

Practice and compliance of essential handwashing among healthcare workers at a regional referral hospital in Uganda: A quality improvement and evidence-based practice

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ABSTRACT

Introduction: Hospital acquired infections (HAI) are a global public health problem. Improper hand hygiene (HH) practices serve as means of infection transmission in hospital wards and proper HH is the single most important means of reducing HAI. The WHO recommends five moments of HH, creating the pillars for effective HH.

Objectives: To assess the availability and suitability of essential hand washing facilities, assess essential hand washing practice and compliance among healthcare workers (HCWs) on surgical and medical ED, ICU, medical and surgical general wards.

Methods: A descriptive cross-sectional design was employed. HCWs providing care to patients admitted on the selected wards were recruited. Data were collected by trained research assistants (RAs) from participants who fulfilled the eligibility criteria using a checklist for HH facilities and HH observation checklist. Data were analysed using SPSS.

Results: Most of the wards had inadequate HH resources. The sink to bed ratio ranged from 1:1 to 1:33. HH resources were not always available. A total of 287 HH opportunities were observed from the five wards. The overall HH compliance before and after patient contact were 25.4% and 33.8% respectively. ANOVA showed ICU had significantly higher rates of HH than surgical ward before and after patient contact. HCWs in ICU and surgical emergency were 4.86 and 3.12 times respectively more likely to perform HH as compared to medical ward. No significant difference in HH compliance among professional categories before or after patient contact was detected.

Recommendations: The low rates of HH compliance reflect the need to put more emphasis on HH for improvement in the healthcare setting.

KEY WORDS:

Essential handwashing, practice, compliance, healthcare workers.

INTRODUCTION

Hand hygiene (HH) is a cornerstone in the prevention of hospital acquired infection (HAI) (Gordis, 2014). It has been noted that at least 25% of all infections of hospitalised patients in the developing world are health care associated (Sax et al, 2009). Studies have shown that HH compliance rates in developed and developing countries rarely exceeded 50% (Mani, Shubangi, & Saini, 2010; Maxfield & Dull, 2011). The World Health Organisation (WHO, 2006) recommends five moments of HH during health care delivery as essential for safe patient care.

HH is instrumental in the management of critically ill patients in intensive care units (ICU) and high dependence areas in clinical care settings. Frequent interaction between the critically ill patients and healthcare workers facilitates transmission of microbes from the healthcare workers (HCWs) to the patients and vice versa. Qushmaq et al. (2008) affirmed

that critically ill patients were highly susceptible to nosocomial infections due to their compromised immune status and the multiple invasive lines in place. Improper HH practices serve as means of infection transmission in hospital wards (Duckro et al., 2005; Riggs et al., 2007) and proper HH is an important means of reducing nosocomial infections in hospitals.

Studies conducted in developing countries show that the adherence rates to HH among HCWs are still low. A recent study conducted in two ophthalmic units in Uganda revealed that 79% of the HH opportunities were missed in hospital A as compared to 82% missed in hospital B (Mearkle et al., 2016). Most of the studies focusing on how HH is practiced had been done in developed countries, yet the impact of HAI is greater in developing countries. Reports of HAI prevalence are high at Mbarara Regional Referral Hospital (MRRH). Despite the devastating outcomes of HAI, it has been

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TABLE 1: Hand hygiene facilities available

Ward	Sink to bed ratio	Proportion of availability of hand hygiene resources /%			
		Water	Soap	Gloves	Alcohol gel
Surgical emergency	1:7	95	75	85	70
Medical emergency	1:11	95	70	80	60
ICU	1:1	100	85	100	100
Medical ward	1:20	75	50	70	45
Surgical ward	1:33	87.5	60	70	50

observed that HH practices among HCWs do not correspond with the recommended WHO HH guidelines. This study sought to assess the availability and suitability of HH facilities in medical and surgical emergency, ICU and medical and surgical general wards, and HCWs' practice and compliance with WHO recommended HH protocols at MRRH.

METHODOLOGY

The study was conducted at Mbarara Regional Referral Hospital in southwestern Uganda. The study was conducted in the five units that specifically treat critically ill patients: medical and surgical emergency (ED), ICU, and surgical and medical general wards.

The study employed a cross sectional design and involved HCWs who were providing care to patients admitted in the selected units.

Sample size was calculated using the a priori power analysis (Buchner et al., 2009). An a priori power analysis determined sample of 247 observations were required for logistic regression model to detect an odds ratio of 1.7 with $\alpha = 0.05$, actual power of 0.95 and a prevalence of the outcome 50%.

On each observational visit, two target patients were randomly selected using simple random numbers and all healthcare workers' contacts with the selected patients were observed until the required sample size was reached. In an attempt to minimise the limitation of HCWs altering their HH behaviour as a result of being observed, the research assistants made regular visits to the wards for two months prior to data collection to allow the HCWs to become familiar to their presence. The HCWs were blinded to the study objectives and observations were concealed. The staffs were only informed that there was a quality improvement and evidence based study going on and that they would be watched as they perform some procedures, but the exact procedure under observation remained concealed.

Observations were conducted using the WHO patient safety observation form to document HCWs hand hygiene practices.

Four research assistants (RA) were trained to assist in data collection. Three of these were postgraduate health care students who assisted in collecting observation data. The RAs collected data from the wards they were not working on to avoid interruption with ward work. The fourth was

a nursing officer and was engaged in collecting data using the questionnaire. All the four RAs were supervised by the principal investigator. Observation data were collected in March and April 2017 over a period of six weeks including the weekends; covering all the shifts; morning, evening and night shifts, each lasting eight hours, in all the five sites of the study.

An inter-observer reliability study was undertaken to record concordance on clinician type, use of gloves, use of soap, use of alcohol-based hand gels and essential handwashing practice. The inter-observer reliability for all data items was excellent, with an average K of 0.95 (range 0.84–1.0). To ensure quality of data, standardized checklists were used. The collected data were checked for the completeness, accuracy, and clarity by

TABLE 2: Demographic characteristics of observation data (N = 287)

Demographic characteristic	n(%)
Time of observation	
Day	166(57.8)
Evening	62(21.6)
Night	59(20.6)
Professional category observed	
Nurse	117(40.8)
Physician	111(38.7)
Others [†]	59(20.5)
Gender of HCW observed	
Male	143(49.8)
Female	144(50.8)
Ward	
Surgical emergency	63(22.0)
Medical emergency	45(15.7)
ICU	86(30.0)
Surgical ward	49(17.1)
Medical ward	44(15.2)

Others[†] including physiotherapists, medical clinical officers and orthopaedic officers

TABLE 3: Practice of essential hand washing actions taken

Hand Hygiene action taken	n(%)
Rinsing with water only	40(13.9)
Hand washing with soap and water	20(7.0)
Using alcohol based hand gel	55(19.2)
No HH action taken	172(59.9)
Donning gloves	
No gloves	119(41.5)
Same pair of gloves for more than one patient	46(16.0)
New pair of gloves	122(42.5)

the investigator. Appropriate measures were taken for ensuring completeness before data entry. Data cleanup and cross-checking were done before analysis.

STUDY FINDINGS

The five wards were surveyed for the availability of HH facilities including all examination rooms. HH facilities in changing rooms, tutorial rooms, store rooms and other rooms were not surveyed because these were considered inaccessible during provision of patient care. The available HH facilities are shown in Table 1. In this study availability of alcohol gel means that there was an alcohol dispenser at the nurses' station or the HCWs carried their own alcohol-based hand gel.

DEMOGRAPHIC CHARACTERISTICS OF OBSERVATION DATA

A total of 287 HH opportunities were observed from the five wards. Thirty percent of the HH opportunities were from the ICU given the nature of patients admitted there and the frequent contacts between HCWs and patients. Nurses had the most HH opportunities observed ($n = 117$, 40%). The gender of the HCWs for each opportunity observed were divided nearly evenly (females, $n = 144$, 50.8%; males, $n = 143$, 49.8%). Most of the observation ($n = 166$, 57.8%), occurred during the day, as shown in Table 2.

HAND HYGIENE COMPLIANCE

Hand hygiene compliance according to the ward/unit

Chi square test was used to determine if there were differences in the rates of compliance of HH on the different wards studied both before and after patient contact and the results are shown in Table 4.

The results show that there is a statistically significant difference in HH compliance between the wards before patient contact ($\chi^2(4) = 18.54$, $p < .001$, $\eta^2 = .15$) and after patient contact ($\chi^2(4) = 13.63$, $p = .009$, $\eta^2 = .08$). Fifteen percent (15%) and 8% of the variability in HH compliance before and after patient contact respectively can be explained by the ward. Post hoc tests using one-way ANOVA showed statistically significantly higher rates of HH in the ICU than observations from medical ward before patient contact (mean difference 0.282 (95% CI .07-.05) $p = .003$) and after patient contact (mean difference .302 (95% CI .07-.54) $p = .003$). HCWs in ICU were more likely to perform HH than those on medical ward.

ASSESSING VARIATIONS IN ESSENTIAL HAND WASHING PRACTICE

To assess the likelihood to perform HH before patient conduct, we conducted a logistic regression analysis using ward and professional category as the predictor variables and HH

TABLE 4: Proportion of HH moments performed before and after patient (N = 287)

Ward	Hand hygiene moments performed before patient contact %	Hand hygiene moments performed after patient contact %
Surgical emergency	28.6	31.7
Medical emergency	26.7	28.9
ICU	38.4	46.5
Medical ward	10.2	16.3
Surgical ward	11.4	36.4
Overall undifferentiated rate of Hand hygiene	25.4	33.8
Chi square value	$\chi^2(4) = 18.54$, $p = .001$, $\eta^2 = .15$	$\chi^2(4) = 13.63$, $p = .009$, $\eta^2 = .08$

TABLE 5: Variation in hand hygiene practice among wards and professional categories in comparison to the medical ward

	Odds ratio	95% CI	p value
Ward			
Surgical emergency	3.12	1.06 – 9.18	0.039
Medical emergency	2.84	0.91 – 8.88	0.073
ICU	4.86	1.74 – 13.57	0.003
Surgical ward	0.89	0.24 – 3.29	0.857
Professional category			
Nurses	0.78	0.38 – 1.57	0.484
Physicians	0.83	0.41 – 1.69	0.614

before patient contact as the outcome variable. The results are displayed in Table 5.

The results from the above table show that HCWs in ICU were 4.86 times (95% CI = 1.74 – 13.57, $p = 0.003$) more likely to perform HH as compared to those on medical ward. HCWs on surgical emergency were 3.12 times (95% CI = 1.06 – 9.18, $p = 0.039$) more likely to perform HH before patient contact compared to those on medical ward. There was no statistically significant difference in the likelihood to perform HH before patient contact on medical emergency and medical ward ($p = 0.073$) and surgical ward ($p = 0.857$) as compared to medical ward.

HEALTH CARE WORKERS' COMPLIANCE TO ESSENTIAL HAND WASHING

Chi square test analysis indicated no statistically significant difference in compliance to essential hand washing among the different professional categories before ($\chi^2 (2) = .50, p = .78$) and after patient contact ($\chi^2 (2) = 1.34, p = .5$) respectively. See Table 5.

DISCUSSION

The current study found great variability of the sink to bed ratio ranging from 1:1 to 1:33. The sink to bed ratio reflects availability and accessibility of the sinks and therefore affects hand washing practice during provision of health care. Inaccessible sinks therefore impede hand washing by HCWs. This is consistent with the findings of Devnani et al. (2010) who reported that inadequate number or inaccessible sinks as well as inconveniently placed sinks is a major barrier to

effective handwashing. Whereas Vernon et al. (2003) reported that accessibility to the sink greatly improves hand washing compliance, Whitby and McLaws (2004) asserts that sink accessibility does not improve compliance. Although Squires et al. (2014) noted that a sink to bed ratio of not more than 1:4 is considered adequate in enhancing hand washing practice in between patients, the findings of this study maybe taken to be appropriate in the low resource settings such as MRRH given the resource limitations encountered in health care settings.

ESSENTIAL HANDWASHING PRACTICE AND COMPLIANCE

From the study findings, more observations of HH opportunities were from the ICU. This larger proportion was expected given the nature of patients admitted there and the frequent contacts between HCWs and patients.

Noteworthy, most observations (40.8%) were from nurses interacting with the patients, 38.7% were from physician interactions, and the remaining 20.5% occurred when other categories of health care providers including medical clinical officers, physiotherapists and orthopaedic officers provided direct patient care. The longer and more intense direct contact that nurses have as compared to other health care providers illustrate the nurses' critical need to comply with HH protocols. This is consistent with Chavali, Menon, and Shukla (2014) who noted that nurses had the highest number of contacts (75.4%), followed by allied healthcare workers (24.5%).

The majority of the observations were conducted during the day given the fact that majority of the health worker patient contacts are seen during the day in major ward rounds and other procedures. From the study findings some HH

TABLE 5: Health care workers' Compliance to hand hygiene

Professional category	Compliance to hand hygiene before patient contact/%	Compliance to hand hygiene after patient contact/%
Nurses	23.9	31.6
Physician	25.2	37.8
Others	23.3	30.5
Chi square value	$\chi^2(2) = .50, p = .78$	$\chi^2(2) = 1.34, p = .5$

moments did not meet WHO definition of HH (WHO, 2006) and therefore such opportunities were considered as missed opportunities, implying that 73.8% of the HH moments were missed opportunities. This could be attributed to the fact that the sinks bed ratio in most of the wards was inadequate on medical and surgical general wards respectively. The findings of this study concur with Mearkle et al. (2016) who noted that 79% and 82% of the HH opportunities were missed in two hospitals A and B respectively in their recent study conducted in two ophthalmic units in Uganda. This is consistent with studies that have revealed that the prevalence of HAI in resource limited settings are proportionately high as a result of infection prevention practices that are non-compliant with recognised standards set by the WHO (Werne & Dieckhaus, 2015). Similarly, Devnani et al. (2010) findings support the notion that insufficient or inconsistently positioned sinks, shortage of water and soap, and unavailability of hand towels reportedly hindered effective hand washing practice.

The largest proportion of the HH moments observed were performed using a new pair of gloves, 41.5% of the HH opportunities were performed with no gloves while 16% were performed with a pair of glove previously used on at least one other patient. The overall HH compliance was 25.4% before patient contact and 33.8% after patient contact. This is consistent with other studies that have shown that HH compliance rates even in developed countries rarely exceeded 50% (Mani, Shubangi, & Saini, 2010; Maxfield & Dull, 2011; Ott & French, 2009) with 50% in USA, 42% in Switzerland, and 32% in UK (Takahashi & Turale, 2010). Omuemu et al. (2013) noted that majority of the respondents washed hands after patient contact due to a significant perceived threat that missing the HH would increase their risk of contracting disease from the patients. This is further affirmed by the fact that the same pair of gloves would be used on more than one patient as seen in 41.5% of the HH moments observed.

HCWs from ICU were statistically more likely to perform HH than HCWs from surgical ward before patient contact. This may possibly be due to the staffing levels in these units and the motivation herein coupled with the influence of the greater sink to bed ratio in ICU of 1:1 as compared to 1:33 sink to bed ratio observed on surgical ward. Also, the other HH resources such as soap, water, gloves and alcohol gel were readily and always available in ICU as opposed to surgical ward.

This study found that there was no statistically significant difference in essential hand washing compliance between physicians and nurses. This is in agreement with the findings of Dredi et al. (2016) who reported that nurses and doctors were the same as far as HH practice and compliance were concerned. However, Hosseinialhashemi et al. (2015) reported that doctors showed a significantly higher rate of HH compliance than other groups of HCWs. Also, studies found 60.9% of the nurses compared to 33.3% of the residents used some form of HH after contact with patients or patient environments and the difference between the two groups was significant [$p = 0.04$] (Qushmaq et al., 2008). It was further affirmed that HH compliance is higher among the nurses compared to the physicians and

other health workers (Akyol, 2007). The failure to realise the difference in HH compliance between nurses and physicians could be attributed to the fact that the hospital does not have a well-established HH culture and there are no HH audits done routinely.

CONCLUSION

Most of the wards had inadequate HH resources and the overall HH compliance was low. Although ICU had the highest rate of HH, it was still quite low despite the resources available.

LIMITATIONS

This study had a number of limitations: hard data collection tools were used especially for collecting observation information and this could have resulted into Hawthorne effect. However, this was minimised by RAs making regular visits to the wards for two months prior to data collection to allow the HCWs become familiar to their presence, the staffs were blinded to the study objectives and observations were concealed.

Non-participant observations were used to assess HH practice. As a result, we were not able to assess practice and compliance of all the five moments of HH. This study only assessed practice and compliance to HH before and after patient contact. There is need therefore to assess practice and compliance of HH regarding the other three moments of HH.

REFERENCES

1. Akyol, A. D. (2007). Hand hygiene among nurses in Turkey: opinions and practices. *Journal of clinical nursing*, 16(3), 431-437.
2. Buchner, A., Erdfelder, E., Faul, F., & Lang, A. (2009). G*power (version 3.1.2)[computer program]. <http://www.psych.uni-duesseldorf.de/aap/projects/gpower/>.
3. Chavali, S., Menon, V., & Shukla, U. (2014). Hand hygiene compliance among healthcare workers in an accredited tertiary care hospital. *Indian journal of critical care medicine: peer-reviewed, official publication of Indian Society of Critical Care Medicine*, 18(10), 689-693.
4. Devnani, M., Kumar, R., Sharma, R. K., & Gupta, A. K. (2010). A survey of hand-washing facilities in the outpatient department of a tertiary care teaching hospital in India. *The Journal of Infection in Developing Countries*, 5(02), 114-118.
5. Dredi, M. t. M., Alrimawi, I., Saifan, A., & Batiha, A.-M. (2016). Hand hygiene knowledge, practices and attitudes among nurses and physicians.
6. Duckro, A. N., Blom, D. W., Lyle, E. A., Weinstein, R. A., & Hayden, M. K. (2005). Transfer of vancomycin-resistant enterococci via health care worker hands. *Archives of internal medicine*, 165(3), 302-307.
7. Gordis, L. (2014). *Epidemiology Epidemiology* (5th edition ed., pp. 1). Philadelphia: Elsevier Saunders.
8. Hosseinialhashemi, M., Kermani, F. S., Palenik, C. J., Pourasghari, H., & Askarian, M. (2015). Knowledge, attitudes, and practices of health care personnel concerning hand hygiene in Shiraz University of Medical Sciences hospitals, 2013-2014. *American journal of infection control*, 43(9), 1009-1011.
9. Mani, A., Shubangi, A., & Saini, R. (2010). Hand hygiene among health care workers. *Indian Journal of Dental Research*, 21(1), 115.
10. Maxfield, D., & Dull, D. (2011). Influencing hand hygiene at spectrum health. *Physician Executive*, May-Jun 2011 37 (3): 30-34; *VitalSmarts, "Spectrum Health Influencer*.
11. Mearkle, R., Houghton, R., Bwonya, D., & Lindfield, R. (2016). Barriers to hand hygiene in ophthalmic outpatients in Uganda: a mixed methods approach. *Journal of ophthalmic inflammation and infection*, 6(1), 1.

12. Omuemu, V. O., Ogboghodo, E. O., Opene, R. A., Oriarewo, P., & Onibere, O. (2013). Hand hygiene practices among doctors in a tertiary health facility in southern Nigeria. *Journal of Medicine in the Tropics*, 15(2), 96.
13. Ott, M., & French, R. (2009). Hand hygiene compliance among health care staff and student nurses in a mental health setting. *Issues in mental health nursing*, 30(11), 702-704.
14. Qushmaq, I. A., Heels-Ansdell, D., Cook, D. J., Loeb, M. B., & Meade, M. O. (2008). Hand hygiene in the intensive care unit: prospective observations of clinical practice. *Pol Arch Med Wewn*, 118(10), 543-547.
15. Riggs, M. M., Sethi, A. K., Zabarsky, T. F., Eckstein, E. C., Jump, R. L., & Donskey, C. J. (2007). Asymptomatic carriers are a potential source for transmission of epidemic and nonepidemic *Clostridium difficile* strains among long-term care facility residents. *Clinical Infectious Diseases*, 45(8), 992-998.
16. Squires, J. E., Linklater, S., Grimshaw, J. M., Graham, I. D., Sullivan, K., Bruce, N., . . . Stockton, K. (2014). Understanding practice: factors that influence physician hand hygiene compliance. *Infection Control & Hospital Epidemiology*, 35(12), 1511-1520.
17. Takahashi, I., & Turale, S. (2010). Evaluation of individual and facility factors that promote hand washing in aged care facilities in Japan. *Nursing & health sciences*, 12(1), 127-134.
18. Vernon, M. O., Trick, W. E., Welbel, S. F., Peterson, B. J., & Weinstein, R. A. (2003). Adherence with hand hygiene: does number of sinks matter? *Infection Control & Hospital Epidemiology*, 24(03), 224-225.
19. Werne, A., & Dieckhaus, K. (2015). Knowledge, attitudes and barriers of infection control among healthcare workers in rural Uganda. *Annals of Global Health*, 81(1), 59.
20. Whitby, M., & McLaws, M.-L. (2004). Handwashing in healthcare workers: accessibility of sink location does not improve compliance. *Journal of Hospital Infection*, 58(4), 247-253.
21. WHO. (2006). WHO guidelines on hand hygiene in health care (advanced draft): global safety challenge 2005-2006: clean care is safer care *WHO guidelines on hand hygiene in health care (advanced draft): global safety challenge 2005-2006: clean care is safer care* (pp. v, 209-v, 209). *