



# **Comparative Study upon using Sanitizers and Personal Protective Equipment during COVID-19 Pandemic between Saudi and Egyptian Health Care Providers**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. Author MRM designed the study, performed the statistical analysis and wrote the protocol. Authors JAJA, SMS, MNZA, OGA and SGA wrote the first draft of the manuscript, collecting data, managed the analyses of the study and the literature searches. All authors read and approved the final manuscript.*

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## **ABSTRACT**

During coronavirus disease (COVID-19) pandemic hand hygiene was one of the most essential preventive practice health care workers (HCWs) due to their frequent washing their hands with sanitizers. Wearing gloves after using hand sanitizers may cause skin irritation and dryness.

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Wearing masks were effective in reducing the probability of infection with COVID-19, but wearing them for long time cause many problems. This paper was aimed to compare between Saudi and Egyptian HCWs upon using sanitizers and personal protective equipment (PPE) during COVID-19 pandemic. Data was collected through a well-structured questionnaire, among Saudi HCWs (online) and Egyptian HCWs through paper questionnaire interview. The questionnaire consists of 23 questions about Socio-demographic, types of masks, gloves and sanitizers they used during their works. It includes the adverse skin reactions on hands and face upon using PPE for long periods during COVID 19 pandemic. Our results revealed that most of Saudi & Egyptian HCWs wearing surgical masks (57.8% & 63.6%), > N95 (12.9% & 18.2%), using latex surgical gloves (44.9% & 56.8%), > plastic gloves (11.1% & 18.2%) respectively. The most affected area from wearing PPE are hands (49.8% & 54.5%) followed by Auricular area (44% & 40.9%), nasal bridge (28.9% & 22.7%), cheek (16.9% & 13.6%), whole face (15.6% & 25%) among Saudi & Egyptian HCWs respectively. About 70% of Egyptian HCWs from our participants used alcohol 70% in form of gel as sanitizer which was significantly higher than Saudi HCWs (59.1%). While no significant differences were found from using other sanitizers such as liquid alcohol 70% or Dettol. The most adverse reaction due to using sanitizers was skin dryness (55.1% & 63.6%) among Saudi & Egyptian HCWs respectively. We can conclude that significant increase was found among HCWs in Egypt either in wearing surgical and N95 masks or in wearing surgical and plastic gloves when compared to Saudi HCWs. According to the side effects on hands and face due to wearing PPE among HCWs either from KSA or Egypt, there were some variations by increase or decrease in the percentages. The most adverse reaction due to using sanitizers (specially alcohol 70% in form of gel) was skin dryness.

*Keywords: COVID-19 pandemic; sanitizers; masks; gloves; Saudi Arabia; Egypt.*

## 1. INTRODUCTION

In December 2019, unexpected outbreak happened in Wuhan city, that later on had been known as COVID-19 by World health organization [1]. The routes of COVID-19 transmission are via droplet, fomites and airborne transmission of droplet nuclei [2]. However, during the COVID-19 pandemic, HCWs were at high risk of COVID-19 transmission due to the direct contact with COVID-19 patients. As a consequence, HCWs had to wear PPEs such as N95 masks and latex gloves for many hours, wash their hands using sanitizers [3]. On other hand, the use of PPEs for long period may lead to increased risk of adverse skin reactions such as dryness, tenderness, itching, burning/pain and others [4-6]. Medical mask is one of the most important PPEs which prevent the spread of respiratory tract infections by reducing the probability of airborne droplets transmission by covering the nose and mouth. Surgical masks and N95 have been used also. On the other hands, N95 have been effective in blocking 95% of airborne particles [7]. Some authors found that N95 mask was the most type that caused a serious adverse skin reaction because HCWs were tie the mask very tightly and press the metal clip hard. N95 mask when used for long period reported adverse reactions including nasal bridge scarring, itching, skin

damage, dry skin, acne, and rash [5]. Another study in Singapore found that Using gloves regularly result in high prevalence of dry skin, itching, and rash. All were using rubber gloves, none reported skin reactions with the use of plastic gloves. There were no significant differences in adverse skin reactions due to sex, race, or profession. However, staff who reported dry skin and itch were younger compared with staff who did not [4]. During COVID-19 pandemic hand hygiene was one of the most essential preventive practice HCWS due to their frequent contact with patients, they were washing their hands more frequently with water and soap and using sanitizers [8]. Hand hygiene products contain an antiseptic to inactivate microorganisms and/or suppress their growth over the skin temporarily [2]. the CDC (centers for disease control and prevention) recommends probably and frequently hand washing either with soap and water or if soap not available, hand sanitizer containing at least 60% alcohol [9]. However, there were many reports of increased incidence of getting dermatologic problems such as dryness and other skin problems due to frequent hand washing and using of sanitizers among HCWs [10]. Alcohol-based hand sanitizer it has been used as a part of hand hygiene, it can be in form of liquid, gel or foam that contains either ethanol or isopropanol. As a result of COVID-19 pandemic, CDC recommends HCWs

to use Alcohol-based hand sanitizers that contain 60%-95% alcohol. However, wearing gloves after using hand sanitizers may cause skin irritation and frequent use of sanitizers cause dryness of hands [9,11]. The aim of this research is to compare between Saudi and Egyptian HCWs upon frequent usage of masks, gloves and sanitizers during COVID-19 pandemic and to clarify their adverse skin reactions.

## 2. SUBJECTS AND METHODS

### 2.1 Study Design

The Study was conducted through Cross-sectional study design. It was carried out through well designed questionnaire among health care providers both in Saudi Arabia (on google Drive) and through paper questionnaire in Egypt in Clinics among health care providers for 2 months starting from first of November 2020. The questionnaire consists of 23 questions about Scio-demographic, types of masks, gloves and sanitizers that used by health care workers in the clinics, hospitals, and medical centers. It includes the adverse effect upon using PPE and sanitizers for long time on skin and face during COVID-19 pandemic.

### 2.2 Sample Collection

This study was carried out among health care workers in Saudi Arabia (through questionnaire on Google Drive, number of participants were 252 HCWs) and in Egypt medical polyclinics (through paper questionnaire, number of

participants were 176 HCWs). All participants were provided with clear and easy understand information about the research paper in order to allow them to make an informed and voluntary decision about their participation. Filling the questionnaire was considered their agreement about participation. Person selection to participate in the research was conducted through convenience sampling, non-probability technique.

### 2.3 Inclusion Criteria

All participants from both genders should be from health care providers who are working in hospitals, medical clinics and health care centers during first of November 2020 till end of December 2020. The age of participants from 18 years-old and above.

### 2.4 Exclusion Criteria

We excluded any participants from health care providers whose age below 18 years-old or who has any psychological disorders.

### 2.5 Statistical Analysis

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) version 22 (SPSS, Chicago, IL, USA). Comparisons of differences between the groups were done using chi-square and 2-sample t-tests and results were considered significant difference at  $P < 0.05$ .

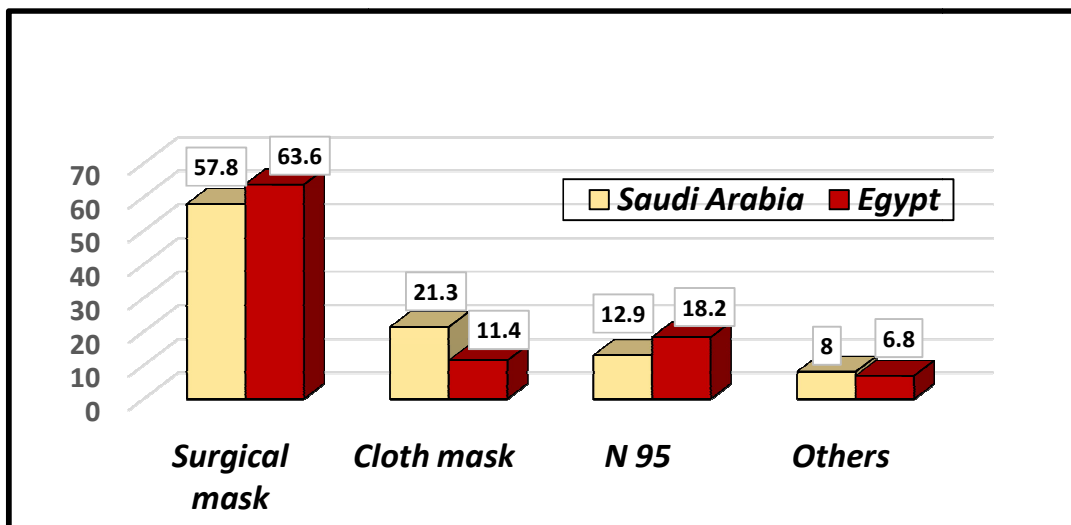


Fig. 1. % HCWs who answered the question about the types of face mask used during COVID 19 pandemic

**Table 1. Frequencies and percentages of HCWs in Saudi Arabia and Egypt who answered the following questions about their sociodemographic during COVID 19 pandemic. [Number of participants: 252 (KSA) and 176 (Egypt)]**

Question		Answers [Frequencies and (%)]							
Sex	Answers	Male				Female			
	KSA	102 (40.4)				150 (59.6)			
	Egypt	68 (38.6)				108 (61.4)			
Age (Years)	Answers	20-30	31-40	41-50	51-60	> 60			
	KSA	111 (44)	96 (38.2)	34 (13.3)	7 (2.8)	4 (1.6)			
	Egypt	48 (27.3) *	76 (43.2)	32 (18.2) *	16 (9.1) *	4 (2.3)			
Job	Answers	Physician	Pharmacist	Dentist	Nurse	Laboratorian	Physiotherapy	Technician	Cleaner
	KSA	44 (17.3)	22 (8.9)	10 (3.9)	41 (16.4)	23 (9.3)	2 (0.7)	100 (39.6)	10 (3.9)
	Egypt	36 (20.5)	28 (15.9) *	20 (11.4) *	32 (18.2)	24 (13.6) *	8 (4.5) *	28 (15.9) *	8 (4.5)
Type of medical institution	Answers	Governmental hospitals with isolated department		Health care centers		Isolation hospitals		Others	
	KSA	117 (46.2)		45 (17.8)		5 (2.2)		85 (33.8)	
	Egypt	96 (54.5) *		44 (25) *		20 (11.4) *		16 (9.1) *	

\*Significant difference from Saudi HCWs at  $P < 0.05$

**Table 2. Percentages of HCWs in Saudi Arabia and Egypt who answered the following questions about the type of masks and gloves and their adverse skin reactions during COVID 19 pandemic. [number of participants: 252 (KSA) and 176 (Egypt)]**

Questions	Answers																														
How many hours you are wearing the mask per day?	<table border="1"> <tr> <td>Answer%</td> <td>Donot wear</td> <td>4-6 hours</td> <td>7-9 hours</td> <td>10-12 hours</td> <td>&gt; 12 hours</td> </tr> <tr> <td>KSA</td> <td>4.1</td> <td>51.1</td> <td>29.3</td> <td>10.3</td> <td>5.2</td> </tr> <tr> <td>Egypt</td> <td>6.8*</td> <td>45.5*</td> <td>34.1*</td> <td>11.4</td> <td>2.3*</td> </tr> </table>	Answer%	Donot wear	4-6 hours	7-9 hours	10-12 hours	> 12 hours	KSA	4.1	51.1	29.3	10.3	5.2	Egypt	6.8*	45.5*	34.1*	11.4	2.3*												
Answer%	Donot wear	4-6 hours	7-9 hours	10-12 hours	> 12 hours																										
KSA	4.1	51.1	29.3	10.3	5.2																										
Egypt	6.8*	45.5*	34.1*	11.4	2.3*																										
Type of face mask you used.	<table border="1"> <tr> <td>Answer%</td> <td>N 95</td> <td>Surgical mask</td> <td>Cloth mask</td> <td>Others</td> </tr> <tr> <td>KSA</td> <td>12.9</td> <td>57.8</td> <td>21.3</td> <td>8</td> </tr> <tr> <td>Egypt</td> <td>18.2*</td> <td>63.6*</td> <td>11.4*</td> <td>6.8</td> </tr> </table>	Answer%	N 95	Surgical mask	Cloth mask	Others	KSA	12.9	57.8	21.3	8	Egypt	18.2*	63.6*	11.4*	6.8															
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How often do you change your mask per day?	<table border="1"> <tr> <td>Answer%</td> <td>Every 2-4 hours</td> <td>Every 5-7 hours</td> <td>Every 8-10 hours</td> <td>&gt;10 hours</td> </tr> <tr> <td>KSA</td> <td>41.3</td> <td>19.1</td> <td>22.2</td> <td>17.3</td> </tr> <tr> <td>Egypt</td> <td>47.7*</td> <td>20.5</td> <td>25*</td> <td>11.4*</td> </tr> </table>	Answer%	Every 2-4 hours	Every 5-7 hours	Every 8-10 hours	>10 hours	KSA	41.3	19.1	22.2	17.3	Egypt	47.7*	20.5	25*	11.4*															
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KSA	41.3	19.1	22.2	17.3																											
Egypt	47.7*	20.5	25*	11.4*																											
Adverse skin reactions due to wearing face mask	<table border="1"> <tr> <td>Answer%</td> <td>No</td> <td>Pain behind ears and indentation</td> <td>Fascial itching</td> <td>acne</td> <td>Nasal bridge scarring</td> <td>skin redness</td> <td>dry skin</td> <td>eczema</td> <td>skin rash</td> </tr> <tr> <td>KSA</td> <td>48</td> <td>26.7</td> <td>19.6</td> <td>16.4</td> <td>16</td> <td>12.4</td> <td>11.6</td> <td>2.2</td> <td>1.8</td> </tr> <tr> <td>Egypt</td> <td>52.3*</td> <td>20.5*</td> <td>11.4*</td> <td>6.8*</td> <td>18.2</td> <td>13.6</td> <td>6.8*</td> <td>4.5*</td> <td>6.8*</td> </tr> </table>	Answer%	No	Pain behind ears and indentation	Fascial itching	acne	Nasal bridge scarring	skin redness	dry skin	eczema	skin rash	KSA	48	26.7	19.6	16.4	16	12.4	11.6	2.2	1.8	Egypt	52.3*	20.5*	11.4*	6.8*	18.2	13.6	6.8*	4.5*	6.8*
Answer%	No	Pain behind ears and indentation	Fascial itching	acne	Nasal bridge scarring	skin redness	dry skin	eczema	skin rash																						
KSA	48	26.7	19.6	16.4	16	12.4	11.6	2.2	1.8																						
Egypt	52.3*	20.5*	11.4*	6.8*	18.2	13.6	6.8*	4.5*	6.8*																						
How many hours you are wearing gloves per day?	<table border="1"> <tr> <td>Answer%</td> <td>Donot wear</td> <td>4-6 hours</td> <td>7-9 hours</td> <td>10-12 hours</td> <td>&gt; 12 hours</td> </tr> <tr> <td>KSA</td> <td>39.6</td> <td>45.8</td> <td>12.0</td> <td>2.6</td> <td>0.0</td> </tr> <tr> <td>Egypt</td> <td>50.0*</td> <td>22.7*</td> <td>13.6</td> <td>9.1*</td> <td>4.5*</td> </tr> </table>	Answer%	Donot wear	4-6 hours	7-9 hours	10-12 hours	> 12 hours	KSA	39.6	45.8	12.0	2.6	0.0	Egypt	50.0*	22.7*	13.6	9.1*	4.5*												
Answer%	Donot wear	4-6 hours	7-9 hours	10-12 hours	> 12 hours																										
KSA	39.6	45.8	12.0	2.6	0.0																										
Egypt	50.0*	22.7*	13.6	9.1*	4.5*																										
Type of gloves you used.	<table border="1"> <tr> <td>Answer%</td> <td>Latex (Surgical gloves)</td> <td>Plastic</td> <td>(latex + plastic)</td> <td>other</td> </tr> <tr> <td>KSA</td> <td>44.9</td> <td>11.1</td> <td>21.3</td> <td>22.7</td> </tr> <tr> <td>Egypt</td> <td>56.8*</td> <td>18.2*</td> <td>15.9*</td> <td>9.1*</td> </tr> </table>	Answer%	Latex (Surgical gloves)	Plastic	(latex + plastic)	other	KSA	44.9	11.1	21.3	22.7	Egypt	56.8*	18.2*	15.9*	9.1*															
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Egypt	45.5*	13.6*	15.9	6.8	11.4*	4.5	2.3*																								
The most area has been damaged in your body from wearing PPE.	<table border="1"> <tr> <td>Answer%</td> <td>Hands</td> <td>Auricular area</td> <td>Nasal bridge</td> <td>Check</td> <td>The whole face</td> <td>Chin</td> </tr> <tr> <td>KSA</td> <td>49.8</td> <td>44</td> <td>28.9</td> <td>16.9</td> <td>15.6</td> <td>9.3</td> </tr> <tr> <td>Egypt</td> <td>54.5*</td> <td>40.9*</td> <td>22.7*</td> <td>13.6*</td> <td>25*</td> <td>15.9*</td> </tr> </table>	Answer%	Hands	Auricular area	Nasal bridge	Check	The whole face	Chin	KSA	49.8	44	28.9	16.9	15.6	9.3	Egypt	54.5*	40.9*	22.7*	13.6*	25*	15.9*									
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\*Significant difference from Saudi HCWs at P<0.05

**Table 3. Percentages of HCWs in Saudi Arabia and Egypt who answered the following questions about the process of washing with sanitizers and adverse skin reactions during COVID 19 pandemic. [number of participants: 252 (KSA) and 176 (Egypt)]**

Questions		Answers				
How many times you washing your hand or using sanitizers per day before COVID-19 pandemic?	Answer%	5-10 times	11-15 times	16-20 times	>20 times	
	KSA	76.9	12.9	6.2	4	
	Egypt	70.5	20.5	6.8	2.3	
How many times you washing your hand or using sanitizers per day during COVID-19 pandemic?	Answer%	5-10 times	11-15 times	16-20 times	>20 times	
	KSA	39.6	28	12.9	19.6	
	Egypt	47.7	45.5	4.5	2.3	
How long you wash your hand per once?	Answer%	>20 seconds	20-30 seconds	31-40 seconds	41-60 seconds	>60 seconds
	KSA	23.1	42.2	21.3	11.6	1.8
	Egypt	20.5	52.3	18.2	6.8	2.3
Type of the sanitizers and disinfectants you used?	Answer%	Alcohol 70% gel	Alcohol 70% liquid	Dettol soap	Dettol liquid	others
	KSA	59.1	48.9	19.6	13.8	7.1
	Egypt	70.5	50	18.6	15.9	13.6
Skin adverse reactions after using sanitizers frequently?	Answer%	No	Skin dryness	Skin rash & redness	Eczema	Others
	KSA	33.3	55.1	21.3	10.7	4.4
	Egypt	27.3	63.6	22.7	13.6	11.4

\*Significant difference from Saudi HCWs at  $P < 0.05$

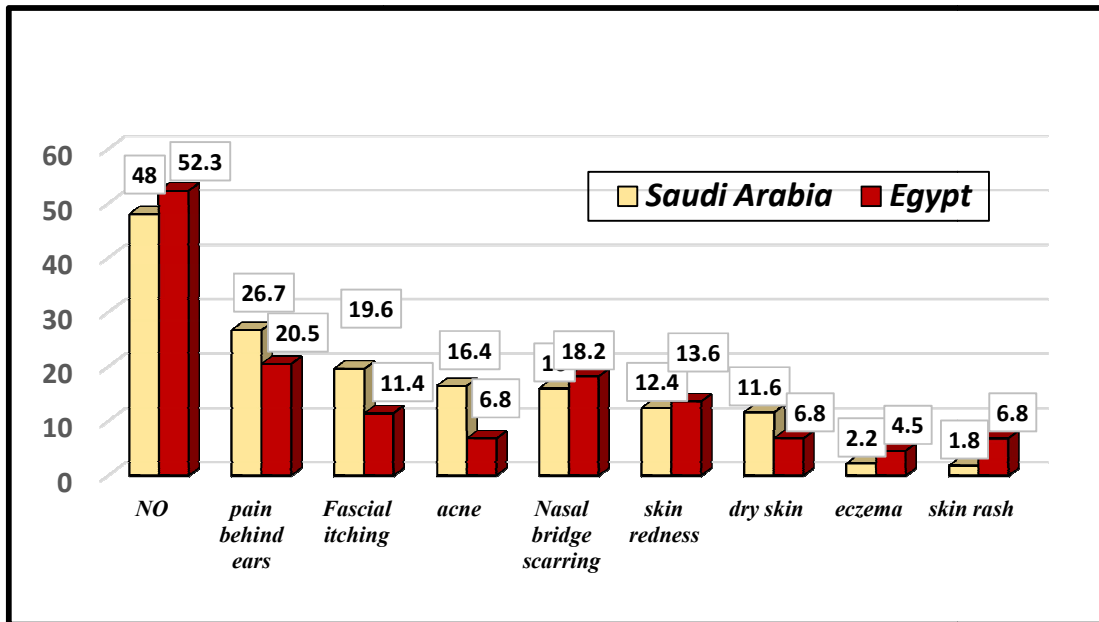


Fig. 2. % HCWs who answered the question about the adverse skin reactions due to frequent wearing face mask during COVID-19 pandemic

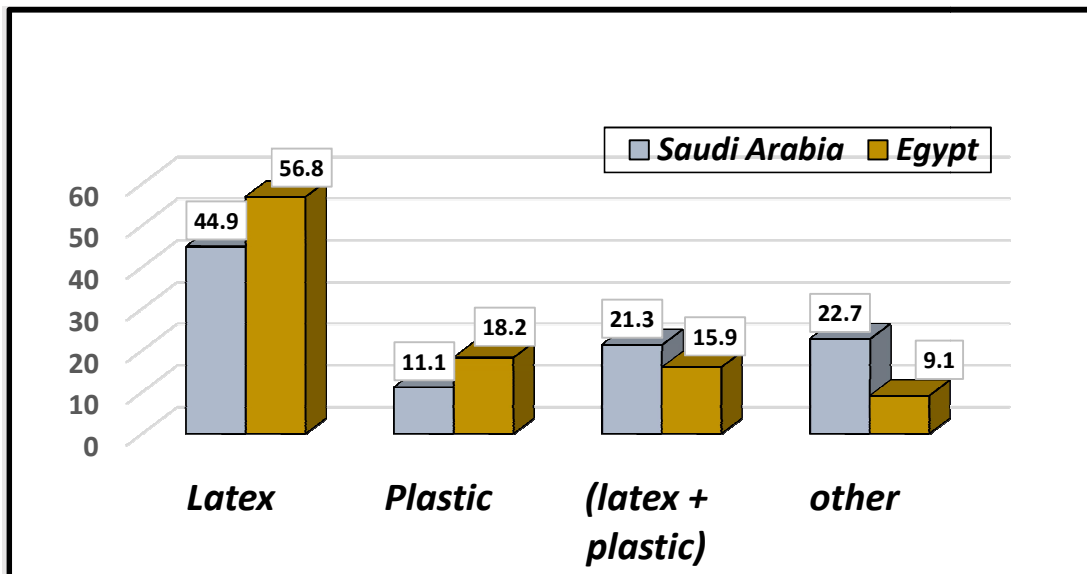


Fig. 3. % HCWs who answered the question about the types of gloves they used during COVID-19 pandemic

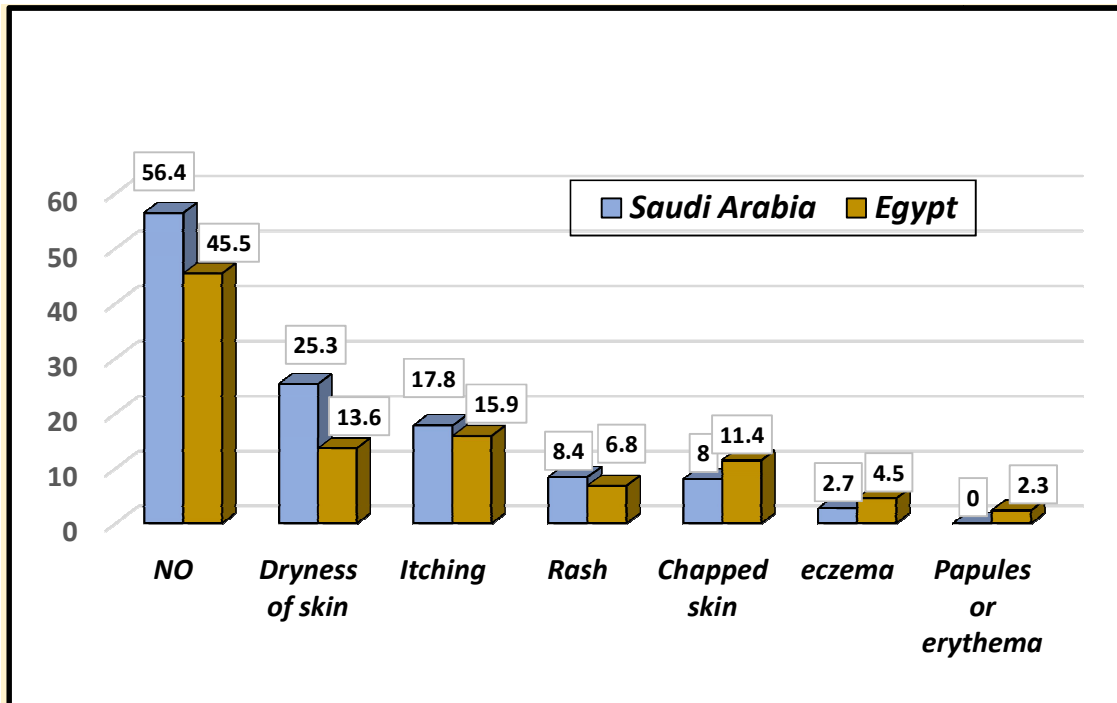


Fig. 4. % HCWs who answered the question about the adverse skin reactions due to frequent wearing gloves during COVID-19 pandemic

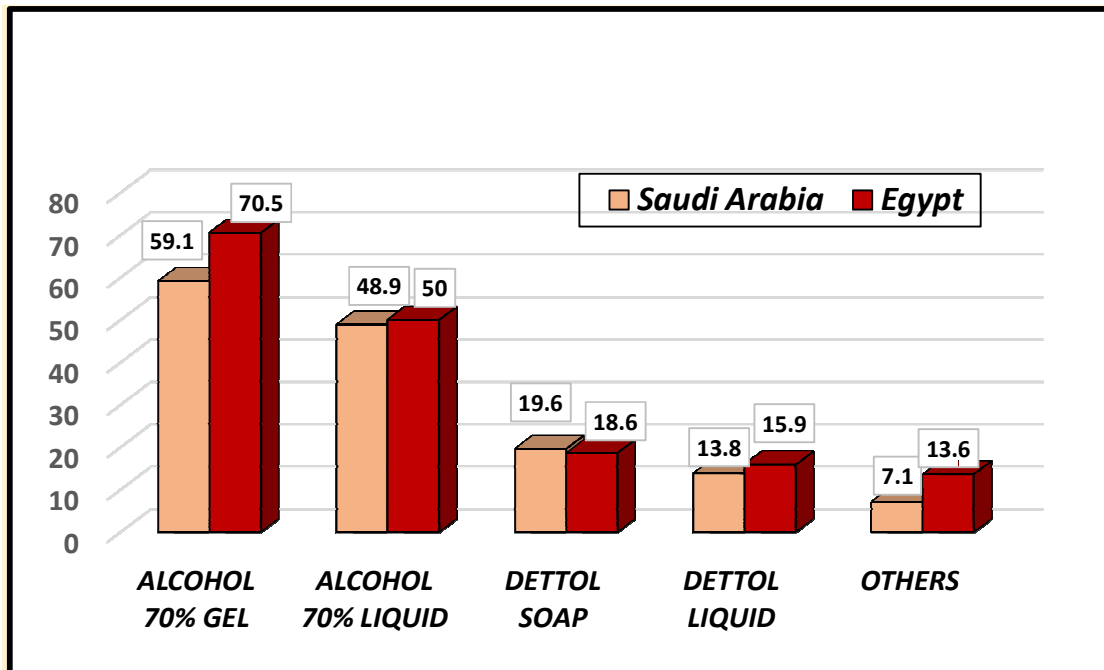


Fig. 5. % HCWs who answered the question about the types of the sanitizers and disinfectants used during COVID-19 pandemic



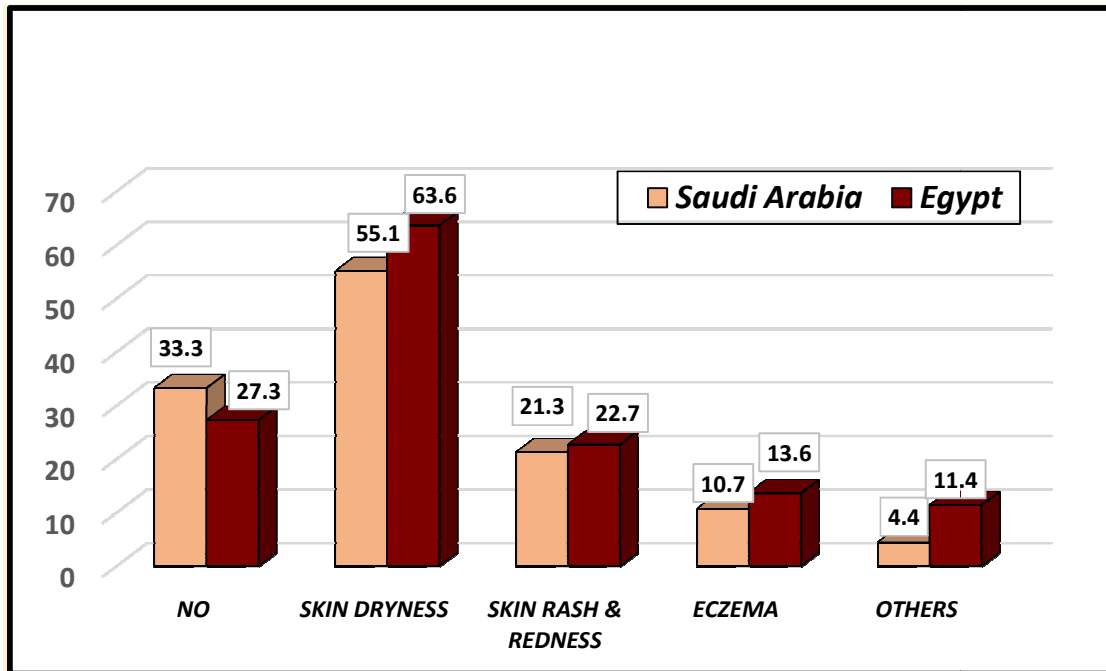


Fig. 6. % HCWs who answered the question about the adverse skin reactions due to frequent use of sanitizers during COVID-19 pandemic

### 3. RESULTS AND DISCUSSION

In this research, 252 health care workers from Saudi Arabia and 176 from Egypt were participated in this study. Table1 showed that the participants from KSA and Egypt (59.6% & 61.4%) are females, their ages range from 20-30 years-old (44% & 27.3%), and from 31-40 years-old (38.2% & 43.2%) respectively. Our results similar to the results of Pei et al who found that about 76% of HCWs were female, 50% with age of 30-40 years-old, followed by 20–30 years-old (about 37%) and 40–50 years-old (11%) [12]. Other study showed that 26.3% of participants their ages range from 20-29, 67.2% from 30-39 and 4.9% from 40-49 years-old [13]. According to our results, most of Saudi participants from eastern region and Hail (32.9% & 32%), followed by 24.4% from southern region. Most of HCWs from KSA and Egypt were from technicians and administrators are (39.6% & 20.4%) followed by physicians (17.3% & 20.5%) > nursing (16.4% & 18.2%) > pharmacists (8.9% & 15.9%) > laboratory specialist (9.3% & 13.6%), respectively (Table 1). Similar study in Singapore stated that about 85% of the participants were females, including nurses, physicians and ancillary staff (73%, 14% & 13%) respectively [4]. Other similar study in Hubei Province, indicated that female participants were more (91.8%),

including 31 nurses and 30 physicians [13]. In the study of Guertler et al., revealed that female participants were 61.4%, and about 65.8% & 34.2% were nurses and physicians respectively [14]. Another study in Turkey found that most HCWs are about nurses (43%), physicians (30%), Cleaning staff (13%) and Secretary (7%) [15]. Our HCWs from KSA and Egypt are working in health care centers (17.8% & 25%), governmental hospitals with isolated department (46.2% & 54.5%), isolation hospitals (2.2% & 11.4%) and others (33.8% & 9.1%) (Table 1). Most of participants did not suffer from any skin reactions (69.3% & 61.4%) while 20.4% & 27.3% suffer from skin dryness and 8% & 11.4% from eczema respectively.

Table 2 showed that during COVID19 pandemic, about 51.1% & 45.5% of participants from KSA & Egypt were wearing masks for 4-6 hours, 29.3% & 34.1% for 7-9 hours, 10.3% & 11.4% for 10-12 hours, 5.2% & 2.3% for more than 12 hours, while small number of them did not wear masks (4.5% & 6.8%) respectively. In our research, most of the participants from KSA & Egypt were wearing different types of masks such as surgical masks (57.8% & 63.6%), cloth masks (21.3% & 11.4%), N 95 (12.9% & 18.2%) (Fig. 1), and most of them used one layer mask (65.8% & 70.5%) but only 12.9% & 11.4% were used two layers

mask for more safety respectively. Our participants from KSA & Egypt changed their masks every 2-4 hours (41.3% & 47.7%), every 5-7 hours (19.1% & 20.5%), every 8-10 hours (22.2% & 25%) and more than 10 hours (17.3% and 11.4%).

Universal mask protects against infection and reduces the risk for resurgence during relaxation of social distancing measures [16]. Study in University of Maryland said that wearing surgical masks in public could help slow COVID-19 pandemic and masks limit the spread of influenza, rhinoviruses and coronaviruses [17] and intercept coronaviruses during coughing [18]. A meta-analysis in China showed that surgical masks and N95 respirators were similarly effective in preventing influenza-like illness among HCWs, but they suggest that N95 respirators not be recommended for the general public or medical staff who are not in close contact with influenza or suspected patients [19]. Case-control study in five Hong Kong hospitals (241 non-infected and 13 infected staff) were surveyed regarding their use of masks, gloves and gowns, and their hand washing. About 27% of staff who used all four measures were not infected, while all infected staff omitted at least one measure. The significant result for catching infection only appear with staff who did not wear masks compared with those who did [20]. Other study in University of Hong Kong Polytechnic (2005) showed that N95 mask induce significantly different temperature and humidity in the microclimates of the facemasks, that affect the heart rate and cause thermal stress and discomfort [21].

Our data revealed that most of our participants did not suffer from adverse skin reactions due to wearing face mask (48% & 52.3%), some of them suffer from pain behind ears and indentation (26.7% & 20.5%), fascial itching (19.6% & 11.4%), acne (16% & 6.8%), nasal bridge scarring (16.4% & 18.2%), skin redness (12.4% & 13.6%), dry skin (11.6% & 6.8%) and low percentages of eczema and skin rash respectively (Table 2, Fig. 2). Another study done by Hu et al. [5] among health care workers in Hubei Province showed that regularly wearing N95 mask (about 12 hours/day for of about 3.5 months) produce several adverse skin reactions such as nasal bridge scarring (about 69%), about 28% (facial itching), 26% (skin damage), 25% (dry skin), and (rash) (about 16%). Few workers had indentation and ear pain and wheals on the bridge of the nose, jaw, and

cheeks. On the hand, there was no any adverse skin reactions were reported by HCWs up on using surgical, cloth or paper masks [5]. Other study reported some adverse reaction such as acne (59.6%), facial itch (51.4%), and rash (35.8%) upon using N95 masks for about 8 hours/day and period of 8.4 months [14].

In our study, the most area has been affected in the body from wearing PPE are hands (49.8% & 54.5%) followed by auricular area (44% & 40.9%), nasal bridge (28.9% & 22.7%), cheek (16.9% & 13.6%), whole face (15.6% & 25%) and chin (9.3% & 15.9%) either in KSA or Egypt respectively (Table 2). Our adverse skin reaction was less than study of Lan et al., they found that high percentages of HCWs in China who are working > 6 hours/day were affected by PPEs including cheek (81.7%), nasal bridge (87.9%), forehead (58.6%), hands (63.9%), while others who were working < 6 hours/day showing adverse reaction approximately on cheek (69%), nasal bridge (76%), forehead (48%), hands (56%) [22].

Also, Table 2 showed that most of participants from KSA & Egypt were wearing different types of gloves such as surgical latex gloves (44.9% & 56.8%), plastic gloves (11.1% & 18.2%), surgical in addition to plastic gloves (21.3% & 15.9%) for more safety (Fig. 3). Most of our participants did not suffer from adverse skin reactions due to wearing gloves (56.4% & 45.5%), some suffer from dry skin (25.3% & 13.6%), itching (17.8% & 15.9%), skin rash & redness (8.4% & 6.8%), chapped skin (8% & 11.4%) and low percentages of eczema respectively (Table 2, Fig. 4). In the study of HU et al. [5] revealed that the HCWs who wearing latex gloves were more than our participants (88%) and they are reported some adverse skin reactions, such as dry skin (55.7%), itching (31.2%), rash (23.0%), and chapped skin (21.3%) [5]. Another study found that adverse skin reactions due to wearing latex gloves for 6 hours in a period of 9 months were dry skin (73.4%), itch (56.3%), rash (37.5%), and wheals (6.3%), while wearing of plastic gloves did not show skin reactions. There was no significant difference in adverse skin reactions due to sex, race, or profession [4].

Table 3 showed that most of our participants from KSA & Egypt washed their hands before COVID 19 pandemic from 5-10 times per day (76.9% & 70.5%), from 11-15 times (12.9% & 20.5%), from 16-20 times (6.2% & 6.8%) and more than 20 times (4% & 2.3%) respectively.

While during pandemic the times were increased, from 5-10 times per day (39.6% & 47.7%), from 11-15 times (28% & 45.5%), from 16-20 times (12.9% & 4.5%) and more than 20 times (19.6% & 2.3%). About 42% & 52% of participants from KSA & Egypt washed their hands from 20-30 seconds, 21.3% & 18.2% for 31-40 seconds, 23.1% & 20.5% less than 20 seconds, 11.6% & 6.8% from 41-60 and few numbers who exceed the 60 seconds respectively. The study of Pittet, 2009 recommended that hand hygiene in hospitals ranged from 5 - 42 times/shift and 1.7–15.2 times/hour and the duration ranged from 6.6 - 30 seconds [23]. Daye et al., reported that the majority of HCWs wash their hands 20 times/day (6-50 times), and for 20 seconds (90.2%) [15].

Also, Table 3 showed that most of our participants from KSA & Egypt used alcohol 70% in form of gel as sanitizer (59.1% & 70.5%), liquid alcohol 70% (48.9% & 50%), Dettol soap (19.6% & 18.6%), Dettol liquid (13.8% & 15.9%) respectively (Fig. 5). Another study revealed that one year prevalence of hand eczema (21%) due to daily hand washing with soap > 20 times at work, 45% used hand disinfectants > 50 times and 54% wore nonsterile gloves for >2 hours [24]. Other study reported that 70% alcohol solutions (ethanol, n-propanol, isopropanol) demonstrated virucidal activity but ethanol with 30-second exposure has superior activity than others [23,25]. About 73% of the HCWs used liquid soap and they showed skin problems [15]. About 33.3% & 27.3% of participants from KSA & Egypt did not show any skin changes after using sanitizers or washing hands frequently, skin dryness (55.1% & 63.6%), skin rash & redness (21.3% & 22.7%), eczema (10.7% & 13.6%) respectively (Fig. 6). Emami reported that frequent use of alcohol-based products can result in skin dryness and irritation [26]. Rundle reported that 98% of cases had irritant contact dermatitis due to frequent hand washing [9].

#### 4. CONCLUSION

From this study we can conclude that there was a significant increase among HCWs in Egypt either in wearing surgical and N95 masks or in wearing surgical and plastic gloves when compared to Saudi HCWs. There were some variations by increment or reduction in the side effects on hands and face due to wearing PPE among HCWs among KSA and Egypt. Skin dryness is the most adverse reaction due to using sanitizers (specially alcohol 70% in form of gel).

#### DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

#### CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

#### ETHICAL APPROVAL

This study has been reviewed and approved by the research Ethical Committee (REC) at the University of Hail with letter number Nr.16784/5/42 dated 23/03/1442H.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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