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ORIGINAL ARTICLE – OPEN ACCESS

Assessment of Hand Hygiene Compliance in the Context of COVID-19 Among Paediatric Nurses in a Nigerian Federal University Teaching Hospital

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ABSTRACT

Objective: The aim of this study was to assess hand hygiene (HH) facilities and to measure HH compliance during the COVID-19 pandemic among pediatric nurses in a single Nigerian federal university teaching hospital.

Materials and Methods: This is a cross-sectional study utilizing the WHO HH observational design. Compliance data were collected by a trained observer using the WHO "my five moments for HH" checklist, while HH facilities were assessed using the infection and control assessment form. The data were analysed using SPSS software version 26.0. A Chi-square test was employed to determine the compliance across units, shifts, and "my five moments for HH".

Results: Most HH facilities in the study were non-functional and inadequate. The overall compliance rate was 38.1%, based on the 561 HH opportunities recorded. The compliance rate was similar across the unit and shift, but varied according to "my five moments for HH" ($p<0.001$). HH compliance was found to be decreased in the moments before the contact with childt (5.6%) and before an aseptic procedure (1.1%). Better compliance was observed after body fluid exposure (100%), after the contact with child (61.2%), and after the contact with the child's environment (61.4%).

Conclusion: The study found inadequate HH facilities, possibly contributing to poor HH compliance. Local facilities need to be restructured to ensure adequate access to resources which would indirectly increase HH practice and compliance, especially in the pediatric settings where HH is very crucial.

Keywords: Hand hygiene, children, nurses, developing countries, infections

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INTRODUCTION

Hospital-acquired infections (HAIs) have been found to cause serious illnesses resulting in harm and even death in the vulnerable population hospitalized, particularly in developing countries (1). Surgical site infections (SSIs) are the most frequent postoperative complication among the hospitalized population (2). The risk of developing SSIs among patients is significantly higher in the developing countries compared to the developed countries; with 23%, 30.9%, and 19% documented, respectively, in Tanzania, pediatric hospitals in Nigeria, and maternity units in Kenya (1). The incidence of HAIs in adult and pediatric units is high, however, hospitalized children are a particularly susceptible population for HAIs (3).

A prospective study evaluated 529 HAI patients; the result showed an overall rate of HAIs among children was 25.9 per 100 admissions (4). Another study conducted in pediatric medical and surgical units in Nigeria, soft tissue and bacteremia infections were shown to be high among hospitalized children (5). Recent scientific evidence has shown that the COVID-19 virus is transmitted via contact with respiratory droplets. However, transmission by contact occurs when the infected hands s have contact with the mucosa of the eyes, nose, and mouth; in addition, the Lassa fever which is also an epidemic in African countries has also become HAIs. These emphasized the need to maintain effective HH practice as a preventive strategy against HAIs. Thus, HH is extremely important to curb the spread of HAIs, including the current COVID-19 pandemic, which is evidence of nosocomial infection spread (6). Healthcare-acquired infections (HAIs) are associated with morbidity, mortality, and prolonged hospitalization, and pose a serious threat to patient safety (3).

To effectively disrupt the transmission of HAIs, the WHO has endorsed an evidence-based measure known as the "My five moments for HH". This method encourages healthcare providers to decontaminate their hands in several situations before they come into contact with the patient 1), before an aseptic procedure 2), after exposure to body fluid 3), after the contact with patient t 4), after contact with patient's environment 5). Despite the high burden of HAIs in developing countries, the evidence for HH practices among HCWs has remained below the expected standard (7). Studies have shown that nurses' HH practices were low (8, 9). Furthermore, the WHO guideline recommendation states that the standard of HH compliance for HCWs must be above 91%. Nurses have numerous HH opportunities in their daily care of pediatric patients, therefore the HH practice is critical in protecting

the children from HAIs (10). Pediatric nurses play an important role in advocating for children and their families in promoting better well-being and health outcomes (11). lthough the awareness of the importance of HH in the prevention HAIs, including the COVID-19, is high, access to HH facilities that include soap and water as well as alcohol-based hand rubs is often inadequate in healthcare facility settings, especially in the low-and middle-income countries. HH compliance assessment is not commonly promoted in Nigeria, however, data from a tertiary hospital in the northern and southern parts of Nigeria have shown poor HH compliance followed by poor access to HH facilities (12, 13). The practice has yet to be assessed in tertiary hospitals in South-Eastern Nigeria and among the pediatric nurses. Therefore, this study aimed to assess the adequacy of HH facilities in pediatric medical and surgical wards and to measure nurse HH compliance during the COVID-19 pandemic using a modified version of the infection control assessment form and the WHO-directed observation method, respectively. Thus. The Research Questions that guided the study were:

What are the HH facilities available in pediatric medical and surgical wards? What is the level of compliance of pediatric nurses with the five moments of HH?

MATERIALS and METHODS

This was a cross-sectional research. This study was conducted in a tertiary university teaching hospital located in South-Eastern Nigeria. The hospital has the capacity to provide service over 720 patients and employs more than 4000 staff at a given time. It serves as a referral hospital from two neighboring states and smaller hospitals in the country. The hospital delivers either insurance coverage or self-pay services. The pediatrics unit has 19 beds and 22 cots, while the pediatric surgical unit is made up of 15 beds and 10 cots with a maximum capacity of 25 to 45 patients, and over 48 full-time nurses are working in these units. The data collection was done between October and November 2020.

Based on the WHO manual for sample size, a 95% confidence level with an 20% expected population ratio compliance with an alpha level of 0.05 was used to calculate the sample size using a power of 80% (14–16). The calculated sample was 273 opportunities across the units required to obtain a reliable estimate (14, 17, 18). Sine 273 opportunities were required for the three (3) consecutive days of observation in each ward; 273 divided by 3 days equaled to 91 opportunities per day, then further dividing 91 opportunities per day by 8–9 hours continuous observation; this gives approximately 9–11 opportunities per hour. Overall, the compliance was determined by dividing the total number of HH actions performed by the total number of opportunities multiplied by 100. Participants in the study were the full-time registered nurses who were positioned in surgical and pediatric medical wards and have had at least six months of pediatrics experience. Internship and student nurses were excluded from the study. A one-week visit to the study area was made by the researcher to get to know the ward environment, participants and to observe HH facilities. In this study, the data on the HH facilities was done by checking on the availability of HH resources such as water supply, the presence and location of alcohol-based hand rub (ABHR), the presence and location of sink and its functionality, the availability of water, soap/hand wash, the presence of hand dryer/disposable towels, and the availability of HH poster at the research site. The observer (CC) was a trained personal in healthcare-acquired infections and HH training and practice for HCWs. She used the WHO training films for standardized data collection prior to the study observation. This was to make the observer acquainted with the concept of "my five moments for HH". The observer used the study-specific form adapted with permission from WHO to record nurses' HH opportunities (19). The research procedure was explained to the nursing staff working in these units, and information and consent forms were distributed accordingly. The consented participants were the nurses on duty who agreed to be observed by the researcher. Only one researcher (CC) performed the HH observation to prevent inconsistency with many observers. During the observation, all opportunities were classified according to the WHO "my five moments for HH": before contact with childt 1) before an aseptic procedure 2) after exposure to body fluid 3) after the contact wth child 4) after contact with the child's environment 5).

Ethical Assessment

The study obtained ethical approval from the Human Research and Ethics Committee of the federal university teaching hospital (REC/17/06/2020-20/08/2020) and the Universiti Sains Malaysia (USM/JEPeM/20070359).

Statistical Analysis

The data analysis was performed using the IBM SPSS Statistics, version 26. Descriptive statistic (frequency and percentages) was used to analyse the data. Chi-square was performed to determine differences in the rate of compliance across units, shift, and "my five moments for HH" compliance, and a p-value of less than 0.05 was considered significant.

Assessment of HH facilities

A modified version of the infection control assessment form (Infection Control Assessment Tool for Primary Health Care, 2013) was used to observe HH facilities (20). The HH facilities observation checklist was made up of the availability of HH supplies and the condition of the sinks. The WHO "my five moments for HH" observation checklist was used to observe nurses' HH practices. The HH concept is defined as the point and time at which hand decontamination should be performed by the HCWs (19). Using the form, the observer noted the sign of contact and categorized the actions by "my five moments for HH", compliance to HH, and the type of HH action taken by the nurse (water and soap or alcohol-based hand rub).

RESULTS

The pediatric surgical and the pediatric medical units had the same layout, received, and followed the same procedure and policies regarding infection control guidelines in the hospital. These units had a mixture of both medical and surgical cases. HH facilities assessment took place in the pediatric medical and pediatric surgical wards as shown in Table 1. Of the eight (8) HH facilities assessed, 87.5% (7) had an intact drain, while only 50% of the taps had piped water. However, because of erratic power supply, sometimes nurses would use a cup and a bucket of water for handwashing. All the functional sinks were manually operated at the nurses' station. Two hand-washing points (25%) were intended for patients, but no water flowing through them. In these two units, ABHR was

Table 1. Result of the survey on the HH facilities in pediatric wards

HH supplies surveyed	Condition of surveyed	Total number of HH facilities surveyed (8)
Sinks	Intact	8 (100)
	Accessible	8 (100)
	Intact drain	7 (87.5)
	Damaged drain	1 (12.5)
Taps	Manually operated	8 (100)
	Automated	Nil
	Elbow operated	Nil
	Water flowing	Yes 4 (50)
	Water not flowing	No 4 (50)
Availability of soap	Yes	4 (50)
	No	4 (50)
Availability of ABHR	Yes	Nil
	No	8 (100)
HH instruction	Yes	2 (25)
	No	6 (75)
Availability of hand drying facilities	Yes	Nil
	No	8 (100)

HH: Hand hygiene

Table 2. HH compliance level among the opportunities presented to nurses

Variables	No of opportunities		Compliance		Non-compliance		p*
	n	%	n	%	n	%	
Overall	561		214	38.1	347	61.9	
HH actions							
Water and soap	211		211	98.59			
Application of ABHR	3		3	1.4			
Unit							0.666
Pediatric surgical	274	48.8	107	39.1	167	60.9	
Pediatric medical	287	51.2	107	37.3	180	62.7	
Shift							0.585
Morning	309	55.1	121	39.2	88	60.8	
Afternoon	252	44.9	93	36.9	159	63.1	
My five moments for HH							<0.000
Before the contact with chilcontact	162	28.9	9	5.6	153	94.4	
Before an aseptic procedure	88	15.7	1	1.1	87	98.9	
After exposure to body fluid	35	6.2	35	100	0	0.0	
After contact with child	219	39.0	134	61.2	85	38.8	
After contact with the child's surrounding	57	10.2	35	61.4	22	38.6	

*: x^2 – test of difference in proportions of opportunities compiled across the level of variables. HH: Hand hygiene

not available at the point of care, except for a few nurses who had personal pocket-sized ABHR. Neither unit had disposable towel or paper towel or automated hand dryers. Water and soap were available throughout the observation period. The observer recorded a total of 561 HH opportunities; with (274, 48.8%) opportunities from the pediatric surgical ward and (287, 51.2%) opportunities from the pediatric medical ward. Overall compliance was 214 out of 561 opportunities (38.1%) (Table 2). The majority of all

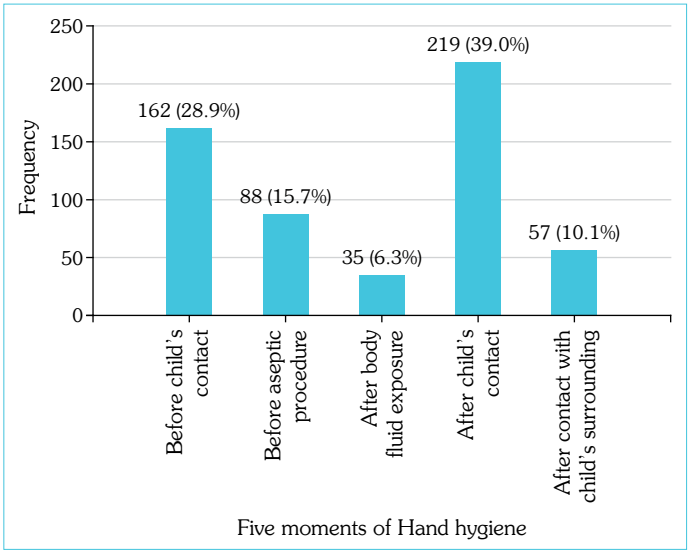

Figure 1. Frequency of five moments of hand hygiene

the HH actions were performed with soap and water (211/214, 98.59%), while only (3/214, 1.4%) of HH were through the application of ABHR (p=0.00) Table 2. HH compliance within the unit was 39.1% and 37.3% for pediatric surgery and pediatric medical units, respectively (p=0.666). The HH compliance was 39.2% for the morning shift and 36.9% for the afternoon shift (p=0.585). HH compliance with "my five moments for HH" varied according to the HH indications. The moment after exposure to body fluid had the highest compliance rate (100%), followed by the moment after contact with the child 61.2%, and the child's environment 61.4%. The moment preceding the contact with child had the lowest compliance rate: the moment before the contact with child 5.6% (p=<0.001), the moment before an aseptic procedure had a compliance rate of (1.1%). Most of the HH opportunities were observed after the contact with patient (39.0%) followed by HH before patients' contact with 28.9% and the least opportunities observed were before the aseptic procedure as shown in Figure 1.

DISCUSSION

To the best of the researchers' knowledge, this is the first study assessing HH compliance among nurses working in pediatric medical and surgical wards in Nigeria using the WHO "my five moments for HH". The conduct of this study has raised the awareness of HH practices in the study site on the issues regarding to HH practices. These findings are considered relevant to the current clinical practice in Nigeria. Though HH is simple, it is an important measure in the preventing HAIs including the recent COVID-19 pandemic across all healthcare settings. Recently, efforts have been made by WHO to improve HH compliance among HCWs through advocating for many accessible HH facilities worldwide. Despite these efforts, HH compliance has often dwindled. The major problem of HH compliance in developing countries is the lack of functional and accessible HH facilities (21). Our study had revealed the key issues on HH resources in the clinical environment and this paradox with WHO recommendations (22). The standard ratio for the sink to patients beds according to WHO is 1:10, (23) but unfortunately this was not seen in our study site. Such barriers to HH facilities increase the likelihood of HAIs and even the COVID-19 infection. Most of the handwashing drains were damaged. The functional handwashing points were few and far from where the nurses provided regular patients care, in addition, ABHR was not available in the clinical area. Inadequate HH facilities and lack of maintenance culture in the country had also been reported in other studies in the country (21, 24). Limited access to HH facilities has proven to be an important risk factor for poor HH compliance in resource-limited settings (25–27). Not prioritizing healthcare funding, erratic power supply, poor maintenance attitude, lack of functional sinks were some of the factors seen in our study (10, 14). All taps were manually operated, and such practices increase the risk of contamination and recontamination of the taps and the cup handle (12). The cleanliness of the handwashing receiver in the pediatric surgical unit becomes even more questionable. Previous studies found that hand washing sink drain harbour infectious agents such as Klebsiella oxytoca and Enterobacteriaceae (28, 29). The WHO promoted the use of elbow-sensor-operated/automated taps or single-use towels for hand drying, although some studies reported that series of contamination have been associated with HAIs when using the automated sensor-operated taps with Pseudomonas aeruginosa (30, 31).

The result of our observation shown that the risk of contamination and recontamination was very high. However, we did not evaluate the cleanliness of each sink or surface, this could be considered in the future study. Nurses were supposed to perform HH regularly during the clinical procedure, but problems with the distance of handwashing points, the lack of a constant water supply, and the absence of ABHR at the point-of-care were limiting the accessibility. This indirectly led to the nurse's non-compliance. Patients' relatives and visitors played a major role in providing pediatric patients' care, especially in pediatric settings (32). The lack of HH facilities for them may also pose a risk factor for HAIs (32), though these groups' HH practices were not considered in this study.

The HH compliance in this study was below the expected average as per WHO. This showed that HCWs performed HH in less than half of the time (33). These findings were not surprising since the HH facilities (the non-functional sink, few and position of handwashing stations, and lack of ABHR) in the units were inadequate. It may also explain why nurses prefer to finish up with their tasks without HH. This situation also compels them to perform HH mostly with soap and water, while some other nurses tend to forget to perform HH. From our observation, there was a minimal proportion (1.4%) of nurses who applied personal ABHR. Previous studies have shown that multimodal promotion of HH with access to ABHR at the point of care, was an important factor in the healthcare setting in both developed and developing countries (34, 35).

We did not find any significant difference between the nurse units and shift and the HH compliance. This study was comparable with another study that also reported a lower compliance rate which was attributed to the distance between the handwashing sink and the patient's bed (36). However, some other studies found higher compliance rates among the HCWs working in the evening shift and in different units with lower compliance found in the pediatric intensive care unit (37). The compliance to "my five moments for HH" varied significantly across the moment with compliance after exposure to body fluids, after contact with child, and after contact

with the child's environment with the highest compliance. The lowest compliance was found before the child's contact and before the aseptic procedure. The lower compliance rate before contact that protects the patient from infection increases the risk of HAIs including the COVID-19 which has also become HAIs. Results from Nigeria found that SSI was the most prevalent form of HAIs in the country and other developing countries, affecting about one-third of the operated patients (38, 39). Nurses play a vital role in the prevention of surgical wound infection and are in the position to implement evidence-based clinical practice guidelines (40). Poor compliance in these crucial moments (before an aseptic procedure and before patient's contact) was influenced by limited facilities which constrained staff from fulfilling their duties and roles. Unfortunately, SSI prevention knowledge among HCWs did not translate into desired practice (41). Lack of resources, the implementation of evidence-based practice (EBP), and management will have a direct impact on outcome and practice. Nurses have limited autonomy to mobilize resources to guide EBP implementation and related activities in the country (42).

Another interesting non-compliance factor observed in this study was the availability of gloves at the patient's bedside. The nurses were seen to be wearing gloves before any procedure instead of performing the HH procedures. We also discovered; the nurses tend to repeat the use of gloves to several children in the ward. This practice was not following the WHO recommendation (43). Such practice may further increase the risk of infection among hospitalized children, especially those who are immunosuppressed and have surgical wounds.

Furthermore, this study was conducted during the COVID-19 pandemic. Even with the increased awareness and sensitivity of the mass media on the importance of HH, the compliance rates were still low. Similarly, a lower HH compliance rate was also reported during the swine flu pandemic (36).

The study was designed to minimize inconsistencies associated with multiple observations performed by many researchers. However, just one observer could not capture all the events of HH opportunities and HH protocol (i.e., techniques and the duration) further research could use two or more observers for data collection and capturing the details of HH behaviors among the nurses. The observation was conducted for three (3) consecutive days for over 8–9 hours per day to minimize the Hawthorn effect. However, despite the appropriate steps the participated HCWs were aware that they were being observed and hence may have performed HH more often than they would have done.

CONCLUSION

HH compliance of nurses was low and the availability of HH facilities in our setting was inadequate. Challenges such as the lack of availability of ABHR, the functional handwashing station, and the lack of running water in our set-up possibly contributed to the poor compliance seen in this study. This may also be the main contributing factor to previously reported surgical wound infections. These observed barriers to optimal HH compliance reveal the need for specific strategies such as training and retraining, improvement in HH facilities, and continuous monitoring with feedback on performance to improve HH compliance among the healthcare staff.

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Ethics Committee Approval: The Universiti Sains Malaysia Human Research Ethics Committee granted approval for this study (date: 17.06.2020/20.08.2020, number: USM/JEPeM/20070359).

Informed Consent: Written informed consent was obtained from nurses who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – CO, AY, FT; Design – CO, AY, FT; Supervision – CO, AY, FT; Resource – CO; Data Collection and/or Processing – CO; Analysis and/or Interpretation – CO, AY, FT; Literature Search – CO, AY, FT; Writing – CO, AY, FT; Critical Reviews – AY, FT.

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REFERENCES

1. World Health Organization (WHO). on Hand hygiene in health care first global patient safety challenge clean care is safer care. Available from: URL: http://whqlibdoc.who.int/publications/2009/9789241597906_eng.pdf.
2. Zhang J, Yuan Y, Li P, Wang T, Gao J, Yao J, et al. Postoperative nosocomial infections among children with congenital heart disease. Pak J Med Sci 2014; 30(3): 554–7. [CrossRef]
3. Aelami. MH LMZW. Ventilator-associated pneumonia in neonates, infants and children. Antimicrob Resist Infect Control 2014; 3: 1–10.
4. Hassan RH, Eldegla H, Elmorsy F, Eldars WM. Clinical and microbiological characteristics of healthcare-associated infections in a tertiary care pediatric hospital. Egypt Pediatr Assoc Gaz 2017; 65(4): 127–31.
5. Ige OK, Adesanmi AA, Asuzu MC. Hospital-acquired infections in a Nigerian tertiary health facility: An audit of surveillance reports. Niger Med J 2011; 52(4): 239–43. [CrossRef]
6. Arshad Ali S, Baloch M, Ahmed N, Arshad Ali A, Iqbal A. The outbreak of coronavirus disease 2019 (COVID-19)-an emerging global health threat. J Infect Public Health 2020; 13(4): 644–6. [CrossRef]
7. Yallew WW, Kumie A, Yehuala FM. Point prevalence of hospital-acquired infections in two teaching hospitals of Amhara region in Ethiopia. Drug Healthc Patient Saf 2016; 8: 71–6. [CrossRef]
8. Sadule-Rios N, Aguilera G. Nurses' perceptions of reasons for persistent low rates in hand hygiene compliance. Intensive Crit Care Nurs 2017; 42: 17–21. [CrossRef]
9. Seyed Nematian SS, Palenik CJ, Mirmasoudi SK, Hatam N, Askarian M. Comparing knowledge and self-reported hand hygiene practices with direct observation among Iranian hospital nurses. Am J Infect Control 2017; 45(6): e65–7. [CrossRef]
10. Saharman YR, Aoulad Fares D, El-Atmani S, Sedono R, Aditianingsih D, Karuniawati A, et al. A multifaceted hand hygiene improvement program on the intensive care units of the National Referral Hospital of Indonesia in Jakarta. Antimicrob Resist Infect Control 2019; 8: 93.
11. Sterling YM. Pediatric nurses as advocates. J Pediatr Nurs 2013; 28(3): 309–10. [CrossRef]
12. 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(1): 30. [CrossRef]

13. Johnson OE, Assi AE, Bakpo IJ, Harrison UE, Angba FE, Okon MA. Knowledge and practice of standard precautions among health care workers in a secondary facility in southern Nigeria. Int J Biomed Res 2019; 10(1): 1–8.
14. World Health Organization. Guide to implementation multimodal hand hygiene improvement strategy - Contents definition of terms. New South Wales Premiers Dep, 2009. p.47.
15. ECDC. Annual epidemiological report. Available from: URL: https://www.ecdc.europa.eu/sites/default/files/documents/1111_SUR_Annual_Epidemiological_Report_on_Communicable_Diseases_in_Europ….pdf.
16. Mahfouz AA, El Gamal MN, Al-Azraqi TA. Hand hygiene non-compliance among intensive care unit health care workers in Aseer Central Hospital, south-western Saudi Arabia. Int J Infect Dis 2013; 17(9): e729–32. [CrossRef]
17. Sax H, Allegranzi B, Chraïti MN, Boyce J, Larson E, Pittet D. The World Health Organization hand hygiene observation method. Am J Infect Control 2009; 37(10): 827–34. [CrossRef]
18. Winnipeg Regional Health Authority. WHO recommendations: "There is no clear evidence on the ideal sample size needed to ensure representativeness, but sample size estimates indicate that 200 opportunities per observation period and per unit of observation (either ward, department, or professional category etc). Available from: URL: https://professionals.wrha.mb.ca/old/extranet/ipc/files/audit-tools/Audit_2_8.pdf.
19. World Health Organization (WHO). Instructions to use the Training Films in education sessions on health care- associated infections and hand hygiene for health-care workers and observers HAND HYGIENE SCENARIOS. 2009; Available from: URL: https://www.who.int/gpsc/media/edu_film_instr_08_07.pdf.
20. USAID, SIAPS. Infection Control Self-Assessment Tool for Primary Health Care Facilities. 2013. Available from: URL: https://siapsprogram.org/wp-content/uploads/2013/01/12-137-ICAT-PCH.FINAL_.pdf.
21. Busari OA, Oje OJ, Adeleke B, Busari OE, Gabriel OE, Agboola SM, et al. Hand hygiene facilities in the clinical laboratories of a tertiary health facility in a lassa fever endemic country. Science PG 2018; 3(2): 25–9. [CrossRef]
22. World Health Organisation (WHO) 2020. Recommendations to member states to improve hand hygiene practices to help prevent the transmission of the COVID-19 virus. Available from: URL: https://www.who.int/publications/i/item/recommendations-to-member-states-to-improve-hand-hygiene-practices-to-help-prevent-the-transmission-of-the-covid-19-virus.
23. Pittet D. Hand hygiene in health care first global patient safety challenge clean care is safer care. World Health [Internet]. 2009;30(1):270. Available from: URL: http://whqlibdoc.who.int/publications/2009/9789241597906_eng.pdf.
24. Shehu N, Onyedibe K, Mark O, Gomerep S, Isa S, Ibrahim C, et al. Assessment of hand hygiene compliance among health care workers in a Nigerian Tertiary Hospital. Antimicrob Resist Infect Control 2017; 6(Suppl 3): 57.
25. Devnani M, Kumar R, Sharma RK, Gupta AK. A survey of hand-washing facilities in the outpatient department of a tertiary care teaching hospital in India. J Infect Dev Ctries 2011; 5(2): 114–8. [CrossRef]
26. Niyonzima V, Brennaman L, Beinempaka F. Practice and compliance of essential handwashing among healthcare workers at a regional referral hospital in Uganda: A quality improvement and evidence-based practice. Can J Infect Control 2018; 33(1): 33–8.
27. Le CD, Lehman EB, Nguyen TH, Craig TJ. Hand hygiene compliance study at a large central hospital in Vietnam. Int J Environ Res Public Health 2019; 16(4): 607. [CrossRef]
28. Leitner E, Zarfel G, Luxner J, Herzog K, Pekard-Amenitsch S, Hoenigl M, et al. Contaminated handwashing sinks as the source of a clonal outbreak of KPC-2-producing Klebsiella oxytoca on a hematology ward. Antimicrob Agents Chemother 2015; 59(1): 714–6. [CrossRef]
29. Franco LC, Tanner W, Ganim C, Davy T, Edwards J, Donlan R. A microbiological survey of handwashing sinks in the hospital built environment reveals differences in patient room and healthcare personnel sinks. Sci Rep 2020; 10(1): 1–11. [CrossRef]
30. Yapicioglu H, Gokmen TG, Yildizdas D, Koksal F, Ozlu F, Kale-Cekinmez E, et al. Pseudomonas aeruginosa infections due to electronic faucets in a neonatal intensive care unit. J Paediatr Child Health 2012; 48(5): 430–4. [CrossRef]
31. Mazzotta M, Girolamini L, Pascale MR, Lizzadro J, Salaris S, Dormi A, et al. The role of sensor-activated faucets in surgical handwashing environment as a reservoir of legionella. Pathogens 2020; 9(6): 446. [CrossRef]
32. Buet A, Cohen B, Marine M, Scully F, Alper P, Simpser E, et al. Hand hygiene opportunities in pediatric extended care facilities. J Pediatr Nurs 2013; 28(1): 72–6. [CrossRef]
33. World Health Organization (WHO). Report on the burden of endemic health care-associated infection worldwide clean care is safer care. Available from: URL: https://www.ncbi.nlm.nih.gov/books/NBK144030/.
34. Abernethy G, Smyth W. The search for an evidence-based intervention to improve hand hygiene compliance in a residential aged care facility. Healthcare Infect 2013; 18(4): 156–61. [CrossRef]
35. Salmon S, Pittet D, Sax H, Mclaws ML. The ' My five moments for hand hygiene ' concept for the overcrowded setting in resource-limited healthcare systems. J Hosp Infect 2015; 91(2): P95–99. [CrossRef]
36. Alsubaie S, Maither A Bin, Alalmaei W, Al-Shammari AD, Tashkandi M, Somily AM, et al. Determinants of hand hygiene noncompliance in intensive care units. Am J Infect Control 2013; 41(2): 131–5. [CrossRef]
37. Scheithauer S, Batzer B, Dangel M, Passweg J, Widmer A. Workload even affects hand hygiene in a highly trained and well-staffed setting: a prospective 365/7/24 observational study. J Hosp Infect 2017; 97(1): 11–6. [CrossRef]
38. Shirol SS, Nimbaragi G, Prabhu M, Ratkal J. Abductor digiti minimi muscle flap in reconstruction of diabetic foot ulcers: A case series. Eur J Plast Surg 2014; 37(4): 227–32. [CrossRef]
39. Oni AA, Ewete AF, Gbaja AT, Kolade AF, Mutiu WB, Adeyemo DA, et al. Nosocomial infections: surgical site infection in UCH Ibadan, Nigeria. Niger J Surg Res 2006; 8(1–2): 19–23. [CrossRef]
40. Boga SM. Nursing practices in the prevention of post-operative wound infection in accordance with evidence-based approach. Int J Caring Sci 2019; 12(2): 1229–36.
41. Oluwakemi AK, Salisu A, Sanusi RA, Hanson VF, Adelani T. Knowledge, attitude and practice of surgical site infection prevention among post-operative nurses in a tertiary health institution in north-central Nigeria. Int J Nurs Midwifery 2017; 9(6): 65–9. [CrossRef]
42. Ominyi J, Ezeruigbo CFS. How nurse manager's position in the hospital hierarchy influences evidence-based practice implementation in nursing: A qualitative case study of the Nigerian acute care setting. J Nurs Educ Pract 2019; 9(6): 14. [CrossRef]
43. World health organization (WHO). Glove Use Information Leaflet. Available from: URL: https://www.who.int/gpsc/5may/Glove_Use_Information_Leaflet.pdf.