

Hand Hygiene in Pediatric Emergency Care Unit in a Teaching Hospital in Benin

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Abstract

Introduction: Appropriate hand hygiene reduces healthcare associated infections (HCAI). The present study was an attempt to determine the real knowledge and practices of healthcare professionals of pediatric emergency care unit in Benin. **Methods:** This was a three-month observational study. First a trained interviewer observed both the premises and the healthcare professionals during their administering treatment, without their knowledge. Second, their level of knowledge about HCAI was examined using a self-administered questionnaire. Finally, bacteria were cultured/measured from their hands before and after hand-washing through swab samples. **Outcome:** The modes of microorganism transmission were poorly known (21.6%), but knowledge about the 5 moments for hand hygiene was satisfactory (84.1%). Hand hygiene adherence rate was 6.9% in the study population. Simple hand-washing was prevalent (82%). The healthcare professionals did not adhere to the recommended duration for hand-washing. The required hand-washing equipment was inadequate, and alcohol-based handrub dispenser was unavailable. Microorganism isolated from healthcare professionals before hand-washing included *Klebsiella pneumonia* and *Enterobacter Cloacae*. After hand-washing, the transient flora decreased. **Conclusion:** Hand hygiene adherence rate is low in the study population. An immediate action is required to improve observance of hand-washing. This may include: training healthcare professionals, displaying visual behavior reminder posters, providing alcohol-based handrub.

Keywords

Hand Hygiene, Healthcare Associated Infections, Adherence, Pediatrics

1. Introduction

One of the risks associated with the administration of healthcare is the transmission of infectious agents. Such transmission usually occurs during unsafe care and can be breeding ground for infections known as healthcare-associated infections (HCAI). Such infections occur during curative or palliative care administered to a patient by a healthcare professional, though they were neither present nor incubated upon admission [1]. The World Health Organization (WHO) estimates that 1.4 million patients contract HCAI at any moment [2]. Their incidence ranges from 5% to 15% in inpatients in developed countries and could reach 25% in emerging countries [2] [3]. Since 1947, it is knowledged that the transmission of infectious agents causing HCAI occurs mainly through the hands of healthcare professionals, and that, proper hand hygiene decreases the incidence [2]. Standards have therefore been set as far as hand hygiene is concerned, regarding necessary equipment, procedures and opportunities to observe in the delivery of care [2]. For poor countries where these optimal conditions are hardly met (safe drinking water, antiseptic soap, suitable faucets, disposable hand towels, etc.) alcohol-based hand rub which has proved effective, is a great option [2]. While it is well recognized that the fight against HCAI requires good hand hygiene, adherence by healthcare professionals seems to be suboptimal in daily practice. In India, a study carried out in 2018 reported 15.7% as hand hygiene adherence rate [4]. In Benin, Yehouenou *et al.* found 33.3% in a survey conducted in six public hospitals across the country [5]. A study carried out in 2016 in the neonatology division of HKM National Teaching Hospital in Cotonou, revealed 15% as hand hygiene adherence rate [6]. The purpose of this study is to assess the knowledge and practices of healthcare professionals with regard to hand hygiene in the pediatric intensive care unit within the same hospital.

2. Methods

2.1. Type of Study

It was a three-month observational study conducted from June 3 to September 12, 2019.

2.2. Study Population

On the one hand, the study targeted the healthcare workers present during the study period: doctors (pediatricians and graduating pediatricians), fifth and sixth year medical students, undergraduate nursing students, and allied health professionals (nurses, nursing assistants, or paramedics); and on the other hand, the infrastructure and equipment that are required to ensure hand hygiene.

2.3. Study Tools and Data Collection

The questionnaire and grids used for observing both the healthcare professionals

and the premises rely on the World Health Organization guidelines [7].

2.4. Study Variables

The variables collected include seniority in the profession, healthcare professionals training in hand hygiene and healthcare associated infections (knowledge about the modes of microorganism transmission, moments for hand hygiene, the different types of hand hygiene and their duration, etc.), accessibility of hand hygiene equipment (water, soap, alcohol-based disinfectant, etc.), compliance with attire prerequisites. The opportunities for hand hygiene during delivery of healthcare were observed, and this made it possible to determine adherence rate. Finally, we tracked microorganism (no virus) present on the hands of healthcare professionals. Epidata 3.1 and STATA 15.0 were used for data processing and analysis.

2.5. Conducting the Study

The study comprises three parts. The first one was basically a covert observation of the health workers in the implementation of their activities day and night, without their knowledge. Among others, the observation focused on the followings: patient physical examination, invasive procedures (such as placement of peripheral venous access catheters, catheterization, lumbar or as cites puncture, etc.), linen change, etc. At this stage, it was an exhaustive enrollment. The observation criteria were based on the five moments for hand hygiene according to the WHO guidelines [2]. It also focused on existing infrastructure and equipment, as well as the staff clothing hygiene. It was conducted by a doctor from the pediatric emergency care unit, familiar with observation technique and WHO guidelines. Through each 30-minute long observation dedicated to a single healthcare professional, the administration of different care provided to the patient was carefully monitored. Opportunities for performing hand hygiene were determined and recorded. The opportunity exists whenever one of the moments for hand hygiene is present and observed. Adherence rate was calculated according to the following formula:

Adherence (%) = $100 \times [\text{number of hand hygiene episodes performed} / \text{number of hand hygiene opportunities}]$.

Hand hygiene was considered properly implemented when the health professional observed all steps and duration associated with such practice.

The second part of the study was a self-administered questionnaire on the staff knowledge about hospital hygiene and healthcare associated infections. For a questionnaire to be validated, it had to be returned by the respondent within 48 hours after administration. For each item of the questionnaire, a respondent knowledge was rated as good if the percentage of correct answers was $\geq 80\%$.

Finally, the health staff had to go through hand swab before and after hand washing. For the last two parts of the study, enrollment of participants was based on convenience. This type of enrollment could constitute a bias for this study.

Therefore, only voluntary personnel hands were swabbed and analyzed by specialists from the hospital hygiene department. A sterile swab was used for specimens collected from the palms, fingernails and interdigital folds of each volunteer healthcare worker. Each specimen was assigned an anonymous reference number according to the healthcare worker category group, then immediately transferred to the laboratory.

2.6. Ethical Consideration

This study was carried out with the agreement of the hospital administration, in collaboration with the department of hospital hygiene. All nursing staff were informed about the study, but they were unaware of the period of covert observation and the interviewer's identity.

2.7. Outcome

2.7.1. Characteristics of Healthcare Workers

A total of 130 healthcare workers were observed, of which 119 returned the correctly completed questionnaires within the allotted time, and 35 gave their consent for swab collection before and after hand washing. The characteristics of these healthcare professionals are presented in **Table 1**.

Table 1. Socio-demographics characteristics of the 119 healthcare workers who return the questionnaire.

	n	Percentage %
Gender		
Male	60	50.4
Female	59	49.6
Occupational group		
Doctors	21	17.6
Nurses	16	13.4
Nursing assistants	18	15.1
Medical students	54	45.4
Nursing students	10	8.4
Professional experience		
<1 year	5	-
1 to 3 years	22	18.4
> 3 years	92	77.3
Initial training on hand hygiene and HAI,		
Doctors	9	42.9
Nurses	14	85.3
Nursing assistants	0	-
Medical students	41	75.9
Nursing students	6	60

2.7.2. Healthcare Workers' Knowledge Regarding the Modes of Microorganism Transmission in Hospital Facilities

Healthcare workers' theoretical knowledge is presented in **Table 2**. It appears that, their knowledge was globally unsatisfactory, although most of them benefited from basic initial training.

2.7.3. Healthcare Workers' Knowledge Regarding the Moments for Hand Hygiene, and Their Components

Healthcare professionals declared that it is necessary to practice hand hygiene before touching a patient (93.3%), after touching a patient (93.3%), after contact with a patient environment (72.3%), before an aseptic procedure (76.5%), after body fluid exposure (85.5%). Simple hand washing and alcohol based hand rub were known to all, however, only doctors and medical students mentioned anti-septic and surgical hand hygiene. The minimum duration of alcohol-based hand rub was only known by doctors, this, in a proportion of 50%.

2.7.4. Hand Hygiene Adherence Rate by Healthcare Workers during Healthcare Delivery

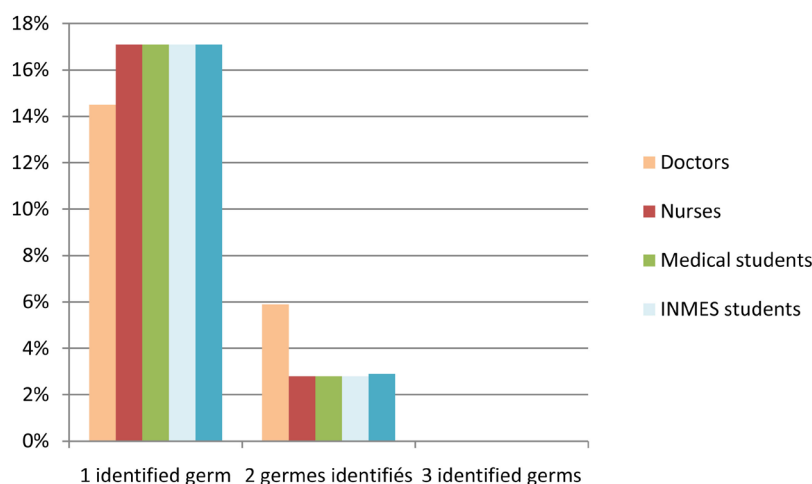
During the observation period, hand hygiene adherence rate was low (6.9%) regardless of the category and seniority: doctors 9%, nurses 7.5%, nursing assistants 0%, medical students 6.7%, and nursing students 3.8%. Simple hand washing was largely practiced in a proportion of 82%, while alcohol-based hand rub represented 18%. No health professional observed the minimum required duration regardless of the type of hand hygiene practiced. **Table 3** is an overview of hand hygiene adherence according to category group and WHO five moments for hand hygiene.

2.7.5. Results of Healthcare Workers' Hand Swab before and after Hand Washing

The following microorganism was identified in healthcare professionals before hand washing: *Staphylococcus saprophyticus*, *Staphylococcus epidermidis*, gram-positive type *Bacillus*, *Enterobacter cloacae*, *Enterococcus faecalis*, *Klebsiella pneumoniae*, *Serratia marcescens* and *Candida* yeast. Transient flora reduced from 15% to 2% after hand washing. **Graph 1** shows the number of microorganism isolated according to the category after simple hand washing.

Table 2. Healthcare workers' knowledge regarding the modes of microorganism transmission in a hospital facility.

Key modes of microorganism transmission	Doctors (n = 21)	Nurse (n = 16)	Nursing assistants (n = 18)	Medical students (n = 54)	Nursing students (n = 10)
Healthcare workers' hands in poor hygiene environment	10	23	0	35	5
Circulating air	0	1	0	2	1
Exposure to contaminated surfaces	1	8	0	10	2
Use of non-invasive medical devices for multiple patients	0	1	0	7	2



Graph 1. Number of microorganism isolated according to the professional category after simple hand washing.

Table 3. Hand hygiene adherence rate according to professional category and 5 moment for hand hygiene.

Category	% of good practices compared to the 5 WHO moments for hand hygiene				
	Before touching a patient	Before an aseptic procedure	After risk of exposure to body fluid	After touching a patient	After touching a patient's environment
Doctor	3.7	100	0	37	6.3
Nurse	0	0	45	5.4	3.7
Nursing assistants	0	-	0	0	0
Medical students	1.9	25	9.4	4.1	0
Nursing students	0	-	66.6	0	0
Total	1.6	7.1	12.3	11.4	2.3

-: This category didn't do any aseptic procedure.

2.7.6. Observing Prerequisites for Hand Hygiene

In structural terms, hospital water point-of-use was defective, particularly the absence of faucets, or their unsuitable positioning. The soap used for hand hygiene was a mild, non-antiseptic liquid soap. There was shortage of soap and tap water supply. Moreover, disposable hand towels, alcohol based hand rub dispenser at point-of-care, posters or leaflets for visual reminder were non-existent. As far as attire is concerned, almost all the healthcare personnel wore short-sleeved outfits. However, 75% of them had rings on their fingers, jewelry hanging from their ears, and almost half left their hair unprotected.

3. Discussion

The moments for hand-washing and associated techniques are cross-cutting

knowledge in human medicine, both for the medical personal and paramedics. Its impact in the fight against healthcare-associated infections has been formally established [8] [9]. A proper practice of hand hygiene by healthcare professionals requires basic equipment: water point-of-use, adequate soap, alcohol-based hand rub, disposable hand towels, etc. [8] [9]. This observational study carried out in CNHU pediatric emergency care unit identified deficiencies with regard to this minimum requirement. These deficiencies could have an impact on healthcare workers' practice. Engdaw *et al.* in Ethiopia reported that factors influencing hand hygiene adherence involved access to soap and water [10]. This lack of hand washing equipment is a common situation in low and middle countries [11], and that is the reason WHO recommends alcohol-based hand rub, which is easier to implement [2] [7]. Clothing requirements should be improved within the care unit, especially the wearing of rings, which can be a breeding ground for germs [12]. With the exception of nursing assistants, almost all healthcare professionals attended basic hand hygiene training. However, their level of awareness was low especially regarding transmission modes, the duration of hand washing, and alcohol-based hand rub. The medical staff underrated the risk associated with non-invasive medical equipment such as stethoscopes used from one patient to another. In outpatient medicine services, Zanetti *et al.* also reported a low rate of stethoscope disinfection in-between two patients [13]. A periodic in-service staff training plan with visual support on HCAI could be set up within the care unit. This will contribute to raising staff awareness about the consequences of HCAI, *i.e.* extension of hospital stays, additional financial costs, excess mortality and perhaps better hand hygiene practices [14] [15]. The adherence rate found in this study was low < 10% regardless of the category, and this should be a matter of great concern. Ahmed J *et al.* recorded a rate of 12.3% in Karachi, Tang *et al.* 11% to 36% depending on the season in a rural hospital in Niger [16] [17]. Higher rates of 31% are reported in Nigeria but still significantly lower than those reported in advanced countries such as England [11] [18]. The implementation of a multimodal strategy based on WHO recommendations will certainly improve hand hygiene adherence within the care unit, as various teams experimented [19] [20] [21] [22]. It is also possible to use emoticons, to remind healthcare professional about hand hygiene, and implement strategies that will boost healthcare workers' motivation [23] [24] [25]. For example, in a first pilot study performed by Gaube *et al.* in a German hospital, a monitoring and feedback devices were installed above handrub dispensers that displayed frowny face to remind people to performed hand hygiene. Once used, a smiley face was shown to reinforce the positive behavior. In patient's room, this can reinforce the hand hygiene behavior by providing instant feedback [23]. Despite the deficiencies recorded in the care unit, a reduction in the transient flora after washing was noted and no healthcare worker had more than two microorganisms on their hands. However, direct observation may have modified the behavior of healthcare professionals who unconsciously could focus on adherence to the different steps of hand hygiene, thus creating bias in the study. However, it seems

that the use of simple soap reduced the transient flora as reported in the literature [2]. Nevertheless, given the microorganism isolated from the healthcare professional involved in this study, especially *Enterobacter cloacae* and *Klebsiella pneumoniae* known to be multi-resistant and responsible of HCAI in the neonatology department of the same hospital, there is crucial need to emphasize the use of antiseptic soap [26]. Training, visual reminders, and uninterrupted supply of alcohol-based solution or gel are some of the immediate actions to be taken.

4. Conclusion

Hand hygiene adherence rate in pediatric intensive care unit is low. The emergence of new viruses including SARS-COV 2 should be an opportunity for implementing a sustainable hand hygiene plan in the care unit. Indeed, national mobilization and support from development partners have enabled the acquisition of simple, effective and affordable hand washing stations, local production of chlorinated water and supply of alcohol based solution.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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