

ORIGINAL ARTICLE

Knowledge, attitude and self-reported practice of healthcare workers on infection control in a health facility in Akure, Nigeria

Abiola O. Oluwagbemiga*, Shade J. Akinsete, Godson R. Ana and Olusola O. Ogunseye

Department of Environmental Health Sciences, Faculty of Public Health, College of Medicine, University of Ibadan, Ibadan, Nigeria

Abstract

Background: Infection control is pivotal in reducing healthcare-associated infections (HAIs), one of the leading causes of morbidity with growing prevalence in sub-Saharan Africa.

Objectives: We investigated the knowledge, attitude and self-reported hygiene practices towards hospital infection control among healthcare workers (HCWs) at the State Specialist Hospital, Akure, Nigeria.

Methods: This descriptive cross-sectional study involving self-administered, structured questionnaires administered to 137 randomly selected HCWs (19 doctors, 66 nurses and 52 health assistants) was conducted in 2015. Descriptive and inferential statistics were used for data analysis at 5% level of significance.

Results: Mean age of HCWs was 39.81 ± 8.69 years. Majority (84.7%) was trained on hand hygiene and was knowledgeable about HAIs (86.9%), modes of transmission (57.7%) and effectiveness of hand hygiene (94.9%). However, about half (48.9%) of the HCWs reported did not adhere to hand hygiene often, because of the distance between a water source and the wards. This study also showed that there are relationships between categories of respondents and their knowledge of routes of HAI transmission ($P < 0.01$) and practice of hand hygiene after contacts with hospital surfaces ($P < 0.01$).

Conclusions: Hospital and hand hygiene can be improved by ensuring water supply located close to the wards. There is need for the provision of clear guidance on procedures for hospital hygiene and sanitation.

Keywords: healthcare-associated infections; infection control; hand hygiene; disinfection; healthcare workers; knowledge; attitudes; Nigeria

Received: 18 September 2020; Revised: 15 April 2021; Accepted: 26 June 2021; Published: 26 July 2021

Effective ways of preventing the spread of healthcare-associated infections (HAIs) include hand hygiene by healthcare workers (HCWs), disinfection of environmental surfaces and the use of sterilization techniques in therapeutic procedures (1, 2). Hand hygiene despite being an effective preventive measure against HAIs (3) has not been able to reduce their prevalence because HCWs do not often clean their hands as recommended (4, 5). The compliance level for effective hand hygiene rarely exceeds 50% (6–8), contributing to disease spread. Some factors influencing conformity to hand hygiene include inadequate knowledge of the risk from non-compliance, nonchalant attitude among HCWs towards biosafety, insufficiency of appropriate equipment, minimal staff to patient ratios, allergies to hand hygiene chemical products, inadequate water supply and distance to water (9, 10).

Globally, HAIs affect hundreds of millions of patients every year (11) with about 1.7 million people suffering

annually from HAIs in the United States. The infection density in critical care in low-income countries is three times higher than that of the high-income country such as the United States (12, 13).

Higher rates of HAIs among patients and HCWs in developing countries could be attributed to a combination of factors such as understaffing or poor distribution of staff, lack of motivation by staff, poor attitude of staff to hospital norms, poor hygiene and sanitation, lack or shortage of basic equipment, inadequate structures and overcrowding, and limited financial resources (14, 15).

Studies in developed and developing countries have shown that awareness and information on HAIs, nosocomial pathogens and potential hazards are low even among HCWs (16, 17), although studies from the Lagos University Teaching Hospital and some selected hospitals in South East Nigeria reported that HCWs were knowledgeable about HAIs but poor hygiene practice was also reported (18, 19). There is a need to reinforce awareness

of HAIs among HCWs as well as preventive measures against these infections (16). In South Africa, it was reported that the lack of support from administrators and poor compliance by doctors, nurses and other health workers are challenges of infection control (20). This suggests a need for more pluralistic approach that involves multidisciplinary teams including doctors, nurses and other hospital staff to control hospital infections (21). The prevention of HAIs requires identifying gaps in knowledge, attitude and practice (22). Hence, this study determined knowledge, attitude and self-reported hygiene practices towards hospital infection control among HCWs at the State Specialist Hospital, Akure, Ondo State, Nigeria.

Materials and methods

Study design

This study adopted a descriptive cross-sectional design, carried out in October 2015, involving a survey *via* self-administered, structured questionnaires to determine knowledge, attitude and self-reported hygiene practices towards hospital infection control among HCWs (doctors, nurses and health assistants) at the State Specialist Hospital, Akure. Akure is in southwest Nigeria and is about 350 km from Lagos, the former capital of Nigeria. The State Specialist Hospital is one of the government-owned hospitals in Ondo State, providing care for a population of over 350,000. The hospital has over 150 beds and 13 wards including surgical and medical wards, an intensive care unit, operating theatre and a special care baby unit.

Study population

The focus of the study was HCWs including doctors, nurses and health assistants working at the State Specialist Hospital, Akure. Respondents must have been working in the hospital for at least 1 year before the commencement of data collection to be eligible for inclusion. HCWs working in the hospital for less than 1 year, and administrative staff, were excluded.

The estimated sample size was 137. A nominal list of hospital staff was obtained from the hospital administrative unit, and a simple random sampling method was used in selecting participants who were available during the research period and met the eligibility criteria into each group (doctors, nurses and health assistants). Questionnaires were proportionately allocated according to the ratio of the total number of HCWs on the group list; a systematic sampling of 1 in 3 HCWs in each group was selected until the number of allocated questionnaires was exhausted.

Ethical clearance was obtained from the Ondo State Ministry of Health, while verbal consent was obtained

from the respondents before distributing the questionnaires.

Data collection

Data were collected through a pretested, structured and self-administered questionnaire, guided by relevant studies (14, 16) that were distributed to the respondents by a trained research assistant. The questionnaire comprised five sections: socio-demographic characteristics of HCWs, knowledge of nosocomial microorganisms and infections, knowledge of hand and surface hygiene, attitude to hand and surface hygiene, and self-reported hand and surface hygiene practices. In the knowledge section, 1 point was allotted to every correct answer and 0 to every wrong answer given; attitude was assessed with a five-point Likert scale (i.e. strongly agree, agree, indifferent, disagree and strongly disagree). Practice was assessed using two formats of question: dichotomous questions (i.e. yes, no) and a four-point Likert scale (i.e. sometimes, frequent and always). Frequencies of selected options for every question were calculated.

Statistical analysis

Data were entered and analysed using statistical package for the social sciences (SPSS) version 20 (IBM, Armonk, NY, USA). Frequencies, proportions and means were used to summarize data, while the chi-square test was used to determine the association between categorical variables at 5% level of significance.

Results

All 137 respondents were interviewed, giving a 100% response rate. Table 1 shows the socio-demographic characteristics of respondents. Mean age of the respondents was 39.81 ± 8.69 years, and 90% were female respondents. The majority of respondents were nurses (48.2%), followed by health assistants (37.9%) and doctors (13.9%).

Most (86.9%) of the respondents indicated that HAIs can be transmitted after contact with an infected patient, they were knowledgeable on the effectiveness of hand hygiene in preventing the spread of HAI (95%), and they affirmed that hospital surfaces are possible reservoirs of nosocomial organisms (92%) (Table 2). The majority (84.7%) of the respondents had formal training on hand hygiene in the previous 3 years. Only 62% of the respondents agreed that medical appliances are vehicles or routes through which HAIs are transmitted.

As shown in Table 3, almost all HCWs (97.8%) believed that hospital hygiene can be improved by administrative order and continuous education. Almost half of the respondents felt that hand hygiene was often not adhered to due to the distance between a water source and the wards (48.9%) or busy work schedule (43.1%). A similar proportion reported that the fear of contacting disease

Table 1. Socio-demographic characteristics of respondents

Socio-demographic characteristics	Subgroups	Frequency (%)
Age	≤20	3 (2.2%)
	21–30	18 (13.1%)
	31–40	51 (37.2%)
	41–50	52 (38.0%)
	>50	13 (9.5%)
Gender	Male	13 (9.5%)
	Female	124 (90.5%)
Educational status	No education	1 (0.7%)
	Primary education	13 (9.5%)
	Secondary education	41 (29.9%)
	Tertiary education	83 (59.9%)
Marital status	Single	22 (16.1%)
	Married	111 (81.0%)
	Divorced	2 (1.5%)
	Widow/widower	2 (1.5%)
	Religion	Christianity
	Islam	4 (2.9%)
Ethnicity	Yoruba	136 (99.3%)
	Igbo	1 (0.7%)
Profession	Doctor	19 (13.9%)
	Nurse	66 (48.2%)
	Health assistant	52 (37.9%)
Years of service	≥1	10 (7.7%)
	2–5	32 (23.4%)
	6–10	46 (33.6%)
	>10	49 (35.8%)

motivates HCWs to clean their hands (95.7%) and clean hospital surfaces (91.3%).

Most (81.8%) of the HCWs indicated that there were clearly defined responsibilities for cleaning of hospital environment (Table 4). About half (49.6%) of the HCWs used alcohol-based hand rub routinely. Hand hygiene after every contact with patients was reported to be practised by most (86.9%) of the HCWs, while 55.5% of the HCWs stated that they always practised hand hygiene after touching surfaces in patients' rooms (Table 5).

Statistically significant relationships ($P < 0.01$) existed between categories of respondents (e.g. doctors, nurses and health assistants) and their knowledge of hands and medical appliances being a vehicle or route of transmission of HAI, and their self-reported hand hygiene practices ($P < 0.01$) (Table 6).

Discussion

The knowledge of HCWs (e.g. doctors, nurse and health assistants) could be attributed to the level of their education and training on hand hygiene. Their knowledge on the effectiveness of hand hygiene in preventing the spread of HAIs agreed with studies conducted among HCWs in health facilities in Nigeria and Sri Lanka (18, 23, 24). Having such understanding increases the chances of hygiene practices, which in turn decreases the risk of infections.

Our findings of nurses having more knowledge about hands being vehicles/routes of transmission of HAIs than other categories of HCWs were in accordance with

Table 2. Respondents knowledge on hospital-acquired infections

Variables	Frequencies	Percentage
Possibility of hospital-acquired infections after contact with patients		
Yes	119	86.9%
No	4	2.9%
Contaminated hands of health workers can transfer hospital-acquired infections to patients and other staff		
Yes	79	57.7%
No	58	42.3%
Effective hand hygiene can prevent the spread of hospital-acquired infections		
Yes	130	94.9%
No	6	4.4%
I don't know	1	0.7%
Hospital surfaces are possible reservoirs for nosocomial organisms		
Yes	126	92.0%
No	5	3.6%
I don't know	6	4.4%
Participation in formal training on hand hygiene in the last 3 years		
Yes	116	84.7%
No	21	15.3%
Medical appliances are vehicle/route of hospital-acquired infections		
Yes	85	62.0%
No	52	38.0%

Table 3. Attitudes of respondents to hand and surface hygiene

	Strongly agree	Agree	Indifferent	Disagree	Strongly disagree
Hospital hygiene can be improved by administrative order and continuous education	94 (68.6%)	40 (29.2%)	2 (1.5%)	1 (0.7%)	
Hand hygiene is often not adhered to due to the distance between a water source and the wards	29 (21.2%)	38 (27.7%)	5 (3.6%)	49 (35.8)	16 (11.7%)
Hand hygiene is often not adhered to due to busy work schedule in between contact with patients	27 (19.7%)	32 (23.4%)	3 (2.2%)	53 (38.7%)	22 (16.1%)
The fear of contacting disease motivates healthcare workers to wash their hands	79 (57.7%)	52 (38.0%)	3 (2.2%)	1 (0.7%)	2 (1.5%)
The fear of contacting disease motivates healthcare workers to clean hospital surfaces	66 (48.2%)	59 (43.1%)	8 (5.8%)	3 (2.2%)	1 (0.7%)

Table 4. Self-reported hand and surface hygiene practices among respondents

Variables	Frequencies	Percentage
Clearly defined responsibilities for cleaning of hospital environment		
Yes	112	81.8%
No	25	18.2%
Availability of infection control unit in the facility		
Yes	77	56.2%
No	60	43.8%
Routine use of alcohol-based hand rub for hand hygiene		
Yes	68	49.6%
No	69	50.4%
Hand hygiene after every contact with patients		
Yes	119	86.9%
No	18	13.1%

Table 5. Self-reported hand and surface hygiene practices among respondents

	Sometimes	Frequent	Always
Practice of hand hygiene before and after contact with patients	20 (14.6%)	41 (29.9%)	76 (55.5%)
Practice of hand hygiene after touching surfaces in patients' room	31 (22.6%)	30 (21.9%)	76 (55.5%)
Wearing gloves when hands may be contaminated with body fluids	7 (5.1%)	20 (14.6%)	110 (80.3%)
Practice of hand hygiene after removing gloves	11 (8.0%)	25 (18.2%)	101 (73.7%)

Table 6. Relationship between categories of respondents and their knowledge, attitude and self-reported practice in hospital infection control

	Doctor	Nurse	Health assistant	
Hands of healthcare workers as vehicle/route of nosocomial infections				Chi square 46.164 $P < 0.01$
Yes	14 (73.7%)	54 (81.8%)	11 (21.2%)	
No	5 (26.3%)	12 (18.2%)	41 (78.8%)	
Medical appliances as vehicles/routes of nosocomial infection				Chi square 13.865 $P < 0.01$
Yes	14 (73.7%)	49 (74.2%)	22 (42.3%)	
No	5 (26.3%)	17 (25.8%)	30 (57.7%)	
Hand hygiene after every contact with patient				Chi square 20.108 $P < 0.01$
Yes	11 (57.9%)	64 (97.0%)	44 (84.6%)	
No	8 (42.1%)	2 (3.0%)	8 (15.4%)	
Routine use of alcohol-based hand rub for hand hygiene				Chi square 10.373 $P < 0.01$
Yes	4 (21.1%)	31 (47.0%)	33 (63.5%)	
No	15 (78.9%)	35 (53.0%)	19 (36.5%)	
Practice of hand hygiene after touching surfaces in the patient's room				Chi square 11.135 $P < 0.05$
Sometimes	8 (42.1%)	15 (22.7%)	8 (15.4%)	
Frequently	6 (31.6%)	16 (24.2%)	8 (15.4%)	
Always	5 (26.3%)	35 (53.0%)	36 (69.2%)	

another study carried out in the University hospital in Cairo, where nurses recorded higher knowledge score than doctors (25). Nurses have the most contacts with patients (26–28), and this could consequently deepen their experience and knowledge.

The gap between attitude and hygiene practices often influences the level of compliance to hospital infection control; even though most of the HCWs are knowledgeable about the importance of hand hygiene, compliance is affected by busy work schedule in between contact with patients (24). However, the fear of contacting disease would motivate most HCWs to clean their hands and clean hospital surfaces.

The affirmation of HCWs that hospital hygiene can be improved by administrative order and continuous education is in line with other studies (29) on continuous training and knowledge improvement in addition to the use of appropriate and effective methods of disinfection and sterilization.

The World Health Organization infection control guideline recommends that hand hygiene should be practised before and after every contact with patients (30). However, only about 50% of HCWs, mainly nurses, reported compliance with hand hygiene both before and after contact with a patient. This proportion was lower than that in another report in a different hospital within the country (16). This is also in agreement with other studies that indicated that nurses are more likely to comply with these practices while doctors were reported to have the least compliance (24, 31, 32).

Conclusion and recommendations

Although the majority of respondents were trained on hand hygiene and were knowledgeable about HAIs, modes of transmission and effectiveness of hand hygiene, our findings suggest poor attitudinal tendencies among HCWs. Although a good proportion of HCWs self-reported compliance with hand hygiene after every contact with patients, 100% compliance could not be achieved because of the distance between a water source and the wards. Most HCWs suggested that attitudes towards hospital hygiene can be improved by the water supply located close to wards, administrative order and continuous education; this in turn will increase the compliance to infection control measures. This study also showed that there are relationships between categories of respondents and their knowledge of HAI transmission and hygiene practices. There is need for adequate supervision of HCWs to ensure knowledge gained translates to practice, and practice of hand and surface hygiene can be promoted through clearly defined responsibilities and guidelines related to hospital hygiene and sanitation. The HCWs are encouraged to embrace attitudinal changes and display positive disposition towards hand and surface hygiene within

hospital premises, while the hospital management should ensure HCWs comply with the guidelines on infection prevention and control.

Acknowledgements

The authors acknowledge the management and staff of the State Specialist Hospital, Akure, for their support during the conduct of this study.

Authors' statement

Abiola O. Oluwagbemiga conceived the study. Shade J. Akinsete, Godson R. Ana and Olusola O. Ogunseye contributed to the design, analysis of the results and writing of the manuscript. Shade J. Akinsete, Godson R. Ana supervised the project.

Research funding

Authors state no funding involved.

Conflict of interest and funding

Authors state no conflict of interest. The authors have not received any funding or benefits from industry or elsewhere to conduct this study.

Informed consent

Informed consent was obtained from respondents before participation.

Ethical approval

Ethical approval was obtained from the Ethical Review Board of Ondo State Ministry of Health, Akure, Nigeria (ID: OD/SHREC/15/011).

References

1. Garner JS. Guideline for isolation precautions in hospitals. *Infect Control Hosp Epidemiol* 1996; 17: 54–65. doi: 10.1017/S0195941700006123
2. Anderson JL, Warren CA, Perez E, Louis RI, Phillips S, Wheeler J, et al. Gender and ethnic differences in hand hygiene practices among college students. *Am J Infect Control* 2008; 36(5): 361–8. doi: 10.1016/j.ajic.2007.09.007
3. Yildirim I, Ceyhan M, Cengiz AB, Bagdat A, Barin C, Kutluk T, et al. A prospective comparative study of the relationship between different types of ring and microbial hand colonization among pediatric intensive care unit nurses. *Int J Nurs Stud* 2008; 45(11): 1572–6. doi: 10.1016/j.ijnurstu.2008.02.010
4. Pittet D, Hugonnet S, Harbarth S, Mourouga P, Sauvan V, Touveneau S, et al. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. *Infection Control Programme*. *Lancet* 2000; 356(9238): 1307–12. doi: 10.1016/S0140-6736(00)02814-2
5. Grol R, Grimshaw J. From best evidence to best practice: effective implementation of change in patients' care. *Lancet* 2003; 362(9391): 1225–30. doi: 10.1016/S0140-6736(03)14546-1
6. Bischoff W, Reynolds T, Sessler C, Edmond M, Wenzel R. Hand-washing compliance by health care workers: impact of introducing an accessible, alcohol-based hand antiseptic. *Arch*

- Intern Med 2000; 160(7): 1017–21. doi: 10.1001/archinte.160.7.1017
7. Maury M, Elzieu A, Baudel J, Haram H, Barbut A, Guidet J, et al. Availability of an alcohol solution can improve hand disinfection compliance in an intensive care unit. *Am J Respir Crit Care Med* 2000; 162(1): 324–7. doi: 10.1164/ajrccm.162.1.9908118
 8. Moongtu W, Gauthier D, Turner J. Using peer feedback to improve hand-washing and glove usage among Thai health care workers. *Am J Infect Control* 2000; 28: 365–9. doi: 10.1067/mic.2000.107885
 9. Pittet D, Allegranzi B, Storr J, Donaldson L. ‘Clean care is safer care’: the global patient safety challenges 2005–2006. *Int J Infect Dis* 2006; 10(6): 419–24. doi: 10.1016/j.ijid.2006.06.001
 10. Engdaw GT, Gebrehiwot M, Andualem Z. Hand hygiene compliance and associated factors among health care providers in Central Gondar zone public primary hospitals, Northwest Ethiopia. *Antimicrob Resist Infect Control* 2019; 26(8): 190. doi: 10.1186/s13756-019-0634-z
 11. Pittet D. Burden of endemic healthcare-associated infection in Africa. 16th International Congress on Infectious Diseases (ICID). 16th ICID Abstracts. *Int J Infect Dis* 2014; 21S: 51. doi: 10.1016/j.ijid.2014.03.1371
 12. Agaba P, Tumukunde J, Tindimwebwa JVB, Kwizera A. Nosocomial bacterial infections and their antimicrobial susceptibility patterns among patients in Ugandan intensive care units: a cross sectional study. *BMC Res Notes* 2017; 10: 349. doi: 10.1016/j.apjtb.2017.01.019
 13. Khan HA, Baig FK, Mehboob R. Nosocomial infections: epidemiology, prevention, control and surveillance. *Asian Pac J Trop Biomed* 2017; 7(5): 478–82. doi: 10.1016/j.apjtb.2017.01.019
 14. Adegboye MB, Zakari S, Ahmed BA, Olufemi GH. Knowledge, awareness and practice of infection control by health care workers in the intensive care units of a tertiary hospital in Nigeria. *African Health Sci* 2018; 18(1): 72–8. doi: 10.4314/ahs.v18i1.11
 15. Onyedibe KI, Shehu NY, Pires D, Isa SE, Okolo MO, Gomerep SS, et al. Assessment of hand hygiene facilities and staff compliance in a large tertiary health care facility in northern Nigeria: a cross sectional study. *Antimicrob Resist Infect Control* 2020; 9: 30. doi: 10.1186/s13756-020-0693-1
 16. Olalekan AW, Olusegun BJ, Olufunmilayo AE, Lanre AO. Awareness and attitude of health care workers in a teaching hospital in southwestern Nigeria towards nosocomial infections. *J Publ Health Epidemiol* 2012; 4(10): 285–9. doi: 10.5897/JPHE11.106
 17. Raka L, Kalenic S, Zoutman D, Berisha L, Berisha M, Salihu D, et al. Knowledge, attitudes and practices of health care workers in Kosovo hospitals regarding nosocomial infections. 16th European Congress of Clinical Microbiology and Infectious Diseases Nice, France, 1–4 April 2006. *Clin Microbiol Infect* 2006; 12(4): 84.
 18. Ekwere TA, Okafor IP. Hand hygiene knowledge and practices among healthcare providers in a tertiary hospital, south-west Nigeria. *Int J Infect Control* 2013; 9: 4. doi: 10.3396/IJIC.v9i4.032.13
 19. Oli AN, Ekejindu CC, Ejiofor OS, Oli AH, Ezeobi I, Ibeh CC. The knowledge of and attitude to hospital-acquired infections among public and private healthcare workers in south-east, Nigeria. *J Adv Med Res* 2016; 11(3): 1–10. doi: 10.9734/BJMMR/2016/18272
 20. Saloojee H, Steenhoff A. The health professional’s role in preventing nosocomial infections. *Postgrad Med J* 2001; 77: 16–19. doi: 10.1136/pmj.77.903.16
 21. Beggs C, Knibbs LD, Johnson GR, Morawska L. Environmental contamination and hospital-acquired infection: factors that are easily overlooked. *Indoor Air* 2015; 25(5): 462–74. doi: 10.1111/ina.12170
 22. Sarani H, Balouchi A, Masinaeinezhad N, Ebrahimitabas E. Knowledge, attitude and practice of nurses about standard precautions for hospital-acquired infection in teaching hospitals affiliated to Zabol University of Medical Sciences (2014). *Global J Health Sci* 2015; 8(3): 193–8. doi: 10.5539/gjhs.v8n3p193
 23. Kudavidnange BP, Gunasekara TDCP, Hapuarachchi S. Knowledge, attitudes and practices on hand hygiene among ICU staff in Anuradhapura teaching hospital. *Anuradhapura Med J* 2011; 1: 29–40. doi: 10.4038/amj.v5i1.5781
 24. Bello S, Effa E, Okokon E, Oduwole O. Handwashing practice among healthcare providers in a teaching hospital in southern Nigeria. *Int J Infect Control* 2013; 9: 4. doi: 10.3396/IJIC.v9i4.031.13
 25. Abd Elaziz KM, Bakr IM. Assessment of knowledge, attitude and practice of hand washing among health care workers in Ain Shams university hospitals in Cairo. *J Prev Med Hyg* 2009; 50(1): 19–25. doi: 10.3396/IJIC.v9i4.031.13
 26. Kieft RA, de Brouwer BB, Francke AL, Delnoij DMJ. How nurses and their work environment affect patient experiences of the quality of care: a qualitative study. *BMC Health Serv Res* 2014; 14: 249. doi: 10.1186/1472-6963-14-249
 27. Cohen B, Hyman S, Rosenberg L, Larson E. Frequency of patient contact with health care personnel and visitors: implications for infection prevention. *Jt Comm J Qual Patient Saf* 2012; 38(12): 560–5. doi: 10.1016/S1553-7250(12)38073-2
 28. Butler R, Monsalve M, Thomas GW, Herman T, Segre AM, Polgreen PM, et al. Estimating time physicians and other health care workers spend with patients in an intensive care unit using a sensor network. *Am J Med* 2018; 131(8): 972. doi: 10.1016/j.amjmed.2018.03.015
 29. Askarian M, Honarvar B, Tabatabaee HR, Assadian O. Knowledge, practice and attitude towards standard isolation precautions in Iranian medical students. *J Hosp Infect* 2004; 58(4): 292–6. doi: 10.1016/j.jhin.2004.07.004
 30. World Health Organization. WHO guidelines on hand hygiene in health care, 2009. Geneva: World Health Organization. Available from: <https://www.who.int/publications/item/9789241597906> [cited 20 June 2021].
 31. Samuel R, Almedom AM, Hagos G, Albin S, Mutungi A. Promotion of handwashing as a measure of quality of care and prevention of hospital-acquired infections in Eritrea: The Keren study. *Afr Health Sci* 2005; 5(1): 4–13.
 32. Boyce JM. Antiseptic technology: access, affordability and acceptance. *Emerg Infect Dis* 2001; 7(2): 231–3. doi: 10.3201/eid0702.010216

***Abiola O. Oluwagbemiga**

Department of Environmental Health Sciences
 University of Ibadan
 Ibadan, Nigeria
 Email: abiola.oluwaseun@yahoo.com