and 10 had sub-questions and each had to be answered by the participants. The number and percentage of participants who answered correctly is mentioned in Table 2. Less than 25% doctors answered question 9c correctly. Less than 25% medical students responded correctly to question 5b, 9c. Less than 25% nurses responded correctly to the questions 5b, 5c, 6c, 7d, 9b, 10d.

The average score of all participants on the hand hygiene knowledge survey was 13.42 out of a maximum possible score of 22 (61.04%). Doctors scored an average of 13.89 (maximum score - 19 and a minimum score - 1). Students scored an average of 13.18 (maximum score 17 and a minimum score - 4). Nurses scored an average of 12.97 (maximum score - 18 and a minimum score - 9). But the difference in the average scores among the three study subgroups was not statistically significant ($p>0.001$).

Table 1: WHO Hand hygiene knowledge survey questionnaire with answers.

Sr. No.	Questions
1	Did you receive formal training in hand hygiene in the last three years? ✓Yes No
2	Do you routinely use an alcohol-based hand rub for hand hygiene? ✓Yes No
3	Which of the following is the main route of cross-transmission of potentially harmful germs between patients in a health-care facility? (<i>Tick one answer only</i>) a) Health-care workers' hands when not clean ✓ b) Air circulating in the hospital c) Patients' exposure to colonised surfaces (i.e., beds, chairs, tables, floors) d) Sharing non-invasive objects (i.e., stethoscopes, pressure cuffs, etc.) between patients
4	What is the most frequent source of germs responsible for health care-associated infections? (<i>Tick one answer only</i>) a) Hospital's water system b) Hospital air c) Germs already present on or within the patient ✓ d) Hospital environment (surfaces)
5	Which of the following hand hygiene actions prevents transmission of germs <i>to the patient</i> ? a) Before touching a patient ✓Yes No b) Immediately after a risk of body fluid exposure Yes ✓No c) After exposure to the immediate surroundings of a patient Yes ✓No d) Immediately before a clean/aseptic procedure ✓Yes No
6	Which of the following hand hygiene actions prevents transmission of germs <i>to the health-care worker</i> ? a) After touching a patient ✓Yes No b) Immediately after a risk of body fluid exposure ✓Yes No c) Immediately before a clean/aseptic procedure Yes ✓No d) After exposure to the immediate surroundings of a patient ✓Yes No
7	Which of the following statements on alcohol-based hand rub and hand washing with soap and water are true? a) Hand rubbing is more rapid for hand cleansing than hand washing ✓True False b) Hand rubbing causes skin dryness more than hand washing True ✓False c) Hand rubbing is more effective against germs than hand washing ✓True False d) Hand washing and hand rubbing are to be performed in sequence True ✓False
8	What is the minimal time needed for alcohol-based hand rub to kill most germs on your hands? (<i>tick one answer only</i>) ✓20 seconds 3 seconds 1 minute 10 seconds
9	Which type of hand hygiene method is required in the following situations? a) Before palpation of the abdomen ✓ Rubbing WashingNone b) Before giving an injection ✓ Rubbing WashingNone c) After emptying a bedpan ✓ Rubbing WashingNone d) After removing examination gloves ✓ Rubbing WashingNone e) After making a patient's bed ✓ Rubbing WashingNone f) After visible exposure to blood Rubbing ✓ Washing None
10	Which of the following should be avoided, as associated with increased likelihood of colonisation of hands with harmful germs? a) Wearing jewellery ✓ Yes No b) Damaged skin ✓ Yes No c) Long fingernails ✓ Yes No d) Regular use of a hand cream Yes ✓ No

Table 2: WHO hand hygiene knowledge questionnaire with answers and the results of the study participants (n=317).

Sr. No.	Questions	Doctors (n=131)	Medical students (n=111)	Nurses (n=75)
1	Participants who received formal training in hand hygiene in the last three years	68 (51.9%)	64 (57.6%)	56 (74.6%)
2	Routinely used alcohol based hand rub	122 (93.1%)	106 (95.4%)	60 (80%)
3	Main route of cross-transmission of potentially harmful germs between patients in a health-care facility Correct answer – a - HCWs hands when not clean	103 (78.62%)	87 (78.37%)	27 (36%)
4	The most frequent source of germs responsible for health care-associated infections Correct answer - c - Germs already present on or within the patient	56 (42.74%)	17 (15.31%)	22 (29.33%)
5	Hand hygiene actions which prevents transmission of germs to the patient	117 (89.31%)	101 (90.99%)	67 (89.33%)
5a	Before touching the patient - Correct answer: Yes			
5b	Immediately after a risk of body fluid exposure – Correct answer: No	35 (26.71%)	9 (8.10%)	4 (5.33%)
5c	After exposure to the immediate surroundings of patient – Correct answer: No	74 (56.49%)	78 (70.27%)	7 (9.33%)
5d	Immediately before a clean/aseptic procedure - Correct answer: Yes	105 (80.15%)	60 (54.05%)	71 (94.67%)
6	Which of the following hand hygiene actions prevents transmission of germs to the health-care worker?			
6a	After touching a patient – Correct answer: Yes	128 (97.7%)	104 (93.7%)	69 (92%)
6b	Immediately after risk of body fluid exposure - Correct answer: Yes	128 (97.7%)	100 (90.09%)	70 (93.33%)
6c	Immediately before a clean/aseptic procedure - Correct answer: No	93 (70.99%)	101 (90.99%)	15 (20%)
6d	After exposure to the immediate surroundings of patient – Correct answer: Yes	125 (95.41%)	105 (94.59%)	73 (97.33%)
7	Which of the following statements on alcohol-based hand rub and hand washing with soap and water are true?			
7a	Hand rubbing is more rapid for hand cleansing than hand washing – Correct answer: TRUE	74 (56.49%)	43 (38.74%)	62 (82.67%)
7b	Hand rubbing causes skin dryness more than hand washing – Correct answer: FALSE	62 (47.32%)	34 (30.63%)	19 (25.33%)
7c	Hand rubbing is more effective against germs than hand washing – Correct answer: TRUE	124 (94.66%)	96 (86.48%)	61 (81.33%)
7d	Hand washing and hand rubbing are to be performed in sequence – Correct answer: FALSE	58 (44.27%)	43 (38.73%)	15 (20%)
8	What is the minimal time needed for alcohol-based hand rub to kill most germs on your hands? Correct answer – 20 seconds	99 (75.57%)	88 (79.3%)	17 (22.7%)
9	Which type of hand hygiene method is required in the following situations?			
9a	Before palpation of the abdomen Correct answer: Rubbing	123 (93.89%)	102 (91.89%)	51 (68%)
9b	Before giving an injection Correct answer: Rubbing	117 (89.31%)	109(98.2%)	10 (13.33%)
9c	After emptying a bed-pan Correct answer: Rubbing	14 (10.69%)	10(9%)	60 (80%)
9d	After removing examination gloves Correct answer: Rubbing	100 (76.33%)	88 (79.28%)	20 (26.67%)

9e	After making a patient's bed Correct answer: Rubbing	88 (67.17%)	87 (78.37%)	63 (84%)
9f	After visible exposure to blood Correct answer: Washing	125 (95.42%)	107 (96.4%)	71 (94.67%)
10	Which of the following should be avoided, as associated with increased likelihood of colonisation of hands with harmful germs?			
10a	Wearing jewellery - Correct answer: Yes	117 (89.31%)	109 (98.2%)	57 (76%)
10b	Damaged skin – Correct answer: Yes	114 (87.02%)	109 (98.2%)	32 (42.67%)
10c	Long fingernails – Correct answer: Yes	97 (74.04%)	108 (97.29%)	31 (41.33%)
10d	Regular use of a hand cream - Correct answer: No	78 (59.54%)	101 (90.99%)	10 (13.33%)

A comparison of the knowledge of hand hygiene among HCWs who had received formal training on the subject in the past three years and those who had not, by means of student's t-test, revealed that there was a highly statistically significant ($p < 0.001$) difference in knowledge between the trained and untrained groups.

Table 3 shows the knowledge and an actual practice of the study participants about the WHO's My Five Moments of Hand Hygiene concept. Except for Moment 3 where the subjects' knowledge (94%) and practice (91.8%) were almost equal, there was a significant difference between the knowledge and actual practice of hand hygiene moments.

Table 3: Knowledge versus practice of WHO's My 5 moments of hand hygiene in the study subjects (n=317).

Moments of Hand Hygiene	Number (%) of correct responses for knowledge (Total n = 317)	Number (%) of correct response (Always) for practice (Total n = 317)
Moment 1: Before patient contact	285 (89.90%)	193 (60.88%)
Moment 2: Before an aseptic task	236 (74.44%)	212 (66.87%)
Moment 3: After body fluid exposure risk	298 (94%)	290 (91.48%)
Moment 4: After patient contact	301 (94.95%)	219 (69.08%)
Moment 5: After contact with patient surroundings	305 (95.58%)	180 (56.78%)

DISCUSSION

Formal hand hygiene training was more frequently received by nurses (74.6%) as compared to doctors and students. (51.9% and 57.6% respectively). This finding was similar to other studies done in Sri Lanka and India, where nursing students received formal hand hygiene training more frequently than medical students.^{8,9}

According to WHO guidelines on hand hygiene in health care, when ABHR is available in the health care facility for hygienic hand antisepsis, the use of antimicrobial soap is not recommended.⁶ Knowledge about routine use of an ABHR in the hospital was good amongst all the three subgroups of the study (93.1%, 95.4%, 80%). It was in contrast to a study on hand hygiene knowledge of doctors and medical students conducted in Kolkata, India in 2013 where the knowledge about ABHR was only 51.11%.¹⁰ This might be because of ready availability of ABHR at convenient and visible locations in the hospital. In a study done by Bischoff et al. it was observed that

during the use of an easily accessible, alcohol-based waterless hand antiseptic agent, hand washing compliance significantly improved.¹¹

78.62% doctors, 78.37% students and only 36% nurses correctly answered that the main route of cross-transmission of potentially harmful germs between patients in a health-care facility (Question 3) is the HCWs hands when not clean. Similar studies done by Maheshwari et al., Ariyaratne et al, Nair SS et al showed that the knowledge about this question amongst both medical and nursing students was more than 70%.^{5,8,9} Thus in our study, the nurses gave a poorer response (only 36% nurses gave correct answer) as compared to the other studies. This reflects the poor knowledge amongst nurses in spite of more frequent hand hygiene training sessions for them.

Cross-transmission of pathogens which are already present on or within the patient (especially in the Intensive Care Units (ICUs)) was responsible for majority

of the cases of catheter-related infections, urinary catheter sepsis and ventilator associated pneumonias.¹² 42.74%, 15.31%, 29.33% participants in the three respective subgroups knew correctly that the germs already present on or within the patient was the most frequent source responsible for HCAI's (Question 4) which matched with the findings by Maheshwari et al. (45%, 27.5%) and Ariyaratne et al. (45.4%, 26.9%).^{5,8}

Historically, many different antiseptic agents like chlorhexidine (2%, 4%), iodine compounds, phenol derivatives were tried as hand disinfectants. But they had several limitations including irritation of skin, poor bactericidal and fungicidal actions and slow onset of action. Alcohol based hand disinfectant, with a rapid onset of action, excellent bactericidal and fungicidal properties and minimal skin irritation proved to be far superior to the above mentioned alternative chemicals. In our study, a majority of the participants had false knowledge that hand rubbing causes more skin dryness and irritation than hand washing with soap and water. Thus, there is a need to create awareness about the effectiveness and lower side effect profile of an ABHR amongst the HCWs.

Hand washing with soap and water failed to control HCAIs effectively. This was because hand washing with soap and water was a tedious and time-consuming procedure which proved effective only when it was done in the recommended way and for a recommended time. Thus, HCWs' compliance was always poor. Also, its antimicrobial efficacy was low if the hands were heavily contaminated.¹³ Thus, compared with use of plain soap and water; hand contamination with any transient organism was significantly less likely after use of an alcohol-based hand rub.¹⁴

Knowledge about the differences between ABHR and hand washing with soap and water was poor overall amongst the study subpopulations. The study group's knowledge about hand rubbing being more effective against germs than hand washing was good which was in contrast with some other studies.^{5,8,9} Majority of the participants had a false perception that hand washing and hand rubbing are required to be performed in sequence.

Knowledge about the type of hand hygiene method to be used after different procedures amongst doctors and students was good except for the knowledge of hand hygiene methods adopted before emptying the bed pan and making a patient's bed. Nurses answered the same questions better (80%, 84% correct answers respectively) probably because these procedures are a part of their daily duties.

Doctors and students had fairly good knowledge about the things to be avoided because they increased the colonisation of organisms in hands (wearing jewellery, damaged skin and long fingernails). However, doctors answered incorrectly that hand cream use too increased

chances of colonisation. 59.54% nurses fared poorly in these questions.

A study done by Trick WE et al showed that wearing rings in the fingers was associated with 10-fold higher median skin organism counts in the hands and increased the risk of contamination with any transient organisms as the number of rings worn increased.¹⁴ Another study by Moolenaar RL et al suggested a role of long natural or artificial fingernails of the HCWs (nurses) in the outbreak of *Pseudomonas Aeruginosa* blood stream infection and its cross transmission in the neonatal intensive care unit.¹⁵

Prior formal training in hand hygiene across all the study groups made a significant difference to their knowledge, attitude and practice of hand hygiene (student's t-test, $p < 0.001$).

The "My 5 Moments for Hand Hygiene" approach defines the key moments when health-care workers should perform hand hygiene. According to this approach, a HCW should wash hands before and after touching a patient, before clean/aseptic procedures, after body fluid exposure/risk and after touching patient surroundings to minimize the HCAIs. It describes the fundamental reference points for healthcare workers (HCWs) in a time-space framework (in terms of moments), when hand hygiene is required to be performed to effectively interrupt microbial cross-transmission during care-giving.¹⁶ It has been developed for measuring, teaching, and reporting hand hygiene adherence by the WHO.¹⁷ We assessed the study participants' knowledge and practice about this concept and found that more than two-thirds of the participants had knowledge about the moments but the knowledge was not put into actual practice. A total of 91.48% participants answered "always" in response for actually performing hand hygiene (practice) after a body fluid exposure risk (moment 3), but for the rest of the moments (moment 1, 2, 4, 5) the response was poor (<70%). In a Chinese study by Y. Li et al. there was a good response for moments 2, 3 and 4 but poor response for moments 1 and 5. Thus, there was a vast difference between the knowledge and the actual practice of the "My 5 moments of hand hygiene".

Limitations of the study

It was a self-reported questionnaire given to test the knowledge of the HCWs. Thus, their actual behaviour during the critical "My 5 Moments of Hand Hygiene" might be different than reported. Directly observed hand hygiene behaviours and compliance studies^{11,18,19} may give altogether different results.

The study was performed in a single hospital and therefore the findings may not represent the overall hand hygiene knowledge of the population involved in the health care industry.

CONCLUSION

The knowledge of hand hygiene in HCWs is vital to the prevention of HCAI and pathogen cross transmission in a hospital. The importance of hand hygiene should be emphasised during undergraduate medical and nursing levels. Frequent and repeated training of doctors and nurses about the correct methods of hand washing with soap and water, advantages of an ABHR and implementation of “My 5 Moments of Hand Hygiene” are required. Hospital management can help in this by organising infection control training sessions and ensuring adequate financial resources to meet the need for hand hygiene products.

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REFERENCES

1. Pincock T, Bernstein P, Warthman S, Hols E. Bundling hand hygiene interventions and measurement to decrease health care-associated infections. *Am J Infect Control*. 2012;40,1:S18-27.
2. Allegranzi B, Pittet D. The role of hand hygiene in healthcare-associated infection prevention. *J Hosp Infect*. 2009;73:305-15.
3. Whitby M, Pessoa-Silva CL, McLaws ML, Allegranzi B, Sax H, Larson E, et al. Behavioural considerations for hand hygiene practices: the basic building blocks. *Journal of Hospital Infection*. 2007;65(1):1-8.
4. Trampuz A, Widmer AF. Hand Hygiene: A frequently missed lifesaving opportunity during patient care. *Mayo Clin Proc*. 2004;79:109-16.
5. Maheshwari V, Kaore NM, Ramnani V, Gupta S, Borle A, Kaushal R. A Study to Assess Knowledge and Attitude Regarding Hand Hygiene amongst Residents and Nursing Staff in a Tertiary Health Care Setting of Bhopal City. *J Clin Diagn Res*. 2014;8(8):DC04-DC07.
6. World Health Organization. WHO guidelines on hand hygiene in health care: first global patient safety challenge. Clean care is safer care. World Health Organization. 2009.
7. World Health Organization. World Health Organization; updated 2009 October; cited 2016.
8. Ariyaratne MHJD, Gunasekara TDCP, Weerasekara MM, Kottahachchi J, Kudavidanage BP, Fernando SSN. Knowledge, attitudes and practices of hand hygiene among final year medical and nursing students at the University of Sri Jayewardenepura
9. Sri Lankan Journal of Infectious Diseases. 2013;3(1):15-25.
10. Nair SS, Hanumantappa R, Hiremath SG, Siraj MA, Raghunath P. Knowledge, attitude, and practice of hand hygiene among medical and nursing students at a tertiary health care centre in Raichur, India. *ISRN preventive medicine*. 2014.
11. Biswas P, Chatterjee S. Hand Hygiene compliance among Doctors in a Tertiary care hospital of India. *Indian J Pediatr*. 2014;81(9):967-8.
12. Bischoff WE, Reynolds TM, Sessler CN, Edmond MB, Wenzel RP. Hand washing compliance by health care workers: the impact of introducing an accessible, alcohol-based hand antiseptic. *Archives of internal medicine*. 2000;160(7):1017-21.
13. Godfrey C, Schouten JT. Infection Control Best Practices in Clinical Research in Resource-Limited Settings. *Journal of acquired immune deficiency syndromes*. 2014;65(01):S15.
14. Widmer AF. Replace hand washing with use of a waterless alcohol hand rub? *Clinical Infectious Diseases*. 2000;31,1:136-43.
15. Trick WE, Vernon MO, Hayes RA, Nathan C, Rice TW, Peterson BJ. Impact of ring wearing on hand contamination and comparison of hand hygiene agents in a hospital. *Clinical infectious diseases*. 2003;36(11):1383-90.
16. Moolenaar RL, Crutcher JM, Joaquin VHS, Sewell LV, Hutwagner LC, Carson LA. A Prolonged Outbreak of Pseudomonas Aeruginosa in a Neonatal Intensive Care Unit Did Staff Fingernails Play a Role in Disease Transmission. *Infection Control*. 2000;21(02):80-5.
17. Sax H, Allegranzi B, Uckay I, Larson E, Boyce J, Pittet D. ‘My five moments for hand hygiene’: a user-centred design approach to understand, train, monitor and report hand hygiene. *Journal of Hospital Infection*. 2007;67(1):9-21.
18. Sax H, Allegranzi B, Chraïti, MN, Boyce J, Larson E, Pittet D. The World Health Organization hand hygiene observation method. *American journal of infection control*. 2009;37(10):827-34.
19. Feather A, Stone SP, Wessier A, Boursicot KA, Pratt C. ‘Now please wash your hands’: the hand washing behaviour of final MBBS candidates. *Journal of Hospital Infection*. 2000;45(1):62-4.

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