



(RESEARCH ARTICLE)



Assessment of practice of handwashing as Covid-19 preventive measure among medical students of Abia State University Teaching Hospital, (ABSUTH) Aba, Abia State, Nigeria

Prince Ezenwa Ndubueze Onyemachi ^{1, *}, Igwe Franklin Emenike ², Ibe U Ibe ³, Adaeze Glory Ogbonna ¹, Nnenna Kalu Achi ¹, Iganiru Chukwuebuka Okoli ¹ and Christopher Elekwachi ¹

¹ Department of Community Medicine, Abia State University Teaching Hospital, Aba, Abia State, Nigeria.

² Department of Obstetrics and Gynecology, Abia State University Teaching Hospital, Aba, Abia State, Nigeria.

³ Department of Surgery Urology Unit, Abia State University, Teaching Hospital, Aba, Abia State, Nigeria.

GSC Advanced Research and Reviews, 2023, 16(01), 176–187

Publication history: Received on 07 June 2023; revised on 16 July 2023; accepted on 18 July 2023

Article DOI: <https://doi.org/10.30574/gscarr.2023.16.1.0313>

Abstract

Background: Coronavirus disease (Covid-19) is a communicable disease which is causing morbidity and mortality globally. Hand washing, wearing of a facemask and social distancing are preventive measures that have been options available in our country, Nigeria. The practice of hand washing includes cleansing of hands by rubbing both hands together using and alcohol-based hand sanitizer or washing both hands with soap and water to prevent microbial growth.

Objective: This study aimed at assessing the practice of hand washing as a covid-19 preventive measure amongst medical students of ABSUTH, Aba.

Method: This was a descriptive cross-sectional study carried out among medical students in ABSUTH, Aba, Abia State, A self-administered semi-structured questionnaire was adopted and used to obtain information from the 430 students. Numerical variables were summarized using mean and standard deviation, categorical variables were summarized using frequency and proportions. Association was tested at p-value of 0.05%.

Result: There was a non-response rate of 50 (13.8%) as 380 students participated. Mean age of the participants was 24 ± 5.94. Two hundred and eighty-one (73.9%) constituted the majority and was found among the 21 – 25 age range. Female was in majority as 230 (60.5%) of them participated. The level of practice of handwashing was 195 (51.3%). Majority of the students scored above 52% in all the different aspects of handwashing practices and there was statistically significant association between all the hand washing practices and medical students' participation at a p-value of 0.05%.

Conclusion: Medical students showed a good level of practice towards infection and control measures. Social media was major source of information. Some misconceptions were noted regarding minimum duration of handwashing with soap and water and level of practices.

Keywords: Assessment; Hand washing practice; Covid-19 preventive measures; ABSUTH medical students

* Corresponding author: Prince Ezenwa Ndubueze Onyemachi

1. Introduction

Coronavirus disease (Covid-19) is a communicable disease which is causing morbidity and mortality globally. Hand washing, wearing of a facemask and social distancing are preventive measures that have been options available in our country, Nigeria.¹ Covid-19 is highly transmissible, including from asymptomatic individual² through respiratory droplets and by touching a surface or object infected with the virus and touching eyes, nose or mouth.^{3,4} Symptoms such as breathing difficulty, dry cough, fatigue, fever, malaise and anorexia are presented by people infected by Covid-19 infection.^{5,6} Sever infections of infected persons may have their tissues and organ damaged by this virus and may find themselves admitted into intensive care unit of the hospital. This may result in their death.⁷

The practice of hand washing includes cleansing of hands by rubbing both hands together using and alcohol-based hand sanitizer or washing both hands with soap and water to prevent microbial growth.⁸ In spite of the simplicity of this procedures, compliance has been poor and a faulty behavioural development during medical training has been identified as a central cause.^{9,10} Hand washing 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 healthcare systems to primary health care centers.¹¹ In spite of being a very simple action, compliance with hand hygiene among health care providers is as low as less than 40%.¹² Compliance is also poor among healthcare providers^{12,13} and medical students.¹⁴

According to the World Health Organization (WHO), washing hands with soap and water could reduce diarrhea-related deaths by half.¹⁵ To address this problem of lack of compliance with hand washing, continuous efforts are being made to identify effective and sustainable strategies. One of such efforts is the introduction of an evidence-based concept of “my five moments of hand hygiene” by WHO. The 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, after touching patient surroundings. This concept has been aptly used to improve understanding, training, practice and reporting hand washing among healthcare workers.¹⁶

In a study by Michigan State University researchers, it was found that only five percent (5%) of the participants washed their hands after using the bathroom and about ten percent of them didn't wash their hands at all.¹⁷ They found that people only wash their hands, on average, for about six seconds. This is less than 15 and 20 seconds required for effective hand-washing practice. Dr. Christopher Lee reported that good hand washing is one of the key factors in restricting the transfer of microorganisms from sources of contamination. He says with proper techniques, the simple act of hand-washing with soap and water can significantly reduce the transmission of these pathogens.¹⁸ Research done in Nigeria showed that the practice of hand-washing revealed that 42.2% of respondents always practiced hand washing and 34.3% practiced occasionally, while 23.5% never practiced hand washing.¹⁹ In an observational study conducted among Health professionals in a Tertiary Hospital in Ghana, a hand-washing compliance rate ranging from 9.2% to 57% among doctors and 9.6% to 54% among nurses was reported.²⁰ A survey conducted at Jimma University Hospital in Southwest Ethiopia also showed that hand-washing practice by the nursing staff was inadequate. This study demonstrated that only 43.2% of the nursing staff practice adequate hand washing while 56.8% of them practice inadequate hand washing.²¹

As part of measures to control the pandemic in Nigerian schools, Nigerian government adopted a phased reopening of schools including Universities in March 20th 2020. Also, in Ghanaian schools, the government of Ghana in June 2020 introduced a phased reopening of schools, commencing with final year students in tertiary institutions, and junior and senior high schools to enable them prepare for their final examination, while ensuring that they observe COVID-19 safety protocols.²² However, some students tested positive to COVID-19 after returning to school,²³ which raises concern whether schools have implemented COVID-19 safety protocols, despite the emphasis on students to practice COVID-19 preventive measures while in school.

Hand washing is an easy procedure yet often overlooked by most health care workers, it is a critical component of infectious disease prevention and control,^{24,25} therefore key in the prevention of Covid-19 and other highly infectious disease. Amidst the Covid-19 pandemic, hand washing offers a simple and effective hygienic measure for disease prevention and control. There is paucity of information regarding the practices of handwashing among ABSUTH medical students as the most important safety precaution measure. The observance of hand hygiene by medical students is hypothesized as being poor, yet the practice of hand hygiene among medical students is a reflection of the future healthcare as well as a reflection of the general populace at large, The aim of this study, therefore, is to assess the practice of medical students in hand washing in Abia State University Teaching Hospital, Aba, Abia State, Nigeria, this will limit the spread of Covid-19 and other contagious diseases in the hospital and environ.

2. Material and methods

2.1. Study area

The study was carried out in Umueze Community in OsisiomaNgwa Local Government Area in Aba, Abia State, South Eastern Nigeria. It has 3 wards, one primary health centre and a central market. Abia State is one of the eastern states in Nigeria created on the 27th of August 1991 from the Old Imo State.²⁶ Its administrative capital is located in Umuahia. Abia State is bordered northwards by Anambra, Enugu, and Ebonyi states, to the west by Imo State, to the east and southeast by Akwa Ibom and Cross Rivers States and to the south by Rivers State. The indigenous dwellers of the community are Igbo whose primary occupation is farming. They produce yam, cassava, maize, palm oil and plantain. They are Christians of different denomination but dominated by the Seventh Day Adventist Church and orthodox churches. OsisiomaNgwa is a city found in Abia State, Nigeria. It is located 5.11 Latitude and 7.37 Longitude, and it is situated at elevation 64 meters above sea level. The LGA has an area of 198 Square Kilometer and a population of 220,662 as per 2006 census data of Nigeria projected to 289,100 at 2.7% in 2016 annual growth rate.²⁷ Its residents are made up of civil servants, business people and farmers.

The town houses a tertiary health facility- Abia State University Teaching Hospital, with several Government and privately owned primary, secondary, and tertiary institutions including few banks, churches, industries, hotels, hospitals, etc.

2.2. Study population

The study population was 864 students which comprises of 400 level, 500 level and 600 level undergraduates of medical students in Abia State University Teaching Hospital Aba, Abia State.

2.2.1. Inclusion criteria

All the medical students who gave informed consent to participate and fill the questionnaire.

2.2.2. Exclusion criteria

Non-medical students. Medical students who didn't give informed consent

2.3. Sample size determination

The sample size will be determined using the formula²⁸

$$N = \frac{Z^2 \cdot P \cdot Q}{D^2}$$

Where,

N = Minimum sample size

Z = Standard normal deviate, usually set at 1.96 which corresponds in 95% confidence level.

P = Proportion with deserved characteristics = 50%

Q = I.P (Proportion in the target population not having the deserved characteristics)

D = Degree of accuracy usually set at 0.05

$$N = \frac{(1.96)^2 \times 0.5 \times 0.5}{(0.05)^2}$$

$$N = \frac{384.16 \times 0.25}{0.0025}$$

$$N = 0.96004 - 384.16$$

$$= 0.025$$

Therefore, minimum sample size (N) = 384

Adjustment for non-response, $N_s = N/\text{response rate}$

Assumed response rate = 82% i.e. $0.82 \times 384 / .82 = 469.38$

$$N_s = 384 / .90$$

$$= 429.67$$

$$= 430$$

Therefore, sample size used = 430

2.4. Sampling techniques

Sampling technique was systematic sampling from the class registers of the three classes 400 level, 500 level and 600 level totaling 864 and sample size of 430. Sample fraction was $430/864$ (1/2) and the sampling frame was 001 to 864 and the sampling interval was 2. Starting point lies between 001 and 002 and table of random number was consulted to select 002 as the starting point. With sampling interval of 2, 430 students were selected between 001 and 864.

2.5. Ethical considerations

Ethical approval for this work was sought for and obtained from the ethics and research committee of Abia State University Teaching Hospital, Aba. Permission was obtained from the Umunze community Abayi, OsisiomaNgwa and informed consent was obtained from the participants. All information received from our respondents was handled with utmost confidence.

3. Results

A total of 430 questionnaires were distributed to the study participants but 380 participants returned their questionnaires giving 86.2% recovery which was the response rate and the findings are presented below in tables. Mean age of the respondents was 24 ± 5.94

Table 1 Socio-demographic characteristics of the respondents

Variables		Frequency	Percentage (%)
Age group	≤ 20	28	7.4
	21 – 25	281	73.9
	26 – 30	41	10.8
	31 – 35	7	1.8
	36 – 40	8	2.1
	≤ 41	15	3.9
Sex	Male	150	39.5
	Female	230	60.5
Tribe	Igbo	368	96.8
	Hausa	2	0.5
	Yoruba	3	0.8
	Efik	7	1.8
Class level	400 level class	130	34.2
	500 level class	126	33.2
	600 level class	124	32.6
Mothers' level of education	Secondary education	118	31.1
	Tertiary education	262	68.9

Mother's occupation	Teaching	120	31.6
	Trading	94	24.7
	Civil service	166	42.7

Table 1 shows the socio-demographic characteristic of the students. Majority of the students 281 (73.9%) were found in the age range of 21 – 25 years while the least 7 (1.8%) were in the age range of 32 – 35 years, Female students 230 (60,5%) constituted the majority of the students while male 150 (39.9%) constituted the minority. Majority of the students 368 (96.8%) were Igbo while the least 2 (0.5) were Hausa, Majority of the students 130 (34.2%) were in 400 level class while the least 124 (32.6%) were in 600 level class. Majority of the mothers of the students 262 (68.9%) had tertiary education while the minority of the mothers of the students 118 (31.1%) had secondary education. Majority of the mothers of the students 166 (42.7%) were civil servants while the minority of the mothers of the students 94 (24.7%) were traders

Table 2 Sources of information on Covid-19 for students

Variables		Frequency	Percentage (%)
Sources of information on Covid-19 for students	Friends	42	11.0
	School	60	15.8
	Social Media	128	33.7
	Mass Media	72	19.0
	Community	45	11.8
	Church	33	8.7
Total		380	100.0

Table 2 shows possible sources of information to students on Covid-19, Social media 128 (33.7%) constituted majority of the sources of information to students while information from church 33 (8.7%) constituted the least of source of information to students

Table 3 Availability of good water supply and soap as necessities for handwashing

Variables		Frequency	Percentage (%)
Availability of good water supply and soap as necessities for handwashing	Always	89	23.4
	Sometimes	291	76.6
Total		380	100.0

Table 3 shows the role of availability of good water supply and soap in handwashing as a preventive measure. Few students 89 (23.4%) said that availability of good water and soap always is very necessary for handwashing while majority of the students 291 (76.6%) said that availability of good water supply and soap sometimes is necessary for handwashing.

Table 4 shows the minimum duration of handwashing with soap at a time. Majority of the students 195 (51.3%) washed with soap in a running water for less than 30 seconds was the minimum duration while 185 (48.7%) students washed with soap in a running water for 30 seconds to 1 minute was the minimum duration

Table 4 Minimum duration of handwashing with soap at a time

Variables		Frequency	Percentage (%)
Minimum duration of handwashing with soap at a time	Less than 30 seconds	195	51.3
	30 seconds – 1 minute	185	48.7
Total		380	100.0

Table 5 Number of times handwashing with soap was done in a day

Variables		Frequently	Percentage (%)
Number of times handwashing should be done in a day.	At least 1 – 2 times	37	9.7
	At least 3 – 5 times	69	18.2
	At least 6 – 10 times	274	72.1
Total		380	100.0

Table 5 shows number of times handwashing is done in a day, Majority of the students 274 (72.1%) carry out handwashing with soap at least 6 – 10 times a day which is the gold standard, while 69 (18.2%) washed 3 to 5 times a day and 37 (9.7%) washed 1 to 2 times a day.

Table 6 Washing of hands and soap in a running water

Variables		Frequency	Percentage (%)
Washing of hands with soap in a running water.	Yes	195	51.3
	No	185	48.7
Total		380	100.0

Table 6 showed that 195 (51.3%) participants washed their hands with soap in a running water while 185 (48.7%) participants washed their hands with soap in a running water.

Table 7 Handwashing practices among medical students of Abia State University Teaching Hospital, Aba

Variables	Responses	Frequency (380)	Percentage (%)
Belief in effectiveness of practice of handwashing with soap in running water	Yes	240	63.2
	No	140	36.8
Practice handwashing after touching patients	Yes	220	57.9
	No	160	42.1
Practice of handwashing after touching patient's food package	Yes	210	55.3
	No	170	44.7
Practice of handwashing after touching patient's linen	Yes	200	52.6
	No	180	47.4
	Yes	230	60.5

Practice of handwashing after touching blood or tissue specimen on a gloved hand.	No	150	39.5
Practice of handwashing after physical examination	Yes	240	63.2
	No	140	36.8
Practice of drying hands after handwashing	Yes	230	60.5
	No	150	39.5
Practice of turning off the water taps with elbow after handwashing	Yes	210	55.3
	No	170	44.7
Practice of handwashing after using the lavatory	Yes	220	57.9
	No	160	42.3

Table 7 showed that majority of the students scored above 52% and between 52.6% to 63.2% in all the different aspects of handwashing practices they were presented with.

Table 8 Medical students' Participation in handwashing practices

Variables	Medical students N (%)	χ^2 - value	P-value
Belief in effectiveness of practice of handwashing with soap in running water	240 (63.2)	68.54	0.000
	140 (36.8)		
Practice handwashing after touching patients	220 (57.9)	37.69	0.000
	160 (42.1)		
Practice of handwashing after touching patient's food package	210 (55.3)	81.76	0.000
	170 (44.7)		
Practice of handwashing after touching patient's linen	200 (52.6)	78.34	0.000
	180 (47.4)		
Practice of handwashing after touching blood or tissue specimen on a gloved hand.	230 (60.5)	53.48	0.000
	150 (39.5)		
Practice of handwashing after physical examination	240 (63.2)	46.52	0.000
	140 (36.8)		
Practice of drying hands after handwashing	230 (60.5)	60.46	0.000
	150 (39.5)		
Practice of turning off the water taps with elbow after handwashing	210 (55.3)	52.71	0.000
	170 (44.7)		
Practice of handwashing after using the lavatory	220 (57.9)	54.82	0.000
	160 (42.3)		

Table 8 showed that there was statistically significant association between all the handwashing practices and medical students' participation.

4. Discussion

Many of the respondents in this study were aged between 21-25 years (73.9%), with more females (60.5%). The mean of the respondents was 24 ± 5.94 . Our findings are similar with a study in Ethiopia²⁹ where majority of the participants 263 (64.1%) were aged between 18 – 29 years and a mean age of 27.42 ± 7.37 SD. Their study differed from ours in the sex distribution of the participants where majority of the participants 250 (61%) were male and fewer 160 (39%) were female. All the participants in our study were undergraduate medical students in contrast with their study²⁹ where majority 206 (50.2%) were of Primary level of education. The participants of our study were students in contrast with their study²⁹ where their participants were working class people. Majority of the mothers of the respondents 262 (68.9%) had tertiary education and majority of the mothers of the respondents 166 (42.7%) were civil servants.

Majority of the students 128 (33.7%) said that social media was the major source of information to students on Covid-19. This is similar in a study conducted during the second wave of Covid-19 in Jordan³⁰ in early 2021 where healthcare workers information regarding Covid-19 were radio, TV, and internet website, formal authorities and physicians. These results were similar to a study conducted in a city³¹ close to Jordan where it was noted that social media was the main source of information.

Few students 89 (23.4%) observed that availability of good water and soap were always necessary while majority of the students 291 (76.6%) observed that availability of good water and soap were sometimes necessary for handwashing.

Majority of the students 195 (51.3%) washed their hands with soap in a running water for 30 seconds to 1 minute as the minimum duration of hand washing.

In this study, majority of the students 195 (51.3%) washed their hands in a running water which is the level of good handwashing practice while 185 (48.7%) do not wash their hands with soap in running water. This is similar in a study in Ethiopia²⁹ where the handwashing practice level was 52.9% (95% CI: 48.5 – 57.9). This is similar in a study conducted in Jordan where 51.7% had good practice regarding using personal protective equipment during Covid-19 pandemic. In that study,³⁰ 35.6% of the participants reported that personal protective equipment was not available in their facility. It is worthy to mention that practices related to Covid-19 preventive measures could be influenced by the resources in the hospital. Good handwashing was also seen in a study in Korea³² where the level of hand washing practice was between 50% to 70%. Studies carried out in Saudi- Arabia and other Ethiopia city reported low handwashing practices levels of 39.7% and 29% respectively.^{33, 34, 35}

In contrast, the findings in the studies among attendees of Hajj and Umrah pilgrimage found that hand washing with soap and water was more prevalent than other hand washing methods with hand washing practices of 98% and 99% respectively.^{36, 37, 38} It is also noteworthy that Saudi Arabian citizens have a preference for using soap and water to alcohol-based hand rub (ABHR) as a preventive measure against Covid-19.³⁹ In a study in Al Madinah City⁴⁰ it was found that there was relatively poor hand hygiene behaviour after sneezing or coughing, with only 25.6% washing hands with soap and water and 12.6% using alcoholic hand sanitizer, as well as following handshake (28% and 26%, respectively), and the largest proportion (27.6%) used a handkerchief following a sneeze, while previously, they washed hands with water and soap.³⁶ In spite of the recommendations of washing hands after sneezing or coughing and following handshakes to prevent contracting and spreading infections, it seemed that the low compliance of hand washing during these situations is an issue that persist even during the pandemic.

Similarly. Approximately 27% of the Saudi Arabian citizens did not wash their hands after nose-blowing, coughing, or sneezing amidst the Covid-19 pandemic.⁴¹ Conversely, hand washing compliance in their study⁴⁰ improved slightly following other high -risk actions, eg., about 98% of visitors of the mosque cleaned their hands after touching a patient and 99% cleaned hands following waste disposal, whereas 85% and 90% of pilgrims, respectively, during the 2019 Hajj complied.³⁶ Another survey involving Umrah pilgrims conducted in 2019 showed that over 90% of pilgrims washed their hands with soap and water or sanitizers after coughing and sneezing, before eating or preparing food, and after using the bathroom.⁴²

The fact that fewer participants were complying with ABHR compared with using soap and water may have stemmed from the religious and cultural preferences of Muslims to avoid alcoholic substances when equivalent alternatives are available.⁴³

Majority of the students 274 (72.1%) washed their hands at least 6 to 10 times in a day.

Majority of the students responded positively in all the handwashing practices while minority of the students responded negatively in all the handwashing practices.

There was statistically significant association between all the handwashing practices and students' participation and this is similar to a study in Ethiopia²⁹ where there was statistically significant association between all the handwashing practices and the respondents' participation.

Finally, our study took place in one medical school in one of the 36 states in Nigeria; therefore, our findings might not be generalizable to the entire country. Nonetheless, our findings fill an important gap in the literature and provide relevant information on level of hand washing with the practice of COVID-19 preventive measures among students in Nigeria.

5. Conclusion

The level of hand washing is good. There is statistically significant association between hand washing practices and students' participation. The level of hand washing could have improved markedly if the resources, such as water, soap and other equipment were made readily available in the hospital.

Recommendation

There should be adequate provision of water supply and soap at strategic points in the hospital, school authorities should post general guidelines at each hand washing site. In order to reduce the spread of Covid-19 and other contagious disease, proper health education and public enlightenment campaign should be put in place. There will be need to introduce formal training in hand washing into medical schools especially from the early years of their training.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare no conflicts of interest regarding the publication of this paper.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

- [1] Center for Disease Control and Prevention. <https://www.cdc.gov/coronavirus/2019-nCoV/about/index.html>
- [2] Arons MM, Hatfield KM, Reddy SC, Kimball A, James A, Jacobs JR, et al. Presymptomatic SARS-CoV-2 infections and transmission in a skilled nursing facility. 2020;382(22):2081–90.
- [3] Control and Prevention. What you should know about COVID-19 to protect yourself and others. Centers for Disease Control and Prevention: [https://www-cdc-gov.ezproxy3 ...](https://www-cdc-gov.ezproxy3...); 2020.
- [4] Dhand R, Li J | *Ajor, medicine cc*. Coughs and sneezes: their role in transmission of respiratory viral infections, including SARS-CoV-2. 2020;202(5):651–9. doi: 10.1164/rccm.202004-1263PP
- [5] Chan JF-W, Yuan S, Kok K-H, To KK-W, Chu H, Yang J, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. 2020;395(10223):514–23.
- [6] Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. 2020;395(10223):497–506.
- [7] Team CC-R, Bialek S, Boundy E, Bowen V, et al. Severe outcomes among patients with coronavirus disease 2019 (COVID-19)—United States, February 12–March 16, 2020. 2020;69(12):343–6. doi: 10.15585/mmwr.mm6912e2.
- [8] Pittet D, Allegranzi B, Boyce J. World health organization world alliance for patient safety first global patient safety challenge core group of experts. The World Health Organization Guidelines on Hand Hygiene in Health Care and their consensus recommendations. *Infect Control Hosp Epidemiol*. 2009;30(7):611–22.

- [9] Duroy E, Le Coutour X. Hospital hygiene and medical students. *Med Mal Infect.* 2010;40(9):530–6.
- [10] Feather A, Stone SP, Wessier A, Boursicot KA, Pratt C. Now please wash your hands: The handwashing behaviour of final MBBS candidates. *J Hosp Infect.* 2000;45(1):62– 4.
- [11] Mathur P, “Hand hygiene: back to the basics of infection control” *Indian Journal of Medical Research*, vol. 134, no 11, pp.611-620,2011.
- [12] Pittet D, Hugonnet S, Harbarth S, Mourouga P, Sauvan V, Touveneau S, et al. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. *The Lancet.* 2000;356(9238):1307–12.
- [13] Tibballs J. Teaching hospital medical staff to handwash. *Med J Aust.* 1996;164(7):395–8.
- [14] van De Mortel TF, Kermode S, Prozano T, Sansoni J. A comparison of the hand hygiene knowledge, beliefs and practices of Italian nursing and medical students. *J Adv Nurs.* 2012;68(3):569–79.
- [15] WHO | Water for health: Taking charge [Internet]. WHO. World Health Organization; [Cited 2021 May 18]. Available:http://www.who.int/water_sanitati_on_health/publications/water-for-healthtaking-charge/en/
- [16] Sax H, Allegranzi B, Uzkay I, Larson E, Boyce J and Pillet. D, “My five moments for hand hygiene”: a user-centered design approach to understand, train, monitor, and report hand hygiene”, *Journal of hospital infection*, vol.67, no 1, pp.9-21,2007,
- [17] Anders, M. MSU Study; See How Many People Properly Wash Their Hands. *Michigan Live.* 2013; June 10, 9:17 p.m
- [18] Lee, C. Importance of Hand Hygiene; Hand Washing Is a Form of Social Vaccination, *New Straits Times.*2018
- [19] Ojong, N., et al. The Practice of Hand Washing for the Prevention of Nosocomial Infections among Nurses in General Hospital Ikot Ekpene, Akwa Ibom State, Nigeria. *Archives of Applied Science Research.* 2014; 6: 97-101.
- [20] Yawson, A.E. and Hesse, A.A.J. Hand Hygiene Practice and Resources in a Teaching Hospital in Ghana. *e-Journal of Infection in Developing Countries.* 2013; 7: 338-347. <https://doi.org/10.3855/jidc.2422>
- [21] Zegeye (n.d.) Knowledge and Practices of Hand-Washing among the Nursing Staff of Jimma University Hospital in Southwest Ethiopia.2016.
- [22] Jemal, S. Knowledge and Practices of Hand Washing among Health Professionals in Dubai Referral Hospital, Dubai, Afar, Northeast Ethiopia. *Advances in Preventive Medicine*, 2018, Article ID: 5290797.<https://doi.org/10.1155/2018/5290797>
- [23] Mustapha, K. (2018) Importance of Hand Hygiene. *New Straits Times.* 2018.
- [24] <https://nst.com.my/lifestyle/heal/2018/12/439419/importance-hand-hygiene>
- [25] Graphic Online, Schools and Universities to Reopen for Final Year Students. Available at: <https://www.graphic.com.gh/news/politics/schools-and-universities-to-reopen-for-final-year-students.html>. 2020. Accessed on August 17, 2020.
- [26] Myjoyonline , Schools Will Only Be Shut Down if COVID-19 Infection Rate Reaches 15% – Deputy Health Minister. 2020,Available at: <https://www.myjoyonline.com/news/education/schools-will-only-be-shut-down-if-covid-19-infection-rate-reaches-15-deputy-health-minister/>. Accessed August 17, 2020.
- [27] Federal Republic of Nigeria 1992 Boundary Official Gazette, No 2 Abuja- 2nd February 1992 vol. 96 Pg B20 -21.
- [28] Federal Republic of Nigeria 2006 Population Census Official Gazette, No 2 Abuja- 2nd February 2009 vol. 96 Pg B20 -21 projected up to 2016 (inclusive Osioma Ngwa Local Government Area)
- [29] Charan J, Biswas T. How to calculate sample size for different study designs in medical research? *Indian Journal of Psychological Medicine.* 2013;35(2):121.
- [30] Tarikuwa N, Metadel A, Solomon G: Hand hygiene practices during the Covid-19 pandemic and associated factors among barbers and beauty salon workers in Ethiopia. *PLOS ONE.* 2022; 17(7): e0269225. (Available at: doi: 10.1371/journal.pone.0269225.
- [31] Amro F. M, Ahmad H R, Nidal F E, Sa’d ALBashtawy. M: Knowledge, Attitude, and Practices Concerning Covid-19 Preventive Measures Among Healthcare Providers in Jordan. *SAGE Open Nursing.* 2022; 8: 1-8
- [32] Huynh, T. L. The COVID-19 risk perception: A survey on socioeconomics and media attention. *Economics Bulletin.* 2020; 40(1): 758–764. Retrieved from <https://www.accessecon.com/Pubs/EB/2020/Volume40/EB-20-V40-I1-P64.pdf>

- [33] Lee M-S, Hong SJ, Kim YT. Handwashing with soap and national handwashing projects in Korea: Focus on the National Handwashing Survey, 2006-2014. *Epidemiol Health*. 2015;37: 1–9
- [34] Al Saleh S, Al Rammah AA, Syed W, Al Duhailan R, Kattan S, Al-Mana F. Stethoscope hygiene and barriers among physicians - A cross-sectional study from National Guard Health Affairs in Dammam, Saudi Arabia. *J Patient Saf Infect Control* 2019;7:53-8.
- [35] Ghumman GW, Ahmad N, Pop-Vicas A, Iftikhar S. Stethoscope cleaning during patient care. *R I Med J* (2013) 2018;101:18-20.
- [36] Sahiledengle B. Stethoscope disinfection is rarely done in Ethiopia: What are the associated factors? *PLoS One* 2019;14:e0208365. <https://doi.org/10.1371/journal.pone.0208365>.
- [37] Mahdi, H.; Alqahtani, A.; Barasheed, O.; Alemam, A.; Alhakami, M.; Gadah, I.; Alkediwi, H.; Alzahrani, K.; Fatani, L.; Dahlawi, L.; et al. Hand Hygiene Knowledge and Practices among Domestic Hajj Pilgrims: Implications for Future Mass Gatherings Amidst COVID-19. *Trop. Med. Infect. Dis.* 2020, 5, 160. [CrossRef].
- [38] Alqahtani, A.S.; Tashani, M.; Heywood, A.E.; Almohammed, A.B.S.; Booy, R.; Wiley, K.E.; Rashid, H. Tracking Australian Hajj Pilgrims' Health Behavior before, during and after Hajj, and the Effective Use of Preventive Measures in Reducing Hajj-Related Illness: A Cohort Study. *Pharmacy* 2020, 8, 78. [CrossRef]
- [39] Dauda, G.M.; Hasan, H.; Naing, N.N.; Wan, A.N.; Zeiny, D.Z.; Nor, A.W.; Abubakar, B.A. Assessment of Knowledge, Attitude and Practice towards Prevention of Respiratory Tract Infections among Hajj and Umrah Pilgrims from Malaysia in 2018. *Int. J. Environ. Res. Public Health* 2019, 16, 4569. [CrossRef]
- [40] Almutairi, A.F.; Bani, M.A.A.; Alessa, Y.M.; Almutairi, S.B.; Almaleh, Y. Public trust and compliance with the precautionary measures against COVID-19 employed by authorities in Saudi Arabia. *Risk Manag. Healthc. Policy* 2020, 13, 753. [CrossRef] [PubMed]
- [41] Hashim A. Mahdi, Hamza M. Assaggaf, Mohammad Alfelali, Omar B. Ahmed, Radi Alsafi, Ramon Z. Shaban, Robert Booy and Harunor Rashid; Hand Hygiene Knowledge, Perception, and Practices among Domestic Visitors to the Prophet's Mosque in Al Madinah City Amid the COVID-19 Pandemic: A Cross-Sectional Study. *International Journal of Environmental Research and Public Health*. 2021; 18: 673. (Available at: <https://www.mdpi.com/journal/ijerph>)
- [42] Hanawi, M.K.; Angawi, K.; Alshareef, N.; Qattan, A.M.N.; Helmy, H.Z.; Abudawood, Y.; Alqurashi, M.; Kattan, W.M.; Kadasah, N.A.; Chirwa, G.C.; et al. Knowledge, Attitude and Practice Toward COVID-19 Among the Public in the Kingdom of Saudi Arabia: A Cross-Sectional Study. *Front. Public Health* 2020, 8, 217. [CrossRef]
- [43] Tobaiqy, M.; Alhasan, A.H.; Shams, M.M.; Amer, S.A.; Mac, L.K.; Alcattan, M.F.; Almударра, S.S. Assessment of Preventative Measures Practice among Umrah Pilgrims in Saudi Arabia, 1440H-2019. *Int. J. Environ. Res. Public Health* 2020, 18, 257. [CrossRef] [PubMed]
- [44] Ng, W.K.; Shaban, R.Z.; Mortel, T. Healthcare professionals' hand hygiene knowledge and beliefs in the United Arab Emirates. *J. Infect. Prev.* 2017, 18, 134–142. [CrossRef] [PubMed] Hand hygiene practices during the COVID-19 pandemic and associated factors among barbers and beauty salon workers in Ethiopia
- [45] Lee M-S, Hong SJ, Kim YT. Handwashing with soap and national handwashing projects in Korea: Focus on the National Handwashing Survey, 2006-2014. *Epidemiol Health*. 2015;37: 1–9
- [46] Al Saleh S, Al Rammah AA, Syed W, Al Duhailan R, Kattan S, Al-Mana F. Stethoscope hygiene and barriers among physicians - A cross-sectional study from National Guard Health Affairs in Dammam, Saudi Arabia. *J Patient Saf Infect Control* 2019;7:53-8.
- [47] Ghumman GW, Ahmad N, Pop-Vicas A, Iftikhar S. Stethoscope cleaning during patient care. *R I Med J* (2013) 2018;101:18-20.
- [48] Sahiledengle B. Stethoscope disinfection is rarely done in Ethiopia: What are the associated factors? *PLoS One* 2019;14:e0208365. <https://doi.org/10.1371/journal.pone.0208365>
- [49] The findings in the studies among attendees of Hajj and Umrah pilgrimage found hand washing with soap and water was more prevalent than other hand hygiene methods [15,26–28]. It is also noteworthy that Saudi Arabian citizens have a preference for using soap and water to ABHR as a preventive measure against COVID-19 [19].
- [50] Mahdi, H.; Alqahtani, A.; Barasheed, O.; Alemam, A.; Alhakami, M.; Gadah, I.; Alkediwi, H.; Alzahrani, K.; Fatani, L.; Dahlawi, L.; et al. Hand Hygiene Knowledge and Practices among Domestic Hajj Pilgrims: Implications for Future Mass Gatherings Amidst COVID-19. *Trop. Med. Infect. Dis.* 2020, 5, 160. [CrossRef].

- [51] Almutairi, A.F.; Bani, M.A.A.; Alessa, Y.M.; Almutairi, S.B.; Almaleh, Y. Public trust and compliance with the precautionary measures against COVID-19 employed by authorities in Saudi Arabia. *Risk Manag. Healthc. Policy* 2020, 13, 753. [CrossRef] [PubMed]
- [52] World Health Organization. Coronavirus Disease (COVID-19) Advice for the Public: Mythbusters. Available online: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/mythbusters#5g> (accessed on 1 September 2020)
- [53] Alqahtani, A.S.; Tashani, M.; Heywood, A.E.; Almohammed, A.B.S.; Booy, R.; Wiley, K.E.; Rashid, H. Tracking Australian Hajj Pilgrims' Health Behavior before, during and after Hajj, and the Effective Use of Preventive Measures in Reducing Hajj-Related Illness: A Cohort Study. *Pharmacy* 2020, 8, 78. [CrossRef]
- [54] Dauda, G.M.; Hasan, H.; Naing, N.N.; Wan, A.N.; Zeiny, D.Z.; Nor, A.W.; Abubakar, B.A. Assessment of Knowledge, Attitude and Practice towards Prevention of Respiratory Tract Infections among Hajj and Umrah Pilgrims from Malaysia in 2018. *Int. J. Environ. Res. Public Health* 2019, 16, 4569. [CrossRef]
- [55] Alqahtani, A.S.; Fakeerh, M.; Bondagji, D.; Park, S.; Heywood, A. Hand Hygiene Knowledge, Perception, and Practices among Domestic Visitors to the Prophet's Mosque in Al Madinah City Amid the COVID-19 Pandemic: A Cross-Sectional Study
- [56] Hashim A. Mahdi, Hamza M. Assaggaf, Mohammad Alfelali, Omar B. Ahmed, Radi Alsafi, Ramon Z. Shaban, Robert Booy and Harunor Rashid; Hand Hygiene Knowledge, Perception, and Practices among Domestic Visitors to the Prophet's Mosque in Al Madinah City Amid the COVID-19 Pandemic: A Cross-Sectional Study. *International Journal of Environmental Research and Public Health*. 2021; 18: 673. (Available at: <https://www.mdpi.com/journal/ijerph>)
- [57] In spite of the recommendations of washing hands after sneezing or coughing and following handshakes to prevent contracting and spreading infections, it seems that the low compliance of hand hygiene during these situations is an issue that persists even during the pandemic. This survey shows a relatively poor hand hygiene behaviour after sneezing or coughing, with only 25.6% washing hands with soap and water and 12.6% using alcoholic hand sanitiser, as well as following handshakes (28% and 26.8%, respectively), and the largest proportion (27.6%) used a handkerchief following a sneeze, while previously, they washed hands with water and soap.³⁴ Similarly, approximately 27% of the Saudi Arabian citizens did not wash their hands after nose-blowing, coughing, or sneezing amidst the COVID-19 pandemic.³⁹ Conversely, hand hygiene compliance in this study improved slightly following other high-risk actions, e.g., about 98% of visitors of the mosque cleaned their hands after touching a patient and 99% cleaned hands following waste disposal, whereas 85% and 90% of pilgrims, respectively, during the 2019 Hajj complied³⁴. Another survey involving Umrah pilgrims conducted in 2019 showed that over 90% of pilgrims washed their hands with soap and water or sanitisers after coughing and sneezing, before eating or preparing food, and after using the bathroom.⁴⁰ The fact that fewer participants were complying with ABHR compared with using soap and water may have stemmed from the religious and cultural preference of Muslims to avoid alcoholic substances when equivalent alternates are available.⁴¹
- [58] Hanawi, M.K.; Angawi, K.; Alshareef, N.; Qattan, A.M.N.; Helmy, H.Z.; Abudawood, Y.; Alqurashi, M.; Kattan, W.M.; Kadasah, N.A.; Chirwa, G.C.; et al. Knowledge, Attitude and Practice Toward COVID-19 Among the Public in the Kingdom of Saudi Arabia: A Cross-Sectional Study. *Front. Public Health* 2020, 8, 217. [CrossRef]
- [59] Tobaiqy, M.; Alhasan, A.H.; Shams, M.M.; Amer, S.A.; Mac, L.K.; Alcattan, M.F.; Almударра, S.S. Assessment of Preventative Measures Practice among Umrah Pilgrims in Saudi Arabia, 1440H-2019. *Int. J. Environ. Res. Public Health* 2020, 18, 257. [CrossRef] [PubMed]
- [60] Ng, W.K.; Shaban, R.Z.; Mortel, T. Healthcare professionals' hand hygiene knowledge and beliefs in the United Arab Emirates. *J. Infect. Prev.* 2017, 18, 134–142. [CrossRef] [PubMed].