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# Evaluation of Hand Hygiene Compliance among Healthcare Workers: Strategies for Improvement

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**Abstract**

**1. Introduction**

Despite its known importance, hand hygiene (HH) compliance among health care workers (HCWs) is widely variable and often below 50%. By means of a 4-step step-by-step approach to implementation and monitoring of HH compliance, a total of 519 HH opportunities were assessed at baseline. Strategies are offered such as staff reinforced training followed by feedback. By use of a cohort stepped-wedge study design, the strategies were implemented in various hospital departments escalating from the medical ward, supported by a structure change on how the handrub was provided, and advanced to the operating theatre, the intensive care unit, and a cutaneous leishmaniasis treatment center. The actual implementation of strategies, daily refill and provision of handrub as well as feedback provision was supervised. Thereafter, a first follow-up assessment was performed 2 months after the full implementation of the intervention in all participating departments. A second follow-up with the same method was then performed after a total of 6 months since the intervention was fully set up in the last department, including as well a qualitative study part of selected interviews among HCWs in the last participating department. A structured observational checklist was used to record HH opportunities and indications following the WHO “my five moments for hand hygiene” model. An exclusive surveillance of compliance was implemented at baseline, first, and second follow-up assessments

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**Methods**

A prospective study evaluated hand hygiene compliance among healthcare workers (HCW) in a 19-bed medical ICU and identified factors influencing this compliance. HCWs were observed before and after a multimodal intervention, and self-report questionnaires were distributed to capture factors that discourage adherence to hand hygiene. A multifaceted strategy designed to increase adherence to hospital policy and create monitoring apparatuses for unit-based quality control. Data were collected over six months, totaling about 700 hours of observation with 854 hand washing opportunities noted, 215 of which were essential for accurate compliance assessment. Ranging from 40 to 50 healthcare workers (HCWs) were utilized per shift within the ICUs, which were staffed by trained physicians and nurses who helped care for six to eight patients. Every week we observed.

**Conclusion**

The intervention drove HH compliance considerably. HH of HCW is a key measure to prevent healthcare-associated infections. Hand hygiene (HH) implement -- or perhaps even forego -- by doctors and other healthcare workers (HCW) is one of the principal preventative measures for healthcare-associated infections, foremost among which, perhaps, are those associated with invasive procedures. In low- and middle-income countries, household compliance is low. We use a mixed methods approach to assess what change the Pan African Sanitation (PASQUALE) program has made. PASQUALE is a complex multimodal HH intervention developed by the Institute of Tropical Medicine, Antwerp. PASQUALE was implemented in a hospital in Faranah, Guinea. PASQUALE implementation was evaluated in a time series with a baseline/basic follow-up design, using a before-after analysis. The process evaluation was conducted by the identification of facilitators and barriers to HH improvement, using a theory-based qualitative methodology comprised of focus group discussions and in-depth interviews. HH compliance was assessed by direct observation. After the intervention, healthcare workers (HCWs) were significantly more likely to wash their hands. Since SickKids initially launched its hand hygiene program, overall hand hygiene compliance has significantly improved. Hand hygiene compliance among health care workers in the ICU is poor; however, intervention strategies can be useful in improving the compliance rates significantly. Six years after the introduction of the WHO hand hygiene strategy compliance was still very limited, however significantly improved after a multimodal awareness improvement strategy was introduced. The likelihood of HH at 8 selected wards in Faranah was measured initially and again after 6 and 12 months. In 63 HH opportunities were caught at each point of measurement and 209 of these were again 6 and 12 months later examined. HH compliance was 19.9% at baseline. Compliance improved to 25% in the first follow-up. After the second follow-up compliance was 45.1% (

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### 1.1. Background and Significance

Hand hygiene remains the most important and neglected aspect of infection control. Infections acquired by patients during hospitalization are a major cause of morbidity and mortality and are associated with an increased cost for the healthcare system. Health-care workers (HCWs) hands are important sources of transmission of bacteria and thus play a central role in the cross-transmission of nosocomial pathogens, according to the epidemiological chain of transmission of infections. Compliance with hand hygiene guidelines is the most effective measure for the prevention of nosocomial infections. Despite the evidence that hand hygiene reduces the spread of infections and increases patient health, the compliance of health professionals with adequate hand hygiene measures remains in general disappointingly low (S. Mathai et al., 2011). Since 2005, the World Health Organization (WHO) has implemented the campaign "Clean Care is Safer Care", which emphasizes the critical importance of demonstrating ongoing commitment and promotion of hand hygiene in health care by providing evidence and tools necessary to engage the commitment and participation of the different stakeholders. According to the WHO guidelines concerning Hand Hygiene in Hospitals – Global Patient Safety Challenge 2005-2006, compliance of hand hygiene may be improved implementing multimodal/ multifaceted strategies. However its efficacy is proved by a few and recent studies.

## 2. Importance of Hand Hygiene in Healthcare Settings

Hand hygiene is considered the most effective way to prevent transmission of infectious microorganisms in healthcare settings. Despite powerful evidence of its effectiveness and the publication of guidelines for medical practice in various countries around the world, it remains to be implemented in many healthcare facilities. Hand hygiene compliance by healthcare workers in medical and surgical wards was found to be suboptimal. Hand sanitizer use was lower than use of soap and water, compliance with personal hygiene was lower than other indications for hand hygiene and gloves after washing hands with antimicrobial. It was concluded that healthcare workers need more education about proper hand hygiene technique (Alex Yazaji, 2011). All different sizes and shapes of windows are used for the observation of frequency interreception of hand hygiene in 12 ICUs. Observation is generally a poorly-perceived method particularly when used for assessing a behaviour such as hand hygiene. However, it is widely accepted in the hospital setting that hand hygiene compliance can be effectively measured by direct observation. Unit level consumption of soap and handrub to calculate the number of hand hygiene sessions and the compliance rates of the ICUs. Aggregate consumption data have also been viewed as an alternative method for the measurement of compliance to hand hygiene (S. Mathai et al., 2011).

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### 2.1. Role in Infection Prevention and Control

Hand hygiene is the single most important infection control measure. Many infections are spread by direct contact, and washing hands can prevent transmission of different organisms. The 5 moments for hand hygiene refer to the occasions where hand hygiene is performed by healthcare workers. There are five indications for hand hygiene based on the observed actions performed by the healthcare worker. Infections, such as nosocomial infections, HAI, and hospital-associated infections, were more prevalent before hand hygiene was established as an important preventative measure (S. Mathai et al., 2011).

Hand hygiene compliance among healthcare workers (HCWs) is frequently suboptimal despite well-publicized guidelines, significant publicity, and educational efforts. Infection Control and Isolation Committees (both at the hospital level and the Department of Nursing level) have made consistent efforts to increase HCW compliance with hand hygiene. Perhaps the first step would be to ensure that current guidelines on hand hygiene are being followed. Not uncommonly, HCWs may practice hand hygiene based on personal preferences, misconceptions, and health beliefs, believing that their approach is correct despite instructions. Such noncompliance may occur at all levels of medical service (attending physicians, residents, and medical students), involve different categories of HCWs (physicians, nurses, nursing assistants, respiratory therapists, physical therapists, etc), and relate to various service settings (inpatient and outpatient) (Alex Yazaji, 2011).

## 3. Current Challenges in Hand Hygiene Compliance

Background: Hand hygiene compliance is critical in reducing rates of nosocomial infections. Even though health care workers consider it appropriate, their compliance varies. The aim of this study is to evaluate the hand hygiene compliance of health care workers and to improve compliance through simple interventions. Material and Methods: The study was conducted in a 900 bed tertiary care hospital. An average of 1500 hand hygiene opportunities arise each month. Using a standardized collection form, the observers collected the infractions. Eight months of results were given to the management and asked to take measures to improve compliance. The next 8 months were collected and the obtained results were evaluated. Descriptive statistics were generated. The compliance rates of hand hygiene were given as ratios. The distribution of the compliance rates of the health care workers according to the profession was analyzed. Results: After the necessary measures were taken and the feedback was given, the rate of compliance with hand hygiene increased. The health workers had uncompliant 44% in the first eight months; but when the necessary feedback and precautionary measures were taken, this rate decreased to 11% in the second eight-month period. The participation of nursing students at the beginning of education in in-service training had a significant effect. Compliance rates were determined as 18.9%, 19.4% and 21.1% for twelve subsequent months. It was observed that nurses had the highest rate of

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compliance with hand hygiene and that the compliance of the housekeeping staff was insufficient. Compliance before patient contact was the lowest of all and compliance after contacting with the patient was better than compliance before contacting with the patient. Conclusion: By measuring compliance with hand hygiene and providing feedback in a timely manner, the necessary measures can be taken and it consistently increases over time. Compliance with hand hygiene can be further improved by training all health care workers periodically. Each month's compliance rates should be calculated and compared accurately and measures should be taken. Compliance rates were reported and staff members received their feedback. Compliance rates were reported by nursing units and professions. Health care workers who showed low compliance did not touch water as contamination and compliance increased. If hand hygiene is not performed, the patient is reminded. Compliance rates were determined according to professions and training was given at in-service education. Comparisons of compliance rates were made and feedback was provided.

### 3.1. Barriers to Compliance

Hand hygiene compliance of 28 nurses, 5 physicians and 8 nursing assistants (n=41) in an end-stage renal disease center is evaluated. The compliance of nurses, physicians, nursing assistants is 61%, 51.5% and 53%. All compliance indicates no statistically significant difference between the groups. Consequently, hand hygiene compliance of healthcare workers is generally in low levels. Despite the known benefits of hand hygiene to prevent healthcare-associated infections, healthcare workers may neglect in hand hygiene practices. It seems that hand hygiene compliance of healthcare workers rises a prospective area for improvement by implicating multimodal interventions targeted to all barriers. Hand hygiene is the single most important measure for preventing healthcare-associated infections. Many studies have shown that improving hand hygiene practices of healthcare workers to remove bacteria can significantly decrease healthcare-associated infections. However, the compliance of healthcare workers to hand hygiene generally falls below the desired levels. Barriers to compliance for hand hygiene are divided into several groups such as knowledge, attitude, perception of risk, beliefs of healthcare workers, patient safety climate, technique, social and institutional barriers. Some of those barriers are simply about knowledge or technique. On the other hand, there are still some controversies as to whether healthcare workers follow guidelines and some of them may perceive that glove usage alone provides adequate protection, thereby undermining the importance of hand hygiene. Moreover, we introduced a multimodal strategy to enhance the sustainability of hand hygiene improvements. A few items focus on certain areas that healthcare workers have not been accustomed to, like setting up Glop boxes, stickers, and monitoring and reporting on hand hygiene performance by infection control professionals. In light of these findings and reports, it is vital that healthcare workers' compliance with hand hygiene be increased through effective and sustainable interventions to reduce healthcare-associated infections, mortality, and morbidity.

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## 4. Strategies for Improving Hand Hygiene Compliance

The washing of hands by healthcare professionals is the main measure to prevent hospital-acquired infections. Yet adherence to the directive remains lackluster. Strategies have been put forth to better the efficiency of hand hygiene, published. Patient-to-patient transmission remains a desideratum for more research with either observation or consumption data being taken into account for evaluation of compliance. Practice must still include usage of protective gloves. Opportunities for hand hygiene may occur in immediate proximity to patients when gloves are worn. A goal of further studies should be observation practices of healthcare workers wearing gloves, thus observing whether the recommended procedure for glove use is followed. Although glove usage may lead to a decrease in hand hygiene compliance by some workers, other workers are aware of their hands being contaminated by the patient environment, and they use hand hygiene in addition to gloves. Studies on these interactions are sparse and require in-depth research. Observations are cited several times as sources of estimates of compliance with hand hygiene, which is the principal intervention for prevention of nosocomial infection. Causes of infection due to different potential sources are dissected, and quantitative estimates are derived focusing among others on the input and output of hand pathogens, and contacts on different objects. Nursing staff had the highest probability to perform hand hygiene after contacts considered a potential source of infection, while same-task contacts decreased hand hygiene compliance among physicians. There is evidence that the crowd can be infected from a single source. Scenarios in outpatients' public areas, mass transport, and bars are analytically covered. It is concluded that even activities of a single infected individual can generate multiple infections, although the size and the length of the resulting infection chain are limited.

### 4.1. Education and Training Programs

Health education, training sessions, and on-going training have been shown to yield an immediate impact, as do control measures, including classes on how to handrub, meetings, papers, videos, posters, support by the management, and access to pocket-alcohol. An after-online study found that rates increased in three of five interventions tested, but the overall decline identified as the Hawthorne Effect was 69%, or worse than at baseline. The local results showed a similar degree of decline (Martos Cabrera et al., 2019). In another study, since 2007, the Community Health Unit has implemented an islandwide strategy to tackle infection. Among 23 public clinics, a rotating audit is conducted, with the audited clinics scored their results on the notice board, and bi-monthly performance is mailed to all clinics as a scorecard. After receiving advice, a clinic will have exactly one month to improve its scores. In parallel, local staff are trained to function as auditing nurses under the supervision of nurses from the cluster. They audit the clinic's medical and nursing staff, document the findings at the audited clinics, generate a full report, and report their findings back to the attendances via the Health Monthly Meeting. Hand hygiene rates were found to have

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improved 70% from 2007 to 2010. On this, attending to the clinics and the clinic staff, and proactive smart auditing practices (including correcting serious violations on the spot) had been proven to be an effective hand hygiene auditing strategy.

Particularly since the advent of hand watches, every worthy healthcare worker at launch and suspension was reminded to survey the swine of hang hygiene. Since launch, there has been additional emphasis on teaching and reminders. A training seminar was conducted involving midwives. For doctors and OCDAs concerned with the care of the baby, Demonstration of the right technique in the film and face to face was the highest among 3 commonly used methods. The AOR for training units to show rubs compared to no demonstration was in bivariate testing of which memorandum, the most favorable combination of teaching media was independently associated with significant increases. Nurses were asked what would be their most effective single intervention in good practice in recent student training. The most common response was the need for frequent re-fixation. Concerns about hand rubbing techniques and ABHR's compatibility with gloves are some of the previously non-addressed issues that have been widely received during seminar question and answer sessions with healthcare workers. Beyond CP, the lasting effect of training can largely depend on the supporting environment and system. Over time, base solutions have been shifted closer to the work area, and pumps have been added to some areas where no liquid-based solutions were available before. Compliance has been more strictly enforced, especially with respect to doctors, predominantly through the routine use of gargles during the teething examination.

### 4.2. Use of Technology and Monitoring Systems

Every healthcare setting has to deal with healthcare-associated infections that are common and can potentially be prevented. Proper hygiene in regards to the hands is the best way to avoid microbial transmission and decrease the risk of nosocomial infections. Previous research shows that healthcare workers' hand hygiene compliance rates are suboptimal, and monitoring hand hygiene compliance rates has been shown to be a potential means of ameliorating adherence. So, a review was performed to explore potential hinderances to achieving elevated adherence, and solutions to overcome these barriers and enhance adherence were proposed.

The implementation of new technologies was a useful method applied by higher-performing organisations to improve hand hygiene compliance rates. An extensive review is included of the various technologies available to improve hand hygiene compliance. These technologies include alcohol sensor technology to monitor the quantity of soap used and emitting a flashing light and noise reminder; electronically monitoring hand hygiene compliance with the implementation of a real-time monitoring system, accompanying an improvement in hand hygiene attitudes among personnel; a wrist-worn device emitting a reminder noise when

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tagged sanitizer is not activated after a patient encounter; the use of an automated system and real-time feedback given via healthcare workers' existing wireless phones; an electronic device emitting a noise prompt encouraging sanitizer use, in-use capability disablement, and the qualitative use of sanitizer consumption; an electronic intervention with infra-red scannable badges and wall-mounted detectors; and either direct observation in addition to the badge, or an audit system with sensor-equipped sanitizer dispensers and badges emitting alarms when they do not correspond with a hand hygiene event.

### 4.3. Creating a Culture of Safety

Introduction. Healthcare-associated infections (HAIs), which are primarily caused by cross-transmission of pathogenic organisms, represent an increasing risk to patients admitted to hospitals. The hands of healthcare workers (HCWs) are a reservoir for infectious agents in the healthcare environment and are capable of direct transmission of pathogens from patient to patient or patient to HCW. Implementing prevention strategies that limit the acquisition and subsequent spread of infectious agents by HCWs is an important measure for reducing the incidence of HAIs. Hand hygiene is the most crucial measure to prevent the spread of microorganisms in the healthcare environment (Matthew Linam et al., 2017). The hands of HCWs can conveniently and frequently be contaminated. HCWs' hands thus present a critical vector for pathogens that can cause HAIs. Regular hand hygiene practices can prevent these cross-transmissions. Consequently, it is widely acknowledged that ensuring hand hygiene compliance among HCWs in health-care settings plays a critical role in reducing HAIs. Permanent behavioral changes are most likely to be achieved by creating an institutionalized culture of safety. To this end, compliance with hand hygiene practice as a surrogate marker for safety culture has been strongly emphasized by regulatory agencies and other stakeholders. A number of studies have attempted to identify factors affecting hand hygiene compliance and have suggested strategies to increase hand hygiene compliance. In recent years, these strategies have been organized in a systematic way to help the implementation of infection control programs. A hand hygiene promotion program was developed based on these strategies. Its objective was to evaluate the effectiveness of these strategies in facilitating HCWs' hand hygiene compliance.

## 5. Conclusion

A multimodal educational intervention using WHO guidelines, a Hand-in-Scan monitoring system, and a real-time drying method was implemented to determine its impact on hand hygiene and hand drying compliance among healthcare workers (A. Mahfouz et al., 2014). The intervention included workshops and educational leaflets in accordance with WHO guidelines for the benefit of clinicians and allied health professionals over a period of six weeks. Observations and assessments of hand cleanliness were performed using Hand-in-Scan technology. Hand drying was categorized into 'sufficient', 'insufficient', and 'no

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drying' based on a real-time assessment of physician's hands after the gel application using a non-contact hand drying assessment method.

The results of the hand hygiene compliance showed a significant improvement in the rate of hand hygiene adherence among healthcare workers (51.2% in the intervention arm vs. 40.7% in the control arm) ($P < 0.001$) with an overall adjusted odds ratio (AOR=1.4) compared with the control arm. The results also demonstrated a significant improvement in hand drying compliance (59.7% in the intervention arm vs. 7.2% in the control arm) ($P < 0.001$) and cleaning score ($P < 0.001$) after the educational intervention program was launched. In order to enhance the hospital's hand hygiene environment, targeted interventions, such as educational and continuous evaluation programs as well as hand drying score, should be implemented within hospitals, in addition to providing sufficient resources and facilities to enhance the hand hygiene compliance rates.

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