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Original Article

Infection control practices in health care: Teaching and learning requirements of medical undergraduates

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ABSTRACT

Background: Compliance and implementation of infection control guidelines have been recognized as efficient means to prevent and control hospital acquired infections.

Objectives: To evaluate knowledge and practices about infection control guidelines amongst medical students and to explore their education needs as perceived by them and faculty.

Methods: A total of 160 final year students and 100 faculty members of one of the top medical colleges in India were selected by simple random sampling in each group as per sample size of 143 students (alpha 0.05, error 7%, prevalence 60%) and 99 (error 7.5%) faculty. Data collected by pilot-tested, unlinked, anonymous questionnaire.

Results: Amongst students, knowledge (77.50%; 95% CI, 70.24–83.72) was mixed with misconceptions. Only 31.25% always followed hand hygiene procedure; 50% recapped needles; disposal of hazardous material into designated containers always was low (sharps 20%, contaminated items 25%). Despite experiencing needle stick injury (6.25%) and splashes (40%), less than 30% reported these as 44% were unaware of reporting procedure. The discord between the perceptions of faculty regarding students and students' own perceptions was clearly evident (all Kappa values less than 0.50). Students and faculty agreed on workshops (58.13% and 58%) and reinforcement by colleagues (51% and 54%) but not on on-job training (51% and 34%) and part of curriculum (48% and 40%) for teaching–learning infection control.

Conclusion: Tackling disconnect between students and faculty perceptions and empowering students with knowledge and skills in infection control is important. Approach needs to be researched and formulated as current methods seem to be inadequate.

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Introduction

At least 5–10% of patients admitted to acute care hospitals acquire an infection.¹ Hospital acquired infections exact a tremendous toll, resulting in increased morbidity and mortality, and increased health care costs.² Compliance on the part of HCWs including medical students with standard/universal precautions (SPs) and implementation of these measures has been recognized as efficient means to prevent and control HAIs.³ Such measures not only protect the patient, but also the HCWs and the environment.⁴ In developing countries, in spite of the effectiveness of these infection control practices, studies have shown a very low compliance by professionals and students alike.^{5,6} The undergraduate years are the formative phase and are appropriate moment for acquiring the necessary knowledge and skills. There is a lack of evidence regarding explicit infection control in the curricula of most medical undergraduate courses, which needs to be addressed if infection rates are to be reduced.⁷ Thus teaching and learning requirements of undergraduate medical students regarding these practices need to be assessed.

This study was carried out to evaluate the knowledge and attitude about standard precautions and infection control guidelines and to explore education needs of medical students as perceived by students and faculty.

Methodology

A cross sectional study was carried out in a Medical College and teaching hospital in Pune, India. The participants were all medical undergraduate students (UGs) and Faculty in the Medical College in Pune. Sample size, calculated by using $\alpha = 0.05$, error as 7%, expected prevalence as 60%, worked out to be 143 for UG students. Taking same parameters, except error as 7.5%, sample size for faculty worked out to be 99. A total of 160 UG students and 100 faculty members were selected by simple random sampling in each group. The study excluded medical undergraduates who had not started their clinical rotations, faculty who were not directly involved in patient care and all those who were unwilling to participate in the study. The study period extended from Jul to Aug 2010. Institutional ethical committee clearance was obtained and informed consent of participants was taken.

An interview schedule (questionnaire) was prepared which was subsequently validated through a pilot study. A non-weighted marking system was structured, based on key areas of infection control knowledge and practices. Questionnaire pertaining to the faculty assessed their perceptions regarding medical students' knowledge and practices regarding infection control practices. It also tried to elicit their suggestions towards effective teaching–learning mechanisms for improving the knowledge, fostering correct attitudes and practices amongst medical students in the domain of infection control. Data so collected were entered in MS Excel sheet in the computer and subsequently analysed by using SPSS ver 14.0.

Results

The medical undergraduate students (UGs) comprised of 43.80% males and 56.20% females with mean age $\pm$ SD as 21.71 ± 1.10 . It was found that 100% UGs had heard about the SPs and 90% correctly knew that these are the basic level of infection control practices which are to be used as a minimum, in care of patients. 146 (91.20%) UGs knew that SPs are not applied only to patients with HIV and viral Hepatitis and 148 (92.50%) correctly said that SPs are necessary in situations that might lead to contact with saliva and also that SPs include protection against blood and body fluids and isolation is necessary for patients with blood borne infections.

However, as shown in Table 1 complete knowledge was present only among 77.5% of UGs. Almost all of them (97.50%) believed that most sharps injuries are as a result of carelessness in handling or in disposal. A large number of UGs (32.50%) believed that used needles should be recapped after giving an injection. Majority of UGs knew about other aspects of infection control practices viz. wearing of personal protective equipment (PPE) even when there is slightest risk of exposure to blood & body fluids, health care workers with non-intact skin should not be involved in direct patient care until the condition resolves & that blood spills should be promptly cleaned up.

Table 2 shows that amongst UGs, appropriate knowledge regarding proper hand washing is mixed with some misconceptions. More than 97% UGs were vaccinated against Hepatitis B and of these, 47.50% had received booster doses while 35.00% had received 3 doses.

Table 3 shows UGs' practices regarding infection control procedures. Only 31.25% always followed hand hygiene procedure. Recapping needles was done by half of them either always or sometime and many of them were not always disposing all hazardous material (sharps, contaminated items) into designated containers, covering broken skin and wiping spills.

Personal experience of needle stick injury (NSI) and blood and body fluid (BBF) splashes was experienced by 10 (6.25%) and 64 (40.00%), respectively. However, reporting of NSI and BBF splashes was by only 2 (20.00%) and 17 (26.56%),

Table 1 – Study participants' (UGs) knowledge regarding universal precautions.

Standard precautions include	Number	Percentage
Hand washing	23	14.38
Use of barriers (personal protective equipment)	17	10.63
Environmental control (surface processing protocol)	7	4.38
Adequate discarding of sharp instrument	17	10.63
Adequate professional immunization	12	7.50
None	1	0.63
All actions	124	77.50
Total N more than 160 due to multiple answers by many participants.		

Table 2 – Study participants' (UGs) knowledge regarding hand hygiene.

Hand hygiene (N = 160 for each aspect)	Yes N (%)	No N (%)	Did not answer N (%)
Proper hand washing removes germs	142 (88.75)	13 (8.13)	5 (3.12)
Using gloves eliminates the need to wash hands	45 (28.13)	114 (71.3)	1 (0.63)
Hands wash before and after putting on gloves	136 (85.0)	22 (13.75)	2 (1.25)
With antiseptic soap a quick wash will do	41 (25.62)	118 (73.75)	1 (0.63)
After washing hands and rinsing well turn off taps with your hands	39 (24.38)	119 (74.37)	2 (1.25)
Perform hand hygiene after contact with respiratory secretions	148 (92.50)	08 (5.0)	4 (2.50)

respectively. Moreover, 70 (43.75%) did not know the procedure to follow in case of an NSI or BBF splash.

Out of the 100 faculty members as study participants, 28 were from Medicine and allied while 72 were from Surgery and allied. The experience as a doctor ranged from 13 to 31 years with mean $\pm$ SD as 21.08 ± 4.39 years. Table 4 shows the perceptions of Faculty regarding infection control practices of UGs during their clinical postings.

In Table 5, low Kappa values clearly bring out the discordance between what UGs perceived to be their practices and what the faculty perceived to be UGs practices as observed by them.

Discussion

In this study, the general awareness levels of UGs regarding infection control practices was quite high, which is similar to that found in studies in India^{5,8} and also in China.⁹ However, when questions were asked regarding details of these practices and guidelines, the level of knowledge decreased significantly. This was similar to studies in India^{5,8} and also UK.¹⁰

On further probing it was found that only 77.50% of the students possessed adequate knowledge about various components of the guidelines. This was almost similar to that found amongst health care workers in rural areas,⁸ amongst medical students in a tertiary care health care facility in North India⁵ and also in UK.¹⁰ Similarly level of knowledge regarding infection potential of blood borne viruses was also low like the other studies.^{5,8,10}

There were many areas of concern like almost 55% recap needles always or sometime. These results are similar to those found in India^{5,8} and also other countries like Iran⁶ and China.⁹

Perceived barriers to compliance with SPs clearly influence HCWs' ability and willingness to comply with them in

practice. The reasons for non-compliance clearly brought out lack of adequate knowledge (35%) and also other factors like forgetfulness (45.00%), non-availability of PPE (38.13%), colleagues/seniors not following guidelines (23.75%). These findings are similar to those found by studies in India^{5,8,11,12} and in other countries which showed inability to use PPE during emergencies, overwork and busy schedules.¹³ Other studies have found that this disparity between knowledge and practice could be due to the unavailability of protective barriers, inadequate equipment, and carelessness, malpractice of senior colleagues or interference of devices with working skills.¹⁴

Though overall the knowledge was lesser than desired but the further disparity between knowledge and practice clearly shows that knowledge of transmission pathways and a positive attitude towards infection control measures alone does not influence compliance with current recommendations of infection control.

Multiple sources of information were mentioned by the students in our study. The sources are similar to those of students in many other medical colleges.^{5,10} The evidence for the most appropriate methods of teaching and learning for medical UGs has been conflicting. The effect of the variety of teaching types reported by the students in various studies is uncertain.¹⁰

The UGs rated workshops (58.13%) and on-job training (51.25%) higher than teaching being part of curriculum (48.13%). A study in China has clearly demonstrated that a one-time intervention programme had no effect on knowledge.⁹ A UK study showed that structured teaching programme as effective,¹⁵ which is similar to the perceptions of our medical students. Increasing the emphasis on infection control in the undergraduate curriculum through frequent education and assessment, particularly in the clinical setting, may improve students' knowledge, beliefs, and practices and facilitate a positive practice culture towards these practices.

Table 3 – Study participants' practices regarding infection control procedures.

Practices regarding infection control (N = 160 for each aspect) ^a	Never N (%)	Sometimes N (%)	Always N (%)
Follow hand washing religiously as per procedure	8 (5.00)	102 (63.75)	50 (31.25)
Follow ups	4 (2.50)	63 (39.38)	93 (58.12)
Recap needles	70 (43.75)	26 (16.25)	55 (34.38)
Put needles, sharp objects into designated containers	3 (1.88)	30 (18.75)	125 (78.12)
Cover broken skin before work	13 (8.12)	53 (33.13)	92 (57.50)
Dispose all blood contaminated items into designated bag	05 (3.12)	34 (21.25)	115 (71.88)
Promptly wipe up all the blood spills and other body fluids	22 (13.75)	60 (37.50)	76 (47.50)

a Totals in some of the rows is less than 160 as Not sure/Do not know category not shown.

Table 4 – Medical students' practices as observed by the faculty.

Observations by faculty	Always N (%)	Sometimes N (%)	Never N (%)	Not sure/do not know N (%)
Practicing what have been taught	5 (5.00)	79 (79.00)	00	16 (16.00)
Follow the correct scrubbing procedure	19 (19.00)	57 (57.00)	3 (3.00)	20 (20.00)
Correct use of protective equipments	18 (18.00)	59 (59.00)	3 (3.00)	20 (20.00)
Working in wards/ICU/OT/labour room etc, if suffering from respiratory infections	00	79 (79.00)	11 (11.00)	10 (10.00)
Ever pointed out someone working in wards/ICU/OT/labour room with broken skin	50 (50.00)	00	50 (50.00)	00

Table 5 – Concordance and discordance between UGs knowledge and faculty perceptions regarding UGs.

S no	Aspects of universal precautions	UGs perception N (%)	Faculty perception for UGs N (%)	Kappa coefficient
1	Knowledge regarding respiratory hygiene/cough etiquette is an essential part of Std precautions	Yes 144 (90.00)	89 (89.00)	0.794
2	Dispose of all blood contaminated items in to the designated bag or bucket for disposal	Always Sometimes Never Not sure/don't know 115 (71.88) 34 (21.25) 5 (3.12) 6 (3.75)	30 (30.00) 29 (29.00) 3 (3.00) 38 (38.00)	0.291
3	Promptly wipe up all the blood spills and other body fluids	Always Sometimes Never Not sure/don't know 76 (47.50) 60 (37.50) 22 (13.75) 2 (1.25)	22 (22.00) 21 (21.00) 13 (13.00) 44 (44.00)	0.264
4	Cover broken skin before coming to work	Always Sometimes Never Not sure/don't know 92 (57.50) 53 (33.13) 13 (8.12) 2 (1.25)	38 (38.00) 17 (17.00) 10 (10.00) 35 (35.00)	0.289
5	Put needles and other sharp objects into designated sharp containers	Always Sometimes Never Not sure/don't know 125 (78.12) 30 (18.75) 3 (1.88) 2 (1.25)	34 (34.00) 45 (45.00) 19 (19.00) 2 (2.00)	0.261
6	First aid to be given to the body part, accidentally exposed to blood & other body	Yes 61 (61.00)	156 (97.50)	0.314
7	Reported blood and body fluids splashes to a doctor or a senior nurse	Yes 59 (59.00)	61 (38.13)	0.326
8	Have adequate knowledge about UPs and infection control practices	Yes 31 (31.00)	106 (66.25)	0.364
9	Reason for non-compliance of UPs	Insufficient knowledge Workload Forgetfulness Non-availability of protective measures at workplace Inconvenience in working after putting personal protective equipment Examples of colleagues/seniors not following standard precautions 55 (55.00) 14 (14.00) 51 (51.00) 14 (14.00) 6 (6.00) 51 (51.00)	56 (35.00) 78 (48.75) 72 (45.00) 61 (38.13) 28 (17.50) 38 (23.75)	–0.098 –0.039 –0.019 0.107 –0.100 –0.137
10	Methods which should be adopted	Training sessions Workshops Reinforcement by senior colleagues Part of teaching curriculum/ education On-job training 54 (54.00) 58 (58.00) 54 (54.00) 40 (40.00) 34 (34.00)	70 (43.75) 93 (58.13) 81 (50.63) 77 (48.13) 82 (51.25)	–0.093 –0.087 0.030 –0.200 0.150
11	Perceived need of more training and reinforcement	Yes 96 (96.00)	135 (84.38)	0.456

There was a discord between medical students' knowledge and practices and the faculty perception of these aspects. Though difficult to say which is nearer to the truth, studies have shown that medical students cannot self-assess their performance accurately as the assessment of a topic such as infection control knowledge and practice is potentially complex.¹⁰

The faculty had a poor opinion about adherence to infection control guidelines by the students as they had observed low compliance amongst them. However, only half of them always pointed out the mistakes to the students. This is important as all medical doctors have an important role to play in enhancing knowledge, improving practice and developing appropriate attitudes amongst medical students to the safety and quality of patient care.¹⁶ Many studies have indicated that health care professionals do not treat infection control with the importance it deserves and some feel that this is a matter of inadequate education on this aspect.

Studies have found that teaching infection control to medical students is a challenge while developing a comprehensive programme as well as while engaging students to develop appropriate attitudes.¹⁷

The faculty recommended multi-faceted approach to teach infection control practices to the students. This utilization of various sources has also been recommended by many studies.^{5,18} The perceptions of students and faculty differed when it came to best method of teaching–learning infection control practices. This being a part of curriculum was mentioned by 48% of students while only 40% of faculty thought so. On-job training was more favoured by UGs as compared to faculty. This brings out the aspect that students like contextualizing the learning as being a part of curriculum would involve theory, demonstrations and practice in clinical environment. This has been found to be effective by other studies too.¹⁸

Thus there was disconnect between the students and faculty. This prompts thinking that though appropriate knowledge is a starting point for improving practice and for instilling the correct attitude to infection prevention, multi-faceted approaches using several methodologies are required.

Conclusion

Providing medical students with knowledge and ensuring that they acquire the correct practical skills in infection control is important. The approach within the medical schools needs to be researched and formulated to bridge this disconnect between faculty and students. Contextualizing education and assessment in the clinical setting may also improve learning outcomes; however studies with a larger and more diverse sample are needed to confirm this approach.

Intellectual contribution

Study concept: Col Atul Kotwal, SM, Med Cdt Afreen Ayub.

Data collection and analysis: Med Cdt Afreen Ayub, Aniket Kulkarni.

Statistical analysis: Anupam Kotwal, Ashish Goyal.

Study supervision: Col Atul Kotwal, SM, Air Cmde Ajoy Mahen.

Conflicts of interest

All authors have none to declare.

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