

Original Research Article

Assessment of knowledge and practice toward infection control and prevention standards among intern doctors in Saudi Arabia

Ahmad M. Albarrag^{1*}, Abdulmajeed A. Aloraini², Abdulaziz I. Alhussain²,
Faris I. Alwarhi², Abdullah I. Altashlan², Naif M. Alhadi²

¹Department of Pathology, Faculty of Medicine, King Saud University, Riyadh, Saudi Arabia

²College of Medicine, King Saud University, Riyadh, Saudi Arabia

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*Correspondence:

Dr. Ahmad M. Albarrag,

E-mail: aalbarrag@ksu.edu.sa

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ABSTRACT

Background: Patients and healthcare workers are susceptible to health care associated infections if they are not compliant with infection prevention and control standards. There are no previous studies regarding the assessment of knowledge and practice of intern doctors toward infection prevention and control precautions in Saudi Arabia.

Methods: A cross-sectional study that was carried-out on 259 intern doctors at the main hospitals of Riyadh city in Saudi Arabia. A self-administered questionnaire was distributed to the participants after validation during their clinical rounds and their morning meetings of their departments. Data were analysed using SPSS version 21.0.

Results: Out of 259 participants, the overall mean score for knowledge assessment was 79.4 ± 7.52 . For hand hygiene mean score was 23.53 ± 2.66 out of 30, personal protective equipment mean score was 20.63 ± 2.49 out of 25. A significant low level of knowledge regarding needle stick injury with a score of 19.18 ± 2.50 out of 30. Regarding, knowledge towards isolation precautions, around 50% reported adequate knowledge regarding isolation precautions. Meanwhile, 78 (30.1%) denied receiving any form of training or orientation in infection control.

Conclusions: There is a moderate level of knowledge and satisfactory level of practice among intern doctors in Riyadh. However, there was some misconceptions regarding needle stick injury and isolation precaution. Implementing infection control education and training programs is recommended before starting clinical practice.

Keywords: Infection control, Hygiene, Personal protective equipment, Needle-stick injury, Healthcare associated infections

INTRODUCTION

As defined by the World Health Organization (WHO), health care-associated infections (HCAIs) also known as nosocomial infections (NI) are those affect patients in a hospital or other healthcare facility and are not present or incubating at the time of admission. They include infections acquired by patients in the hospital or health facility after 48 hours of admission, three days after discharge or 30 days following operation.^{1,2} It is also attributed as being associated with increased patients'

morbidity, mortality, length of hospital stays and treatment cost.³ Furthermore, it is one of the most important factors that cause high bacterial resistance against antimicrobial drugs; according to the centers for disease control and prevention (CDC), more than 70% of the bacteria now causing health care-associated infections (HCAIs) are resistant to at least one of the drugs most commonly used to treat them and approximately 15% of all hospitalized patients suffer from these infections.^{4,5} Such infections frequently include central line-associated bloodstream infections, catheter-associated urinary tract

infection, surgical site infections and ventilator-associated pneumonia.⁶

Healthcare workers (HCWs) also are susceptible to serious infections since they are exposed to several risk factors such as needle stick injuries and blood-borne pathogens as they perform their clinical practices in their workplace.⁷ Compliance on the part of HCWs with infection prevention and control standards (IPCS) has been acknowledged as being an efficient wherewithal and fundamental to prevent and control HCAs as well as to decrease antimicrobial resistance.⁸ Such measures not only protect the patients, but also the HCWs and the environment.

There are very few studies targeted mainly medical interns who are considered an important sample among HCWs. Since they annually start their training in different hospitals and departments, it is essential for them to be fully aware and well educated about IPCS during their clinical practices. As stated in a previous study, introducing training programs to intern doctors about IPCS have proven their efficiency in reducing HCAs.⁹

This study was carried out to assess knowledge and practice of intern doctors toward infection control and prevention standards which include Hand hygiene, Personal protective equipment, needle stick injury and isolation precautions. Along with their education and training about ICPs.

METHODS

This is a cross-sectional study that was done on 259 intern doctors at the main hospitals in Riyadh, Saudi Arabia, using a self-administered questionnaire between January and February of 2018. The questionnaire was designed based on important aspects and necessary information that were obtained from reviewed literature of previous studies as well as CDC and WHO guidelines, which meet our research objectives. It was reviewed for its comprehensiveness by a panel of experts in infection control and prevention and piloted for its validity and reliability among 20 intern doctors at King Khalid University Hospital (KKUH) resulting in Cronbach's alpha score at 0.788 for overall items reflecting good reliability and internal consistency of the items in the questionnaire. Raosoft online software was used to calculate the appropriate sample size of our cross-sectional study. With a primary estimated population size of 1000 interns in Riyadh, margin of error of 5%, response distribution of 50%, and a confidence level of 99%, the suggested sample size in our study was determined at 400 participants, in which only 259 interns agreed to participate.

Participants were approached by the research team using convenient sampling during their clinical rounds and morning meetings of their departments. We distributed the survey among the medical intern groups which only

included doctors doing their internship in Riyadh city. While we excluded incomplete data, medical students, graduated physicians and interns living outside Riyadh city. Participants were assured that their data are anonymous and will only be used for the research purposes. This study was approved by the Institutional review board committee at King Saud University, research project No. E-19-4260

This questionnaire was mainly constructed on four sections, the first section contained demographic data including age, gender, elapsed duration of internship program, and the number of hospitals they have trained at. The second section consisted of questions that measure the knowledge about hand hygiene (HH), personal protective equipment (PPE), needle stick injury (NSI), HCAs as well as their knowledge about isolation precautions and its approach. The third section contained questions about the practice of IPCS to assess their appropriate and correct use of hand hygiene and personal protective equipment along with the right way for handling needles. Finally, the last section contained questions on their own opinion about their education and training in IPCS.

The items of the questionnaire were typical five-level likert scale assessing the degree of agreement (strongly agree, agree, neutral, disagree and strongly disagree) for knowledge assessment with a score of 1 to 5, where a score of 5 was given to the most appropriate response and a score of 1 given to the least appropriate response for each item. It is possible to obtain a maximum score of 30 and a minimum score of 6 in HH and NSI domains which contain 6 items for each domain. For PPE domain, which contains 5 items, it is possible to obtain a maximum score of 25 and a minimum score of 5.

For HCAs domain, which contains 3 items, it is possible to obtain a maximum score of 15 and a minimum score of 3. Therefore, an overall of 100 is the maximum possible score and 20 is the minimum possible score. The overall knowledge of all domains was determined to be low (≤ 73.33), moderate (73.34 to 86.66), or high (≥ 86.67). For HH and NSI domain, level of knowledge was determined to be low (≤ 22), moderate (22.1 to 26) or high (≥ 26.1). For PPE domain, level of knowledge was determined to be low (≤ 18.33), moderate (18.34 to 21.66), or high (≥ 21.67). For HCAs domain, level of knowledge was determined to be low (≤ 11), moderate (11.1 to 13), or high (≥ 13.1).

Isolation precaution knowledge was assessed through three basic multiple-choice questions. For practice assessment, adverbs of frequency (always, usually, sometimes, rarely, and never) were adopted. Finally, four opinion based (Yes/No and multiple responses) questions about their education and training regarding IPCS.

Data were entered and analysed using IBM SPSS 21.0 version statistical software. Descriptive statistics

(frequencies, percentages, mean and standard deviation) were used to describe the categorical and quantitative variables. A p value of ≤ 0.05 and 95% confidence intervals were used to report the statistical significance and precision of results.

RESULTS

A total of 259 participants completed the questionnaire. As shown in Table 1, 146 (56.4%) were males and 113 (43.6%) were females aged mostly 24 to 25 (80.4%) years old with mean age of 24.62 ± 1.33 ranging from 23 to 33. Among the participants, 114 (44%) were from King Saud University, 31 (12%) were from Almaarefa Colleges, 20 (7.7%) were from King Saud Bin Abdulaziz University for health sciences, 20 (7.7%) were from Imam Muhammad University, 13 (5%) were from Princess Nora University, 7 (2.7%) were from Alfaisal University, 11 (4.2%) were from Hail University, 9 (3.5%) were from Jazan University and 34 (13.1%) were from different universities.

Table 1: Distribution of socio-demographic data and characteristic of study subjects (n=259).

Variable	N (%)
Gender	
Male	146 (56.4)
Female	113 (43.6)
University	
King Saud University	114 (44)
King Saud Bin Abdulaziz University	20 (7.7)
IMAM Muhammed University	20 (7.7)
Princess Nora University	13 (5)
Alfaisal University	7 (2.7)
Almareefa Colleges	31 (12)
Jazan University	9 (3.5)
Hail University	11 (4.2)
Other	34 (13.1)
Elapsed training duration	
0-3 months	17 (6.6)
3-6 months	43 (16.6)
6-9 months	172 (66.4)
9-12 months	22 (8.5)
More than 12 months	5 (1.9)
Number of hospitals participants have trained at	
One hospital	125 (48.3)
Two hospitals	64 (24.7)
Three hospitals	43 (16.6)
Four or more hospitals	27 (10.4)

Furthermore, 172 (66.4%) of the participants have been in their internship program for 6-9 months, 50 (23.2%) for less than 6 months and 27 (10.4%) for more than 9 months. Regarding the training hospitals, 125 (48.3%) have trained in only one hospital, 64 (24.7%) have trained in two hospitals, 43 (16.6%) have trained in three hospitals and 27 (10.4) have trained in four or more than

four hospitals. 224 (86.2%) stated that they are aware of the standard precautions within healthcare settings and 82 (31.9%) of the participants think they do not have a clear knowledge about use of personal protective equipment.

Table 2: Comparison of knowledge toward infection control and prevention standards between male and female interns.

Variable	Mean \pm SD			P value
	Male	Female	Total	
Hand hygiene	23.33 \pm 2.56	23.97 \pm 2.75	23.53 \pm 2.66	0.043
PPE	20.43 \pm 2.46	21.05 \pm 2.33	20.63 \pm 2.49	0.038
NSI	18.93 \pm 2.62	19.52 \pm 2.33	19.18 \pm 2.50	0.062
HCAIs	11.87 \pm 2.22	12.33 \pm 1.84	12.02 \pm 2.08	0.051
Overall score	78.37 \pm 7.29	80.71 \pm 7.64	79.40 \pm 7.52	0.015

The participants were assessed for their knowledge through statements presented in Table 2. Their score was an overall of 79.4 out of 100 with a standard deviation of 7.52. Knowledge questions consisted of four main domains; first domain was hand hygiene with mean score of 23.53 ± 2.66 out of 30. The second domain was about personal protective equipment with mean score of 20.63 ± 2.49 out of 25. The third domain concerned about needle stick injuries with mean score 19.18 ± 2.50 out of 30. Finally, the last domain contained general statement regarding the risk of getting HCAIs with mean score of 12.02 ± 2.08 out of 15. Statistically significant difference was detected (P value=0.015) between females and males revealing that females' overall score was higher than males' as shown in Table 2. However, the difference was not found to be statistically significant between universities of education, training duration or between those who have trained at single hospital or multiple hospitals. The percentages of respondents for each statement about IPCS assessment are shown in Table 3.

Knowledge of isolation precautions was assessed through three multiple choice questions, 130 (50.4%) incorrectly answered that "droplet precautions should be taken in case of a patient with pneumonia. Interestingly, 63 (25.6%) of the participants incorrectly answered the question "airborne precautions should be taken in case of a patient with open pulmonary TB. Additionally, only 131 (50.6%) correctly reported the type of contact precautions should be taken in case of a patient with shingles.

Practice assessment was done through statements regarding HH, PPE, and NSI which are presented in Figure 1. There were two yes/no questions about their own opinion in their education and training in IPCS. In these 2 questions 181 (69.6%) stated that they have

received some form of training or orientation about IPCS. However, 78 (30.1%) denied receiving any form of training or orientation. Nevertheless, among those who

stated that they received training and orientation, 60 (33.1%) were not satisfied with their training and education about IPCS.

Table 3: Percentages of respondents for each statement regarding knowledge towards ICPS.

	Agree/strongly agree	Neutral	Disagree/strongly disagree
Proper hand hygiene contributes in decreasing morbidity and mortality associated with HCAIs	94%	4%	2%
Hand washing with regular soap is enough to kill germs	41%	22%	37%
Using gloves eliminates the need to wash hands*	19%	14%	68%
Alcohol-based hand rub is preferred over hand washing when hands are not visibly soiled	46%	30%	24%
Hand hygiene is performed before and after patient encounter	93%	5%	3%
Prolonged use of gloves without hand hygiene can contribute in germs transmission	73%	22%	6%
Gloves provide complete protection against hand contamination*	38%	28%	34%
Gloves must be worn when touching mucosal surfaces or in contact with bodily fluids	87%	9%	4%
Gloves must be changed immediately after they rupture	93%	5%	2%
Mask must be disposed after each use	89%	7%	4%
Wearing N95 mask can protect healthcare workers from TB	73%	18%	9%
Gloves offer protection against needle stick injury*	21%	16%	63%
All unsterile needles are considered contaminated	79%	15%	5%
The risk of transmission of HBV and HCV following needle-stick injury is more than the risk of HIV	66%	25%	10%
Following needle-stick injury, the wound should be washed with soap and water	57%	29%	13%
Following needle-stick injury, the wound should be squeezed*	37%	32%	31%
Needles should remain sheathed until immediately before injection	83%	14%	3%
Geriatric and pediatric patients are at higher risk to get nosocomial infection than others	85%	12%	3%
All patients are considered potentially contagious	62%	24%	13%
Precaution standards only protect the patients*	17%	14%	69%

*disagreement is the correct response

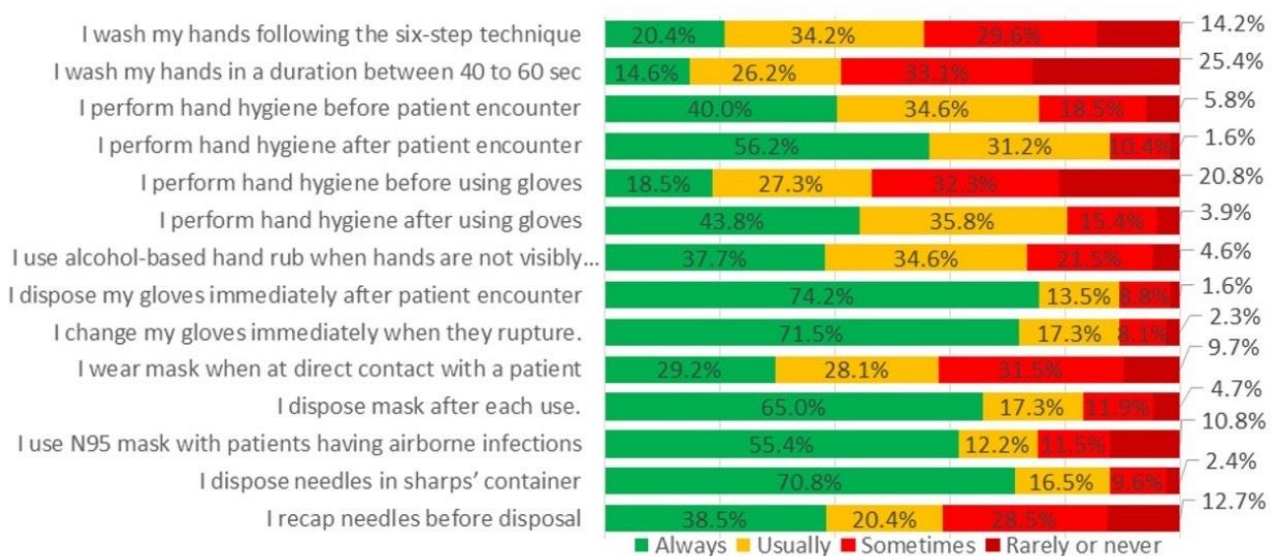


Figure 1: Practice assessment.

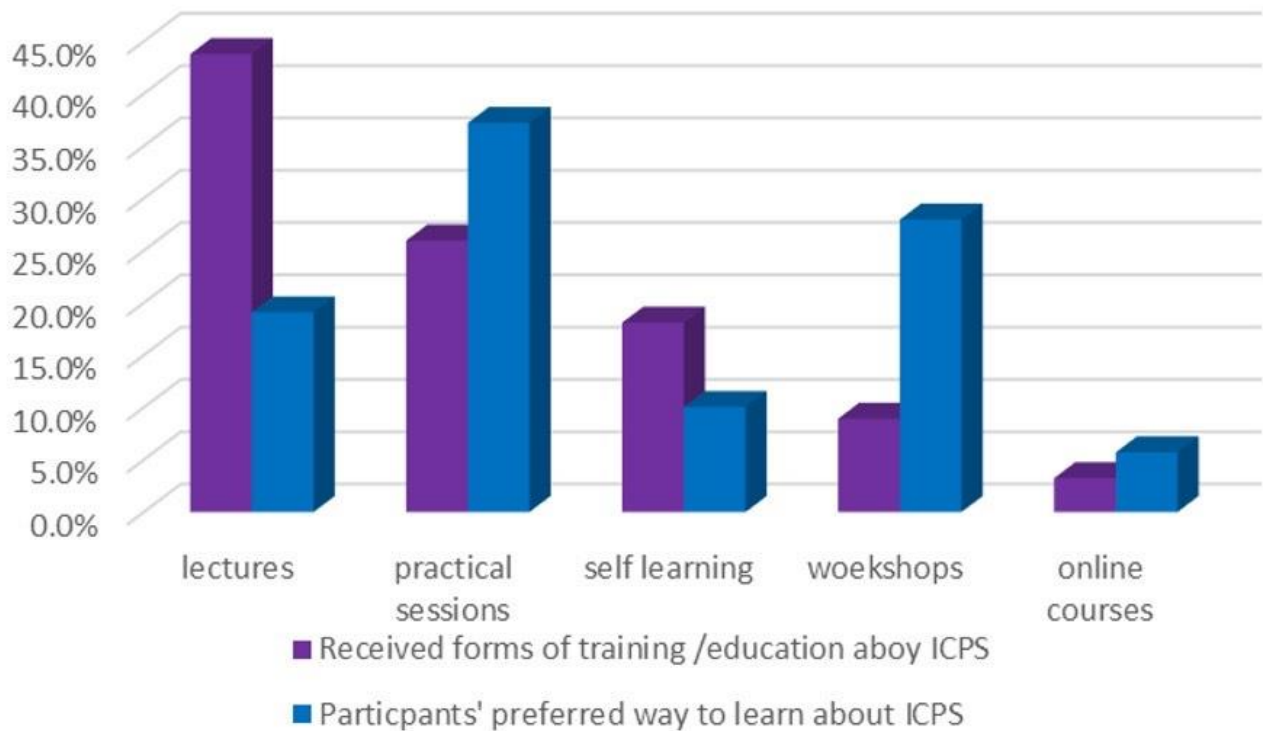


Figure 2: Multiple responses question how received their education in IPCS.

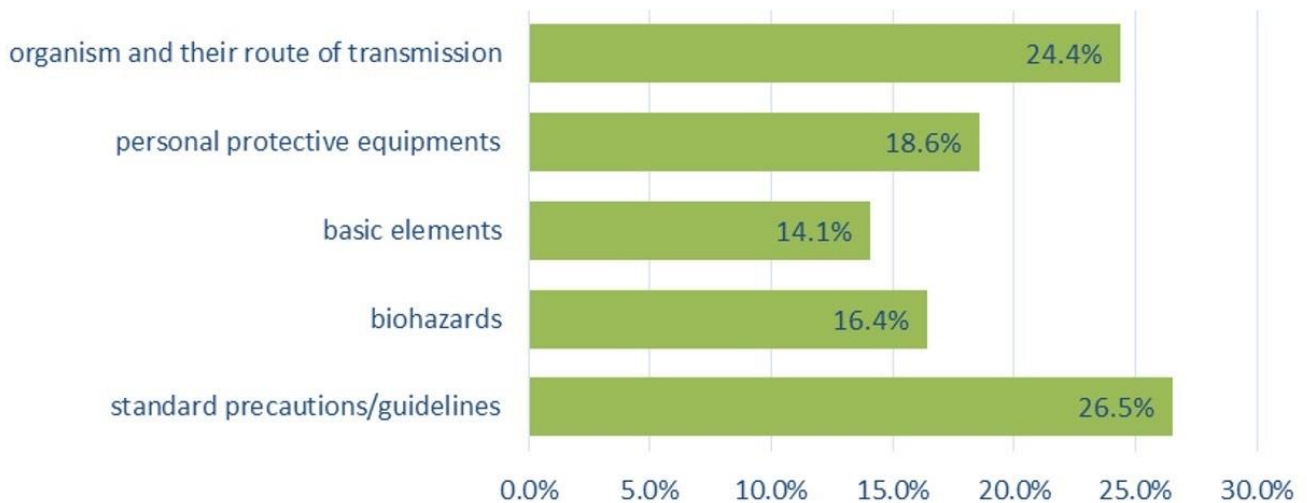


Figure 3: Multiple responses question about the aspects of IPCS.

Figure 2 illustrates a multiple responses question about how they received their education in IPCS and their opinion about the best method to learn about IPCS. Figure 3 illustrates a multiple responses question about the aspects of IPCS that participants wish to learn more about.

DISCUSSION

Exposure to infectious diseases is one of the major occupational hazards facing HCWs in general. Compliance of HCWs with IPCS has been recognized as a fundament to prevent and control HCAIs. The aim of

the study is to assess knowledge and practice of infection control and prevention standards among intern doctors through different standards including hand hygiene, personal protective equipment, needle stick injury, healthcare associated infections, and isolation precautions. In our study, intern doctors showed an overall moderate level of knowledge towards IPCS. However, there is a low level of knowledge regarding NSI. Poor compliance was noticed in some of the hand hygiene statements as well as in the statements of the appropriate way to handle needles.

The level of knowledge regarding hand hygiene was moderate with a score. In our study 94.2% agreed that a proper hand hygiene contributes to decreasing morbidity and mortality associated with HCAs which is found to be compatible with a previous study was done in Alfaisal University.¹⁰ According to CDC, traditional hand washing with regular soap is enough to kill significant number of germs, Interestingly, a big variation has been noticed in our current study and previous studies regarding the statement “hand washing with a regular soap is enough to kill germs” for which our study revealed that 41% agreed on this statement while in Alfaisal university study and a previous study in India showed 14% and 88% respectively.^{10,11} Intern doctors showed a higher level of knowledge comparing to fourth-year medical students in hand hygiene.¹⁰ In our study, only 40% of the participants reported doing appropriate hand hygiene according in the six-step technique.

The level of knowledge regarding PPE was moderate. In our study only 34% correctly disagreed that gloves provide complete protection against hand contamination which is found to be lower than other studies.¹² In terms of compliance with PPE we found that 87% responded always and usually that they dispose gloves immediately after patient encounter which is similar to a previous study conducted on HCWs in Italy.¹³ However, 57% of the participants responded always and usually to wearing mask when at direct contact with a patient which is found to be higher than that reported on HCWs in the Italian study with 35% compliance. It is possible that such difference may be due to environmental and methodological factors.¹³

A significant low level of knowledge regarding NSI with a score of 19.18±2.50 out of 30. In our current study, only 30% correctly defined the recommended procedure of wound cleaning following needle stick injury. In terms of practice regarding recapping needles before disposal, there was a high significant percentage of our interns (59%) and the HCWs from the Italian study (49%) who stated always and usually which is a wrong practice according to CDC and needle should be disposed without recapping to avoid NSI.¹³

Knowledge towards isolation precautions was assessed through three basic multiple-choice questions revealing that a high and noticeable percentage of the participants

incorrectly answered the questions regarding pneumonia and shingles and the appropriate precautions to be taken in these two cases. Only around 50% of the participants answered these two questions correctly. However, this inadequate knowledge of interns may be due to insufficient teaching and training about isolation precautions through pre-graduate curricula and healthcare centres.

There are few limitations of our study. The sample size does not subjectively represent the whole population of medical interns in Riyadh or Saudi Arabia. Furthermore, the medical knowledge of the interns might have inaccurately reflected how the questionnaire is perceived and answered.

CONCLUSION

In conclusion, this study points to an overall moderate level of knowledge and satisfactory level of practice among intern doctors in Saudi Arabia. However, there was some misconceptions regarding NSI and isolation precaution. We recommend implementing infection control education and training programs through practical sessions and workshops, as preferred by most of the participants, before starting clinical practice to increase the safety of the healthcare workers and the patients. In addition to, more emphasis should be applied during post-graduate education and training.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Bello AI, Asiedu EN, Adegoke BO, Quartey JN, Appiah-Kubi KO, Owusu-Ansah B. Nosocomial infections: knowledge and source of information among clinical health care students in Ghana. *Int J Gen Med*. 2011;4:571-4.
2. Pittet D, Allegranzi B, Boyce J. The World Health Organization Guidelines on Hand Hygiene in Health Care and Their Consensus Recommendations. *Infect Cont Hospit Epidemiol*. 2009;30(7):611-22.
3. Revelas A. Healthcare - associated infections: A public health problem. *Niger Med J*. 2012;53(2):59-64.
4. Allegranzi B, Bagheri Nejad S, Combescure C, Graafmans W, Attar H, Donaldson L, et al. Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis. *Lancet*. 2011;377(9761):228-41.
5. Muto CA. Why Are Antibiotic-Resistant Nosocomial Infections Spiraling Out of Control? *Infect Cont Hosp Epidemiol*. 2005;26(1):10-2.
6. Khan HA, Baig FK, Mehboob R. Nosocomial infections: Epidemiology, prevention, control and

- surveillance. *As Pac J Trop Biomed*. 2017;7(5):478-82.
7. Adefolalu A. Needle stick injuries and health workers: a preventable menace. *Ann Med Health Sci Res*. 2014;4(Suppl 2):S159-60.
 8. Wise R, Hart T, Cars O, Streulens M, Helmuth R, Huovinen P, et al. Antimicrobial resistance. *Bio Med J*. 1998;317(7159):609.
 9. Ng YY, Abdel-Latif ME-A, Gan CS, Siham A, Zainol H, Lum LCS. Impact of infection control training for interns on PICU-acquired bloodstream infections in a middle-income country. *Singapore Med J*. 2015;56(9):506-12.
 10. Hamadah R, Kharraz R, Alshantqity A, AlFawaz D, Eshaq AM, Abu-Zaid A. Hand Hygiene: Knowledge and Attitudes of Fourth-Year Clerkship Medical Students at Alfaisal University, College of Medicine, Riyadh, Saudi Arabia. *Cureus*. 2015;7(8):e310.
 11. Ayub A, Goyal A, Kotwal A, Kulkarni A, Kotwal A, Mahen A. Infection control practices in health care: Teaching and learning requirements of medical undergraduates. *Med J Armed Forces Ind*. 2013;69(2):107-12.
 12. Tenna A, Stenehjem EA, Margoles L, Kacha E, Blumberg HM, Kempker RR. Infection control knowledge, attitudes, and practices among healthcare workers in Addis Ababa, Ethiopia. *Infect Control Hosp Epidemiol*. 2013;34(12):1289-96.
 13. Parmeggiani C, Abbate R, Marinelli P, Angelillo IF. Healthcare workers and health care-associated infections: knowledge, attitudes, and behavior in emergency departments in Italy. *Bio Med Cent Infect Dis*. 2010;10:35.

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