IMPACT OF HAND WASHING TRAINING ON PHARMACY STUDENTS: A QUASI EXPERIMENTAL STUDY

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ABSTRACT

Background*: Globally, poor hand washing practices have led to a remarkable increase in the rate of infection and spread of infectious diseases. Hands are the main route of germ transmission during medical management. Hence, hand washing is an effective measure to prevent the transmission of infectious diseases in healthcare.*

Objective: *The study assessed the impact of hand washing training on pharmacy students' knowledge of hand washing.*

Methods*: The study employed quasi-experimental study design. Pre-test data collection was carried out with a structured questionnaire to assess the student's knowledge of hand washing technique at baseline. This was followed by an educational workshop on proper hand washing technique and post-test data collection using the same questionnaire. All the students (299) who gave their informed consent participated in the study. Mean score of individual response was computed for the different sections of the questionnaire. Data analysis was performed using SPSS version 22 computer software. Statistical analysis was done using Paired t-test. A value of p<0.05 was considered significant.*

Results*: Out of the 299 students that indicated willingness to participate in the study, only 284 completed the post-test questionnaire. The baseline results revealed that majority of the respondents have good general knowledge on proper hand washing technique based on cutoff value of >4. However, the educational workshop had significant impact on the students' hand washing technique in all the three domains assessed with p-values of 0.000 for each domain.*

Conclusion: *This study suggests that handwashing training had a positive impact on the students' handwashing knowledge.*

Keywords: *hand washing, impact, assessment, survey, educational workshop, students*

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INTRODUCTION

Hand washing is a process of washing the hands with soap and water or rubbing the hands with alcohol-based sanitizers to remove dirt, potential harmful microorganisms or other unwanted substances on the hand.[1-4] Handwashing, often used interchangeably with hand hygiene is a component of hand hygiene. The World Health Organization (WHO) defined hand hygiene as a general term that relates to a behavior of hand washing with either soap and water or hand-rubbing using alcohol-based hand sanitizers.[5, 6]

Several methods of hand washing have been employed in the healthcare setting. However, except when the hands are visibly soiled with dirt, blood or body fluids, an alcohol-based hand rub is the most desirable over soap and water in most clinical circumstances because it is more effective than soap at eliminating harmful microbes on hands and it requires less time.[7]Hospital acquired infections are one of the real threat facing the health care system with its major concern on patient safety. Thus, its prevention must be a priority for settings and institutions committed to making health care safer.[8-11]

A range of health promotion and improvement of hand washing is recommended in the hand hygiene guidelines published by the Center for Disease Control (CDC) Atlanta and WHO.[12,13] In 2004, the Federal government of Nigeria (FGN)/UNICEF/Water, Sanitation and Hygiene (WASH) Programme introduced hand washing as an approach for hygiene promotion. This programme was re-activated on 20th May 2008 as one of the programs designed to mark the International Year of Sanitation declared by the United Nations General Assembly.[14-16] These programs focused more on mothers, workers, students, children and adolescents.

Numerous studies have assessed hand washing techniques among healthcare students like medical, nursing, dental students etc and students from other discipline.[17-27] Analyses have also been done on the impact of educational intervention on hand washing

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techniques.[28-38] However, studies on assessment of knowledge of hand washing practices before and after an educational intervention among pharmacy students appear to be relatively unexplored. Hence, this study assessed the impact of hand washing training on pharmacy students' knowledge of hand washing.

METHODS

STUDY AREA

This study was carried out in the Faculty of Pharmaceutical Sciences of Nnamdi Azikiwe University, Awka, Agulu Campus. It is located in Anaocha Local Government Area (LGA) of Anambra State. Anambra State is situated in the southeastern part of Nigeria. This site is a satelite campus

STUDY POPULATION

This study was carried out among the students studying pharmacy from 200 to 500 level and comprised of males and females irrespective of age.

ELIGIBILITY CRITERIA

Inclusion criteria: Students in School of Pharmacy, Nnamdi Azikiwe University, Agulu campus who gave their informed consent

Exclusion criteria: Students in School of pharmacy, Nnamdi Azikiwe University, Agulu campus who were medically unfit and those absent at the time of the study.

STUDY DESIGN

The study was a cross-sectional quasi-experimental study of pharmacy students.

SAMPLE AND SAMPLING TECHNIQUE

There was no sample selection procedure as everybody in the sampling frame was targeted. Hence, we sampled all students who gave their informed consent to increase the reliability of the data

INSTRUMENT FOR DATA COLLECTION

A structured questionnaire was adapted from the illustrative questionnaire for Interview-Survey with the students. The questions were adapted from the WHO guidelines on the proper hand washing techniques and modified. The questionnaire was divided into 4 sections; section 1 contained the demographic data of the respondents. Section 2 composed of 5 questions to evaluate general knowledge of hand washing technique. Section 3 composed of 11 questions to evaluate hand washing procedure. Section 4 composed of 6 questions to evaluate approaches towards hand washing. Response options for sections 2 and 3 were structured on a five-point Likert scale: 5. Strongly agree, 4. Agree, 3. Unsure, 2. Disagree, 1. Strongly disagree while section 4 was structured as 5. Always, 4. Usually, 3. Often, 2. Sometimes, 1. Never. The questionnaire was piloted on 10 pharmacy students who did not participate in the main study. It excluded all means of identification such as name, address, and phone numbers.

QUESTIONNAIRE ADMINISTRATION AND COLLECTION

The questionnaire was self-administered and collected by hand to get the baseline data, followed by educational workshop on the proper hand washing techniques for the intervention phase based on WHO hand washing protocol. At the end, the same questionnaire was self administered again to the respondents and collected back.

STATISTICAL ANALYSIS

The data was analyzed using SPSS version 22 computer software. Descriptive statistics using frequency and percentage was computed for the demographic variables. Mean score of individual response for sections 2-4 of the questionnaire was computed before and after the training. Statistical analysis was done using Paired t-test (to determine the impact of the training on pharmacy students). Significant results were accepted at $p<0.05$

RESULTS

DEMOGRAPHICS OF PARTICIPANTS

A total of 299 students indicated willingness to participate in the study. All of them completed the baseline questionnaire and attended the educational workshop. However, only 284 completed the post-test questionnaire. **Table 1** summarizes the demographic characteristics of respondents at baseline and post-intervention. Most of the respondents fell within the age group 21-25 years with an average age of 22.6 years. Majority of the respondents were males, 183 at baseline and 174 post-intervention. The 200L class had the highest number of participants; 128 students at pre and posttest. This is followed by 400L (66 students at baseline) though only 59 students filled the post-intervention questionnaire.

Table 1: Demographic Data

S/N	Variables	Frequency of Respondents, n(%) Pre-test (n=299)	Post-test (n=284)
1	**Age group**		
	16-20 years	86 (28.76%)	80 (28.17%)
	21-25 years	184 (61.54%)	182 (64.08%)
	26-30 years	22 (7.36%)	20 (7.04)
	>30 years	7 (2.34%)	7 (2.46)
2	**Gender**		
	Male	183 (61.20%)	174 (61.27%)
	Female	116 (38.79%)	110 (38.73%)
3	**Year of study**		
	200L	128 (42.81%)	128 (42.81%)
	300L	55 ((18.39%)	55 (18.39%)
	400L	66 (22.07%)	59 (20.77)
	500L	50 (16.72%)	42 (14.79%)

The average age of pharmacy students in this survey was computed to be 22.6 year

APPROPRIATE TIMING OF HANDWASHING

Mean score was lowest for item 1 (3.6±1.6) followed by item 2 (3.9±1.6) before the intervention as shown in **Table 2**. It is pertinent to mention that most of the students agree that they wash their hands after defecation, before eating and before preparing food with mean scores of 4.6±0.8 and 4.7± 0.7 respectively. Overall, mean scores for the entire item improved after the intervention.

SA= Strongly agree, A=Agree, NS=Not sure, D=Disagree, SD= strongly disagree

BEST HANDWASHING PROCEDURE

Variables		Before training							After training						
		SA	A	NS	D	SD	Total	Mean ±sd	SA	A	NS	D	SD	Total	Mean
1.	When hands are visibly dirty	149	37	10	48	55	299	**3.6±1.6**	234	30	1	9	10	284	**4.7±0.9**
2.	When hands are visibly soiled with blood or fluid	175	36	12	27	49	299	**3.9±1.6**	255	19	3	4	3	284	**4.8±0.6**
3.	After defecation	228	51	6	7	7	299	**4.6±0.8**	268	14	1	1	0	284	**4.9±0.3**
4.	Before eating	224	59	7	3	6	299	**4.7± 0.7**	265	16	2	1	0	284	**4.9± 0.3**
5.	Before preparing food	225	60	8	1	5	299	**4.7± 0.7**	264	18	2	0	0	284	**4.9±0.3**

The students agreed practicing all the 11 steps of hand washing with variations in their agreement scores **(Table 3).**The mean scores for variables 1-5 as well as 8 and 9 at baseline were approximately 5. The mean scores at baseline for variables 6,7,10 and 11 which involves rubbing the back of fingers to opposing palms with fingers interlocked, rotational rubbing of left thumb clasped in right palm and vice versa, drying of hands thoroughly with a single used towel and use of towel to turn off faucet were 4.4±0.9, 4.3±0.9, 4.3±1.0, 4.0±1.1 respectively. Increment in the mean scores was seen after the intervention.

Variables		Before training							After training						
		SA	A	NS	D	SD	Total	Mean ±sd	SA	A	NS	D	SD	Total	Mean
1.	Wet hands with water	199	75	8	10	7	299	**4.5± 0.9**	265	18	1	0	0	284	**4.9± 0.3**
2.	Apply soap to cover all hand surfaces	234	58	4	1	2	299	**4.7± 0.6**	256	14	2	2	0	284	**4.9± 0.3**
3.	Rub hands palm to palm	221	66	7	2	3	299	**4.7±0.7**	262	18	1	2	1	284	**4.9±0.4**
4.	Right palm over left dorsum with interlaced fingers and vice versa	200	65	27	1	6	299	**4.5± 0.8**	268	16	0	0	0	284	**4.9± 0.2**
5.	Palm to palm with finger interlaced	175	95	23	3	3	299	**4.5± 0.8**	263	21	0	0	0	284	**4.9±0.3**
6.	Back of fingers to opposing palms with fingers interlocked	174	77	32	10	6	299	**4.4±0.9**	264	17	2	1	0	284	**4.9±0.3**
7.	Rational rubbing of left thumb clasped in right palm and vice versa	158	88	40	6	7	299	**4.3±0.9**	266	16	2	0	0	284	**4.9±0.3**
8.	Rational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa	183	88	23	4	1	299	**4.5±0.7**	259	23	2	0	0	284	**4.9±0.3**
9.	Rinse hands with water	234	57	1	4	3	299	**4.7±0.6**	269	16	0	0	0	284	**4.9±0.2**
10.	Dry hands thoroughly with a single used towel	181	74	14	18	12	299	**4.3±1.0**	255	24	3	2	0	284	**4.9±0.4**
11.	Use towel to turn off faucet	141	79	52	13	14	299	**4.0±1.1**	248	28	3	4	1	284	**4.8±0.5**

Table 3: Students' Responses on best hand washing procedure

APPROACH TO HANDWASHING

The majority of students demonstrated good knowledge of the various approach to hand washing as seen in **Table 4** below. However, item 3 which inquired about the use of alcohol-based hand rub for hand washing had a poor mean score (3.4±1.5) as compared to other items. An improvement was seen after the intervention.

Table 4. Students' Responses on approach to hand washing

Variables	Before training							After training						
	AL	**US**	**OF**	**SOM**	**NEV**	**Total**	**Mean ±sd**	**AL**	**US**	**OF**	**SOM**	**NEV**	**Total**	**Mean**
1. Apply soap during hand washing	220	43	18	17	1	299	**4.6±0.9**	270	7	2	5	0	284	**4.9± 0.5**
2. Moisten hands under running water before applying soap	229	47	13	10	0	299	**4.7±0.7**	268	10	4	2	0	284	**4.9± 0.4**
3. Use alcohol-based hand rub for hand washing	112	45	34	76	32	299	**3.4±1.5**	198	22	10	22	32	284	**4.2± 1.4**
4. Dry hands after hand washing	194	47	32	22	4	299	**4.4± 1.0**	260	14	7	3	0	284	**4.9± 0.5**
5. Wash hands after performing practical	246	32	13	6	2	299	**4.7± 0.7**	274	5	5	0	0	284	**4.9± 0.3**
6. Wash hands when back from school	245	26	19	7	2	299	**4.7± 0.7**	277	3	4	0	0	284	**4.9± 0.3**

AL= Always, US=Usually, OF=Often, SOM=Sometimes, NEV= Never

IMPACT OF HANDWASHING TRAINING

Table 5 explains the relationship between mean score outcomes before and after training of pharmacy students on hand washing. The first pair of relationship in the table below reveals that there is significant difference between means score on knowledge of timing for hand washing by pharmacy students before and after the training ($p<0.05$; df=283). The knowledge score on the appropriate timing for washing increased by 0.5fold after training. This showed that the training had significant impact on the students' knowledge of appropriate timing for hand washing.

The second pair of relationship in the table show that there is a significant difference in the mean score on hand washing procedure before and after the training of pharmacy students ($p<0.05$; df=283). The knowledge score on hand washing procedure by pharmacy student's increase by approximately 0.5-fold after training hence, the training impacted the students' knowledge on hand washing procedure.

The third pair relationship in the table reveals that there is a significant difference in the mean score of approach to hand washing before and after training of pharmacy students ($p<0.05$; df=283). The knowledge score on approach to hand washing by pharmacy student's increase by approximately 0.4-fold after training hence, the training impacted the students' approach to hand washing procedure

Variable Pair	**N**	**Mean score ± SD**	**Mean difference**	**t value**	**df**	**Sig. (2-tailed)**
1. Mean score of knowledge on appropriate time for hand washing before training	299	4.3155 ± 0.83	-	-	-	-
Mean score of knowledge of appropriate time for hand washing after training	284	4.8507 ± 0.39	0.53521	12.736	283	**0.000***
2. Mean score of knowledge on hand washing procedure before training	299	4.4497 ± 0.72	-	-	-	-
Mean score of knowledge on hand washing procedure after training	284	4.9094 ± 0.27	0.45967	12.293	283	**0.000***
3. Mean score on knowledge of approach to handwashing before training	299	4.4255 ± 0.76	-	-	-	-
Mean score on knowledge of approach to handwashing after training	284	4.7952 ± 0.42	0.36972	10.983	283	**0.000***

DISCUSSION

To the best of our knowledge, current study is the first to assess the knowledge of pharmacy students with respect to hand washing. Pharmacy students, our future pharmacists, are trained to be actively involved in matters of hygiene and infection control.[39]In the present study, pharmacy students' knowledge of hand washing technique is satisfactory at baseline based on cut-off value of >4. However, the knowledge component in few areas was dissatisfactory.

The majority of students that participated in this study have high knowledge of the appropriate timing of hand washing. Generally, critical times recognized in hand washing include: after defecation, before and after meals as well as before food preparation.[6,40-41]As presented in **Table 2,** at baseline, majority of the students agreed with washing their hands after defecation with a mean score of 4.6±0.8, before eating with a mean score of 4.7±0.7, and before preparing food with a mean score of 4.7±0.7. Hand washing is an effective measure for the prevention and spread of gastrointestinal and respiratory infections like diarrhea and pneumonia.[42-45]This result is comparable to those recorded by Opara & Alex-Hart[46]on two hundred and sixty-one 4th to 6th year medical students of the University of Port Harcourt, where 58.3% and 58.9% washed hands before meals and after defecating respectively. Another study by Ergin et al[47] on all existing 1st year students in the medical and educational faculty, plus all existing 2nd and 3rd year students in the Medical Faculty of Pamukkale University, Denizil, Turkey reported that high number of participants wash their hands after using restrooms but participants who claimed washing hands before meals was lower. Surprisingly, a recent study conducted in Ogun state, Southwest Nigeria reported that only few students wash their hands after using the toilets.[48] The difference from the present study could be attributed to the population group (University of Education). Ordinarily, healthcare students are expected to be more knowledgeable of preventive measures against infectious diseases but media has been proven to be a major source of information on these preventive measures rather than university academic programmes.[49]

In the present study, knowledge regarding the different steps of hand washing was satisfactory in majority of the students before the intervention **(Table 4).**In the brochure, Hand Hygiene: Why, How & When? The WHO recommended 11 steps of handwashing.[6]These steps when carried out correctly, ensures that hands are free of germs that causes serious infections. A study carried out by Novak et al[50]at the Jessenius Faculty of Medicine in Martin of Comenius University in Bratislava (JFM CU) among seventy 3rd year students of General Medicine (medical study program), and Nursing, Midwifery and Public Health (non-medical study programs)reported that majority of the participants frequently omitted rubbing the back of fingers to opposing palms with fingers interlocked (41.4%), drying the hands thoroughly with a disposable towel, usage of a disposal towel to turn off faucet (21.4%) and rotational rubbing of left thumb clasped in right palm and vice versa (14.3%).

Although students in this current study achieved a satisfactory score on approach to hand washing **(Table 4),** the results showed deficits in the area of the use of alcohol-based hand rub for hand washing with a mean score of 3.4±1.5 which is dissatisfactory. However, knowledge regarding the use of alcohol-based hand rub increased after the intervention with a mean score of 4.2±1.4. Nevertheless, it is important to address the gaps of knowledge with regards to the use of alcohol-based hand rub for hand washing. Cleaning the hands with a hand sanitizer that contains at least 60% alcohol is a very important step of hand washing as this helps in reducing hand contamination.[50] But, it is very necessary to know the right situation to use it. Hand washing with soap and water is employed when hands are visibly soiled whereas alcohol-based hand rubs is used when hands are visibly clean because they reduce bacteria count on hands and is more accessible than a hand washing sink.[6, 51]

In a comparative study conducted by Kingston et al [52]aimed at providing insight into the current hand hygiene and hand rubbing practices of nursing and medical students in Ireland reported that more medical students (46%) than nursing students (22%) were routinely using alcohol-based hand rub for decontamination of hands as recommended. Barriers such as skin sensitivity (30%)and skin damage (20%), with over half of students believing that if they follow the hand rubbing recommendations they will experience dermatology issues was perceived to have informed reasons for suboptimal use of alcohol-based hand rubs among nursing and medical students.

Overall, our study highlights the impact of educational training at improving hand washing

knowledge among pharmacy students. The one-day workshop on hand washing focused on why, when and how we should wash our hands. The workshop specifically addressed the call for improve education of pharmacy students regarding hand washing. The approach used in the training includes lectures and practical demonstrations of the steps of hand washing techniques.

Further analysis of the results showed that the training had statistically significant impact ($p<0.05$;$df=283$) on the student's knowledge of appropriate timing for hand washing, hand washing procedure and approach to hand washing **(Table 5).** Similarly, a study conducted at the Faculty of Medicine, General Sir John Kotelawala Defense University, Sri Lanka to compare the knowledge before and after a workshop on hand hygiene held for medical students concluded a statistically significant improvement of knowledge about hand hygiene among medical students (preclinical and clinical) after conclusion, the knowledge of the students as aspiring healthcare professionals was impressive. However, the positive impact of educational reinforcement cannot be overemphasized. One needs to be reminded of the procedures and approaches of hand washing in order to grasp the best practices.

Overall, hand washing training sessions and workshops should be conducted regularly for each batch of new students to promote behavioral changes among students. Hand washing reminders in the form of posters should be displayed in strategic places like the restrooms. This will help motivate the students to adhere to correct hand washing steps which will ultimately promote hand hygiene.

STUDY LIMITATION

The study has few limitations such as:

1. Only one stratum of students in the healthcare setting was surveyed. The study would have been more robust if it had included several other groups of student involved in training in a healthcare setting.
2. The sample size may have not provided enough insight into the hand washing knowledge of pharmacy students
3. We only assumed improvements in the students' knowledge of hand washing due to the training provided but cannot really establish improved practices as the students were not directly observed practicing hand washing in real life. Thus, further studies should be conducted among these students in real life.

ETHICAL CONSIDERATIONS

Full ethical approval (ref no. NAUTH/CS/66/VOL.12/027/2019/014) was obtained from the Ethical Review Board of Nnamdi Azikiwe University Teaching Hospital, Nnewi on June 11th, 2019.

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AUTHOR CONTRIBUTIONS: OBO, NK and MHN designed the study. ONN, OE and EU were responsible for data collection, OSO, OA, AMU and AUA were involved in analysis of results, UIB, ELI and NJ interpreted the data. OBO and MHN drafted the manuscript. All authors read and approved the final manuscript.

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