



Knowledge-Practice Gap Regarding Surgical Scrubs among Medical Students: A Cross-Sectional Survey

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ABSTRACT

Background: Medical students are involved in various aspects of patient care. Their lack of knowledge regarding infection control can compromise the safety of the patients. In this study, we describe the current knowledge and practice of medical students regarding surgical scrubs.

Methods: We conducted a cross-sectional survey among medical students using a self-administered questionnaire. The questions were based on the American Association of Surgical Technologists Standards of Practice for Surgical Attire, Surgical Scrub, Hand Hygiene, and Handwashing.

Results: Most students correctly identified the components of surgical scrubs including scrub suit (95.5%), shoe covers (95.4%), headcover (94.9%), and masks (93.9%). 82.7% of students were aware of the policy of wearing surgical scrubs off-campus, 78.7% knew the correct method of using the protective over gowns, only 52.8% knew permissible areas for wearing surgical scrubs. Student's adequate knowledge did not translate into their practices. 57.1% of the students reported not having received any formal education on scrub use. Inconvenience (66.9%), was cited as the most common cause of scrub re-use and unsafe practices.

Conclusion: Medical students have sufficient knowledge regarding surgical scrubs which does not translate into their practices. The majority of the students report as not having received any formal training regarding surgical scrub guidelines. Improving medical student surgical scrub practices may help reduce the burden of HAIs in developing countries.

Keywords: Medical students, Surgical scrubs, Practice, Knowledge

INTRODUCTION

Healthcare Associated Infections (HAIs) are a major cause of morbidity, mortality, and economic burden [1,2] increased length of hospital stay [3,4] and the emergence of multidrug resistant bacteria [5]. Common causes of HAIs include invasive devices and surgical procedures, as well as surgical environment [6]. The risk is substantial for patients as well as health care workers (HCWs), including medical students [7,8]. Surgical scrubs are an important component of the healthcare provider's attire and were primarily introduced to maintain the sterility of the operating room environment. However, the emphasis

to use the surgical scrubs exclusively in sterile areas faded in the early 1900's, as evidence emerged suggesting that they can be a potential source of harboring bacteria [9]. Recent evidence has established the need for the development of the operating room (OR) protocols to ensure the safe use of surgical scrubs [10,11]. Healthcare worker's compliance with standard protocols is recognized as an efficient means to prevent and control HAIs [12]. The correct use of surgical scrubs decreases the burden of surgical site infections [13], which are a major contributor of HAIs in the developing world [14]. Hence, such measures not only protect the patient and family, but also the HCWs, students, and the environment at large [15]. As an essential com-

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ponent of medical training, medical students are often involved in direct patient care. They can be a potential source of harboring bacteria [9] and are considered to be super-spreaders [16]. Medical students are the youngest members of a surgical team and are often less knowledgeable than other members of the operating room staff [17,18]. A study from Pakistan showed that medical students have limited knowledge regarding infection control [19]. A Lack of knowledge regarding standard protocols may lead to unsafe practices, which is a major concern, as medical students provide care to many patients. Understanding the current level of medical student knowledge and practices can help us explore a potential area where targeted interventions can improve compliance with standard protocols. Globally, data regarding medical student knowledge of surgical scrubs and its correct usage remains scarce, especially in lower and middle-income countries. There is already a higher burden of HAIs in developing countries as compared to developed countries [20], therefore identification of deficiencies can help in improving current practices. In this study, we aim to describe medical student's knowledge and practice regarding surgical scrubs.

METHODS

This cross-sectional, questionnaire based study was conducted among medical students enrolled in their Bachelor of Medicine, Bachelor of Surgery program (MBBS). Data was collected through a newly formulated, self-administered questionnaire. The Questionnaire had two sections, namely a "Knowledge" and "practice" section, and the questions were based on international guidelines such as the American Association of Surgical Technologists Standards of Practice for Surgical Attire, Surgical Scrub, Hand Hygiene, and Hand washing [21]. The questionnaire was contextualized, and the cultural sensitivity and quality of the content were validated by surgeons at the institute. The sample size was calculated *via* calculator.net. As this is a previously untested population in our subject of research, the prevalence was estimated at 50% to get the maximum sample size, which was found to be 169. Data from the questionnaire were entered and analyzed using SPSS 23. Categorical variables were reported as a frequency and percentages and were assessed by the chi-square/Fisher exact test. A $p < 0.05$ was considered significant.

RESULTS

A total of 216 students were interviewed, from which 196 provided complete information. Of the 196 students, 96 (48.7%) were males and 101 (51.3%) were females. Of these, 80 (40.8%) were students living off-campus, and 116 (59.2%) were living on-campus, at the hospital's hostel buildings.

Knowledge

Our results showed that almost all the participants had good knowledge regarding the major components of surgical scrubs including surgical scrub suit (95.9%), shoe covers (95.4%), head covers (94.9%), and masks (93.9%). In terms of surgical scrub usage, a proportion of respondents were knowledgeable as

shown below:

Surgical scrubs: 52.8% were able to correctly identify the areas where surgical scrubs were permissible; 82.7% knew that surgical scrubs were not permissible to be worn off-campus.

Protective gowns: 81.3% of the students knew that protective gowns need to be worn over surgical scrubs before leaving the operating room; and 78.7% of the students were aware of the correct method of using a protective gown (i.e tied at 3 ends).

Laundering: 78.2% of the students knew that surgical scrubs should be laundered through hospital designated laundry services.

Shoe covers: 80.2% of students knew the appropriate colors of outside shoe covers while 92.3% of students knew to change the shoe covers immediately after surgery if contaminated.

Masks: Most students (92.4%) students knew that masks must be discarded and not dangle in the neck.

Practices

The percentage of students reporting correct practices regarding important components of surgical scrubs are shown in **Table 1**. The percentage of students reporting correct practices was lower than the percentage of students reporting correct knowledge. Practices were most deficient in the cover gown and shoe cover usage. Among the 80% of students who do wear the cover gown when leaving the OR (vs those who do not), only 13.2% of them wear it in the proper way (tied at back and waist). While 80% of the students reported being able to correctly differentiate between white outside shoe covers and blue inside shoe covers, only 39% were appropriately switching between the two and utilizing the outside shoe covers. Out of 35.5% of students who used the surgical scrubs as nightwear, 9.6% did not change into a new pair of scrubs before entering the Operating Room. The results depicted that 57.1% of students reported not having received formal training regarding surgical scrub use. Only 12.7% of students read up on proper guidelines regarding surgical scrub detailed in the student handbook or institution's Dress code policy regarding operating room attire. 52% of the participants reported that they have neither received formal training nor have read up on the rules and procedures in the handbook. Students who said that they received formal education had higher correct responses for the correct use of protective over-gown ($P=0.038$) and shoe covers ($P=0.016$). Area of residence and the "Receipt of Formal Education regarding scrub etiquette" was significant for unsafe practices using Chi-Square analysis. On-campus students were 14.2% more likely to use scrubs as nightwear compared to students living off-campus ($P=0.04$). Off-campus students were 17.7% more likely to use surgical scrubs off-campus when compared to those who reside in the hostel ($P=0.005$). With regards to the reasons for gaps in knowledge and practice, the major reasons reported were inconvenience (66.9%), lack of appropriate scrub sizes (63.3%), and the risk of theft from changing rooms (83.7%) contributed to unsafe practices by the students. ext for this Chapter [2,3].

Table 1: Students with Correct Practices regarding Surgical Scrubs.

Practice Components	Correct Practice Responses Percentages (n)
Appropriately wearing a scrub protective overcoat while leaving the OR	80.6 (158)
Using a fresh mask while returning to the OR (from outside)	76.5 (150)
Surgical scrub use off campus*	75.1 (148)
Surgical scrub use as nightwear*	64.5 (127)
Re-entering OR with a fresh pair of surgical scrubs	19.3 (38)

*Surgical scrubs are not permissible to be worn off-campus or to be used as nightwear.

DISCUSSION

- Medical student's knowledge regarding components of surgical scrubs is sufficient however their knowledge regarding surgical scrub usage is deficient.
- Practice of surgical scrub usage is majorly incorrect and in areas where the knowledge is sufficient practice remains insufficient.
- More than half the students believe that they have never received any formal education/training regarding surgical scrub use.

Our study showed that most students were aware of the general components of the surgical scrubs; however, they lacked knowledge in the details of its usage. Furthermore, medical student's knowledge did not appear to translate into their practices. Even in areas where knowledge was sufficient, practices remained sub-par. The most striking was the majority of the students reporting as not having received formal education training despite having received mandatory orientation at the beginning of the clinical years. Studies from regional neighbors including India and China showed similar results. Students had sufficient knowledge regarding provider attire, however, when probing for details, the level of knowledge decreased significantly [22-24]. This provides insight into medical student's lack of importance given to details of protocols. One way of addressing this problem is to teach medical students the implications of unsafe practices. For example, while teaching students about the correct method of wearing a protective gown while leaving the operating room, it would be beneficial to emphasize the rate or risk of HAIs associated with incorrect practices. Furthermore, a special emphasis on the details of the protocols may curb the deficiencies in the knowledge. These "how-to" instructions can be displayed in key areas such as changing rooms, entrances, and exits of the ORs, etc, in the form of posters or distributed as flyers or manuals. These instructions must be included as part of the undergraduate curriculum and may be tested in objective structured clinical examinations (OSCEs) to increase their knowledge [25].

Our study highlighted that medical student's knowledge did

not translate into their practice. This is consistent with a study conducted in India that showed that a significant proportion of medical students were not laundering their lab coats routinely, despite being aware that their white coats harbored pathogen bacteria [10]. This shows that merely educating medical students is not enough, as sufficient knowledge does not translate into good practices. Institutions should make efforts to explore the reason behind these negligent practices. As in our study, medical students reported "inconvenience" as the most common reason for having unsafe practices. Reasons can differ based on individual institutions circumstances. Therefore, it is important to explore how to minimize inconvenience for medical students so that their practices can be improved.

Interestingly, more than half of the students believed that they have never received any formal education/training regarding surgical scrub. This is of concern as all the students receive training at the beginning of the clinical years as well as before starting their first surgical rotation. Furthermore, since the knowledge regarding most components of surgical scrubs in medical students is adequate, a lack of formal training would have not produced such results. Students may have forgotten the initial training they received (as it was on time only) or may have not attended it voluntarily. Similarly, a study conducted in Brazil showed that medical students were generally dissatisfied with the previously received instructions on exposure prevention. Furthermore, a study from the United Kingdom found that half the students thought that there was not enough emphasis on infection control in their curriculum. These findings highlight the disadvantage of one-time training which does not increase [24] or improve medical student knowledge in the long term. Once missed, it cannot be rescheduled and students resort to learning from their peers. A recommended method to bridge this gap is through more frequent refresher courses or arranging infection control workshops.

This study has major implications in the field of medical education. Our results emphasized the need to integrate standard guidelines regarding surgical scrubs into the current medical undergraduate curriculum. Medical institutes shall ensure that content targeting correct surgical scrub use guidelines become a mandatory part of surgical clerkship examinations or OSCEs.

Furthermore, state licensing exams and international accreditation bodies should monitor the institutional undergraduate curriculum. Quality control regulation bodies can penalize hospitals that fail to display surgical scrub guidelines in ORs and related areas such as changing rooms, recovering rooms, entrances, and exits. Further research is needed to study the medical student's practice across the region and identify similarities and differences in their knowledge and practices. Furthermore, medical student's attitudes need to be explored to learn the reasons behind such behaviors. It is worth exploring a direct link between the misuse of scrubs leading to growth and the possible transmission of pathogens [26].

Our study is the first study within the region to assess the knowledge and practice of medical students regarding surgical scrubs.

The study also attempts to explore why practices or knowledge may be lacking, as opposed to simply reporting the deficit. Our biggest limitation was using a self-created questionnaire; however, researchers created the content based on standard guidelines and ensured content validation by the surgeons and medical students of the university. Data were collected from a single institute and may not represent the entire medical student population of the country.

CONCLUSION

Medical students had good knowledge regarding surgical scrub components but lacked details regarding permissible areas where scrubs can be used. This adequate knowledge however did not translate into their practices. The findings of our study suggest that the knowledge and practices of medical students regarding surgical scrubs need improvement. A one-time training at the beginning of the clinical years does not suffice. Training should be integrated into the curriculum and more repeated and structured training is required to improve medical student practices regarding the appropriate use of surgical scrubs. These results can potentially contribute to shaping the curriculum regarding infection control measures in medical colleges of lower and middle-income countries that could be mandated to medical schools and as continuing education for doctors in practice. Thus, infection control is not just an issue of individual practice; it is also relevant to the policy at national levels. A coherent policy to mandate infection control training by the medical students can evoke a trickle-down effect on other professions, health care agencies, as well as national and international health care outcomes which may reduce the burden of HAIs in developing countries in the future.

ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was obtained from the Ethical Review Committee, of the Aga Khan Hospital, and written informed consent was taken from the participants after explaining the background, rationale, advantages and disadvantages to the patients by the data collectors.

CONSENT FOR PUBLICATION

Not applicable

AVAILABILITY OF DATA AND MATERIALS

The datasets generated and/or analysed during the current study are not publicly available due to privacy and confidentiality but are available from the corresponding author on reasonable request.

COMPETING INTEREST

The authors declare that they have no competing interests.

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AUTHOR'S CONTRIBUTION

Drs. Hania Shahzad, Khan Osama Bin Fraz, Ayat Siddiqui were involved in the conception, study design, data acquisition, analysis and interpretation of the data. Drs. Hania Shahzad, Khan Osama Bin Fraz, Ayat Siddiqui drafted and revised the manuscript under the supervision of Dr. Narjis Rizvi. Final approval of the manuscript was taken from all the authors and they all agreed to be accountable for all aspects of the work.

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