



RESEARCH ARTICLE

Perceptions and Mindset toward Infection Control and Prevention among Medical Microbiology Students

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ABSTRACT

Health-care-associated infections (HCAIs) are significant public health problems. They can lead to high rate of morbidity and mortality, and raise the cost of health care services, in developed and developing countries. Simple and routine education for health-care personnel, including students of medical colleges or departments about the main preventive measures and infection control, can help them to enhance their hand-washing practices and adhere to necessary precautions to prevent the spread of infection and reduce incidence of HCAIs. The period of first stages of medical education is the suitable phase and proper time for getting the necessary information and skills about infection prevention and control (IPC) practices. This study aimed to assess the knowledge, awareness, and attitude of students of Medical Microbiology Department in Cihan University-Erbil toward the guidelines and main practices of IPC. The study revealed variable levels of knowledge and awareness about infection control precautions among students and also showed inadequate practical adherence to some important precautions among a significant percentage of students. To enhance the safety of students and patients, we believe that it is necessary to begin teaching the basic knowledge about infections and the principles of IPC precautions during the first period of study in the college.

Keywords: Health-care-associated infections, infection prevention and control, hygiene, awareness, attitude, medical microbiology students

INTRODUCTION

Health-care-associated infections (HCAIs) or hospital acquired infections are different types of infections that affect patients while they are receiving healthcare in the hospital or other health-care settings, or occur among healthcare workers during their work in hospitals.^[1] HCAIs are serious public health issues. They can lead to high rate of morbidity and mortality, in addition to raising the financial cost of healthcare, in both developing and developed countries. Different recent studies showed that 5–7 of every 100 hospitalized patients in developed countries and 10–15 patients out of every 100 patients, in developing countries may acquire an HCAI during hospitalization.^[2-4]

According to the US Center for Disease Control and Prevention, there are about 1.8 million hospitalized patients that acquire health-care-associated infection annually during treatment for other health problems, and studies estimate that about 100,000 patients may die due to these infections.^[3] An important factor that makes hospital-acquired infections dangerous and expensive is that most of the bacteria that cause them are multi-drug resistant to the most common antibiotics.^[5]

Unfortunately, the HCAI usually receives public attention only when they become epidemics.^[6] A recent study in the European Union showed that about 2,600,000 new patients were identified as having HCAI every year. These studies also found that for every 20 hospitalized patients, at least one of them acquired an HCAI which was preventable.^[7,8]

Studies showed that HCAI is linked with prolonged hospital stay, and are associated with emergence of multidrug-resistant organisms.^[9] The impact of hospital-acquired infections is seen not just at an individual patient or healthcare workers level, but also is seen at the community level because most

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of these infections have been linked to multidrug-resistant microorganisms.^[7]

HCAIs have important impacts on patients with severe diseases, in about 0.5 million cases of HCAIs being reported annually in intensive care units (ICUs). Patients in ICU are often with severe illness and low immune status, which makes them more susceptible to HCAIs.^[10]

Several recent studies revealed that routine infection-control measures such as hand washing with an alcohol-based disinfectant, or hand rub with simple antiseptic can help prevent high percentage of health-care-associated infections and save many lives, reduce morbidity rate, and minimize costs of healthcare.^[11,12]

Simple and routine education for health-care personal about the main preventive measures and infection control can help them to enhance their hand-washing practices and adhere to necessary precautions to prevent the spread of infection and reduce incidence of HCAI. For this goal, the World Health Organization has formed different guidelines to encourage hand-washing practices among health-care personal.^[11]

The risk of hospital acquired infections is significant not only for hospitalized patients, but also for health-care personal including medical students.^[11] Healthcare workers and medical students and trainees in medical sittings, particularly in hospitals, can be exposed to different infectious microorganisms and can then become infected with these pathogens and/or become carriers, and in both cases, they can spread the infection to hospitalized patients or to other staff, or even to their families and surrounding community.^[7,13] Medical students, as all healthcare workers, are at high risk of exposing to different HCAIs, including severe infections, especially if they were not adhering to infection control and prevention methods.^[14] Therefore, it is important for medical students to have enough and suitable information and skills about infection prevention and control (IPC) techniques and to include them in adequate training courses about important IPC guidelines.^[12]

IPC practices are a standard measure employed by health-care personal to reduce the risk of transmission of infectious pathogens during their work among patients and themselves.^[14] Most studies revealed that adequate compliance of the healthcare workers, including medical students, with standard precautions and infection control and prevention practices, such as hand hygiene practices, has been documented as an effective measure to prevent and control HCAIs. Adherence to such measures and practices not only protect the patient but also protect the healthcare workers, their families, and community.^[15]

Most researchers agree that the starting phase of the medical education is the most appropriate period and proper time for acquiring an adequate knowledge and necessary skills about practices of IPC.^[16] Some researchers believe that there is deficiency of evidence about adequate infection control and training courses in the core of the curriculum of most undergraduate medical faculties and institutions, and this needs to be taken into consideration if HCAIs incidences are to be reduced.^[13,14,17]

Medical students should adhere to infection control and prevention training courses, mainly hand hygiene, and knowledge regarding IPC should be a relevant and central topic in their study, but they may feel that learning about the IPC may be negotiated or not adequate during the first period of their medical studies due to the overfilled curriculum.^[18] Hence, the adequate teaching and necessary training needs and necessities of medical students about practices of IPC need to be evaluated.^[18-20]

This study was designed and aimed to evaluate the knowledge, awareness, and attitude of students of Medical Microbiology Department in Cihan University- Erbil towards the guidelines and main practices of IPC, such as standard precautions and use of adequate personal protective tools.

MATERIALS AND METHODS

This study is a cross-sectional questionnaire-based survey among students of Medical Microbiology Department, Cihan University- Erbil.

(331) students (161 females and 170 males) of different years of study in the Department of Medical Microbiology at Cihan University Erbil were included in this research. Participant students filled out an online questionnaire about awareness, knowledge, and attitude regarding IPC practices. Online questionnaire with 29-items was distributed to 331 students of Medical Microbiology Department, that are studying in different years of study through email. One hundred and seven of students were of the 4th year, 117 students of the 3rd year, 75 students of the 2nd year, and 32 students in the 1st year. 256 out of 350 students responded to the questionnaire.

The used questionnaire was designed by researchers to cover key points of IPC practices guidelines, including hand hygiene methods, knowledge about prevention methods of different types of common infections, prudent use of personal protective tools, cleaning, and disinfection, as well as their satisfaction with their IPC teaching and education during their study in the department.

Students' knowledge about infection control and prevention practices was assessed depending on their answers to the used questionnaire.

Collected data were analyzed using SPSS program. All percentages for the entire variables were calculated, and relevant figures and tables were computed.

RESULTS

The participant students were distributed according to the years of study in the department as follows: 107 students in the 4th year, 117 students in the 3rd year, 75 students in the 2nd year, and 32 students in the 1st year.

Results revealed that 77.3% of students responded to the questionnaire (256: 131 females and 125 males). The percentages of respondents to the questionnaire were 49% of 1st-year students, 76% of 2nd-year students, 76.9% of 3rd year students, and 86.8% of 4th year students [Table 1].

Regarding general knowledge and awareness, results of the study showed that a total of 212 (82.8%) respondent

students were aware of standard precautions within the health care setting. About 79% (202/256) had adequate knowledge about hand hygiene, also 67% of them were exposed to hand hygiene training course (172/256). However, only 65% of students (167/256) responded that they are committed to hygienic hand washing before and after each contact with patients or with suspected materials.

Regarding the minimum time needed for hand washing, 76% of respondents (196/256) responded that the minimum time needed for hand washing is 20 s [Table 2].

When the students were asked about their behavior regarding respiratory hygiene, 197 of them (77%) responded that they “I cough/sneeze on a disposable napkin” and wash their hands after coughing or sneezing, but only 176 responders (69%) were aware of alternative behavior in case when napkins are not available, such as cough/sneeze over shoulder, also 204 (79.6%) usually keep a distance more than 1 meter from others during cough [Table 3].

Regarding using protective measures and healthy attitude during laboratory sessions, 78 of responders (30.4%) responded that they usually wear their laboratory coat outside the laboratories and other hospital setting, and 43 of female

students (33%) responded that they usually wear jewelries and/or artificial fingernails during laboratory sessions. Furthermore, 72 of the responders (28%) sometimes are eating or drinking during laboratory session.

Regarding using gloves in some situations, 207 of students (80.8%) responded that they use gloves when there is a risk of contact with the blood or body fluid, while only 191 of students (74%) responded that they usually use gloves for any laboratory or medical procedure, and 89 of students (34.7%) answered that they can handle body fluids with bare hands if gloves are not available. Furthermore, 62 of responders (24%) think that they do not have to wash their hands when they use gloves [Table 4].

Regarding the knowledge and awareness about the transmission modes of some common and important infectious diseases, the study showed that 189 of responders (73.8%) believe that invasive procedures increase the risk of nosocomial infections, and 204 (79.6%) responded that transmission of blood borne infection is possible after a single contaminated needle stick injury, while 152 (59%) of responders think that hepatitis B and C have a high rate of spread through saliva and respiratory droplets, and 112 (43.7%) believe that HIV has a high rate of transmission through respiratory droplets. One hundred and twenty of responder students (46.8%) responded that influenza and COVID-19 have a high rate of transmission through needle stick [Table 5].

DISCUSSION

Adequate awareness and healthy attitude are the main requirements for prevention of infectious diseases especially among healthcare workers and medical students.^[14,20] In this study, a high rate of questioned students (77.3%) responded to the questionnaire, and the percentages of respondents to the questionnaire were significantly high (76%) among 2nd-, 3rd-, and 4th-year students comparing with 1st-year students (49%).

Table 1: Main characteristics of responding students

Characteristics	Total	Number of respondents	Percentage
Questioned students	331	256	77.3
Females	170	138	81.0
Males	161	118	73.2
1 st year	32	15	46.8
2 nd year	75	58	76.0
3 rd year	117	90	76.9
4 th year	107	93	86.8

Table 2: Awareness about standard precautions

Questions	Number of responders	Number of responded:	Number of responded:
		Yes (%)	No (%)
Are you aware of the standard precautions within the health care setting	256	212 (82)	44 (18)
I have sufficient knowledge about hand hygiene	256	202 (79)	54 (21)
I was exposed to hand hygiene training	256	172 (67)	84 (33)
I adhere to hygienic hand washing	256	167 (65)	89 (35)
The minimum time needed for hand washing is 20 seconds	256	196 (76)	60 (24)

Table 3: Students' behavior regarding respiratory hygiene

Questions	Number of responders	Number of responded: Yes (%)	Number of responded: No (%)
I Cough/sneeze on a disposable napkin and wash their hands after coughing or sneezing	256	197 (77)	59 (23)
I am aware of alternative behavior in case when napkins are not available	256	176 (69)	80 (31)
I keep a distance more than 1 meter from others during cough	256	204 (79.6)	52 (20.4)

Table 4: Protective measures and healthy attitude during laboratory sessions

Questions	Number of responders	Number of responded: Yes (%)	Number of responded: No (%)
I wear laboratory coat outside the laboratories and other hospital setting	256	78 (30)	178 (70)
I wear jewelries and/or artificial fingernails during laboratory sessions	131	43 (33)	88 (67)
I eat or drink during labs.	256	72 (28)	184 (72)
I use gloves when there is a risk of contact with the blood or body fluid, while	256	207 (81)	49 (19)
I use gloves for any laboratory or medical procedure	256	191 (74)	65 (26)
can handle body fluids with bare hands if gloves are not available	256	89 (34.7)	167 (65.3)
I do not have to wash my hands when I use gloves.	256	62 (24)	

Table 5: Knowledge about the transmission of common infectious diseases

Questions	Number of responders	Number of responded: Yes (%)	Number of responded: No (%)
Invasive procedures increase the risk of nosocomial infections. And	256	189 (73.8)	67 (26.2)
transmission of blood borne infection is possible after a single contaminated needle stick injury	256	204 (79.6)	52 (20.4)
Hepatitis B and C have a high rate of transmission through saliva and respiratory droplets	256	152 (59)	104 (41)
HIV has a high rate of transmission through saliva and respiratory droplets	256	112 (43.7)	144 (56.3)
Influenza and COVID-19 have a high rate of transmission through needle stick.	256	120 (46.8)	136 (53.2)

This may reflect the lack of experience regarding electronic questionnaires among 1st-year students.

The rate of responding female students was higher than the rate among males, but without significant difference (81% and 73.2 prospectively).

Responding students showed high percentage of theoretical knowledge regarding general standard prevention precautions of infections, as (82.8%) of respondent students were aware about the main standard precautions within the health-care setting, and 79% of them think they had adequate knowledge about hand hygiene, although only 67% of them were included in hand hygiene training course.

Despite the high percentage of theoretical awareness, only 65% of students responded that they are committed to hygienic hand washing before and after each contact with patients or with suspected materials. This moderate adherence to hand hygiene practice may indicate an important gap between knowledge and practice. This may be due to the lack of good role models for these students among their teachers and supervisors. This perhaps may be also due to the lack of effective monitoring of them while they are training in the hospital or laboratory. Similar results were shown in other studies.^[14,21]

This study showed important unhealthy students' attitudes and practices during laboratory sessions and

contact with patients and suspected materials, as (30.4%) of responders responded that they usually wear their laboratory. Coat outside the laboratories and other hospital setting: About 33% of female students usually wear jewelries and/or artificial fingernails during laboratory sessions. Furthermore, (28%) responders sometimes eat or drink during laboratories. Moreover, (34.7%) answered that they can handle body fluids with bare hands if gloves are not available. This may indicate a general lack of adherence to the instructions among many students. It may also indicate a lack of appreciation for the importance of these instructions in preventing infections.

Regarding the knowledge and awareness about the transmission modes of some important infections, as (26.8%) of respondents believe that invasive procedures do not increase the risk of nosocomial infections, and (59%) of responders think that Hepatitis B, C, and HIV viruses have a high rate of transmission through saliva and respiratory droplets, while (46.8 %) responded that Influenza and COVID-19 have a high rate of transmission through needle stick, and this was significantly clear in responses of 1st- and 2nd-years students, and may reflects the lack of theoretical knowledge of transmission routs of infections in this group of students.

Similar studies showed that a short course of infection control that is provided in most medical schools is not enough to make all students awarded of infection control measures and safety techniques.^[14,22-24]

CONCLUSION

This study revealed variable levels of knowledge, awareness, of most infection control precautions among students of Medical Microbiology Department in Cihan University-Erbil and also showed inadequate practical adherence to some important precautions among significant percentage of our students.

To enhance the safety of our students and patients, we believe that it is necessary to begin teaching the basic knowledge of infections and the principles of infection control and prevention precautions during the first period of study in the college.

Education courses should be enforced by peers, seniors, and by acting as role models of infection control to achieve acceptable and an adequate level of adherence to infection control principles and precautions. Understanding and acceptance the commitment to preventive and infection control measures should be an important goal of education in medical departments.

REFERENCES

1. A. Hoxha, E. Duysburgh and L. Mortgat. Healthcare-associated infections in home healthcare: An extensive assessment, 2019. *Eurosurveillance*, vol. 26, no. 5, p. 1900646, 2021.
2. A. Ghashghaee, M. R. Benis, A. Aryankhesal, K. Tanha, H. Hosseinfard, L. Janani, S. Raoofi, A. Lahimchi, S. Alihosseini, D. Gharagozlou, M. Javanbakht, Z. M. Kiaee and H. Shabaninejad. The prevalence of hospital-acquired infections in the EMRO: A systematic review and meta-analysis from 2000 to 2018. 2019. *SSRN Electronic Journal*, vol. 3, pp. 32-37.
3. V. Rangelova, R. Raycheva, A. Kevorkyan, M. Krasteva and T. Dermendzhiev. Surveillance of nosocomial infections in a Bulgarian neonatal intensive care unit. *Folia Medica*, vol. 62, no. 4, pp. 753-761, 2020.
4. M. G. Gozel, C. H. Hekimoglu, E. Y. Gozel, E. Batir, M. L. McLaws and E. A. Mese. National infection control program in Turkey: The healthcare associated infection rate experiences over 10 years. *American Journal of Infection Control*, vol. 49, no. 7, pp. 885-892, 2021.
5. R. Gazzarata, M. E. Monteverde, C. Ruggiero, N. Maggi, D. Palmieri, G. Parruti and M. Giacomini. Healthcare associated infections: An interoperable infrastructure for multidrug resistant organism surveillance. *International Journal of Environmental Research and Public Health*, vol. 17, no. 2, p. 465, 2020.
6. N. B. Johnson, L. D. Hayes, K. Brown, E. C. Hoo and K. A. Ethier. CDC National Health Report: Leading causes of morbidity and mortality and associated behavioral risk and protective factors-United States, 2005-2013. *MMWR Supplements*, vol. 63, no. 4, pp. 3-27, 2014.
7. M. Haque, M. Sartelli, J. McKimm and M. A. Bakar. Health care-associated infections-an overview. *Infection and Drug Resistance*, vol. 1. pp. 2321-2333, 2018.
8. A. Cassini, D. Plachouras, T. Eckmanns, M. Abu Sin, H. P. Blank, T. Ducomble, S. Haller, T. Harder, A. Klingeberg, M. Sixtensson, E. Velasco, B. Weiß, P. Kramarz, D. L. Monnet, M. E. Kretzschmar and C. Suetens. Burden of six healthcare-associated infections on European population health: Estimating incidence-based disability-adjusted life years through a population prevalence-based modelling study. *PLoS Medicine*, vol. 13, no. 10, p. e1002150, 2016.
9. J. L. Vincent. Nosocomial infections in adult intensive-care units. *The Lancet*, vol. 361, no. 9374, pp. 2068-2077, 2003.
10. W. Duszynska, V. D. Rosenthal, A. Szczesny, K. Zajackowska, M. Fulek and J. Tomaszewski. Device associated-health care associated infections monitoring, prevention and cost assessment at intensive care unit of University Hospital in Poland (2015-2017). *BMC Infectious Diseases*, vol. 20, no. 1, p. 761, 2020.
11. R. Danasekaran, G. Mani and K. Annadurai. Prevention of healthcare-associated infections: Protecting patients, saving lives. *International Journal of Community Medicine and Public Health*, vol. 1, p. 67, 2014.
12. D. Hazard, M. von Cube, K. Kaier and M. Wolkewitz. Predicting potential prevention effects on hospital burden of nosocomial infections: A multistate modeling approach. *Value in Health*, vol. 24, no. 6, pp. 830-838, 2021.
13. A. Ayub, A. Goyal, A. Kotwal, A. Kulkarni, A. Kotwal and A. Mahen. Infection control practices in health care: Teaching and learning requirements of medical undergraduates. *Medical Journal Armed Forces India*, vol. 69, no. 2, pp. 107-112, 2013.
14. A. A. Ibrahim and S. S. Elshafie. Knowledge, awareness, and attitude regarding infection prevention and control among medical students: A call for educational intervention. *Advances in Medical Education and Practice*, vol. 7, pp. 505-510, 2016.
15. R. S. Al-Kayali, H. A. Al-Essa, A. Khouri, W. Khaddam, M. Salloum, S. Shehade and A. Jaddouh. Knowledge, attitudes and practices toward Covid-19 among population: An online-based cross-sectional study from Syria. *European Journal of Biomedical and Pharmaceutical Sciences*, vol. 7, no. 12, pp. 16-24, 2020.
16. S. P. Clarke, J. L. Rockett, D. M. Sloane and L. H. Aiken. Organizational climate, staffing, and safety equipment as predictors of needlestick injuries and near-misses in hospital nurses. *American Journal of Infection Control*, vol. 30, no. 4, pp. 207-216, 2002.
17. M. Sommer, G. Zulaika, M. L. Schmitt, S. Khandakji and P. A. Phillips-Howard. Advancing the measurement agenda for menstrual health and hygiene interventions in low- and middle-income countries. *Journal of Global Health*, vol. 10, no. 1, p. 010323, 2020.
18. S. Scheithauer, H. Haefner, T. Schwanz, L. Lopez-Gonzalez, C. Bank, R. Schulze-Röbbecke, M. Weishoff-Houben and S. W. Lemmen. Hand hygiene in medical students: Performance, education and knowledge. *International Journal of Hygiene and Environmental Health*, vol. 215, no. 5, pp. 536-539, 2012.
19. W. B. Melenhorst, H. P. Poos and N. E. Meessen. Medical students need more education on hygiene behavior. *American Journal of Infection Control*, vol. 37, no. 10, pp. 868-869, 2009.
20. A. Richter, I. F. Chaberny, A. Surikow and B. Schock. Hygiene in medical education-increasing patient safety through the implementation of practical training in infection prevention. *GMS Journal for Medical Education*, vol. 36, no. 2, p. Doc15, 2019.
21. K. Calabro, K. Bright and K. Kouzekanani. Long-term effectiveness of infection control training among fourth-year medical students. *Medical Education Online*, vol. 5, no. 1, p. 5850, 2000.
22. Z. Zhang, T. Yamamoto, X. Wu, K. Moji, G. Cai and C. Kuroiwa. Educational intervention for preventing bloodborne infection among medical students in China. *Journal of Hospital Infection*, vol. 75, no. 1, pp. 47-51, 2010.
23. R. Kaur, H. Razee and H. Seale. Facilitators and barriers around teaching concepts of hand hygiene to undergraduate medical students. *Journal of Hospital Infection*, vol. 88, no. 1, pp. 28-33, 2014.
24. M. H. Ubeid, T. S. Salih and A. S. Juma. HIV, HBS and HCV in dump site workers of Erbil governorate. *Cihan University-Erbil Scientific Journal*, vol. 5, no. 2, pp. 20-23, 2021.