

## Assessment of Medical Students' Hand Hygiene Knowledge, Attitude and Practices at Kampala International University–Western Campus and Teaching Hospital, Bushenyi District, Western Uganda

Mutabazi Abraham

Department of Medicine and Surgery of Kampala International University, Uganda.

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### ABSTRACT

Unclean hands are the most common vehicle for the transmission of health care associated infections (HCAIs) between patients and the health care environment. This study sought to assess the level of knowledge, attitude and self-reported practices (KAP) of Medical Students at Kampala International University - Western Campus and Teaching Hospital, Bushenyi District in Western Uganda. A quantitative, descriptive study using a pre-tested self-administered questionnaire was conducted among medical students in the clinical and biomedical sections at KIU -WC. Data collection was carried out between August and September 2021. Questionnaire tools were checked for their accuracy and data completeness, then data was coded and entered into Epi info version 7, then exported into SPSS version 22.0 for analysis, KAP scores were summarized into means, standard deviations and percentages. Chi-square and Fisher's exact tests were used to determine association between KAP scores and selected independent variables (gender, age, medical school section and years in medical school). There were 324 respondents, majority were females 74.4%, aged between 20 - 25 years 38.0%, had spent 1 - 2 years in medical school 36.7% and those in the Biomedical section of medical school 52.5%. Majority had moderate knowledge (83%), positive attitude (88.8%) and good practices (87.9%). Respondents had knowledge gaps on HCAIs, WHO "Five (5) moments for hand hygiene" and alcohol-based hand rub. Association was found between respondent's KAP scores and age ( $p < 0.05$ ). Biomedical section was associated with good practices ( $p = 0.000$ ). Knowledge and attitude were associated with years of clinical experience ( $p < 0.05$ ). Most students at KIU-WC had moderate knowledge, positive attitude and good practices. Respondent's variety in KAP scores and associated factors indicate that a multimodal, multifaceted improvement approach should be undertaken to address KAP gaps.

**Keywords:** multimodal, multifaceted, and hand hygiene.

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### INTRODUCTION

Worldwide, hand (washing) hygiene is recognized as the leading measure to prevent cross-transmission of microorganisms and to reduce the incidence of health care associated infections [1, 2]. Hand washing among medical students with soap and water is one of the most effective and inexpensive means of preventing infections. [3], the value of hand washing among medical students for the prevention of cross infection was first observed in the middle of the nineteenth century. This practice especially when done with soap can remove agents of infection both at the time they were emitted from the primary host and prevent them from reaching the secondary host.

According to [4], hand washing is a health care issue attracting attention globally. It is considered a cost-effective way of reducing cross infections in health facilities from advanced health care system to primary health care centers. In most health care facilities the practice has been found faulty with little compliance to the recommended standard by WHO. [5], regular hand washing is thus an excellent way of preventing the transmission of microbes from one person to another and has been described as a modest measure with big effects.

The centers for disease control and prevention and the association for professionals in infection control and epidemiology in the United State has

clearly identified that successful hand washing practice is the most significant method of preventing the spread of diseases. Teaching appropriate hand hygiene practices can promote healthy balance and have many benefits in a vast variety of places such as learning institutions, which include day cares, primary, secondary schools and universities [6].

[4], reported that giving knowledge to people about hand washing helps them and their communities stay healthy.

Hand washing education helps to:

- i. Decrease the rate of people who get sick with diarrhea by 31%.
- ii. Decrease diarrheal illness in people with weakened immune systems by 58%.
- iii. Decrease respiratory infections, like common colds, in the general population by 16-21%

Despite the relative simplicity of this procedure, compliance with hand washing among health care providers is as low as 40%. To address this problem, continuous efforts are being made to identify effective and sustainable strategies [7]. These five moments that call for the use of hand washing include the moment before touching a patient, before performing aseptic and clean procedures, after being at risk of exposure to body fluids, after touching a patient, and after touching patient surroundings. This concept has been aptly used to improve understanding, training, monitoring, and reporting hand washing among medical students [6].

In Asia there is a paucity of studies exploring this subject, although the prevalence of health care associated infections is high in this region; especially medical and nursing student's knowledge of standard precautions is rarely compared [6]. The observance of hand washing by students is reported as being weak. Therefore, it is absolutely essential to investigate and know hand washing knowledge, attitudes, and practices among medical students so that appropriate strategies can be developed to promote hand washing compliance [8].

Medical students constitute the largest percentage of the health care workers (HCW) and they are the "nucleus of the health care system". Because they spend more time with patients than any other

HCWs, their compliance with hand washing guidelines seems to be more vital in preventing the disease transmission among patients [10].

In Africa, one of such efforts is the introduction of an evidence-based concept of "My five moments for hand hygiene" by World Health Organization. These five moments that call for the use of hand hygiene include the moment before touching a patient, before performing aseptic and clean procedures, after being at risk of exposure to body fluids, after touching a patient, and after touching patient surroundings [11]. This concept has been aptly used to improve understanding, training, monitoring, and reporting hand hygiene among healthcare workers [10].

[12], health-care associated infections due to poor hand hygiene have been linked to an unacceptably high level of morbidity, mortality, and health-care costs. In African developing countries, its prevalence is found to be as high as 19%. Effective hand hygiene can lower the prevalence of health-care associated infections. According to [13], the prevalence of these infections continue to rise and pose challenges to health-care providers. In spite of being a very simple action, compliance with hand hygiene among health-care providers is as low as <40%. To address this problem of lack of compliance with hand washing among medical students' hygiene, continuous efforts are being made to identify effective and sustainable strategies.

In East Africa, hand-washing behavior in institutions of higher learning has been shown to cut the number of child deaths from diarrhea (the second leading cause of child deaths) by almost half and from pneumonia (the leading cause of child deaths) by one-quarter [13]. There are five critical times in washing hands with soap and/or using of a hand antiseptic related to fecal-oral transmission. After using a bathroom (private or public), after changing a diaper, before eating and before preparing food or handling raw meat, fish or poultry or any other situation leading to potential contamination.

To reduce the spread of germs, it is also better to wash the hands and/or use a hand antiseptic before and after tending

to a sick person [14]. The CDC recommends hand-washing over hand sanitizer rubs, particularly when hands are visibly dirty. The increasing use of these agents is based on their ease of use and rapid killing activity against micro-organisms; however, they should not serve as a replacement for proper hand-washing unless soap and water are unavailable [15].

Studies have been conducted in Uganda to study hand washing practices in both medical students and certified health-care providers, but only one significant study has been undertaken where medical students were also evaluated [16].

Another strategy in Makerere University to improve hand washing practices among medical students is to ensure proper education of the trainee health workforce, and in this regard, hand hygiene practices of nursing and medical students. Such studies are important as the students in their clinical training phase through the health-care facilities and can potentially transmit infections besides being the health-care providers of future when their pattern of training will reflect on their infection control practices [16].

In western Uganda, the most important measures for preventing the spread of pathogens among patients and medical students is effective hand-washing. It protects best against diseases transmitted through fecal-oral routes (such as many forms of stomach flu) and direct physical contact (such as impetigo) [16]. The purpose of hand-washing among medical students in the health-care setting is to remove pathogenic micro-organisms ("germs") and avoid transmitting them. There are reports that a lack of hand-washing among remains at unacceptable levels in most medical environments, with large numbers of doctors and nurses routinely forgetting to wash their hands before touching patients. One study showed that proper hand-washing and other simple procedures can decrease the rate of catheter-related bloodstream infections by 66% [16].

#### **Problem Statement**

Globally, [13] indicated the five moments for hand hygiene" by World Health Organization as well as hand

washing are the leading measures which improve hand washing among different health workers, to reduce healthcare-associated infections. This is one of the principal public health problems among many countries all over the world. Hand washing is considered the most important measure to reduce the healthcare associated infections and prevent the cross transmission of microorganisms, mainly among the practicing medical interns in every hospital.

In Africa, hand washing is recognized as the leading measure to prevent cross-transmission of microorganisms and to reduce the incidence of health care associated infections. Despite the relative simplicity of this procedure, compliance with hand washing among medical students is as low as 40% [15]. To address this problem, continuous efforts are being made to identify effective and sustainable strategies.

In Uganda according to [17], most people have neglected hand washing, yet this is the leading cause of diseases mainly oral in the community. According to [18], hand washing mainly in teaching institutions means much more than health. It means being free of germs, controllable diseases among others.

In Ugandan universities and training institutions, there is continued lack of knowledge concerning the correct indications for hand disinfection. Regardless of previous experience in hospitals, it is assumed that medical students expect less compliance towards hand hygiene which would be worse and more if hand washing is not complied with since the medical students get into contact with most patients. Among the experienced physicians and senior consultants, hand washing among medical students is living by a health example and helps to control a number of diseases, and by doing a regular hand wash, students are often considered to be role models for the patients they treat.

The above background will form a cornerstone to examine medical students' knowledge, attitude and practices in hand washing at KIU WC TH in Ishaka.

## METHODOLOGY

### Study Design

This study was descriptive and cross-sectional in nature [19]. It was descriptive in nature so as to give a clear picture on medical students' knowledge, attitude and practices in hand washing at KIU - TH in Ishaka. This enabled the researcher to establish the knowledge, attitude and practice of medical students on hand washing. The study was a qualitative study design where in-depth information from key informants was obtained.

### Study Area

The study was conducted at KIU - WC & TH, located in Ishaka municipality of Bushenyi district, in the Western part of Uganda. The school is situated 365 kilometers from Kampala, the capital of Uganda along the Mbarara Kasese high way, opposite Basajabalaba Secondary School. The Teaching Hospital helps to train the next generation of medical professionals.

### Study Population

The study mainly enrolled KIU medical students offering bachelors of medicine and surgery from Biomedicals and Clinicals rotation of study. These were selected for the study because; this group of respondents is expected to have information first on knowledge, attitude and practices on hand hygiene as this subject is handled right from orientation into medical school at KIU - WC & TH.

### Inclusion Criteria

All medical students offering bachelors of medicine and surgery from KIU - WC who consented to participate in the study, were included in the study.

### Exclusion Criteria

All other students other than those mentioned above in inclusion criteria were excluded.

### Sample Size Determination

The sample size was determined using the formula by Wayne Daniel (1986)

$$n = \frac{Z^2PQ}{D^2}$$

Where n= desired sample size.

Z=Standard normal deviation taken at 1.96 at confidence level of 95%.

P= Proportion of targeted population estimated to have similar characteristics. There for in this study, P represents all medical students at KIU-

TH wards. Therefore, P will be taken as 0.5.

$$Q = 1 - p = 1.0 - 0.5 = 0.5$$

D = degree of accuracy desired using 0.05

In this case, 95% confidence level has 5% error,

Hence

$$N = \frac{Z^2PQ}{D^2} = \frac{1.96^2(0.5 \times 0.5)}{0.05^2} = \frac{0.7375}{0.0025}$$

$$= 295 \text{ respondents}$$

Considering 10% for non-response, a total of 324 students were enrolled for the study.

### Sampling Procedures

Convenience sampling was applied in this study as students who met the eligibility criteria and consented to take part in the study were recruited until the desired number was attained.

### Data Collection Methods and Management

The study involved qualitative methods. Qualitatively, the study sought to establish facts on the ground basing on an elaborative analysis and questionnaires that led to the collection of non-numerical data.

Data was collected using administered questionnaires, the targeted respondents that took part in the study were met, after obtaining permission for data collection from respondents. Each participant gave an informed consent before enrolling in the study. The respondents were assisted in filling the questionnaires by explaining to the respondents for clarifications. The properly filled questionnaires were then collected and then data taken for analysis.

### Data Analysis

Data from the questionnaire was entered into Microsoft office excel spreadsheet. Appropriate measure was taken to check for completeness before data entry. Data clean up and cross-checking was done before analysis. Data was coded and entered into Epi info version 7, then exported into SPSS version 22.0 for analysis. To determine the level of knowledge, attitude and practices, a scoring system derived from the WHO hand hygiene guideline and literature was applied to the responses [20, 21]. A score of one (1) point was given for each correct KAP response whereas zero (0)

was given for each incorrect KAP response. Likert scales were later collapsed into dichotomous values (one or zero) for data analysis.

The total scores of knowledge, attitude and practices were equated to 100 %. For knowledge assessment which is the primary outcome measure, a score of more than 75% was considered good, 50-74% moderate and less than 50% poor. The cut-off values to determine good, moderate, and poor levels were taken from previously studies with some modification to suit the purpose of this study [21, 22]. An attitude score of 50% and above was positive, and a score less than 50% was considered negative. For practices, a score of 50% and above was good, and a score less than 50% was considered as poor [23].

Descriptive statistics was used to calculate the numbers and percentages for categorized data. Before analysis, all numerical variables including the KAP scores were checked for normal distribution using Shapiro Wilk test and visual observation of the histogram. Means and standard deviations (SD) were then calculated for normally distributed data. Analytic statistics were

used to determine the relationship between predictor variables (such as age, medical school section, etc.) and the outcome variable (KAP).

Chi-square and Fisher's exact tests of independent association were used to test for relationship between categorical variables. For association, knowledge score was collapsed into two (2) categories; good (by combining good and moderate) and poor categories. To further test for association, the following categories had to be combined; age group (<25 and >25), P value less than 0.05 was considered statistically significant.

#### Quality Control

The questionnaire was pretested amongst 50 medical students that were not included in the final data analysis.

#### Ethical Considerations

Ethical approval was sought from Kampala international university western campus Faculty of clinical medicine and dentistry and an introduction letter was given after to seek permission for data at the University. A written and verbal consent was sought from the respondents before they were recruited in the study [24].

### RESULTS

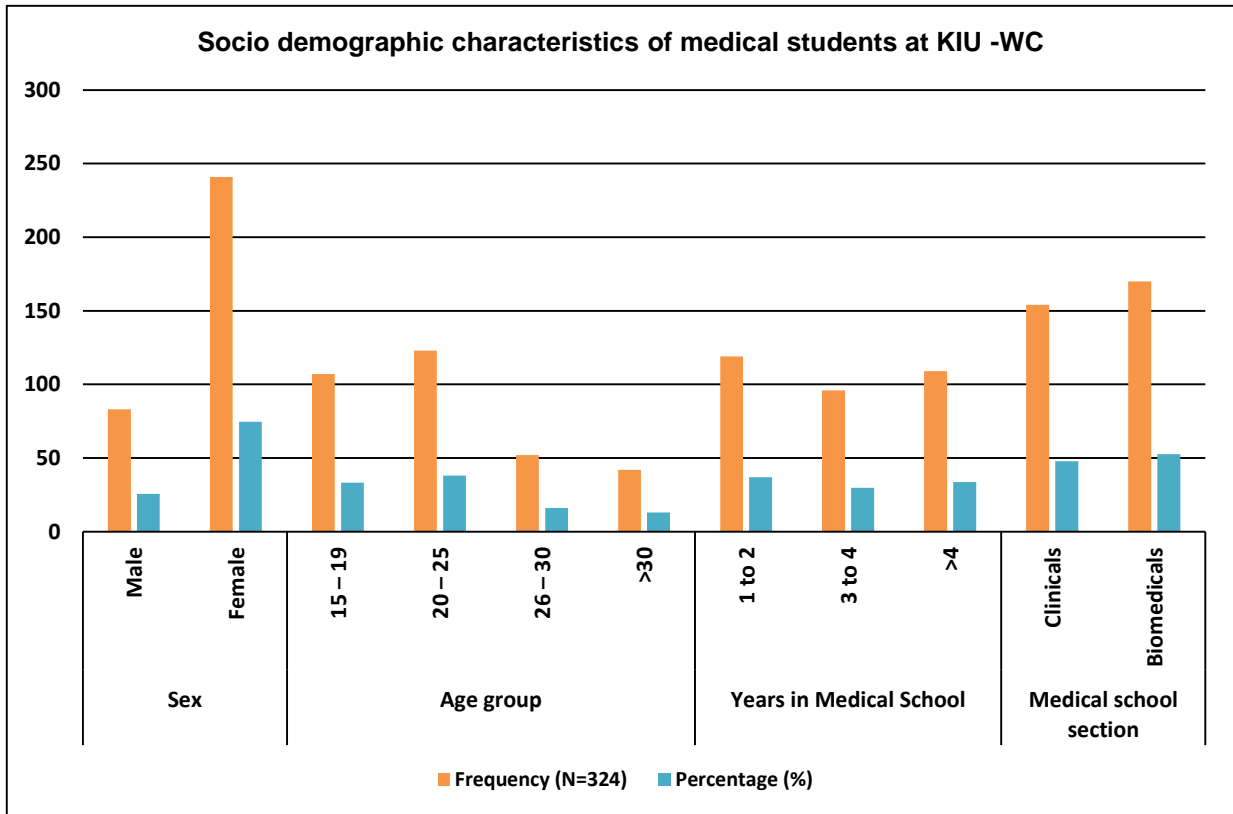
#### Demographic Characteristics of the Medical Students

Majority of the medical students that participated in the study at KIU - WC were female 74.4%, aged between 20 -

25 years 38.0%, had spent 1 - 2 years in medical school 36.7% and where in the Biomedical section of medical school 52.5% as shown in Table 1 and Figure 2.

**Table 1:** Sociodemographic distribution of the medical students

Characteristic	Category	Frequency (N=324)	Percentage (%)
<b>Sex</b>	Male	83	25.6
	Female	241	74.4
<b>Age group</b>	15 - 19	107	33.0
	20 - 25	123	38.0
	26 - 30	52	16.0
	>30	42	13.0
<b>Years in Medical School</b>	1 - 2	119	36.7
	3 - 4	96	29.6
	>4	109	33.6
<b>Medical school section</b>	Clinicals	154	47.5
	Biomedicals	170	52.5



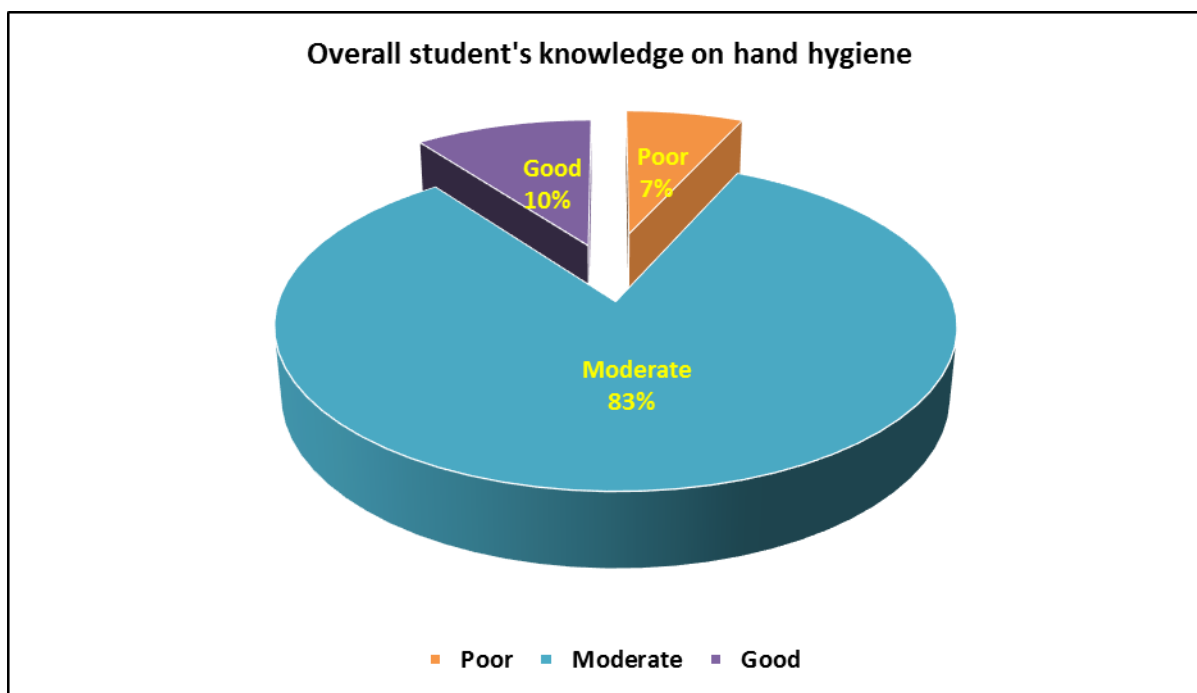
**Figure 1:** Column bar showing distribution of Socio demographic distribution of the medical students

**Students' Knowledge on Hand Hygiene**  
 The mean overall score for students' knowledge on hand hygiene was  $15.81 \pm 2.4$  (63.2%). Students with moderate knowledge were 269(83.0%),

33(10.1%) had good knowledge and 22(6.8%) had poor knowledge on hand hygiene as shown in Table 2, 3 and Figure 3.

**Table 2:** Students' overall knowledge on hand hygiene (n=324)

Knowledge on hand hygiene		
Knowledge level	Frequency (n=324)	Percentage (%)
Poor	22	7
Moderate	269	83
Good	33	10



**Figure 2:** Pie Chart showing students' overall knowledge on hand hygiene

The percentages of correct responses of the students to the individual questions on hand hygiene knowledge are shown in Table 3

**Table 3:** Students' answers on knowledge questions (n=324)

No	Knowledge based questions	n	%
<b>K1</b>	Main route of cross-transmission of potentially harmful germs between patients in Hospital (HCWs hands when not clean)	257	79
<b>K2</b>	Frequent source of germs responsible for health care-associated infections (Germs already present on or within the patient).	104	32
<b>K3</b>	Hand hygiene actions that prevent transmission of germs to the patient		
	Before touching a patient (Yes)	315	97
	Immediately after a risk of body fluid exposure (No)	74	23
	After exposure to the immediate surroundings of a patient (No)	108	33
	Immediately before a clean/aseptic procedure (Yes)	287	89
<b>K4</b>	Hand hygiene actions that prevents transmission of germs to the health-care worker		
	After touching a patient (Yes)	292	90
	Immediately after a risk of body fluid exposure (Yes)	285	88
	Immediately before a clean/aseptic procedure (No)	115	35
	After exposure to the immediate surroundings of a patient (Yes)	268	83
<b>K5</b>	True statements on alcohol-based hand rub and handwashing with soap and water		
	Hand rubbing is more rapid for hand cleansing than handwashing (True)	219	68
	Hand rubbing causes skin dryness more than handwashing (False)	103	32
	Hand rubbing is more effective against germs than handwashing (True)	81	25

	Handwashing and Hand rubbing are recommended to be performed in sequence (False)	96	30
<b>K6</b>	Minimal time needed for alcohol-based hand rub to kill most germs (20 seconds)	99	31
<b>K7</b>	Type of hand hygiene method required in the following situations		
	Before palpation of the abdomen (Rubbing)	199	61
	Before giving an injection (Rubbing)	148	46
	After emptying a bedpan (Rubbing/washing)	299	92
	After removing examination gloves (Rubbing/washing)	321	99
	After making a patient's bed (Rubbing)	41	13
	After visible exposure to blood (Washing)	292	90
<b>K8</b>	Actions to be avoided during hand hygiene		
	Wearing jewelry (Yes)	293	90
	Damaged skin (Yes)	297	92
	Artificial fingernails (Yes)	307	95
	Regular use of a hand cream (No)	225	69

#### **WHO “My five (5) moments for hand hygiene” and indications for hand hygiene**

Few students (22.8% and 35.5%) knew that moments for hand hygiene as defined by WHO “Immediately after a risk of body fluid” and “Immediately before a clean/aseptic procedure” protect the HCW (and hospital environment) and patient respectively. Students who knew that hand rubbing was the required method before giving an injection were 148(45.7%). Few (12.7%) of them chose the correct method for the question on “after making a patient’s bed”.

#### **Comparing hand rubbing and hand washing**

Hand rubbing was known to be more rapid for hand cleansing than hand

washing by 219 (67.6%) respondents. Only 103 (31.8%) respondents knew that hand rubbing does not cause skin dryness. Of the 324 respondents, only 81 (25.0%) knew that hand rubbing was more effective against germs than handwashing, while few 96 (29.6%) knew that hand rubbing and handwashing are not recommended to be performed in sequence. Minimal time needed for AHBR to kill most germs was known by 99 (30.6%) respondents.

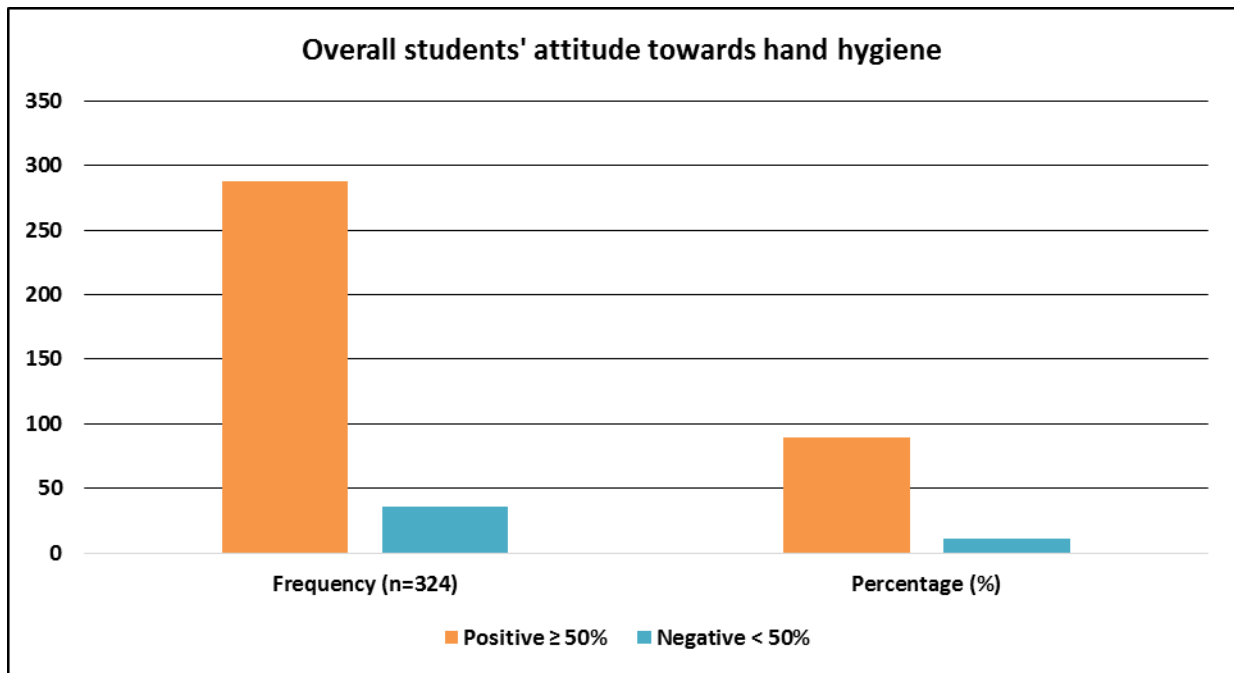
#### **Students’ Attitude on Hand Hygiene**

The mean overall score of the students’ attitude was 6.99 ±1.90 (69.9%). Majority of the students (88.9%) had positive attitude towards hand hygiene, while 36 (11.1%) had negative attitude towards hand hygiene as shown in Table 4, 5 and Figure 4 and 5.

**Table 4: Students’ overall practices on hand hygiene (n=324)**  
**Students’ attitude towards hand hygiene**

<b>Overall attitude % score</b>	<b>Frequency (n=324)</b>	<b>Percentage (%)</b>
<b>Positive ≥ 50%</b>	288	89
<b>Negative &lt; 50%</b>	36	11





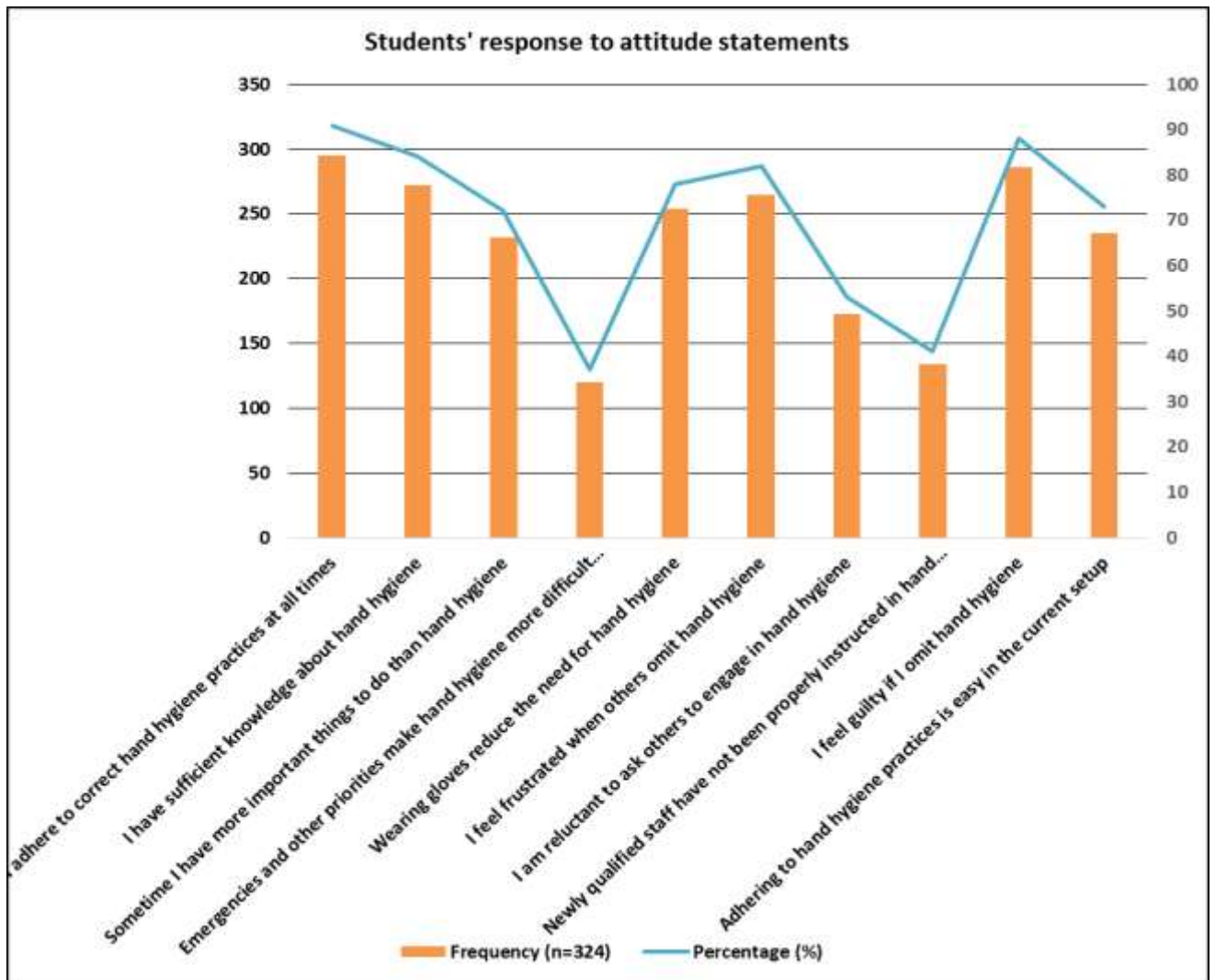
**Figure 3: Column graph showing overall students' attitude towards hand hygiene**

Respondent's responses to individual attitude statement are presented in Table 5. Eight (8) out of the ten (10)

attitude statements were selected correctly by >70% of the respondents.

**Table 5: Students' responses to attitude statements (n=324)**

No	Statement	n	%
A1	I adhere to correct hand hygiene practices at all times (Yes)	295	91
A2	I have sufficient knowledge about hand hygiene (Yes)	272	84
A3	Sometime I have more important things to do than hand hygiene (No)	232	72
A4	Emergencies and other priorities make hand hygiene more difficult at times (No)	120	37
A5	Wearing gloves reduce the need for hand hygiene (No)	254	78
A6	I feel frustrated when others omit hand hygiene (Yes)	265	82
A7	I am reluctant to ask others to engage in hand hygiene (No)	173	53
A8	Newly qualified staff have not been properly instructed in hand hygiene in their training (No)	134	41
A9	I feel guilty if I omit hand hygiene (Yes)	286	88
A10	Adhering to hand hygiene practices is easy in the current setup (Yes)	235	73
	<b>Average</b>	227	70



**Figure 4:** Stacked column line graph showing students' responses to attitude statements (n=324)

#### Gaps in Attitude

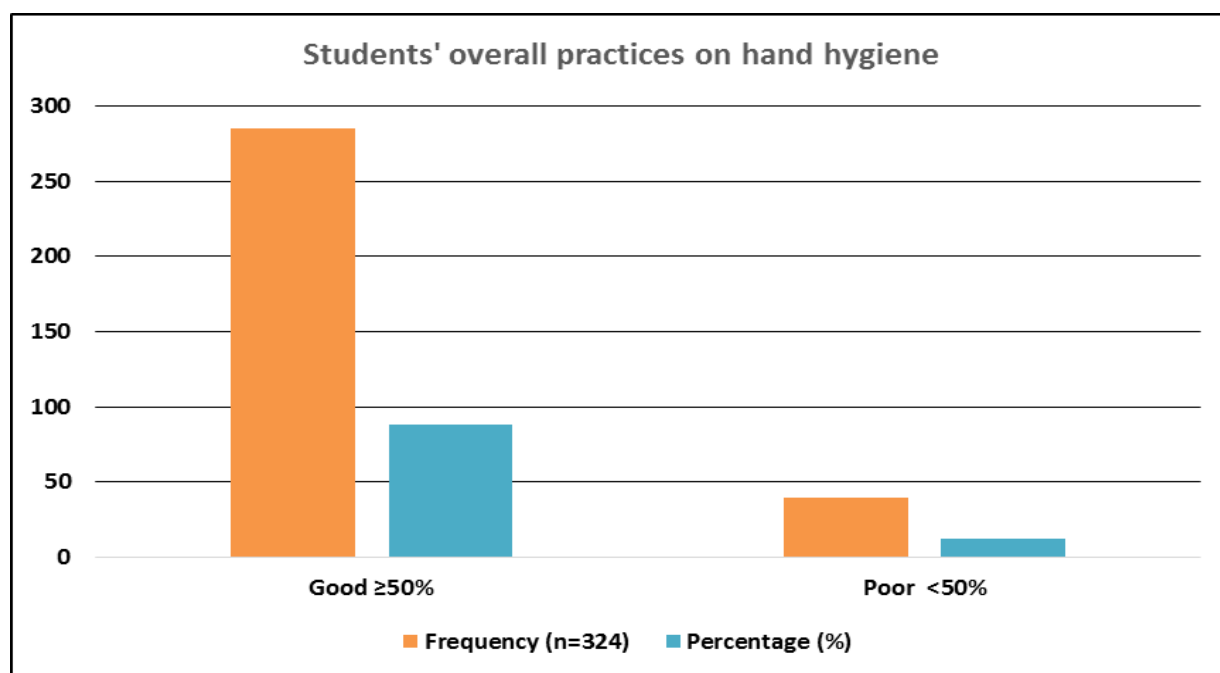
Some students (37.0%) felt that emergencies and other priorities did not make hand hygiene difficult at times. Respondents who were not reluctant to ask others to engage in hand hygiene were 173(53.4%), and 134(41.4%) disagreed with the statement that "newly qualified staff have not been properly instructed in their training".

#### Students' Self-Reported Practices on Hand Hygiene

The mean overall score of self-reported practices on hand hygiene was  $4.02 \pm 1.30$  (67.1%). Majority of the students (87.9%) reported good hand hygiene practices, whereas few (12.0%) reported poor practices. Of the six (6) practice statements, more than 70% of the students reported good practices on more than three (3) of the six (6) statements as shown in Table 6, 7 and Figure 6 and 7.

**Table 6: Students' overall practices on hand hygiene (n=324)**

Students practice as regards hand hygiene		
Overall practice % score	Frequency (n=324)	Percentage (%)
Good $\geq$ 50%	285	88
Poor <50%	39	12

**Figure 4:** Column bar chart showing students' overall practices on hand hygiene (n=324)**Table 7: Students' responses to practice statements (n=324)**

No.	Statement	n	%
P1	Sometime I miss out hand hygiene simply because I forget it (No)	174	54
P2	Hand hygiene is an essential part of my role (Yes)	311	96
P3	The frequency of hand hygiene required makes it difficult for me to carry it out as often as necessary (No)	174	54
P4	Infection prevention team have a positive influence on my hand hygiene(Yes)	251	77
P5	Infection prevention notice boards remind me to do hand hygiene (Yes)	254	78
P6	It is difficult for me to attend hand hygiene courses due to time pressure (No)	141	44
<b>Average</b>		218	67

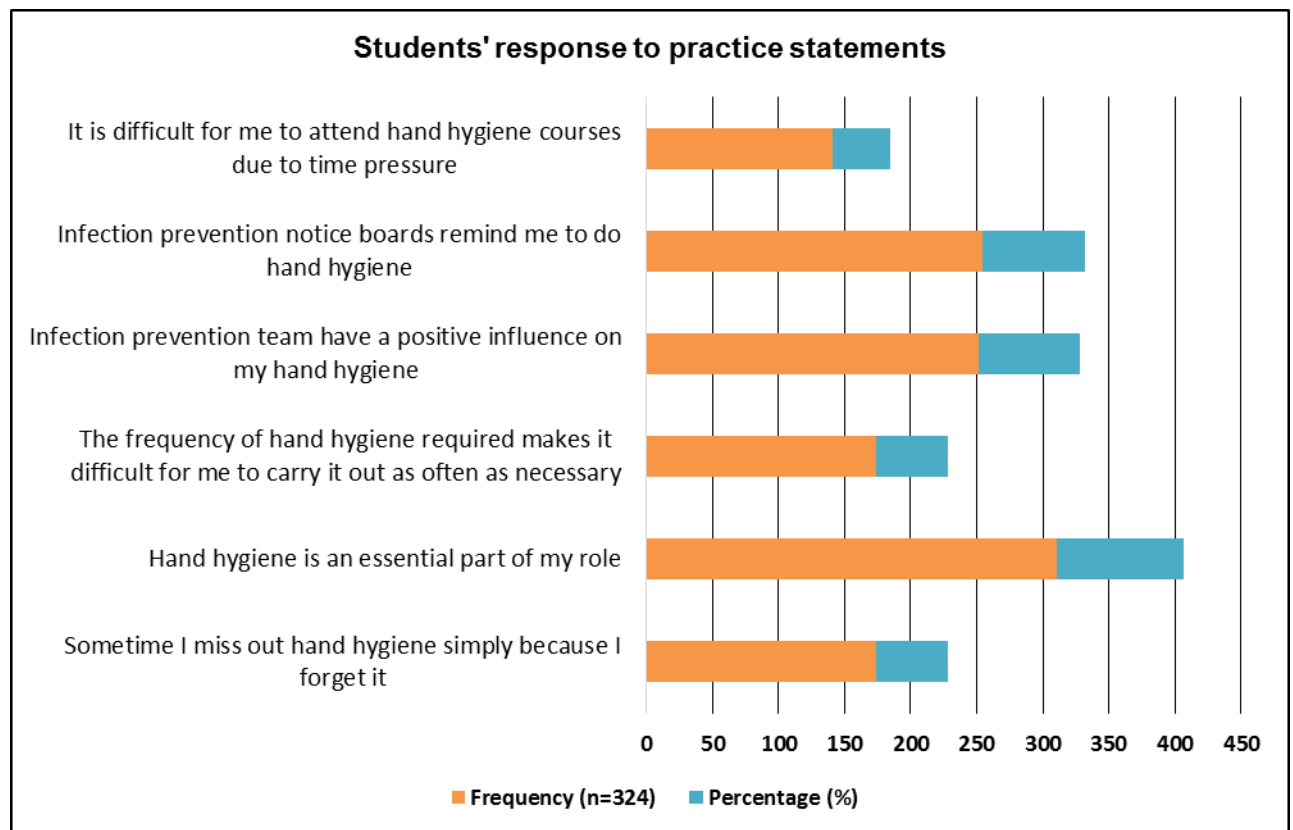
***Gaps in Self-Reported Practices***

Missing hand hygiene sometimes due to forgetfulness was reported as poor practice by 174 (53.7%) respondents. Respondents who disagreed with a

statement that the frequency of hand hygiene required made it difficult for them to carry out hand hygiene as often as necessary, were 174 (53.7%). In terms of attendance of hand hygiene courses,

141 (43.5%) respondents reported difficulty in attending courses due to

time pressure.



**Figure 6:** Stacked bar graph showing students' responses to practice statements (n=324)

**Association between the KAP and Explanatory (Independent) Variables**

The association between selected demographics and hand hygiene knowledge, attitude and practices is shown in Table 8. There was no statistical significant relationship between knowledge (p=0.854), attitude (p=0.472) and practices (p=0.436) on hand hygiene and gender (p>0.05). However, female students were more knowledgeable and had positive attitude than males. Students' knowledge decreased significantly with increase in age (p=0.003). The attitude (p=0.033) and practices (p=0.015) of students also showed statistically significant relationship with age (p<0.05). However, age group >25 years had positive attitude and good practices than age groups <25 years. There was significant statistical relationship between hand hygiene attitude and practices and Student's

medical school section (p=0.000). Students in the Clinical section group had more knowledge (p=0.377) but, the difference was not statistically significant. Students in Biomedical section had positive attitude (p= 0.051) and good practices (p=0.000) compare to students in the Clinicals (p<0.05). Significant association was also observed between students' knowledge (p=0.033) and practices (p=0.012) on hand hygiene and years in medical school. Students with less than 4 years in medical school had more knowledge than those with more than 4 years in medical school. Though, >4 years of medical school presence was associated with good hand hygiene practices (p=0.012). There was no statistical significant relationship between the knowledge, attitude and practices on hand hygiene and medical school section (p>0.05).

**Table 8:** Association between KAP score and independent variables (n=324)

Variable	Knowledge			Attitude		Practices	
	n	Good K*	P value	Positive A	P value	Good P	P value
<b>Gender</b>							
Female	241	225(93)	0.854	216(90)	0.472	210(87)	0.436
Male	83	92(77)		72(87)		75(90)	
<b>Age group</b>							
<25 years	229	221(97)	0.001	198(86)	0.033	195(85)	0.015
≥25 years	95	81(85)		90(95)		90(95)	
<b>Medical school section</b>							
Clinicals	154	146(95)	0.377	131(85)	0.051	121(79)	0.000
Biomedicals	170	156(92)		157(92)		164(96)	
<b>Years in Medical school</b>							
1 - 2	119	114(96)	0.033	104(87)	0.707	99(83)	0.012
3 - 4	96	92(96)		85(89)		82(85)	
>4	109	96(88)		99(91)		104(95)	

K=knowledge, A=attitude, P=practices

Good K\*=knowledge=score 50-74% and above 50%

## DISCUSSION

HCWs hands are the most common vehicle for the transmission of HCAIs from patient to patient and within the health care environment [25]. Hand hygiene is regarded as the most important, simplest, and least expensive means of reducing the burden of HCAIs and the spread of antimicrobial resistance [18]. Optimal hand hygiene behavior is considered the cornerstone of prevention of HCAIs. However, compliance among HCWs is as low as 40 percent despite the relative simplicity of the procedure. Some of the reasons for low compliance to hand hygiene include; lack of appropriate infrastructure and equipment to enable hand hygiene performance, allergies to hand washing products, perception and knowledge of the transmission risk and of the impact of HCAI; and casual attitudes of HCWs towards IPC [25, 23].

### Knowledge

The results for this study indicate that medical students at KIU - WC had moderate 269 (83.0%) and good 33 (10.2%) knowledge on hand hygiene. This was a positive finding correspondingly found in Ethiopia,

Nigeria and Nepal [26, 27]. This means that the students were knowledgeable on hand hygiene. However, there were critical knowledge gaps on HCAIs, “My 5 moments for hand hygiene” and ABHR.

### Knowledge gaps related to HCAIs

In terms of HCAIs, majority (79.3%) of the students knew that HCW’s hands when not clean, were the main route of transmission of potentially harmful germs between patients in a health care setting. But, few (32.1%) knew the frequent source of these germs that are responsible for HCAIs. Comparable results were observed in India and China [28, 29]. Locally, a study in Tygerberg Hospital observed poor knowledge when majority (76%) of the HCWs incorrectly identified the environment as the predominant source of HCAI [30]. It seems respondents knew that hands transmit HCAIs but, were not sure of the source of pathogens responsible for HCAIs. A possible explanation could be that, training focused more on hand hygiene technique than the theory of hand hygiene in relation to its role on HCAIs. Knowledge on HCAIs need to be

reinforced during training at undergraduate and continuous professional training (CPD).

#### **Gaps on WHO 5 moments for hand hygiene**

Though students answered correctly most of the questions on “My 5 moments for hand hygiene”, there were gaps on this knowledge topic. For instance, most (>60%) respondents did not know that performing hand hygiene immediately after a risk of body fluid exposure and after exposure to the immediate surroundings of a patient, protects the HCW and the hospital environment. Langoya et al in Sudan likewise, observed similar knowledge gap to these knowledge questions. [31] Found both doctors and nurses had low knowledge on WHO’s five moments for hand hygiene. An important focus of the “My 5 moments” concept is the visualization of the individual patient zone, which defines hand hygiene indications [32]. In our study, the results identified crucial knowledge gaps around the concept and indications for hand hygiene. It means respondents are not aware of the purpose of each of the five (5) moments for hand hygiene.

#### **Gaps on alcohol-based hand rub**

Another critical gap in knowledge was on students’ misconception of ABHR and hand washing with soap and water. Majority of the respondents indicated that they routinely use ABHR (79.9%) and wash (93.3%) with soap and water. Different from a study in China where only 30.0% of physicians and 50.9% of nurses reportedly used ABHR. It shows that respondents prefer washing than hand rubbing. ABHR has been shown to be more effective for hand antiseptics than hand washing with soap and water [33, 14, 34]. Although most (67.6%) respondents knew that hand rubbing was more rapid for hand cleansing than handwashing, few (25.0%) knew that hand rubbing was more effective than hand washing. These findings were similar to that of a KAP study in Saudi Arabia [35]. This might be that pre-2009 undergraduate and in-service training promoted hand washing than hand rubbing.

Although most respondents (67.6%) said ABHR was rapid, only 30.6% knew the minimum time needed for ABHR to kill most germs. Similarly, in a study by

[36], only a few undergraduate students (medical 40.4%, dental 37.8%, and nursing 32.5%) knew that 20 seconds was the minimum time required for ABHR to be effective as per the WHO hand hygiene guideline (2009). The reason might be the lack of reminder posters on “how to hand rub” or lack of training on ABHR.

Furthermore, few (31.8%) respondents knew that hand rubbing does not cause skin dryness. It means respondents associate ABHR with skin dryness. According to Uganda National Bureau of Standards (UNBS) criteria for ABHR in Uganda, all ABHR must contain emollient to prevent skin dryness. Additionally, few (29.6%) respondents knew that hand rubbing and hand washing were not performed in sequence. Comparable, [27, 37] observed similar responses. It means respondents have conflicting knowledge on ABHR. This mismatch and misconception may have serious impact on hand hygiene compliance. [38] likewise found some confusion among nursing students around when to use soap and water and when to use ABHR. The level of knowledge shown by the proportions of respondents in answering these questions correctly, was clearly inconsistent and inadequate on the aspects of ABHR. To change this misconception, dedication and time is needed to educate HCWs on the use ABHR.

#### **Attitude**

Overall, majority (88.8%) of the students in this study had positive attitude on hand hygiene similar to a study in Nigeria [39]. This was a positive finding. It means respondents are aware of the importance of hand hygiene. Contrary to [40, 22] in Iran and India respectively, the attitude of their participants towards hand hygiene was overall poor. However, respondents had attitude gaps related to emergencies, undergraduate training and mentoring of colleagues.

#### **Attitude gaps**

Interestingly, most (91.0%) of the students felt hand hygiene was important and should be adhered to. However, few (37.0%) felt emergencies and other priorities made hand hygiene more difficult at times. This was different to findings of [27] where participants felt the opposite. It means

respondents miss hand hygiene during emergencies. This was worrisome as emergencies are common in health care settings.

Although most respondents (81.8%) felt frustrated when others omit hand hygiene, some (46.6%) were however reluctant to ask their colleagues to perform hand hygiene. [28, 41, 22] similarly observed this negative attitude. Furthermore, some (41.4%) respondents thought newly qualified staff have not been properly instructed on hand hygiene in their training. It shows that respondents are afraid to correct fellow colleagues and lack confidence in the current training prescribed for newly qualified staff. Respondents displayed a mixer of positive and negative attitude in these statements. It might be that respondents over-reported by responding positively what is acceptable as opposed to how they genuinely felt. IPC team can recommend hand hygiene champions for each ward to solve this problem.

#### **Practices**

In relation to self-reported practices, most (87.9%) students reported good hand hygiene practices. Comparable in Cape Town (SA), [30] observed higher (88%) self-reported adherence on hand hygiene practices among HCWs. Contrary in a study by [21], most participants reported poor hand hygiene practices (medical -73%, nursing -57%) and only few showed good hand hygiene practice (medical -3%, nursing -5%). However, the high proportion of respondents who indicated personal compliance with hand hygiene practices is of interest.

Self-reported practices may need to be confirmed by a reliable method such as direct observation of the respondents during patient care. A study in New York found major differences between self-reported hand hygiene and observational data, though the study was unable to confirm which data collection strategy was more accurate or less biased [42]. However, direct observation of HCWs during patient care activity by trained and validated observers is considered as the gold standard for monitoring hand hygiene compliance [43]. Even so, respondents had crucial gaps on some reported practices relating to forgetfulness,

frequency of hand hygiene and course attendance.

#### **Gaps in practices**

For instance, some (46.3%) respondents reported missing out on hand hygiene simply because they forgot it. This was similarly found in a study by [28]. Furthermore, some (46.3%) respondents said the frequency of hand hygiene required made it difficult for them to carry it out as often as necessary. This means compliance to hand hygiene is compromised by forgetfulness and the frequency of the procedure. Some (56.5%) respondents reported that it was difficult for them to attend hand hygiene courses due to time pressure. Similar results were observed by [22]. It means respondents miss hand hygiene training because they lack time to attend.

However, respondents said IPC teams had a positive influence on their hand hygiene, and that IPC notice boards reminded them to perform hand hygiene. This shows that respondents value IPC teams and IPC reminder posters. Continued use of promotional and instructional materials was considered useful for reminding staff of the need to perform hand hygiene in Malaysia [44]. [26] found that the presence of IPC committees was positively associated with hand hygiene compliance of HCWs. These responses indirectly indicate that respondent's compliances was influenced by various factors amongst them, the frequency (time) of hand hygiene, forgetfulness, IPC teams, IPC reminders and hand hygiene course attendance. Top three reasons for not practicing hand hygiene in a teaching hospital in Ghana included; heavy patient load; forgetfulness and lack of time [45]. In order for HCWs to encourage good practices regarding hand hygiene, it is important to address these issues with hospital management.

#### **Association between KAP and Selected Predictors (Independent Variables)**

##### **KAP and gender**

In this study, there was no statistical relationship between students' KAP and gender. Likewise, [39, 46, 47] did not find association between knowledge and gender. In contrast, [48] in Egypt, demonstrated the role of gender on hand hygiene when they found better

knowledge and self-reported practice in females than male students in their study. [49] however, found significant difference between male and female only in reported practices. Interestingly, the study by [47] in Sudan was dominated by male participants.

#### ***KAP and age***

Statistical significant relationship was found between students' KAP and age. [47] also, found a significant association between age and knowledge score, whereas [49] found association between age and attitude score. In the current study, this implied that younger (<25 years) students are more knowledgeable but then again, the older respondents had better attitude and practices. This might mean the younger students recall theory better, whilst the older students have more practical experience.

#### ***KAP and Medical school section***

There was no significant association between students' knowledge and attitude on hand hygiene and medical school section. Comparable [49, 47], likewise did not find significant difference in their studies. However, [29] in China and [23] in Nigeria, both found that students in lower Biomedicals section had significant better knowledge on hand hygiene than doctors. On the contrary, [31] in India, found students in Clinicals had better knowledge of hand hygiene than those in biomedical. In another study, the other professionals combined (clinical), had more knowledge than nurses although not statistically significant. Perhaps smaller groups of biomedical students, were easily accessible to educate on hand hygiene.

The study indicates that medical students at KIU -WC have moderate knowledge, positive attitude and good practices on hand hygiene. However, they have knowledge gaps on HAIs, WHO 5 moments for hand hygiene and ABHR. Noteworthy, they have remarkable misconceptions on ABHR indication and effectiveness. Knowledge was associated with age and years of clinical experience.

Although students had positive attitude, they had negative attitude on hand hygiene during emergencies and towards newly qualified staff. Positive attitude was associated with age.

Significant association was however observed between students' practices and medical school section in the present study. It meant biomedical's section students had better hand hygiene practices than other HCWs. However [30] at Tygerberg Hospital, did not find significant difference between students in either section of medical school and self-reported practice on hand hygiene. Overall, although biomedical students were less knowledgeable in the current study, it appears they have more positive attitude and good practices than other students in the clinicals. These findings were comparable to [31].

#### ***KAP and time spent in medical school***

Statistical significant relationship was observed between respondent's knowledge and attitude, and years of clinical experience. [49] found statistically significant differences among groups of years spent in medical school and attitude score. Work experience and previous training on hand hygiene were found to be the two main predictors of knowledge among participants in Iran [50]. However, in the present study, students with greater than 4 years in medical school were less knowledgeable. This finding could be that the knowledge on hand hygiene is still fresh or better recalled by the younger students as compared to the older ones. Those with less time spent in medical school can also recall knowledge from their basic introductory to medical school training better than those with > 4 years of time in medical school.

### **CONCLUSION**

Similarly, most students had good practices. However, there were practice gaps related to forgetfulness. Practices were associated with age, medical school section and years spent in medical school. These findings suggests deficiencies in both undergraduate training and in-service training. They further highlight the need to review and improve on current hand hygiene education and training. Students' variety in KAP scores and associated factors indicate that a multimodal, multifaceted improvement approach should be undertaken to address the gaps in



knowledge, attitude and practices at KIU - WC.

### Recommendations

We recommend implementation of the WHO multimodal hand hygiene improvement intervention approach to improve medical students' knowledge, attitude and practices on hand hygiene. A combination of interventions which include training and education, observation and feedback, reminders in the workplace, system change and institutional safety climate should be implemented.

Medical students' knowledge can be improved by a combination of educational strategies such as slide presentations, interactive sessions, training films, internet, and hand hygiene brochures and pocket leaflets. Emphasis should be on the gaps identified during the study such as HCAs, moments for hand hygiene and ABHR. Education and training should be conducted during orientation and thorough out various stages of medical school for the students.

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