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Original Research Article

Hand hygiene practice in intensive care unit in port Harcourt, Nigeria

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ABSTRACT

Background: Modern healthcare practice recognizes the critical importance of handwashing / hand hygiene with recommendations made to that effect by the centre for disease control and the World Health Organization. This study evaluated the hand hygiene practices of staff users of the intensive care unit before and after patients' care.
Methods: A prospective analytical observational study was conducted in the first quarter of the year 2023, among health workers using mixed methods approach. Data was analysed using the Statistical Package for Social Sciences (SPSS) version 20.0.
Results: Out of the 154 respondents who filled questionnaire, there were 72 (46.8%) males, 82 (53.2%) females and a mean age of 34.22±7.39 years. One hundred and thirty (84.4%) respondents were aware of the WHO five moments of hand hygiene. Ninety-six (62.3%) respondents opined that they practiced hand hygiene. However, observation revealed that 510 (98.5%) out of the 518 covertly observed participants did not carry out hand hygiene before patient care and 209 (40.3%) performed hand hygiene after patient care. The dominant reasons for non-compliance were lack of running water (n=126, 81.8%), absence of awareness posters (n=100, 64.9%) and absence of soap for hand washing (n=26, 16.9%). A statistically significant relationship was observed between the frequency of practice of hand hygiene and the category of staff.
Conclusions: Less than expected hand hygiene practice was observed among members of staff, revealing need for emphasis and retraining of staff.

Keywords: Hand hygiene practice, Intensive care unit, Nigeria, Port Harcourt

INTRODUCTION

History holds some relevance in hygiene matters, as even the word "hygiene" as we know and use today was derived from the Greek goddess of healing called "Hygeia".[1,2] Earliest Egyptian use of a mixture of animal fat and vegetable oil and alkaline salt in soap formation, is an evidence of a people's struggle with evolution of some form of hygiene measures, although such use was intended for both hygiene and spiritual purposes.[3,4]

Several researchers and practitioners have made useful contributions towards the state of knowledge now known in hygiene. Also, issues of hygiene have been of paramount importance in varying degrees in different religions and culture. Judaism, Islam and Sikhism, are known to have hand-washing practices written in their holy books with daily crucial moments of practice.[5,6] The relationship between hand hygiene and disease spread has also been known for more than 200 years as evidenced by low mortality among the Jews following their ritual handwashing practice during the Black Death of the 14th century, the historic reduction in puerperal sepsis following implementation of hand hygiene to mention some historic few.[2,7,8] In the United State of America, there were reports of existence of hand washing recommendations for patient care (before and after) in 1961.[2,9] This was before the first formal handwashing recommendations for hospitals was published by the Centre for Disease Control (CDC) in 1975 and 1985.[10,11]

Modern health practice has not de-emphasized hand hygiene, but rather built on the above history. The five famous surgeons' swabs and the five moments of hygiene are reminiscent of the understanding of skin, hand or surface colonization by germs and the need for depopulation before the action or procedure.[12] Modern healthcare practice recognizes the critical importance of handwashing / hand hygiene with recommendations made to that effect by the centre for disease control and the World Health Organization.[13-16]

The practice of hand hygiene and the peculiarity of certain categories of patients, critical areas of the hospital and critical procedures have well been documented.[4,17,18] However, compliance with these guidelines have been noted to be poor globally.[2,19,20] There must be a reason for every behavior or action taken by humans and this assertion seem to hold true when theory-practice-ethics gap in hand hygiene was observed among practitioners in intensive care unit in Saudi Arabia.[21] Although this phenomenon had earlier been reported, the author amongst others explained that ethical issue was responsible for non-compliance.[21-23] It may also have been a challenge because hand hygiene may not have been emphasized in the first ten years of life, considered formative years.

The intensive care unit is one of the critical sectors of the hospital environment where the risk of infection transmission to patients is high and infection control measures especially hand hygiene practice is highly recommended in patients care.[24-27] Informal observations in our practice shows some level of non-compliance by users of the ICU.

In line with efforts to improve services, we set out to have a scientific basis through research findings in our local practice, with which to engage staff users of the ICU for improved service delivery. This study therefore evaluated the hand hygiene practices of staff users (medical doctors, nurses and others) of the intensive care unit of the University of Port Harcourt Teaching Hospital, before and after patients' care, in the first quarter of the year 2023.

METHODS

Study design

A prospective analytical observational study was conducted with mixed methods approach (qualitative and quantitative) was carried out.

Study place

This study was carried out in Port Harcourt the Capital City of Rivers State in Nigeria.

Study setting

The intensive care unit of the University of Port Harcourt Teaching Hospital was the setting for the study. The ICU of the hospital operated a semi-closed system where both ICU anesthesiologists and specialist units of specific patient participated in caring for admitted patients.

Study population/participants

The members of staff (medical doctors, nurses and others) who used the intensive care unit from January 2023 to March 2023 formed the study population (inclusion criteria). Exclusion criteria: ICU staff who declined consent for inclusion, who were on sick leave (not on duty), were excluded.

Sample size determination

All consenting consecutive patients were included until a minimum of four hundred is achieved. The formula for descriptive studies (medical studies) was used to obtain the minimum number of enrollees 28, n= (Z^2 P (1-P))/d^2 Where n is the sample size, Z is the statistic corresponding to level of confidence, P is expected prevalence (that can be obtained from same studies or a pilot study conducted by the researchers) and d is precision (corresponding to effect size).

Study instrument

Mixed method of data collection was used the semi-structured self-administered questionnaire was used to obtain data from ICU users, a disguised naturalistic observation of their hand hygiene in the ICU was done (before and after touch/examining their patients).

Study variables

Knowledge of hand hygiene, practice of hand hygiene, challenges encountered in hand hygiene practice, reasons for poor compliance.

Bias

Although patients' relatives also come into the ICU, this study was restricted to medical and nursing staff of the hospital who work or visit the intensive care unit, excluding the relations of patients.

Validity/reliability of instrument

The study instrument (questionnaire) was developed, scrutinized by all the authors before usage and pretested. The Cronbach alpha (in SPSS) was used for the validity of the study instrument and yielded 0.749.

Data analysis

Data was analysed using the Statistical Package for Social Sciences (SPSS) version 20.0.

Ethical consideration

The approval of the Ethics Review Committee of the University of Port Harcourt Teaching Hospital was obtained before commencement of the study. No personal identities of the participants other than the microbiological swabs was be taken.

RESULTS

Only one hundred and fifty-four respondents filled the study questionnaire out of the 518 participants who were covertly monitored and observed for hand hygiene practices at the intensive care unit. Table 1 shows the socio-demographic characteristics of respondents. Seventy-two (46.8%) of the respondents were male and female respondents were 82 (53.2%). The mean age of the respondents was 34.22±7.39 years, minimum age was 21 years and the oldest was 55 years. Eighty-eight (57.1%) respondents were married and 64 (41.6%) were single. All the respondents (n=154, 100%) were Christians. Respondents from the Nursing (n=30, 19.5%), Intensive Care Unit (n=24, 15.6%), Anesthesia (n=24. 15.6%), Obstetrics and Gynecology (n=20, 13%), Surgery (n=14, 9.1%), Hematology (n=14, 9.1%), were in the majority.

The respondents' awareness and practice of hand hygiene is shown in Table 2. One hundred and thirty (84.4%) of the respondents were aware of the WHO "five moments of hand hygiene", while the rest (n=24, 15.6%) were not. However, 96 (62.3%) admitted to practicing the "five moments of hand hygiene", while the rest (n=58, 37.7%) did not practice it. Those who practiced the WHO "five moments of hand hygiene", did so always (n=32, 20.8%), often (n=37, 24,0%) and sometimes (n=27, 17.5%). Table 3 shows the challenges/reasons affecting hand hygiene practices in the area of study.

The multiple responses of challenges to hand hygiene practice of the respondents shows that one hundred and twenty-eight (83.1%) reported that non-flowing water tap (water not running), was the challenge that they encountered in practicing hand hygiene measures; while 26 (16.9%) respondents, considered lack of soap at vantage point, as a challenge. Additionally, the reasons for non-compliance with the five moments of hand hygiene was reported to be due to lack of running water (n=126, 81.8%), no postal for awareness and procedure (n=100, 64.9%), absence of soap for hand washing (n=26, 16.9%).

Table 4 shows the relationship between the frequency of practice of hand hygiene and the category of staff. A statistically significant relationship is shown between the frequency of practice of hand hygiene and the category of staff. The proportion of nursing staff who practice the hand hygiene were significantly higher (p=0.000) than other staff categories. The proportion of those who did not practice the hand hygiene was highest among the medical doctors.

Table 5 shows the demographics and outcome of covert observation of hygiene practices among 518 participants. There were 269 (51.9%) males and 249 (48.1%) females from different departments. There were 60 (11.6%) consultants, 83 (16%) senior registrars, 112 (21.6%) registrars, 66 (12.7%) house officers, 72 (13.9%) nurses, among others. Five hundred and ten (98.5%) participants did not carry out hand hygiene before patient care and 209 (40.3%) performed hand hygiene after patient care.

Table 1: Socio-demographic characteristics of respondents (n=154).

Variables	Number	%
Sex		
Male	72	46.8
Female	82	53.2
Age (mean=34.22±7.39 years, min=21 years, max=55 years)		
21-30 years	52	33.8
31-40 years	68	44.2
41-50 years	30	19.5
More than 50 years	4	2.6
Marital status		
Single	64	41.6

Continued.

Variables	Number	%
Married	88	57.1
Separated/divorced	2	1.3
Religion		
Christianity	154	100.0
Category of staff		
Surgery	14	9.1
Nursing	30	19.5
ICU	24	15.6
O and G	20	13.0
Anesthesia	24	15.6
Neurology	10	6.5
Physiotherapy	8	5.2
Hematology	14	9.1
Orthopedics	6	3.9
Others	4	2.6

Table 2: Awareness and practice of hand hygiene (n=154).

Variables	Number	%
Aware of WHO five moments of hand hygiene		
Yes	130	84.4
No	24	15.6
Practice the five moments of hand hygiene		
Yes	96	62.3
No	58	37.7
Frequency of practicing the five moments of hand hygiene		
Always	32	20.8
Often	37	24.0
Sometimes	27	17.5
Do not practice	58	37.7

Table 3: Challenges and reasons to hand hygiene practice among the respondents (n=154).

Variables	Number	%
Challenges to hand hygiene practice		
Water tap not running (flowing)	128	83.1
Lack of soap at vantage point	26	16.9
Forgetting the Technique	4	2.6
Emergency and work pressure	6	3.9
Reasons for non-compliance (multiple choice)		
No running water	126	81.8
No postal for awareness and procedure	100	64.9
Soap not available	26	16.9
Fear of transfer of infection	14	9.1
Lack of hand washing materials	14	9.1

Table 4: Relationship between frequency of practice and category of staff.

	Category of staff					
Frequency of practicing five moments of hand hygiene	**Medical doctor**	**Nurse**	**Others**	**Total**	**(X^2)**	**P value**
Always	10 (31.3%)	20 (62.5%)	2 (6.2%)	32		
Often	20 (54.1%)	13 (35.1%)	4 (10.8%)	37		
Sometimes	10 (37.0%)	13 (48.1%)	4 (14.8)	27	33.647	0
Do not practice	36 (62.1%)	8 (13.8%)	14 (24.1%)	58		
Total	76	54	24	154		

Table 5: Covert observation of hygiene practices of respondents (n=518).

Variables	Number	%
Sex		
Male	269	51.9
Female	249	48.1
Department		
Surgery	52	10.0
Nursing	66	12.7
ICU	35	6.8
O and G	58	11.2
Anesthesia	48	9.3
Neurology	69	13.3
Physiotherapy	24	4.6
Hematology	4	0.8
Orthopedics	25	4.8
Family medicine	17	3.3
Microbiology	5	1.0
Nephrology	29	5.6
Respiratory medicine	19	3.7
Pediatrics	14	2.7
Cardiology	18	3.5
Endocrinology	15	2.9
Pharmacy	4	0.8
ENT	2	0.4
Radiology	3	0.6
CTU	11	2.1
Category/Status of staff		
Consultant	60	11.6
Senior registrar	83	16.0
Registrar	112	21.6
House officer	66	12.7
Intern	9	1.7
Nurse	72	13.9
Physiotherapist	24	4.6
Radiology	3	0.6
Technician	7	1.4
Pharmacy	4	0.8
Others	78	15.1
Hand hygiene practice before patient care		
Yes	8	1.5
No	510	98.5
Hand hygiene practice after patient care		
Yes	209	40.3
No	309	59.7

DISCUSSION

The role of an undercover observer is similar to the part played by a referee/video-assisted referee in a game of soccer and the impartial judge in a court of law.[29-33] These individuals help to identify the truth and remove bias or flaws in self-judgement of the parties involved. A covert observer was deployed in this mixed method study where fewer number of staff consented to filling the questionnaire and about three-fold that number were covertly observed for hand hygiene practice. Out of the total number, more than two-third were medical doctors and nurses. There were more females than males with a young mean age of 34.22±7.39 years and all the respondents were Christians. The mean age in this study was similar to the report from Sokoto in Northern Nigeria with a mean age of 32.1±7.4 years.[34] Staff in nursing, ICU, anaesthesia, obstetrics and gynaecology, surgery, haematology and neurology departments formed the majority of respondents who participated in the

questionnaire component of the study. This is not unexpected since these departments among others were more likely to be called to care for critically ill patients by virtue of their discipline. Moreso, it is the only adult intensive care unit in the hospital used by all specialties. This model and staff distribution is similar to what was reported in studies from other centres in Nigeria.[35-37]

More than three-quarter of respondents were aware of the WHO "five moments of hand hygiene" and more than half respondents admitted to practicing hand hygiene. Only about a fifth claimed to practicing always. Similar to our findings, a study in Bangladesh showed that hand hygiene intervention measures increased knowledge level from mean knowledge score from 68.6% to 78.9%,38 however, sustaining this knowledge base and converting it into practice has been challenging as the global health workers compliance was reported to be 50%.[39]

Our finding is also similar to another study done in Karachi City in Pakistan, where hand hygiene awareness was 62.73% and compliance was found to 12.3%.[40] However, their compliance was higher than what we reported in this study. The knowledge or awareness of hand hygiene that does not translate to practice or compliance would not impact on infection control. Health workers are knowledgeable about hand hygiene and similar to our report, many studies from Nigeria have demonstrated this point of view over the years.[36,41-43]

It was found from the covert observation that almost a hundred percent of the 518 participants did not carry out hand hygiene before patient care and less than half performed hand hygiene before patient care. This observation differs from the questionnaire-based pre-patient care (60.1%) and post patient care (97%) compliance earlier reported among community Health Officers in Rivers State, Nigeria.[44] However, it is in consonance with globally reported non-compliance with recommended hand hygiene practice.[2,19,20] There is significant evidence of theory-practice-ethics gap observed in this study, as evidenced by the almost 100% noncompliance with hand hygiene recommendations. Similar gap between theory and practice had been reported by another author in adult cardiac surgical intensive care in Riyadh, Saudi Arabia.[21] A study in Freetown in Sierra Leone, West Africa, reported far higher had hygiene compliance ranging from 32% to 60%.[45]

However, 98% non-compliance in this study far exceeded what had been reported in earlier studies. This study finding is lower than the observed overall compliance of 31% reported among health workers in a tertiary health facility in Plateau State Nigeria.[46] However, there was a lecture on hand hygiene given to health workers along with other sensitization activities before the study was carried out to achieve the reported 31%, which was not done in our case. Our study outcome on hygiene practice is also lower than reported observations in other Nigerian studies from public health facilities.[35,36,41,47,48] It is also lower than what was observed in a similar covertly observed study from a private tertiary health facility in Western Nigeria.[35]

Quite unlike the ethical issues and lack of emphasis on hand hygiene at formative years advanced as reasons for non-compliance with hand hygiene measures in other studies, this study shows that majority of the respondents considered non-flowing water tap (water not running) and lack of soap at vantage point as the major challenges militating against the practice of hand hygiene.[21] The reasons for non-compliance were also similar lack of running water, absence of awareness/procedure posters and absence of soap for hand washing. Our study findings share similarity with studies reported in public hospitals from other parts of Nigeria.[48-50] Despite the challenges prevalent in this study centre, the nursing staff were found to be more compliant with hand hygiene practices and a statistically significant relationship was found between the frequency of practice of hand hygiene and the category of staff.

Our finding is similar to the observations in another study in Lagos Nigeria where nurses were found to have better hand washing practices than doctors.[41] Our study is different from another cross-sectional study in a tertiary health facility where hand hygiene compliance was reported to be highest among medical students (82%) and lowest among attendants (20%).[46] It also differs from the findings of another study in Western Nigeria among surgical healthcare workers in a private setting.[48] In this study from a private setting, compliance was observed to improve relatively with the seniority of the doctors.[51]

The number of members of staff who consented to filling the questionnaire component of the study was less than the number of staff who were covertly observed. However, the findings of the study are without doubt very revealing of the status of the practice of hand hygiene in the center.

CONCLUSION

Awareness of the five moments of hand hygiene was reported among majority of members of staff, but less than expected hand hygiene practice was observed among members of staff. Issues of non-flowing tap water, absence of soap at vantage point for hand washing and absence of awareness posters, were the main challenges encountered by hospital workers in the intensive care unit.

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REFERENCES

1. Britannica E. Encyclopædia Britannica Online: Britannica Online. 2004.

2. Jumaa P. Hand hygiene: simple and complex. International J of Infectious Diseases. 2005;9(1):3-14.
3. Reynhout IC, Cornelissen JJ, Nolte RJ. Synthesis of polymer− biohybrids: from small to giant surfactants. Accounts of Chem Res. 2009;42(6):681-92.
4. Vermeil T, Peters A, Kilpatrick C, Pires D, Allegranzi B, Pittet D. Hand hygiene in hospitals: anatomy of a revolution. J of Hospital Infection. 2019;101(4):383-92.
5. Kiani MA, Saeidi M. Importance of hand hygiene in different religions. Joint Commission Perspectives on Patient Safety. 2015;3:1-2.
6. Allegranzi B, Memish ZA, Donaldson L, Pittet D. Religion and culture: Potential undercurrents influencing hand hygiene promotion in health care. AJIC: American J of Inf Control. 2009;1(37):28-34.
7. Staub E. The roots of evil: The psychological and cultural origins of genocide and other forms of group violence: Cambridge University Press. 1989.
8. De Costa CM. "The contagiousness of childbed fever": a short history of puerperal sepsis and its treatment. Medical J of Australia. 2002;177(11):668-71.
9. Coppage C. Hand washing in patient care Motion picture. Washington, DC: US Public Health Service. 1961.
10. Steere AC, Mallison GF. Handwashing practices for the prevention of nosocomial infections. Ann Internal Med. 1975;83(5):683-90.
11. Garner J, Favero M. CDC Guideline for Handwashing and Hospital Environmental Control, 1985. Infection control: IC. 1986;7(4):231-43.
12. Chou D, Achan P, Ramachandran M. The World Health Organization '5 Moments of Hand Hygiene' The scientific foundation. The J of bone and Surg Brit Vol. 2012;94(4):441-5.
13. Boyce JM, Pittet D. Guideline for hand hygiene in health-care settings: recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. Infection Control & Hospital Epidemiology. 2002;23(12):3-40.
14. Donaldson L, Philip P. Patient safety: a global priority. Bulletin of the World Health Organization. 2004;82:892-9.
15. Pittet D, Donaldson L. Clean care is safer care: a worldwide priority. The Lancet. 2005;366(9493):1246-7.
16. Organization WH. WHO guidelines on hand hygiene in health care (advanced draft): global safety challenge 2005-2006: clean care is safer care. World Health Organization. 2006.
17. Carrascal GC, Ramírez JDM. Hygiene: basic care that promotes comfort in critically ill patients. Enfermería Global. 2015;14(4):340-61.
18. Challenge FGPS. WHO guidelines on hand hygiene in health care: a summary. Geneva: World Health Organization. 2009;119(14):1977-2016.
19. Erasmus V, Brouwer W, Van Beeck E, Oenema A, Daha T, Richardus JH, et al. A qualitative exploration of reasons for poor hand hygiene among hospital workers lack of positive role models and of convincing evidence that hand hygiene prevents cross-infection. Infection Control & Hospital Epidemiol. 2009;30(5):415-9.
20. Wendt C. Hand hygiene—comparison of international recommendations. J of Hospital Inf. 2001;48:23-8.
21. Mortell M. Hand hygiene compliance: is there a theory-practice-ethics gap? British Journal of Nursing. 2012;21(17).
22. Allmark P. A classical view of the theory-practice gap in nursing. Journal of Advanced nursing. 1995;22(1):18-23.
23. Hewison A, Wlldman S. The theory-practice gap in nursing: A new dimension. Journal of Advanced Nursing. 1996;24(4):754-61.
24. Blot S, Ruppé E, Harbarth S, Asehnoune K, Poulakou G, Luyt C-E, et al. Healthcare-associated infections in adult intensive care unit patients: changes in epidemiology, diagnosis, prevention and contributions of new technologies. Intensive and Critical Care Nurs. 2022;70:103227.
25. Nasa P, Azoulay E, Chakrabarti A, Divatia JV, Jain R, Rodrigues C, et al. Infection control in the intensive care unit: expert consensus statements for SARS-CoV-2 using a Delphi method. The Lancet infectious diseases. 2021.
26. Despotovic A, Milosevic B, Milosevic I, Mitrovic N, Cirkovic A, Jovanovic S, et al. Hospital-acquired infections in the adult intensive care unit—Epidemiology, antimicrobial resistance patterns and risk factors for acquisition and mortality. American journal of infection control. 2020;48(10):1211-5.
27. Organization WH. Minimum requirements for infection prevention and control programmes. 2019.
28. Pourhoseingholi M, Vahedi M, Rahimzadeh M. Gastroenterol Hepatol Bed Bench. Winter. Sample size calculation in medical studies. 2013;6(1):14-7.
29. Teixeira da Silva JA, Nazarovets S, Carboch J, Deutscher C, Almeida CH, Webb T, et al. The video assistant referee in football. Sports Engineering. 2024;27(1):1-15.
30. Han B, Chen Q, Lago-Peñas C, Wang C, Liu T. The influence of the video assistant referee on the Chinese Super League. Int J Sports Sci Coaching. 2020;15(5-6):662-8.
31. Auferoth F, Cohen A, Neeman Z. Judging Under Public Pressure: Foerder Institute for Economic Research, Tel Aviv University, The Eitan. 2021.
32. Kavanaugh BM. The judge as umpire: Ten principles. Cath UL Rev. 2015;65:683.
33. McKee TA. Judges as umpires. Hofstra L Rev. 2006;35:1709.
34. Ango U, Awosan K, Adamu H, Salawu S, Sani M, Ibrahim Au. Knowledge, attitude and practice of hand hygiene among healthcare providers in semi-

urban communities of Sokoto State, Nigeria. Int J Trop Dis Health. 2017;26(2):1-9.
35. Shobowale EO, Adegunle B, Onyedibe K. An assessment of hand hygiene practices of healthcare workers of a semi-urban teaching hospital using the five moments of hand hygiene. Nigerian Medical J. 2016;57(3):150-4.
36. 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.
37. Solomon A, Jimoh O, Ejembi J, Anjuwon T, Ige O, Jimoh A. Knowledge and Satisfaction with Hand Hygiene Practices among Healthcare Workers in Emergency and Intensive Care Units of a Tertiary Hospital in Nigeria. J Med Basic Sci Res. 2021;1(1):83-91.
38. Chakma SK, Hossen S, Rakib TM, Hoque S, Islam R, Biswas T, et al. Effectiveness of a hand hygiene training intervention in improving knowledge and compliance rate among healthcare workers in a respiratory disease hospital. Heliyon. 2024;10(5):67.
39. Knepper BC, Miller AM, Young HL. Impact of an automated hand hygiene monitoring system combined with a performance improvement intervention on hospital-acquired infections. Infection Control Hospital Epidemiol. 2020;41(8):931-7.
40. Ahmed J, Malik F, Memon ZA, Arif TB, Ali A, Nasim S, et al. Compliance and knowledge of healthcare workers regarding hand hygiene and use of disinfectants: a study based in Karachi. Cureus. 2020;12(2):56.
41. Ekwere TA, Okafor IP. Hand hygiene knowledge and practices among healthcare providers in a tertiary hospital, south west, Nigeria. Int J Infection Control. 2013;9(4):56.
42. Orji B, Oliveras E, Odio B, Anoke C, Onuoha H, Ugwa E, et al. Knowledge, attitudes and practices of infection prevention and control among healthcare workers during the COVID 19 pandemic: a descriptive cross-sectional study in three Nigerian states. BMC Health Services Research. 2023;23(1):253.
43. Abiodun O, Afolabi O, Ehwarieme T. Assessment of Knowledge and Factors Affecting Preventive Practices Against Nosocomial Infections Among Healthcare Professionals in a Teaching Hospital in Ondo State, Nigeria. 2021.
44. Braimoh O, Udeabor S. Hand hygiene practices among community health officers in Rivers State, Nigeria. African Heal Scis. 2013;13(2):507-11.
45. Moiwo MM, Kamara GN, Kamara D, Kamara IF, Sevalie S, Koroma Z, et al. Have hand hygiene practices in two tertiary care hospitals, Freetown, Sierra Leone, improved in 2023 following operational research in 2021? Tropical Med Infectious Dis. 2023;8(9):431.
46. 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. Antimicrobial Resistance Infection Control. 2020;9:1-9.
47. Garba MB, Uche LB. Knowledge, attitude and practice of hand washing among healthcare workers in a tertiary health facility in northwest Nigeria. J Med Tropics. 2019;21(2):73-80.
48. Ataiyero YO. Barriers and Levers to Hand Hygiene Practices Among Nigerian Healthcare Workers: A Mixed Methods Research Study: Univ Hull. 2020.
49. Omuemu VO, Ogboghodo EO, Opene RA, Oriarewo P, Onibere O. Hand hygiene practices among doctors in a tertiary health facility in southern Nigeria. J Med Trop. 2013;15(2):96-101.
50. Gwarzo GD. Hand hygiene practice among healthcare workers in a public hospital in North-Western Nigeria. Nigerian J Basic Clin Sci. 2018;15(2):109-13.
51. Ataiyero Y, Dyson J, Graham M. An observational study of hand hygiene compliance of surgical healthcare workers in a Nigerian teaching hospital. J Infection Prevent. 2022;23(2):59-66.

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