Original Article :

Behaviors and Associated Factors of Hand Hygiene and Mask-Wearing among Higher Education Students during the COVID-19 Pandemic: A Cross-sectional Study from Kingdom of Saudi Arabia.

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Abstract

Background and Aims:

Even though more emphasis has been given to the preventive behavior that includes hand washing and wearing mask during this pandemic situation; not all the people are adhering to it. Therefore the study aimed to evaluate the hand hygiene and mask wearing behavior among the university students in the Kingdom of Saudi Arabia.

Methods:

A cross-sectional study was conducted among the students enrolled in all the branches of Saudi Electronic University that predominantly covers the representative samples of students across the nation. The participants were recruited by using a convenience sampling to participate in this study. A self-reported online questionnaire was used to collect the information and Chi-square test was performed to determine the association between the sociodemographic characteristics and the hand hygiene mask wearing behavior of students.

Results:

Six hundred and thirty five students from all the branches of Saudi Electronic University were participated in this study. Majority of the students were females and in the age group ranges between 20 to 25 years old. Most of the respondents in the study were living in a joint family and having children in their home. Majority of the students in the study were appropriately practicing the hand washing and mask wearing behavior. A positive correlation was established between the hand hygiene of students and gender, educational level and working sector. The study also highlighted that the mask wearing behavior is influenced by the working status

and the working sector among the students.

Conclusion:

Although most of the students were wearing the mask properly and washing their hands appropriately; it varied based on the sociodemographic characteristics. Therefore, there is a need for continual guidance and training programs on hand hygiene and proper mask wearing behavior, regardless of any factors.

Keywords:

Hand hygiene, Mask wearing behavior, COVID-19, University students, Saudi Arabia.

Introduction

The coronavirus disease 2019 (COVID-19) plays a significant role in the current global pandemic that has a harmful impact on the health and the development of the population across the world[1]. The death toll due to this COVID-19 has tremendously increased and it is exponentially higher than the similar sorts of pandemic reported in certain countries. The total global death rate due to COVID-19 was 6,159,474 deaths across the world in early April 2022 which has happened within the time frame of four as soon as it has been declared by the World Health Organization (WHO) as a pandemic[2-4]. According to the recent literatures the SARS-CoV-2 spreads through small droplets during normal conversation, coughing or sneezing[5].

Although the asymptomatic cases of SARS-CoV-2 started to increase throughout the globe and it also further increases the transmission of diseases which substantially increased the mortality rate. As a result of it SARS-CoV-2 has become a most serious issue in the entire world and the experts started to explore the scientific evidence in order to control the spread and mitigate the effect of COVID-19[6-7].

Currently both therapeutic and the non-therapeutic measures are available for limiting the transmission of infection caused by the SARS-CoV-2. Though the pharmaceutical are highly effective but it may not work in case of an outbreak that are caused by the variants SARS-CoV-2 pathogens. However non-pharmaceutical measures plays a vital role in reducing the risk and it also establishes the barriers to control the aerosol spread. It plays a pivotal role in protecting the vulnerable population against SARS-CoV-2 by implementing an appropriate non-medical intervention[8-9].

The Center for Disease Control and Prevention (CDC) recommends several non-medical interventions in order to control the spread of SARS-CoV-2 that includes washing hands frequently, sanitizes surface regularly, social distancing and protecting the mouth and nose with

the help of face masks [10]. Hand hygiene either washing the hands with the help of soap or using a chemical to disinfect the hand are considered to be the most effective non-medical interventions that could help us to prevent the nosocomial infection especially during this pandemic crisis[11-12]. A study conducted in China reported that 60% of the students in the school did not wash their hands properly even during this COVID-19 pandemic[13]. However the literatures suggest that compliance with the hand hygiene completely rely on the perception and the knowledge of an individual person[14-15]. Continuous efforts have been made in order to increase the compliance of hand hygiene practices especially during the pandemic crisis.

Wearing a face masks is another significant response behavior among the individual persons in order to tackle the public health problems of COVID-19. Mask is considered to be the most useful tool that helps the individuals to protect themselves against the spread of influenza pandemic and the acute respiratory infections[16]. World Health Organization (WHO) recommends the healthy individual to use the non-medical masks for controlling the spread of COVID-19 particularly in the locations in which the social distancing cannot be maintained[17].

It is quite evident that even the non-medical face masks reduce the transmission of infections that is caused through the droplets and infectious aerosols[18-19]. Wearing face masks not only helps the individuals who are wearing it in order to safeguard themselves but it can also provide protection for others from contracting the infection[20]. During the current pandemic situation washing hands and wearing a face mask are considered to be very important recurrently highlighted and successful preventive measures among the population across the entire world[13]. During this COVID-19 pandemic crisis young adult especially the college students faced more challenges including academic pressure, employment pressure and family pressure and are considered to be the most vulnerable groups for contracting COVID-19. In order to full fill the gaps and to have a better understanding about the current trend the present study has been primarily designed to evaluate the behaviors and associated factors of hand hygiene and mask-wearing among higher education students in the Riyadh, Dammam, Jeddah, Abha, Tabuk region of the kingdom of Saudi Arabia.

Materials and Methods

Study design:

This was a cross-sectional study.

Study setting & Study period: This study was conducted among registered students

of Saudi Electronic University from all the branches during May 2021 to July 2021.

Sample size calculation: The sample size was calculated by the Raosoft statistical program [21] by taking the population (students from all branches of specialization) size as 27855, The hypothesized frequency of outcome factor in the population is 50% at a significance level of 0.05, a design effect of 1 and confidence interval of 95% ending with a minimum sample size equal 379.

Sampling technique and procedure: Students from all the colleges of Saudi Electronic University from all the branches were invited to participate in this study. Convenience sampling technique was used to recruit the study participants.

Ethical Permission: Ethical permission was obtained from the Institutional Research Ethics Committee, Saudi Electronic University, Riyadh, Kingdom of Saudi Arabia. A written informed consent was obtained from the study participants.

Study instrument and procedure:

An online structured questionnaire was developed based on the extensive literature search from various databases and the previously published scholarly literature[13] on behaviors and associated factors of hand hygiene and mask-wearing was identified, selected and used to frame the questionnaire. The first part of the questionnaire included questions on socio-demographic characteristics of the study participants (Gender, Age, Educational level, Area of specialization, Working history, Marital status & Family type). The second part of the questionnaire comprised of questions exploring the hand hygiene among the students (washing hands before eating, after toilet, after returning home, after touching public goods, before and after wearing mask, after handling animal wastes, after contacting with saliva, tears & sputum, after sneeze/cough & after rubbing nose, eyes, mouth with hands). The Third parts of the questionnaire had questions related to the masks wearing behavior of the students (kind of mask, size of mask, change of mask, correct operation of wearing a surgical mask, touching mask with hands, take off & pulling of face mask).

The behavior has been classified as good or poor based on the total scores. The score of hand hygiene behavior more than or equal to 6 points (out of 9 points) and mask wearing behavior more than or equal 5 points (out of 10 points) was classified as good behavior. (1=good; 0=poor).

Validity and Reliability: The questionnaire was validated by conducting a pilot study and test-retest reliability was done by Alpha (Cronbach's) for internal consistency and it was >0.70.

Data management and analysis: The data

analysis was carried out by using SPSS (Version 16.0, SPSS Inc. Chicago, IL, USA). The demographic characteristics, hand hygiene and mask wearing behavior are described as frequencies and percentages. The association between the demographic variables and the hand hygiene and mask wearing behavior was evaluated by using the chi-square test.

Results

Demographic characteristics of the study population

Six hundred and thirty five students from all the branches of Saudi Electronic University from various regions of kingdom of Saudi Arabia were participated in this study. Table 1 shows the demographic characteristics of the study population; Majority (61.7%) of the participants in the study was females and 28.5% of them were in the age group between 20 to 25 years. Most of those (45.5%) were in the preparatory year; 37.5% of the students in the study were belonging to the speciality of administrative and financial sciences. More than half of the participants in the study were not working and single. However 57.8% of them living in a joint family and 60.2% of the study participants were having children at home.

able 1: Sociodemographic characteristics of respondents (n=635)

Characteristics	Total subjects N=635	
	Frequency (n)	Percentage (%)
Gender		
Male	243	38.3
Female	392	61.7
Age (years)		
<20	94	14.8
20-25	181	28.5
26-30	162	25.5
31-35	96	15.1
>35	102	16.1
Education level		
Preparatory year	289	45.5
Bachelor	275	43.3
Master	71	11.2
Specialization		
Health sciences	197	31
Computing and informatics	89	14
Science and theoretical studies	99	15.6
Administrative and Financial science	238	37.5
Others	12	1.9

Characteristics	Total subjects N=635	
	Frequency (n)	Percentage (%)
Currently working		
Yes	292	46
No	343	54
Working Sector		
Government	160	25.2
Private	124	19.5
Self-Employed	9	1.4
Unemployed	342	53.9
Marital status		
Single	370	58.3
Married	240	37.8
Divorced	23	3.6
Widowed	02	0.3
Family type		
Nuclear	268	42.2
Joint	367	57.8
Children at home		
Yes	382	60.2
No	253	39.8

Hand Hygiene behavior among students

Hand Hygiene behavior of the students were described in the table 2. Majority of the participants in the study were washing their hands before eating, after going to toilet, after returning home after touching the public goods, after contacting with animals & animal waste, after contacting with tears, sputum and saliva, after covering with cough/sneeze. However more than half of the participants in the study did not wash their hands before and after wearing a mask. Most (44.2%) of the students in the study wash their hands with running water and scrub with hand sanitizer or soap and only 10.1% of the study participants wash their hands while rubbing eyes, nose or mouth with their hands.

Table 2: Hand Hygiene among students (n=635)

Hand Hygiene	Total subjects N=635	
	Frequency (n)	Percentage (%)
Wash hands		
Before Eating		
Yes	570	89.8
No	19	3
Not sure	46	7.2

Hand Hygiene	Total subjects N=635	
	Frequency (n)	Percentage (%)
After going to the toilet		
Yes	612	96.4
No	6	0.9
Not sure	17	2.7
After returning home		
Yes	530	83.5
No	35	5.5
Not sure	70	11
After touching the public goods		
Yes	461	72.6
No	62	9.8
Not sure	112	17.6
Before and after wearing a mask		
Yes	183	28.8
No	339	53.4
Not sure	113	17.8
After contacting with animals or handling animal feces		
Yes	592	93.2
No	11	1.7
Not sure	32	5
After contacting with tears, snot, sputum and saliva		
Yes	453	71.3
No	45	7.1
Not sure	137	21.6
After covering with cough or sneeze		
Yes	332	52.3
No	169	26.6
Not sure	134	21.1
How do you usually wash your hands?		
Use running water and scrub with hand sanitizer or soap for at least 20 seconds, and the standard seven step hand washing method was adopted	235	37
Wash your hands with the water in the basin	90	14.2
Rinse under running water	29	4.6
Use running water and scrub with hand sanitizer or soap	281	44.2
Rub your eyes, nose or mouth with your hands		
Always	64	10.1
Often	289	45.5
Seldom	249	39.2
Never	33	5.2

Table 3 explains the comparison of good rate of hand hygiene among students; A positive significant association was established between the hand hygiene of students and gender (p=0.005), educational level (p=0.001) and working sector (p=0.047).

Table 3: Comparison of good rate of hand hygiene among students (n=635)

Category	Group	Hand Hygiene		
		Good/Poor rate	χ2	p
Gender	Male	147/96	20.17	0.005*
	Female	293/99		
Age	<20	116/65	40.87	0.055
	20-25	114/48		
	26-30	68/28		
	31-35	71/23		
	>35	71/31		
Educational Level	Preparatory year	214/75	21.95	0.001*
	Bachelor	185/90		
	Master	41/30		
Area of Specialization	Health sciences	134/63	35.54	0.155
	Computing and informatics	55/34		
	Science and theoretical studies	68/31		
	Administrative and Financial science	175/63		
	Others	08/04		
Currently working	Yes	189/103	13.42	0.063
	No	251/92		
Working sector	Government	112/48	32.92	0.047*
	Private	72/52		
	Self-Employed	06/03		
	Unemployed	250/92		
Marital status	Single	251/119	16.81	0.723
	Married	168/72		
	Divorced	19/04		
	Widowed	00/02		
Family type	Nuclear	184/84	05.34	0.618
	Joint	256/111		
Children at home	Yes	267/115	03.53	0.832
	No	173/80		

*P<0.05, Statistically Significant

Mask-Wearing behavior among students

Mask wearing behavior and comparison of good rate of mask wearing behavior among students are illustrated in the table 4; Majority (75.4%) of the students in the students was using the mask while going

out. Most (66.9%) of them were using the disposable medical mask and 30.2% of the students were always choosing the right size of the mask based on its features. 44.6% of the participants in the study were daily changing their mask and more than half of the study participants were wearing the mask by themselves in a correct way. 46.8% of the students were touching the front of the mask with their hands and majority (80.3%) of the students were feel free to take off the mask of them or others. 36.1% of the students in the study pulled the mask down to reveal the nose or mouth. A positive significant association was established between the mask wearing behavior among study participants and currently working (p=0.012) and working sector (p=0.025).

Table 4: Mask wearing behavior & Comparison of good rate of mask wearing behavior among students (n=635)

Mask wearing behavior	Total subjects N=635	
	Frequency (n)	Percentage (%)
How often do you wear a mask when you go out?		
Always	479	75.4
Often	120	18.9
Seldom	28	4.4
Never	8	1.3
What kind of mask do you usually choose?		
Cotton yarn mask	79	12.4
Disposable medical mask	425	66.9
Medical surgical mask	43	6.8
Medical protective mask	41	6.5
Particulate protective mask	15	2.4
Other types	32	5
Will you choose the right size mask according to your features?		
Always	192	30.2
Often	168	26.5
Seldom	129	20.3
Never	146	23
How often do you change your mask?		
2-4 hours	214	33.7
1 day	283	44.6
2-5 days	74	11.7
More than 5 days	24	3.8
I do not replace the new mask, and continue to use it after cleaning	40	6.3
What is the correct operation for wearing a surgical mask?		
Distinguish the inside and outside of the mask, as well as the top and bottom. The mask is light inside and dark outside, and there are metal strips (nose clips) on the top	297	46.8

Mask wearing behavior	Total subjects N=635	
	Frequency (n)	Percentage (%)
What is the correct operation for wearing a surgical mask?		
Fully unfold the folded face of the mask to cover the nose, mouth and chin	94	14.8
Put the fingertips of both hands on the nose clip, start from the middle position, and shape the nose clip according to the shape of the nose bridge	104	16.4
Check whether the edge of the mask fits your face	43	6.8
Wear at will regardless of the front and back	63	10
Never wear a mask	34	5.4
How do you usually wear a mask?		
Wear it by yourself, but never in the correct way	36	5.7
Wear it by yourself, but rarely in the correct way	35	5.5
Wear it by yourself, and often in the correct way	200	31.5
Wear it by yourself, and always in the correct way	341	53.7
Never wear a mask	23	3.6
Touch the front of the mask with your hand		
Yes	297	46.8
No	187	29.4
Not sure	151	23.8
Feel free to take off the mask of yourself or others		
Yes	510	80.3
No	56	8.8
Not sure	69	10.9
Take off the mask and put it back on		
Yes	307	48.3
No	233	36.7
Not sure	95	15
Pull the mask down to reveal the nose or mouth		
Yes	229	36.1
No	289	45.5
Not sure	117	18.4

Category	Group	Hand Hygiene		
		Good/Poor rate	$\chi 2$	p
Gender	Male	21/222	13.07	0.110
	Female	46/346		
Age	<20	13/81	34.64	0.343
	20-25	21/160		
	26-30	18/144		
	31-35	12/84		
	>35	03/99		
Educational Level	Preparatory year	36/253	11.88	0.752
	Bachelor	26/249		
	Master	05/66		

Category	Group	Hand Hygiene		
		Good/Poor rate	$\chi 2$	p
Area of Specialization	Health sciences	27/170	32.98	0.419
	Computing and informatics		06/83	
	Science and theoretical studies		11/88	
	Administrative and Financial science			
	Others		22/216	
			01/11	
Currently working	Yes	24/268	07.75	0.012*
	No		43/300	
Working sector	Government	16/144	28.97	0.025*
	Private		22/102	
	Self-Employed		00/09	
	Unemployed			
			43/299	
Marital status	Single	49/321	20.33	0.678
	Married		16/224	
	Divorced		02/21	
	Widowed		01/01	
Family type	Nuclear	26/242	05.81	0.670
	Joint		41/326	
Children at home	Yes	41/341	06.97	0.540
	No		26/227	

*P<0.05, Statistically Significant

Discussion

The present study focused on assessing the behaviors and associated factors of hand hygiene and mask-wearing among higher education students in the kingdom of Saudi Arabia. It appeared that greater portion of students in the study had good behavior regarding the hand hygiene and wearing the face mask however it was witnessed from this study that considerable numbers of students were still having a poor compliance in performing an essential and also basic preventive measures towards COVID-19 like hand washing and wearing a face mask.

The findings of the current study were based on the nationally represented student population of kingdom of Saudi Arabia. The present study also highlights the importance of preventive behaviors inclusive of hand hygiene and mask wearing during the ongoing pandemic situation.

The results of the present study declared that greatest numbers of the participants in the study were adequately using most of the preventive measures against COVID-19 which is similar to the findings of several studies that has been conducted in different parts of the world[22-26]. Amongst the several hand hygiene moments prac-

ticed by the participants in the current study higher compliance was observed during contact with animals or handling animal feces. However previously conducted studies[27] reported higher compliance rate of hand washing was observed during the high touch surfaces which were in contrast to the findings of the present study.

The unique finding of the current study is the hand hygiene behavior varies based on the gender. The study found a statistically significant positive association between the hand hygiene behavior and gender. Similarly a study conducted by Olaimat et al.[28] in Jordan found that the female students were more appropriately practicing the hand hygiene in comparison with their male counterparts and this may be due to the cautious nature of females which is similar to the findings of the present study. Approximately fifty percent of the students in the present study were washing their hands after sneezing or coughing. Likewise in a study conducted in Vietnam[29] less than half of the participants in the study were washing their hands after sneezing or coughing which is comparatively a lesser proportion than the present study. Another important finding of the current study is that a positive association was established between the hand hygiene and the working sector. In the present study; most of the students used running water and scrub with hand sanitizer or soap to wash their hands. However in the study conducted among the university students in Vietnam[29] used alcohol-based handrub in all the circumstances including those requiring hand washing with water and soap which is in contrast to the findings of the current study.

Three-fourth of the students in this study were always using a face mask while going out; Nevertheless in the study conducted in Greece [30] showed that almost three fourth of the participants in their study were using face mask while going out of their home which is similar fraction in comparison with the present study. Likewise in a study conducted by Falk et al.,[31] among the students in the rural k-12 schools in the United States regarding the mask wearing behavior found that the compliance was higher among the students; however still there was quite alarming rate of non-compliance among the students which is similar to the findings of the current study.

Similarly a study that has been conducted in the United States[32] among the high school students reported that the majority of the students wore mask all the time in the classroom; however lower compliance on wearing mask was reported on the school buses, restroom and during extra-curricular activities which is also supporting the findings of the present study. Likewise a

study carried out by Al Naam et al[33] in the kingdom of Saudi Arabia among the children and the young adults found that three fourth of the study participants were having a good compliance score of wearing mask which is acknowledging the results of this study.

The current study showed no significant positive association between the mask wearing and the age group. However a study carried out by Beckage et al[34] in the United States among the community members found that mask wearing behavior decreases with decreasing age and increases with increasing age which clearly shows that the usage of face mask varies based on the age group which is in contrast to the findings of the present study. Likewise a study carried out by Szablewski et al[35] also explained that the mask wearing compliance among the students varied based on the age group; it increased with increasing ages which is controversial to the findings of the current study.

There was no statistically significant association between the mask wearing behavior and the gender in the present study. In a study conducted in china among the students by Hou et al.,[36] there was a positive association between the gender and the mask wearing behavior which clearly stated that girls were less likely to wear mask in comparison with the boys which is contradictory to the findings of this study. Similarly, a study conducted in china[37] among the students found that the mask wearing behavior varies based on the gender which is also opposite to the findings of the present study.

The present study showed only slightly higher than one-fourth of the students were wearing the mask correctly. A study carried out by the Mueller et al.,[38] showed that almost three-fourth of the students in the study were wearing the mask properly which is higher fraction in comparison with the findings of the current study. The unique findings of the present study are there was a statistically significant positive association between the mask wearing behavior and the working status and the working sector.

There was no positive association between the mask wearing behavior and the educational level of the students in the present study. A study conducted by DeJonckheere et al.,[39] found that there was no statistical significance between the mask wearing behavior among the students and their educational level which is in concurrence with the results of the present study.

Limitations

The results of the study should be interpreted with the following limitations. The participants in the study were enrolled us-

ing the convenience sampling therefore there may be selection bias that affects the generalizability of the results. This was a cross-sectional study which failed to identify the longitudinal factors of the purpose of wearing face mask in order to overcome this there is a need to conduct a longitudinal study in the near future for determining the hand hygiene and mask wearing behavior among the university students.

Conclusion

Majority of the participants in the study were showing an adequate hand washing and mask wearing behavior. However it is also evident that some of the students were still not having the compliance with the preventive behavior inclusive of hand washing and mask wearing even during this ongoing pandemic situation. There is a need for routine behavioral educational programs at the university level that particularly emphasizing on the significance of hand hygiene and wearing mask in preventing the infectious diseases. The government and the policy makers also should create awareness among the students by sensitizing the problems and advocating the need for proper preventative measures.

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