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Hand Hygiene Compliance and Associated Factors among Health Professionals in Wachemo University Hospital, Hossaena, South West Ethiopia

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Abstract:
Background: Hand hygiene (HH) is a compliance of cleansing hands using soap and water or using antiseptic hand rub for removal of transient microorganism from hands. The authors of this study were asses the level of HH compliance, to provide baseline survey data on hand hygiene practices among health professionals in Wachemo university Hospital and to determine the resources available for hand hygiene in all the major clinical service provision centres.
Methods: Facility based cross sectional study design supported by observation was employed to assess the level of Hand hygiene compliance and associated factors. Source population for this study was all health professionals working at N/E/M/M/G Hospital. Quantitative data was collected using a self-administered questionnaire
Results: Overall hand hygiene compliance rate according to WHO "My Five Moments for HH" was 9.2%. The more compliance was observed for after contact with body fluid which is 21.1 % of the health professionals have good hand hygiene compliance, health professional who clean their hand before patient contact was 4.58%, compliance rate after contact with patient surrounding was 9.57%. Compliance rate after patient contact was 10.47%, before aseptic technique 3.79%. General practitioners were more HH compliance than nurses, specialist doctors and laboratory professionals
Conclusion: HH compliance among health professionals in Wachemo University Nigist Eleni hospital was found to be very low. HH training, HH policy, the presence of enough and functional HH sinks and the presence of comfortable place to wash hands were the independent significant predictors for HH compliance.

Keywords: *HH, WHO 5 moments, alcohol based hand rub, health workers*

1. Background

Hand hygiene (HH) is a compliance of cleansing hands using soap and water or using antiseptic hand rub for removal of transient microorganism from hands and in the way of keeping the skin condition. Any action of hand cleaning is referred to as hand hygiene(1).It is an important healthcare issue globally and is a single most cost-effective and practical measure to reduce the incidence of healthcare-associated infection and the spread of antimicrobial resistance across all settings—from advanced health care systems to primary healthcare(2, 3).

Globally, nearly 1.4 million patients are affected by health care-associated infection (HAI) at any one time(4).HAI is defined as an infection occurring in a patient during the process of care in a hospital or health facility, which was not present or was incubating at the time of admission(5). Healthcare-associated infections (HCAIs) have a great impact on morbidity, length of hospital stay, and treatment costs(6).

Hand hygiene is the simplest and effective measure to prevent infections. However, about 50% of health care associated infection occurs due to hand of health care providers (HCPs).Health care workers' hands are the most usual type of vehicle for transmission of health care associated infections. Pathogenic microorganisms can stay for 2-60 minutes on health care workers' hands(7).During patient care unless there is recommended hand hygiene compliance of health care providers kept, hands will be contaminated with microorganism(8).Substantial epidemiologic evidence supports that hand hygiene reduces the transmission of healthcare-associated pathogens and the incidence of health-care associated infections(9).

Annually about hundreds of millions of patients have suffered from health care associated infections (HCAIs) worldwide. The majority happened due to health care providers hands which will cause prolonged hospital stay, high amount of economical cost of patients, unnecessary laboratory investigation, high cost of drugs, and result to serious morbidity and mortality(10).Improper hand hygiene by healthcare workers (HCWs) is responsible for about 40% of nosocomial infections(11). If hands are known to be or suspected of being contaminated, transient flora must be eliminated by washing or disinfecting the hands to render them safe for the next patient contact. Plain soap with water can physically remove a certain level of microbes, but antiseptic agents are necessary to kill microorganisms(12).

Lack of knowledge and lack of recognition of hand hygiene opportunities during patient care are mainly responsible for poor hand hygiene among HCWs. Although many countries have guidelines regarding hand hygiene for healthcare settings, overall compliance among HCWs remains poor(13, 14).

If hands are known to be or suspected of being contaminated, transient flora must be eliminated by washing or disinfecting the hands to render them safe for the next patient contact. Plain soap with water can physically remove a certain level of microbes, but antiseptic agents are necessary to kill microorganism(15).

The WHO "SAVE LIVES: Clean Your Hands" program reinforces the "My 5 Moments for Hand Hygiene" approach as key to protect the patients, HCWs and the health-care environment against the spread of pathogens and thus reduce HAIs. This approach encourages HCWs to clean their hands: before touching a patient, before clean/aseptic procedures, after body fluid exposure/risk, after touching a patient and after touching patient surroundings(16).

CDC guidelines state that hand washing is the single most important procedure to prevent nosocomial infection; studies continue to report unacceptable health-care worker hand-hygiene compliance rates. Efforts to improve hand-hygiene behaviour that have focused on broad based educational and motivational programs have had minimal sustained success(16).

Health care workers' hands are the most usual type of vehicle for transmission of health care associated infections. Pathogenic microorganisms can stay for 2-60 minutes on health care workers' hands. During patient care unless there is recommended hand hygiene compliance of health care providers kept, hands will be contaminated with microorganism(16)

Many nosocomial infection are caused by pathogen transmitted from one patient to another patient by health care workers who did not wash their hands between patients or health care workers who do not practice control measure such as use of glove and hand disinfectant(17)

Nosocomial infection increase the costs of neonatal intensive care , prolong hospitalization by several weeks ,and are responsible for almost 50% of the deaths that occur beyond 2 week of age .Although the epidemiology of neonatal nosocomial infections is complex, both simple and theoretical strategies can reduce hospital acquired infection .Health care workers frequently are implicated in transmission from patient to patient by transient hand carriage(18).

Studies in the literature have repeatedly documented that the importance of hand hygiene is not sufficiently recognized by healthcare workers (HCWs), and compliance with recommended practices is unacceptably low. Average adherence with hand hygiene recommendations is usually estimated to be below 50%(19).

Hand hygiene is considered the most important single and simple procedure for preventing nosocomial infection Failure to practice or perform hand hygiene is a complex problem that may be caused by the number of factors. To change the behaviour to practice hand hygiene is helpful to have some understanding of the factors that influence this behaviour

The objective of this study will be to provide baseline survey data on hand hygiene practices among health professionals in Wachemo university Hospital and to determine the resources available for hand hygiene in all the major clinical service provision centres. The information generated from this study will provide the basis for health educational interventions and technical training of health workers with the aim of significantly improving health workers' compliance with hospital infection prevention standards

2. Methods

The study was conducted at Wachemo University, Nigist Eleni Mohammed Memorial General Hospital. Which is a government owned general Hospital under the S/N/N/P/R/S health bureau with 250 beds which plays a pivotal role in supporting primary secondary and tertiary health service for 2.4 million zonal and the nearby population. Facility based cross sectional study design supported by observation and focus group discussion was employed to assess the level of hand hygiene compliance and associated factors. Source population for this study was all health professionals. Quantitative data was collected using a self-administered questionnaire adapted and reconstructed from different literatures(20).A modified version of the WHO form for hand hygiene direct observation (16) for one hour was used to assess HH compliance among health workers. Observation was conducted weekdays between 8:30 a.m. and 5:00 p.m.Data was entered into Epi data version 3.1 and exported to statistical package for social science SPSS window version 20.0 for analysis. Different tests were used to analyze data including frequencies, means, percentage, Pearson correlation test, ANOVA, and t test, Bivariate (correlation) analyses were used to assess the relationships between independent and dependent variables. Then, multiple linear regression analysis was employed to identify the predictors of hand hygiene compliance and associated factors of health professionals

3. Results

A total of 264 self-administered questionnaires were distributed to hospital health professionals those who have direct contact to patients, of which 214 correctly completed questionnaires were returned, representing 81.06% return rate. Most of the participants were male 146(68. 2%).The mean age of respondents were 27.6 %(CI, 26.94, 28.27). The skill mix of respondents shows 125(58.4%) were nurses, 23(10.7%), 23(10.7%), 22(10.3%), 17(7.9%) were laboratory, midwifery, general practitioners and other health

professionals respectively. Majority of the respondents 99 (46.3%) were bachelor degree, 90(42.1%) were diploma 19 (8.9%) were GP and the rest were postgraduate. Eighty-point four percent of the respondent was not taking hand hygiene or infection prevention training for the past one year.

Variable	Value	N	%
Sex	Male	146	68.2
	Female	68	31.8
Educational level	Diploma	90	42.1
	Bachelor	99	46.3
	GP	19	8.9
	Postgraduate	6	208
Profession	Specialist doctor	4	1.9
	GP	22	10.3
	Nurse all type	125	58.4
	Lab all type	23	10.7
	Midwifery	23	10.7
	Other *	17	7.9
Length of service	0 to 5	175	81.7
	6 to 10	31	14.4
	11 to 15	3	1.4
	>15	5	2.33
Unit of work	OPD	45	21
	Emergency	13	6.1
	Inpatient	74	34.6
	Laboratory	21	9.8
	OR	26	12.1
	OBY GYNY	20	9.3
	Other****	15	7
HH training	Yes	42	19.6
	No	172	80.4

Table 1: Socio demographic characteristics for self-administered questioner in Wachemo University N/E/M/M/G/H
** Other: physiotherapist, Psychiatry ****Other: Eye unit, ART,*

A one-hour observation for each health professionals were performed on different occasions for a total of 224 hours. 224 healthcare workers–patient interactions were observed, resulting in 589 hand-hygiene opportunities. For the observational data collection method, we recorded actions, both hand washing and hand rubbing, according to five indications: before patient contact, before an aseptic task, after risk of exposure to body fluid, after patient contact, and after contact with patient surroundings. The compliance was calculated by dividing the number of positive actions by the number of opportunities. Over all hand hygiene compliance rate according to WHO "My Five Moments for HH" was 9.2%. The more compliance was observed for after contact with body fluid 21.1 % of the health professionals have good hand hygiene compliance, health professional who clean their hand before patient contact was 4.58%, compliance rate after contact with patient surrounding was 9.57%. Compliance rate after patient contact was 10.47%, before aseptic technique 3.79%.

3.1. HH Compliance between Profession

General practitioners were more HH compliance than nurses, specialist doctors and laboratory professionals in cleansing hands before patient contact, after contact with patient surroundings, and after patient contact, and the list were for specialist doctors. After contact with body fluid the more compliance observed for specialist doctors than other professionals. Nurses have relatively good hand hygiene compliance than other health professionals in cleansing hands before aseptic technique.

WHO 5 moments for hand hygiene		before pt contact	%	after contact with body fluid	%	After contact with patient surrounding	%	After patient contact	%	Before aseptic technique	%	Total	% of compliance
Compliance	Yes	5	4,58	15	21.1	9	9.57	11	10.47	3	3.79	43	9.2
	No	104	95.41	56	78.87	94	91.2	94	89.52	76	96.2	424	90.7
	Total	109		71		103		105		79		469	

Table 2: Average HH compliance of all health professionals according to WHO five moments for hand hygiene

	Clean hands before patient contact				After contact with patient surrounding				After patient contact				After contact with body fluid				Before aseptic technique			
Professions	Yes		No		Yes		No		Yes		No		Yes		No		Yes		No	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Specialist doctor	0	0	3	100	0	0	3	100	0	0	3	100	1	33.3	2	66.6	0	0	3	100
General practitioner	2	8.6	21	91.3	3	42.8	4	57.1	5	41.6	7	58.33	2	10.52	17	89.4	2	8.69	21	91.3
Nurse	2	2.4	79	97.5	6	25	18	75	6	7.69	72	92.3	10	21.2	37	78.7	2	2.4	79	97.5
Laboratory	1	50	1	50	0	0	2	100					0	0	2	100				

Table 3: Percentage compliance rate between profession and WHO five moment for HH

3.2. HH Compliance between Departments

Sixteen points six % of the medical ward staffs had good HH compliance, next to OPD 9.2%, but emergency, paediatrics ward and obygyny department staffs had zero compliance rates for HH before patient contact. HH compliance after contact with patient surrounding was fair for emergency department, 31.2% which is greater than the overall HH compliance in this study, but the rest departments had poor HH compliance

Outpatient staffs and medical ward staffs HH compliance after patient contact had greater than the overall hand hygiene compliance percentage in this study, but the rest department were poor HH compliance. HH compliance after contact with body fluid in medical ward and emergency department were near to good HH compliance, but HH compliance in another department was poor. HH compliance before aseptic technique was 0% in all departments.

Running water had available in 73.9 % of the observation, but functionality of the sink was too low (30.6%). In 60.4 % of the area HH posters were posted. From those who had good hand hygiene compliance 26(74.2%), of the health professionals used alcohol based hand rub and the rest were clean their hands by using water and soap.

Glove usage was observed during observation period, 68 (64.76%) of the health professionals use gloves before giving service to patients, but 24.4 % of the health professionals do not change their gloves between patients. 68.5 % of the staff have no personal towel.

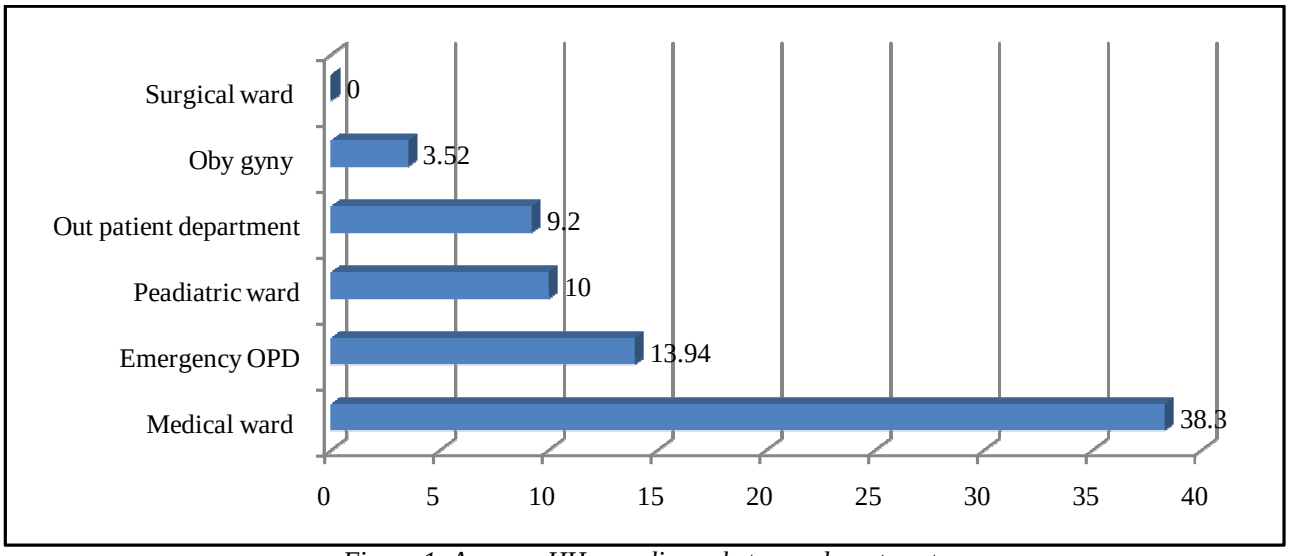

Figure 1: Average HH compliance between departments

The Bivariate correlation analysis of the WHO 5 moment for HH and other factors revealed that, cleaning hands before patient contact had significantly positively associated with the presence of pocket size bottle for HH, taking of HH training and length of service at P= 0.005, 0.05and 0.05, r=0.19, 0.14, 0.13 respectively positively and negatively associated with the presence of sink and the presence of comfortable place for hand hygiene at P= 0.05, r= 0.14 and 0.15 respectively.

Cleaning hands after body fluid contact had significantly positively associated with the presence of hand hygiene representative, the presence of training and the presence of pocket size bottle for HH at P=0.05, r= 0.142, 0.142, 0.145 respectively and negatively associated with length of service at P=0.005, r=0.26. Washing hands before aseptic technique was significantly associated with the presence of individual towel at P=2.25, r= 0.005, the taking of training, the presence of hand hygiene lotion, comfortable place for HH and enough hand hygiene sinks at P= 0.05 r= 0.14, 0.17,0.16, 0.17, and negatively to length of service at P= 0.05, r= 0.14.

Multiple linear regression analysis was conducted to test the effects of the independent variables on the dependent variable. HH training, the presence of enough HH sinks, the presence of HH policy, how often HH sinks empty were significant predictor variables of cleaning hands before patient contact at P= 0.000,0.05,0.05,0.05 level.
Beta coefficients represent contributory weights in predicting HH compliance before patient contact. A unit change increase or decrease in HH training, the presence of HH policy and the frequency of HH sinks empty, increase or decrease HH compliance before patient contact an average of 1.17 unit (95% CI:0.57,1.77), .58 unit (95% CI: -.01,1.1), and .20 unit (95% CI:.04,0.36), respectively. A unit change in the perception of the presence of enough HH sinks had lowered HH compliance before patient contact by 1.15 units (*B* -1.15 and 95 % CI: -2.22, -0.75)

	Unstandardized Coefficients		**Standardized Coefficients**	**Sig.**	**95.0% CI for B**	
	B	Std. Error	Beta		Lower Bound	Upper Bound
(Constant)	-.099	.969		.919	-2.038	1.841
Have you taken hand hygiene training	1.177	.301	.451	.000***	.575	1.778
Do you think enough hand hygiene sinks	-1.152	.538	-.261	.036*	-2.228	-.075
Is there HH policy	.582	.300	.220	.050*	-.019	1.183
How often HH sinks empty	.202	.081	.342	.015*	.040	.363

Table 4: Multiple linear regression analysis result of HH compliance of health professional before patient contact at Wachemo University Nigist Eleni hospital south west Ethiopia 2017

-significant at p<0.05, *-significant at p<0.001*
NB: negative values of standard β indicate negative predictors of HH compliance before patient contact and positive values indicate positive predictors of HH compliance before patient contact

The significant predictors of HH compliance as demonstrated by the cleaning of hands after touching patient surrounding were, are HH sinks in the entrance area to patient room (P<0.01), Do you wash your hands when you are in hospital, are there hand hygiene sinks in the toilet, is there comfortable place to wash your hand in soap and water (p<0.05) were significant predictors of HH compliance after touching patient surrounding.
A unit change in the presence of HH sinks in the entrance area to patient room, washing hands when they are in the hospital, the presence of HH sink in the toilet, the presence of comfortable place to wash hands in soap and water increase HH compliance after touching patient surrounding by an average of -0.32 (95% CI: -0.05–-0.12), 0.135 (95% CI: 0.11-0.26), 0.16 (95% CI: 0.001-0.32) and 0.25units (95% CI: 0.004-0.5) respectively.

Explanatory variables	**Un standardized Coefficients**		**Standardized Coefficients**	**Sig.**	**95% Confidence Interval for B**	
	B	Std. Error	Beta		Lower Bound	Upper Bound
(Constant)	.430	.106		.000	.221	.640
Do you wash your hands when you are in hospital	.135	.063	.148	.034*	.011	.260
Are HH sinks in the entrance area to patient room	-.322	.100	-.225	.001**	-.518	-.126
Are there hand hygiene sinks in the toilet	.164	.083	.151	.049*	.001	.327
Is there comfortable place to wash your hand in soap & water	.253	.126	.147	.046*	.004	.502

Table 5: Multiple linear regression analysis result of HH compliance of health professional after touching patient surroundings at Wachemo University Nigist Eleni Hospital South West Ethiopia 2017.

**-significant at p<0.05, **-significant at p<0.01*
NB: negative values of standard β indicate negative predictors of HH compliance after touching patient surrounding and positive values indicate positive predictors of HH compliance after touching patient surrounding.

A unit increment on workers length of service and the frequency of HH sinks empty of water lowered the HH compliance score by 0.016 and 0.054 unit respectively. A unit change in the presence of HH sink in the toilet and the presence of HH representative in the department increase HH compliance by 0.175 and 0.15 units respectively for cleaning hands before aseptic technique dimension of HH compliance.

	Un standardized Coefficients		Standardized Coefficients	Sig.	95% Confidence Interval for B	
	B	Std. Error	Beta		Lower Bound	Upper Bound
(Constant)	.219	.094		.020	.035	.404
How long have you worked	-.016	.006	-.160	.013*	-.028	-.003
Do you wash your hands when you are in hospital	.184	.060	.193	.003**	.065	.303
Are HH sinks in the entrance area to patient room	-.389	.103	-.246	.000***	-.593	-.185
Do you clean your hands before starting your job	.250	.064	.249	.000***	.125	.376
Are there hand hygiene sinks in the toilet	.175	.075	.152	.020*	.028	.322
Do you have individual towel	.345	.095	.249	.000***	.157	.533
Is there a hand hygiene representative	.150	.070	.144	.033*	.012	.288

-significant at p<0.05, **-significant at p<0.01, *-significant at p<0.001*
NB: negative values of standard β indicate negative predictors of HH compliance after touching patient surrounding and positive values indicate positive predictors of HH compliance after touching patient surrounding.

Table 6: Multiple linear regression analysis result of HH compliance of health professional before aseptic technique at Wachemo University Nigist Eleni Hospital South West Ethiopia 2017

3.3. Reason for non-compliance

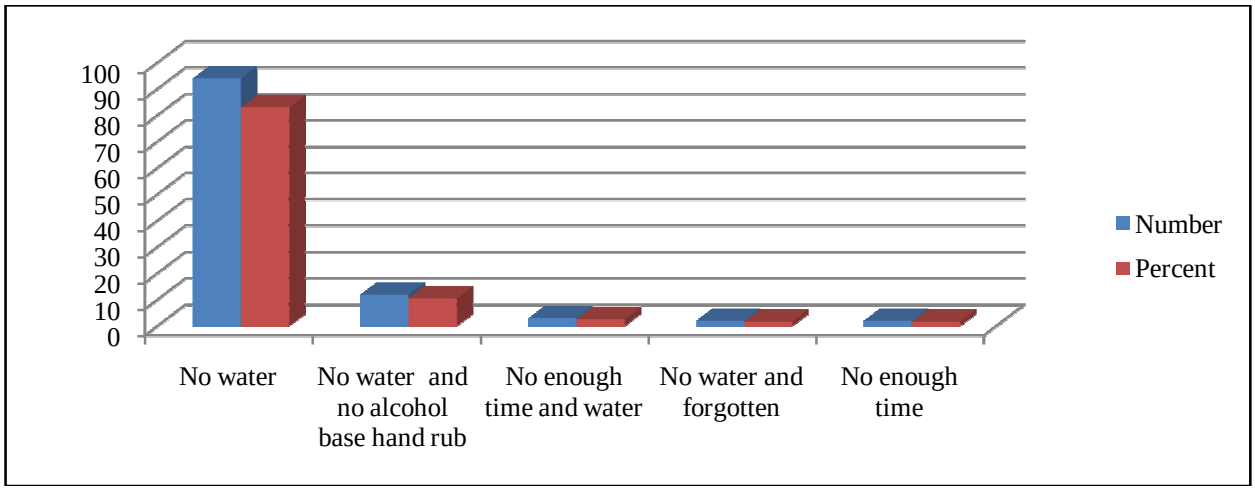

Figure 2: Reason for noncompliance of HH by health professional's perspective.

4. Discussion

HH principles remain the same across the world, although hospitals in resource-limited areas have unique challenges to HH adherence, including limited availability of needed resources and lack of knowledge. This study tried to assess HH compliance of hospital health professionals and associated factors both by using direct observation and self-reporting. Direct observation is recognized by WHO as the gold standard and most reliable method for measuring HH compliance rates(21)

Good Hand hygiene compliance of health care providers as measured by this study was found to be 9.2%; this shows that HH was not conducted as frequently as recommended by WHO guidance and this result was as low as the result of hand washing compliance in a study conducted in India which is 63.3%(22), and as much as better than a study conducted in Komfo Anokye teaching Hospital in Kumasi Ghana which is 4%, and in Jimma university specialized hospital Jimma Ethiopia which is a compliance of 2% for using an effective hand washing technique involving three stages, and 4% for washing hands that were visibly soiled with liquid soap and water(23, 24).

Many studies in the literature, compliance with HH among nurses is better than doctors, but our result shows different to the many studies. General practitioners were more HH compliance than nurses, specialist doctors and laboratory professionals in cleansing hands before patient contact, after contact with patient surroundings, and after patient contact, this result was similar to the study conducted in *Korle-Bu Teaching Hospital* Ghana and Iran , but it was incomparable to the study conducted in Mysore University south India which is noncompliance was highest among doctors(22, 25, 26).

HH compliance before patient contact had 4.58%, this result had as low as compared to the study conducted in Istanbul, Marmara University, Pendik Training and Research Hospital which is 43.2%, at National Taiwan University Hospital which is (38.6%),another study in Iran *Nemazee Hospital* shows 31 % compliance before patient contact , the Eritrean Keren hospital shows 30% of health workers routinely washed their hands between patient contact, at Mulago National Referral Hospital in Uganda which is 16%, in Switzerland Geneva which is 14.1 and 8% compliance rate at Jimma university specialized hospital, but it was comparable to the study conducted in Ghana teaching hospital in Kumasi which is 6%(24, 27-32).
HH compliance after patient contact in this study was 10.47; this result had a little bit greater than the mean HH compliance rate which is 9.2 %, but it was very little compliance rate than the study conducted Austria University Hospital Graz, Iran, Istanbul Turkey, Ghana Komfo Anokye Teaching Hospital, Eritrean keren hospital and Jimma university specialized hospital Ethiopia which is 81.1%, 54.2%, 60.1% 20% 20% and 57.1% respectively, and nearly similar to the study conducted in Uganda Mulago national referral hospital and Ghana *Korle-Bu Teaching Hospital* which is 8% and 9.2% respectively(24, 26, 29, 30, 33).

HH compliance after contact with body fluid had higher than other WHO five moments for HH which was 21.2%, this result was comparable to the study conducted in Ghana and Turkey shows the majority of HH attempts 20%and 18.1% respectively (28, 34), ,and this result was a much lesser result than the study conducted in Shiraz University of Medical Sciences, Shiraz, Iran which is 50% compliance rate, and the same to the study conducted in Poland which is 78%(26, 28).
HH compliance after touching patient surrounding had nearly equal to the mean HH compliance, which is 9.57%, this result shows least compliance rate compared to other studies in Istanbul Marmara University, Pendik Training and Research Hospital which is 60.1% for nurses and 28.5% compliance for doctors, in Nemazee Hospital Iran 24.6%, National Taiwan University Hospital, Taipei which is 16.1%,but it is comparable in the study conducted in Ghana Komfo Anokye Teaching Hospital which is 8%(24, 28-30).
HH compliance before aseptic technique was 3.79% this result was below the mean HH compliance. Five of the WHO my five moments for HH in this research was very low compliance rate, HH compliance before aseptic technique was the least compliance rate in this study. This result was not comparable to the study conducted in Iran, Turkey, Komfo Ankoye hospital in Ghana and national Taiwan University hospital which is 16.4%, 12.5%, 13 % and 6.8% compliance rate respectively(24, 25, 28).
HH compliance was good in medical ward when compared to other wards; in 38.3% of the opportunities health professionals was good HH compliance. Even though there is a high difference of compliance but this result was similar to the study conducted in Komfo Anokye Teaching Hospital Ghana and in Korle-Bu Teaching Hospital in Ghana, but this is incomparable to study conducted in Indonesia which is medical ward was the least compliance than other wards which is 5.2 %. Surgical ward staff HH compliance was 0%.

4.1. Reason for non-compliance

Reason for noncompliance in this research by health professionals were no water (81.7%), this result was similar to other African hospitals like Jimma university specialized hospitals, Komfo Anokye teaching Hospital and Gondor university specialized hospital(23, 24, 35). Another reason for noncompliance was shortage of alcohol based hand rub and no enough time.

4.2. Conclusion

HH compliance among health professionals in Wachemo University Nigist Eleni hospital was found to be very low. HH compliance before aseptic technique was necessary to prevent nosocomial infection but in this hospital HH compliance before aseptic technique was 0% in all departments. HH training, HH policy, the presence of enough and functional HH sinks and the presence of comfortable place to wash hands were the independent significant predictors for HH compliance, this suggests that interventions aimed at improving the above-mentioned things, HH compliance will be improved.

4.3. Competing Interests

There is no competing interest with the presented data as external data collectors collected it. There was not financial interest between the funder and the research area community and us. We have no any form of competing financial and non-financial interest between ourselves.

4.4. Authors' Contributions

The three authors have made significant contribution in the proposal development, defending for fund obtaining, data collection and data analysis and manuscript preparation process of this work.

4.5. Acknowledgments

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