International Journal of Advanced Community Medicine

E-ISSN: 2616-3594
P-ISSN: 2616-3586
www.comedjournal.com
IJACM 2021; 4(3): 41-50
Received: 21-05-2021
Accepted: 24-06-2021

Naif Alqahtani
Family Medicine Academy
King Saud Medical City,
Riyadh, Saudi Arabia

Halimah Alhifzi
Family Medicine Academy
King Saud Medical City,
Riyadh, Saudi Arabia

Hamad Alhothaily
Family Medicine Academy
King Saud Medical City,
Riyadh, Saudi Arabia

Mohammad Alotaibi
Family Medicine Academy
King Saud Medical City,
Riyadh, Saudi Arabia

Omar Alkenani
Family Medicine Academy
King Saud Medical City,
Riyadh, Saudi Arabia

Corresponding Author:
Family Medicine Academy
King Saud Medical City,
Riyadh, Saudi Arabia

Knowledge and attitude of family medicine residents toward Personal protective equipment correct usage in king Saud medical city, Riyadh

Naif Alqahtani, Halimah Alhifzi, Hamad Alhothaily, Mohammad Alotaibi and Omar Alkenani

DOI: https://doi.org/10.33545/comed.2021.v4.i3a.204

Abstract
Background: COVID-19 infection among healthcare workers is a major concern whenever a pandemic occurs. Health care professionals are the frontline in the war against this vicious outbreak which makes them at a higher risk of inquiring the infection than the general population. Use of Personal protective equipment (PPE) is considered a pivotal role in infection control measures. We aimed to study usage of personal protective equipment (PPE) among KSMC family medicine Residents to determine if the appropriate PPE were used by family medicine physician and to examine the factors that may determine inappropriate.
Methodology: This is a cross-sectional study conducted on Family Medicine Residents of KSMC, Riyadh. All levels of residency of family medicine specialty were included in this research. We used convenient non-probability sampling technique.
Results: A total of 134 Family Medicine Residents of KSMC, Riyadh were finally enrolled in this study. 86% of junior and 90% of senior residents received formal training in hand hygiene in the last three years. Most of them know that the main route of cross-transmission of potentially harmful germs between patients is health-care workers' hands when not clean. Higher percentage of junior cleaning their hands after each consultation compared to senior (98% vs 86% respectively, P = 0.009). There was no statistically significant difference between males and females residents about wearing surgical masks by suspected patients whilst in common areas or throughout the consultation, and 87% of both of them received formal training in hand hygiene in the last three years. There was a significant difference between males and females residents in their knowledge about the main route of cross-transmission of potentially harmful germs between patients (P = 0.006); a higher percentage of males know that the main route is health-care workers' hands when not clean compared to females (58% vs 52% respectively, P = 0.006), also higher percentage of females using PPE in infection room when a patient confirmed to have Covid-19 when compared to males (97% vs 80% respectively).
Conclusion: At the time of the study, most medical residents were knowledgeable, had a positive attitude, and good level of awareness was observed regarding PPE as it prevents their infection when fighting COVID-19 pandemic. Despite these findings, there were few gaps in resident's knowledge in certain situations and this need to be addressed through more training courses regarding PPE and this which will significantly raise the level of knowledge and also will set better attitude and practices regarding PPE.

Keywords: protective equipment, attitude of family medicine

Introduction
In December 2019, a new cluster of pneumonia cases were studied and identified as a new virus from the corona family known as the COVID-19 virus. On January, the 30th, 2020 the WHO declared COVID-19 as an international crisis and a cause of concern. Later on March 11, 2020 it was considered as a global pandemic by the WHO [1].
Infection among healthcare workers is a major concern whenever a pandemic occurs. Health care professionals are the frontline in the war against this vicious outbreak which makes them at a higher risk of inquiring the infection than the general population. According to an article from the Lancet, about 30% of Italy's health care workers died during the COVID- 19 pandemic while figures from china have showed that more than 3300 healthcare workers were infected and at least 22 died by the end of March, 2020 [2]. The prevalence of infection among healthcare workers (HCW) 12.5% According to national retrospective study in

Saudi Arabia [3]. Reasons for infections were addressed in a study in China that revealed that one of the most common reasons was lack of awareness about PPE during the beginning of the Pandemic [4]. As the pandemic continues, PPE proper use and availability is a major concern to protect health care workers from acquiring the Infection and developing subsequent complications.

In addition to administrative and environmental control measures, use of Personal protective equipment (PPE) is considered a pivotal role in infection control measures. Although it is ranked low in the hierarchy of infection control, Transmission based precaution tools used by physicians to prevent the spread of disease between each other and between patients through the use PPE and many health care workers got infected and died during the previous outbreaks such as influenza pandemic (H1N1) in 2009 and Middle East respiratory syndrome coronavirus (MERS-CoV) in 2012 due to the lack of infection control Measures [5, 6, 7, 8].

Going back to literature, we explored prior epidemics and pandemics and different beliefs and attitudes of healthcare professionals towards infection control measures. We found multiple studies. A study done in Bergenheim, UK conducted to evaluate the knowledge, attitudes, experience and behaviour of frontline health care workers in H1N1 breakout. The study revealed that the health care providers were well educated and utilized the provided PPE. About 80% of healthcare workers responded that they wore gloves and surgical masks during the consultation while only 1% reported using eye protection [9].

In 2015, within the era of corona virus, a study evaluated the knowledge, attitudes, and practice of hand hygiene among healthcare professionals in Riyadh, KSA. Overall, the study showed that there was positive behaviours from the health care provider and they committed to hand even under high work stress and there was a significant relationship between higher levels of knowledge and practice of hand hygiene [10].

During the Covid-19 pandemic, in a study that perceived infection control practices and infection transmission routes in a tertiary care hospital in Wuhan found that the main transmission source was not keeping a safe distance while managing infected cases. In terms of using PPE among health care workers, it depended on their presence in high or low risk settings of acquiring the virus. Utilization of masks, gloves and strict hand hygiene was higher in high risk settings [11].

All Family Medicine Residents in KSMC, Levels R1 through R4 worked in the hospital during the pandemic. They worked in high risk settings such as Emergency Medicine, Pediatric Emergency medicine, internal medicine, pediatrics and were doing high risk procedures such as swab collection for suspected Covid-19 patients. This study aims at assessing knowledge, attitude and practice of Family medicine residents toward the use of PPE during the pandemic.

Aims of the study

To assess attitude and knowledge about of Personal Protective Equipment PPE among KSMC Family Medicine Residents.

To compare between different levels of residency training (senior vs junior residents) knowledge and attitudes regarding PPE.

To compare between male and female residents knowledge and attitudes regarding PPE

Methods

This is a cross-sectional study conducted on Family Medicine Residents of KSMC, Riyadh. The residents of this specialty received questionnaire after obtaining their permission to fill it up on I heed learning Panel. All levels of residency were included in this research. The sample size included all 169 residents of family medicine specialty. We used convenient non- probability sampling technique. The questionnaire was distributed after obtaining the IRB approval and validating the questionnaire.

The questionnaire contains four sections. First part of the questionnaire about the basic demographics of the participants in addition to weather they were in the front line or not. Second part contains 11 questions about basics about hand hygiene. Third part is about compliance and attitude of the residents towards PPE. Fourth part of the questionnaire assesses knowledge of the residents.

Statistical considerations

This is a cross-sectional study using an online questionnaire built from various studies using permission of the original authors and obtaining IRB approval before distributing the questionnaire. The sample size is 134 as it included all residents of the Family Medicine Academy. The date was entered and analyzed using IBM SPSS® to interpret the results. The data then analyzed using IBM SPSS® to interpret the results. We used $P<5$. We used statistical tests such as ANOVA test to associate the knowledge score and residency level and t-test to associate gender with knowledge level for comparison.

Ethical considerations

After obtaining the IRB approval, we asked all the Physicians for their permission before handing the questionnaire and the data was private and encrypted in the primary author's computer with limited access to those working in the research group.

Note

The general rule is that research involving human participants requires a documented (written) informed consent (in Arabic and English). The consent document includes "basic elements" and when applicable "additional elements" (refer to guidelines for consent documents). The IRB may approve a waiver of signed informed consent or a waiver of informed consent. A copy of the consent form was given to the research participant (or surrogate), another copy was kept in the medical record of the patients involved in the research, and the original document was kept with the principal investigator. The signature of at least one parent or guardian, or more, depending on the risk, is required for children under 18 years-of-age to participate in the study. In addition, elementary school age children provide verbal assent (see certification of assent of minors), and middle school age children provide a written assent (co-sign the consent form). A witness signature on the consent form is only needed when the participant or the participant's guardian cannot read.

Results

A total of 134 Family Medicine Residents of KSMC,

Riyadh were included in this study; most of them were males (53%) and aged 27 years old (28%). Concerning the marital status of the participants; the majority of them were single (58%) while 53 (40%) were married and 3 (2%) were engaged.

59 (44%) of the medical residents were in the second level of residency training and 37 (28%) were in the third level. About their experience, most of them (72%) has more than one and less than 5 years of experience. 128 (96%) of the participants worked in frontline specialty during the pandemic and 115 (86%) were exposed to suspected Covid-19 patients. 52 (39%) of the participants did not conduct nose and throat swabs for any suspected cases they saw while 41 (31%) conducted nose and throat swabs for 10 cases or less. The characteristic of the participants is shown in Table 1.

Table 1: Baseline characteristic of participants

Variable	Category	N	%
Gender	Male	71	53
	Female	63	47
Age	25	14	10
	26	23	17
	27	38	28
	28	15	11
	29	22	16
	30 and above	22	16
Marital Status	Single	78	58
	Married	53	40
	Engaged	3	2
Residency training Level	1	25	19
	2	59	44
	3	37	28
	4	13	10
Years of Experience	less than one year	31	23
	More than one and less than 5 years	96	72
	More than 5 and less than 10 years	7	5
	More than 10 years	0	0
Exposure to suspected Covid-19 Patients	No	19	14
	Yes	115	86
worked in frontline specialty during the pandemi6c: (primary care clinic, ER, ICU, Inpatient medicine wards, Medical quarantine)	No	6	5
	Yes	128	96
How many suspected cases of covid-19 did you see on whom you conducted nose and throat swabs? Please provide an exact number or a range?	Not any case	52	39
	10 and less	41	31
	11-20	26	19
	21-30	4	3
	More than 30	11	8

Knowledge about hand hygiene practice was compared among senior and junior residents (Table 2), 86% of junior and 90% of senior residents received formal training in hand hygiene in the last three years and there was no significant difference between them (P = 0.471).

Table 2: Comparing knowledge about hand hygiene practice among senior and junior residents

Variable	Category	Junior		Senior		P-value
		N	%	N	%	
1. Did you receive formal training in hand hygiene in the last three years?	No	12	14	5	10	0.471
	Yes	72	86	45	90	
2. Which of the following is the main route of cross- transmission of potentially harmful germs between patients in a health-care facility? (Tick one answer only)	Health-care workers' hands when not clean	43	51	31	62	0.063
	Air circulating in the clinic	5	6	7	14	
	Patients' exposure to colonised surfaces (i.e., beds. Chairs, tables, floor)	23	27	10	20	
	Sharing non-invasive objects (i.e., stethoscope, pressure cuffs, etc) between patients	13	16	2	4	
3. What is the most frequent source of germs responsible for health-care associated infections? (Tick one answer only) 8	The health Centre's water system	6	7	1	2	0.544
	The health centre air	7	8	3	6	
	Germs already present on or within the patients	18	21	13	26	
	The health centre environment (surfaces)	53	63	33	66	
4. Which of the following hand hygiene actions prevents transmission of germs to the patients	Before touching a patient	82	98	49	98	0.885
	Immediately after a risk of body fluid exposure	76	91	46	92	0.765
	After exposure to the immediate surroundings of a patient	76	91	43	86	0.427
	Immediately before a clean/aseptic procedure	82	98	45	90	0.055
5. Which of the following hand hygiene actions prevents transmission of germs to the health-care workers?	After touching a patient	82	98	47	94	0.285
	Immediately after a risk of body fluid exposure	81	96	45	90	0.129
	Immediately before a clean/aseptic procedure	71	85	44	88	0.577

	After exposure to the immediate surroundings of a patient	83	99	50	100	0.439
6. Which of the following statements on alcohol-based hand rub and hand washing with soap and water are true?	Hand rubbing is more rapid for hand cleaning than hand washing	64	76	41	82	0.43
	Hand rubbing causes skin dryness more than hand washing	60	71	37	74	0.747
	Hand rubbing is more effective against germs than hand washing	34	41	18	36	0.607
	Hand washing and hand rubbing are recommended to be performed in sequence	51	61	31	62	0.883
7. What is the minimal time needed for alcohol-based hand rub to kill most germs on your hands? (Tick one answer only)	10 seconds	10	12	9	18	0.768
	20 seconds	64	76	35	70	
	50 seconds	1	1	1	2	
	1 minute	9	11	5	10	
8. Which type of hand hygiene method is required in the following situations?						
Before palpation of the abdomen	None	0	0	0	0	0.021
	Rubbing	66	79	30	60	
	Washing	18	21	20	40	
Before giving an injection	None	3	4	1	2	0.601
	Rubbing	46	55	24	48	
	Washing	35	42	25	50	
After emptying a bedpan	None	4	5	2	4	0.151
	Rubbing	16	19	17	34	
	Washing	64	76	31	62	
After removing examination gloves	None	0	0	0	0	0.684
	Rubbing	40	48	22	44	
	Washing	44	52	28	56	
After making a patient's bed	None	1	1	1	2	0.929
	Rubbing	40	48	24	48	
	Washing	43	51	25	50	
After visible exposure to blood 9	None	4	5	1	2	0.705
	Rubbing	9	11	5	10	
	Washing	71	85	44	88	
	Wearing jewellery	72	86	45	90	0.471
9. Which of the following should be avoided, as associated with increased likelihood of colonisation of hands with harmful germs?	Damaged skin	73	87	42	84	0.641
	Artificial fingernails	75	89	43	86	0.571
	Regular use of a hand cream	27	32	12	24	0.316
10. In the alcohol based hand rub method during the Covid-19 pandemic, the CDC recommends using alcohol based hand rub (ABHR) with ….% ethanol or …% isopropanol	10-20%	7	8	2	4	0.002
	60-70%	27	32	33	66	
	75-90%	30	36	9	18	
	90-100%	20	24	6	12	
11. Hands should be washed with soap and water for at least …. Seconds When visibly soiled before eating or using the toilet	10 seconds	6	7	2	4	0.784
	20 seconds	32	38	20	40	
	50 seconds	24	29	17	34	
	1 minute	22	26	11	22	

There was also no significant difference between junior and senior residents in their knowledge about the main route of cross-transmission of potentially harmful germs between patients in a health-care facility (P = 0.063); most of them know that the main route is health- care workers' hands when not clean. 63% of junior residents and 66% of senior residents stated that health centre environment (surfaces) is the most frequent source of germs responsible for health-care associated infections and the difference between them was not statistically significant (P = 0.544).

There was no significant difference between junior and senior residents in their knowledge about hand hygiene actions that prevents transmission of germs to the patients which includes hand hygiene actions before touching a patient (98% of both of them), immediately after a risk of body fluid exposure (91% vs 92% respectively), after exposure to the immediate surroundings of a patient (91% vs 86% respectively) and immediately before a clean/aseptic procedure (98% vs 90% respectively) as the calculated P values were recorded as 0.885, 0.765, 0.427 and 0.055 respectively.

Also there was no significant difference between junior and senior residents in their knowledge about hand hygiene actions that prevents transmission of germs to the health-care workers which includes hand hygiene actions after touching a patient (98% vs 94% respectively), immediately after a risk of body fluid exposure (96% vs 90% respectively), and immediately before a clean/aseptic procedure (85% vs 88% respectively) and after exposure to the immediate surroundings of a patient (99% vs 100% respectively) as the calculated P values were recorded as 0.285, 0.129, 0.577 and 0.439 respectively.

In a comparison between alcohol-based hand rub and hand washing with soap and water most of junior and senior residents agreed that hand rubbing is more rapid for hand cleaning than hand washing and also most of them agreed that hand rubbing causes skin dryness more than hand washing and both of them are recommended to be performed in sequence, but there no difference between junior and senior residents in their answers about this comparison. 76% of junior and 70% of senior residents know that the minimal time needed for alcohol- based hand rub to kill most germs on your hands is 20 seconds and this difference between them is no statistically significant (P = 0.768). Concerning the type of hand hygiene method which required in different situations, there were no significant difference between junior and senior residents in their knowledge about hand hygiene method before giving an

injection, after emptying a bedpan, after removing examination gloves, after making a patient's bed and after visible exposure to blood (P = 0.601, 0.151, 0.684, 0.929 and 0.705 respectively), while a significant difference was found between them in the hand hygiene method required before palpation of the abdomen (P = 0.021); a higher percentage of junior select rubbing compared to senior (79% vs 60% respectively).

There was no significant difference between junior and senior residents in their knowledge about the things that should be avoided, as associated with increased likelihood of colonization of hands with harmful germs which include wearing jewellery (P = 0.471), damaged skin (P = 0.641), artificial fingernails (P = 0.571), regular use of a hand cream (P = 0.316). In contrary, a significant difference was found between junior and senior residents in their knowledge about the concentration of ethanol and isopropanol which recommended by CDC when using alcohol based hand rub (P = 0.002); a higher percentage of senior selected 60-70% compared to junior (66% vs 32% respectively) and most of the junior (36%) selected the concentration of 75%-90%.

There was no significant difference between junior and senior residents in their knowledge about the duration of hands washing when using soap and water when visibly soiled before eating or using the toilet (P = 0.784); most of them stated that the duration of hand washing is 20 seconds.

Attitude toward usage of PPE was compared among senior and junior residents (Table 3). There was no statistically significant difference between junior and senior residents about wearing surgical masks by suspected patients whilst in common areas or throughout the consultation (P = 0.366, 0.946 respectively). Also there was no statistically significant difference between junior and senior residents in wearing surgical mask, gloves or Apron/ Gown whilst they in close contact (within 2 meters) with suspected cases. In contrary higher percentage of junior use eye protection compared to senior (67% vs 46% respectively) and the difference was statistically significant (P = 0.019). There was no significant difference between junior and senior residents in cleaning their hands before each consultation (P = 0.341) while higher percentage of junior cleaning their hands after each consultation compared to senior (98% vs 86% respectively) and the difference was statistically significant (P = 0.009). Also there was no statistically significant difference between junior and senior residents in their confidence about their knowledge around infection control procedures when consulting a suspected case of Covid-19 (P = 0.261); most of junior (54%) and senior (62%) were somewhat confident. When comparing knowledge about correct usage of PPE in different situations among junior and senior residents (Table 4); no significant difference was found between them in knowledge about correct usage of PPE in infection room when a patient confirmed to have Covid-19 (P = 0.528). We found that 88% of both of them use medical mask, gown, gloves and eye protection (goggles or face shield).

Table 3: Comparing attitude toward usage of PPE among senior and junior residents

Variable	Category	Junior		Senior		P-value
		N	%	N	%	
Did patients who were suspected cases wear surgical masks	Whilst in common areas	73	87	46	92	0.366
	Throughout the consultation	77	92	46	92	0.946
Did you wear the following whilst in close contact (within 2 meters) with suspected cases?	Surgical mask	82	98	49	98	0.885
	Gloves	73	87	38	76	0.105
	Apron/Gown	69	82	37	74	0.262
	Eye protection 10	56	67	23	46	0.019
Did you clean your hands (with either alcohol gel or soap and water)	before each consultation	71	85	39	78	0.341
	after each consultation	82	98	43	86	0.009
How confident do you feel about your knowledge around infection control procedures when consulting a suspected case of Covid-19?	Not confident at all	0	0	2	4	0.261
	Not very confident	9	11	4	8	
	Somewhat confident	45	54	31	62	
	Very confident	29	35	12	24	
	Extremely confident	1	1	1	2	

Table 4: Comparing knowledge about correct usage of PPE in different situations among senior and junior residents

Variable	Category	Junior		Senior		P-value
		N	%	N	%	
Inpatient settings: 1. In a patient confirmed to have Covid-19 infection room:	Medical mask, Gown, Gloves, Eye protection (goggles or face shield)	74	88	44	88	0.528
	Medical mask, Gown, Gloves	7	8	6	12	
	Medical mask,, Gloves	2	2	0	0	
	No PPE required	1	1	0	0	
Inpatient settings: 2. While providing care for a Covid- 19 patient and doing Aerosol-generating procedures:	Respirator N95 or FFP2 standard, or equivalent. Gown Gloves Eye protection Apron	72	86	40	80	0.532
	Medical mask, Gown, Gloves, Eye protection (goggles or face shield)	8	10	8	16	
	Medical mask, gown, gloves	4	5	2	4	
	No PPE required	0	0	0	0	
3. In outpatient facilities, in consultation rooms while examining a patient with respiratory symptoms:	Medical mask, Gown, Gloves, Eye protection (goggles or face shield) 11	52	62	32	64	0.94
	Medical mask, Gown, Gloves	22	26	13	26	
	Medical mask,, Gloves	10	12	5	10	
	No PPE required	0	0	0	0	
4. In outpatient facilities, in consultation rooms while examining a patient without respiratory symptoms:	Medical mask, Gown, Gloves, Eye protection (goggles or face shield)	24	29	13	26	0.112
	Medical mask, Gown, Gloves	22	26	13	26	
	PPE according to standard precautions and risk assessment	27	32	23	46	

	No PPE required	11	13	1	2	
5. In Ambulance or transfer vehicles, while transferring covid-19 patients to the referral health care facility	Medical mask, Gown, Gloves, Eye protection (goggles or face shield)	54	64	35	70	0.727
	Medical mask, Gown, Gloves	12	14	5	10	
	PPE according to standard precautions and risk assessment	18	21	10	20	
	No PPE required	0	0	0	0	

There was also no significant difference between junior and senior in knowledge about correct usage of PPE while providing care for a Covid- 19 patient and doing Aerosol-generating procedures (P = 0.532); most of junior and senior (86% and 80% respectively) know that they must use respirator N95/FFP2 standard, or equivalent and gown, gloves, eye protection and apron. Also there were no significant differences between junior and senior in knowledge about correct usage of PPE in outpatient facilities in consultation rooms while examining a patient with or without (P = 0.94, 0.112 respectively) respiratory symptoms; a higher percentage of both of them using all PPE when examine examining a patient with respiratory symptoms comparing to patient without respiratory symptoms.

There was also no significant difference between junior and senior in knowledge about correct usage of PPE in Ambulance or transfer vehicles, while transferring covid-19 patients to the referral health care facility (P = 0.727); 64% of junior and 70% of senior use medical mask, gown, gloves and eye protection (goggles or face shield). Knowledge about hand hygiene practice was compared among males and females residents (Table 5), 87% of both of males and females residents received formal training in hand hygiene in the last three years and there was no significant difference between them (P = 0.997).

Table 5: Comparing knowledge about hand hygiene practice among male and female residents

Variable	Category	Male		female		P-value
		N	%	N	%	
1. Did you receive formal training in hand hygiene in the last three years?	No	9	13	8	13	0.997
	Yes	62	87	55	87	
2. Which of the following is the main route of cross-transmission of potentially harmful germs between patients in a health-care facility? (Tick one answer only)	Health-care workers' hands when not clean	41	58	33	52	0.006
	Air circulating in the clinic	11	16	1	2	
	Patients' exposure to colonised surfaces (i.e., beds. Chairs, tables, floor)	15	21	18	29	
	Sharing non-invasive objects (i.e., stethoscope, pressure cuffs, etc) between patients	4	6	11	18	
3. What is the most frequent source of germs responsible for health- care associated infections? (Tick one answer only)	The health centre's water system	6	9	1	2	0.344
	The health centre air	5	7	5	8	
	Germs already present on or within the 13 patients	15	21	16	25	
	The health centre environment (surfaces)	45	63	41	65	
4. Which of the following hand hygiene actions prevents transmission of germs to the patients	Before touching a patient	70	99	61	97	0.49
	Immediately after a risk of body fluid exposure	65	92	57	91	0.828
	After exposure to the immediate surroundings of a patient	62	87	57	91	0.564
	Immediately before a clean/aseptic procedure	68	96	59	94	0.581
5. Which of the following hand hygiene actions prevents transmission of germs to the health-care workers?	After touching a patient	69	97	60	95	0.553
	Immediately after a risk of body fluid exposure	65	92	61	97	0.198
	Immediately before a clean/aseptic procedure	61	86	54	86	0.973
	After exposure to the immediate surroundings of a patient	71	100	62	98	0.287
6. Which of the following statements on alcohol-based hand rub and hand washing with soap and water are true?	Hand rubbing is more rapid for hand cleaning than hand washing	59	83	46	73	0.157
	Hand rubbing causes skin dryness more than hand washing	54	76	43	68	0.313
	Hand rubbing is more effective against germs than hand washing	33	47	19	30	0.053
	Hand washing and hand rubbing are recommended to be performed in sequence	36	51	46	73	0.008
7. What is the minimal time needed for alcohol-based hand rub to kill most germs on your hands? (Tick one answer only)	10 seconds	11	16	8	13	0.284
	20 seconds	55	78	44	70	
	50 seconds	1	1	1	2	
	1 minute	4	6	10	16	
8. Which type of hand hygiene method is required in the following situations?						
Before palpation of the abdomen	None	0	0	0	0	0.74
	Rubbing	50	70	46	73	
	Washing	21	30	17	27	
Before giving an injection	None	4	6	0	0	0.16
	Rubbing	36	51	34	54	
	Washing	31	44	29	46	
After emptying a bedpan	None	4	6	2	3	0.054
	Rubbing	23	32	10	16	
	Washing	44	62	51	81	
After removing examination gloves	None	0	0	0	0	0.456
	Rubbing	35	49	27	43	
	Washing	36	51	36	57	
After making a patient's bed	None	1	1	1	2	0.563
	Rubbing	37	52	27	43	

	Washing	33	47	35	56	
After visible exposure to blood 14	None	3	4	2	3	0.928
	Rubbing	7	10	7	11	
	Washing	61	86	54	86	
	Wearing jewellery	59	83	58	92	0.12
9. Which of the following should be avoided, as associated with increased likelihood of colonisation of hands with harmful germs?	Damaged skin	59	83	56	89	0.338
	Artificial fingernails	59	83	59	94	0.06
	Regular use of a hand cream	20	28	19	30	0.8
10. In the alcohol based hand rub method during the Covid-19 pandemic, the CDC recommends using alcohol based hand rub (ABHR) with ….% ethanol or ……% isopropanol	10-20%	5	7	4	6	0.076
	60-70%	35	49	25	40	
	75-90%	14	20	25	40	
	90-100%	17	24	9	14	
11. Hands should be washed with soap and water for at least …. Seconds When visibly soiled before eating or using the toilet	10 seconds	4	6	4	6	0.158
	20 seconds	30	42	22	35	
	50 seconds	25	35	16	25	
	1 minute	12	17	21	33	

There was a significant difference between males and females residents in their knowledge about the main route of cross-transmission of potentially harmful germs between patients in a health-care facility (P = 0.006); a higher percentage of males know that the main route is health-care workers' hands when not clean compared to females (58% vs 52% respectively). 63% of males residents and 65% of females residents stated that health centre environment (surfaces) is the most frequent source of germs responsible for health-care associated infections and the difference between them was not statistically significant (P = 0.344).

There was no significant difference between males and females residents in their knowledge about hand hygiene actions that prevents transmission of germs to the patients which includes hand hygiene actions before touching a patient (99% vs 97% respectively), immediately after a risk of body fluid exposure (92% vs 91% respectively), after exposure to the immediate surroundings of a patient (87% vs 91% respectively) and immediately before a clean/aseptic procedure (96% vs 94% respectively) as the calculated P values were recorded as 0.49, 0.828, 0.564 and 0.0581 respectively.

Also there was no significant difference between males and females residents in their knowledge about hand hygiene actions that prevents transmission of germs to the health-care workers which includes hand hygiene actions after touching a patient (97% vs 95% respectively), immediately after a risk of body fluid exposure (92% vs 97% respectively), and immediately before a clean/aseptic procedure (86% of both of them) and after exposure to the immediate surroundings of a patient (100% vs 98% respectively) as the calculated P values were recorded as 0.553, 0.198, 0.973 and 0.287 respectively. In a comparison between alcohol-based hand rub and hand washing with soap and water and there was no significant difference between 12 males and females in their answers. Most of males and females residents agreed that hand rubbing is more rapid for hand cleaning than hand washing (83%, 73% respectively) and also most of them agreed that hand rubbing causes skin dryness more than hand washing (76%, 68% respectively), but there was significant difference between them about that hand washing and hand rubbing are recommended to be performed in sequence (P = 0.008); higher percentage of females agreed that hand washing and hand rubbing are recommended to be performed in sequence compared to males (73% vs 51% respectively). 78% of males and 70% of females residents know that the minimal time needed for alcohol- based hand rub to kill most germs on your hands is 20 seconds and this difference between them is no statistically significant (P = 0.284). Concerning the type of hand hygiene method which required in different situations, there were no significant difference between males and females residents in their knowledge about hand hygiene method before palpation of the abdomen, before giving an injection, after emptying a bedpan, after removing examination gloves, after making a patient's bed and after visible exposure to blood (P = 0.74, 0.16, 0.054, 0.456, 0.563 and 0.928 respectively). There was no significant difference between males and females residents in their knowledge about the things that should be avoided, as associated with increased likelihood of colonization of hands with harmful germs which include wearing jewellery (P = 0.12), damaged skin (P = 0.338), artificial fingernails (P = 0.06) and regular use of a hand cream (P = 0.8). Also there was no significant difference between males and females residents in their knowledge about the concentration of ethanol and isopropanol which recommended by CDC when using alcohol based hand rub (P = 0.076). There was no significant difference between males and females residents in their knowledge about the duration of hands washing when using soap and water when visibly soiled before eating or using the toilet (P = 0.158); most of them stated that the duration of hand washing is 20 seconds. Attitude toward usage of PPE was compared among males and females residents (Table 6). There was no statistically significant difference between males and females residents about wearing surgical masks by suspected patients whilst in common areas or throughout the consultation (P = 0.285, 0.075 respectively). Also there was no statistically significant difference between males and females residents in wearing surgical mask, gloves, Apron/ Gown or eye protection whilst they in close contact (within 2 meters) with suspected cases (P = 0.099, 0.405, 0.227, 0.315 respectively). Also there was no significant difference between females and males residents in cleaning their hands after each consultation (P = 0.395) while higher percentage of females cleaning their hands after each consultation compared to males (91% vs 75% respectively) and the difference was statistically significant (P = 0.017). Also there was no statistically significant difference between males and females residents in their confidence about their knowledge around infection control procedures when consulting a suspected case of Covid-19 (P = 0.472); most of males (61%) and females (52%) were somewhat confident.

Table 6: Comparing attitude toward usage of PPE among male and female residents

Variable	Category	Male		Female		P-value
		N	%	N	%	
Did patients who were suspected cases wear surgical masks	Whilst in common areas	65	92	54	86	0.285
	Throughout the consultation	68	96	55	87	0.075
Did you wear the following whilst in close contact (within 2 meters) with suspected cases?	Surgical mask	68	96	63	100	0.099
	Gloves	57	80	54	86	0.405
	Apron/Gown	59	83	47	75	0.227
	Eye protection	39	55	40	64	0.315
Did you clean your hands (with either alcohol gel or soap and water)	before each consultation	53	75	57	91	0.017
	after each consultation	65	92	60	95	0.395
How confident do you feel about your knowledge around infection control procedures when consulting a suspected case of Covid-19?	Not confident at all	2	3	0	0	0.472
	Not very confident	7	10	6	10	
	Somewhat confident	43	61	33	52	
	Very confident	18	25	23	37	
	Extremely confident	1	1	1	2	

When comparing knowledge about correct usage of PPE in different situations among males and females residents (Table 7); a significant difference was found between them in knowledge about correct usage of PPE in infection room when a patient confirmed to have Covid-19 (P = 0.03). We found that higher percentage of females using PPE when compared to males (97% vs 80% respectively).

Table 7: Comparing knowledge about correct usage of PPE in different situations among male and female residents

Variable	Category	Male		Female		P-value
		N	%	N	%	
1. Inpatient settings: 1. In a patient confirmed to have Covid-19 infection room:	Medical mask, Gown, Gloves, Eye protection (goggles or face shield)	57	80	61	97	0.03
	Medical mask, Gown, Gloves	11	16	2	3	
	Medical mask, Gloves	2	3	0	0	
	No PPE required	1	1	0	0	
2. Inpatient settings: While providing care for a Covid- 19 patient and doing Aerosol-generating procedures:	Respirator N95 or FFP2 standard, or equivalent. Gown Gloves Eye protection Apron	60	85	52	83	0.602
	Medical mask, Gown, Gloves, Eye protection (goggles or face shield)	7	10	9	14	
	Medical mask, gown, gloves	4	6	2	3	
	No PPE required	0	0	0	0	
3. In outpatient facilities, in consultation rooms while examining a patient with respiratory symptoms:	Medical mask, Gown, Gloves, Eye protection (goggles or face shield)	48	68	36	57	0.073
	Medical mask, Gown, Gloves	13	18	22	35	
	Medical mask,, Gloves	10	14	5	8	
	No PPE required	0	0	0	0	
4. In outpatient facilities, in consultation rooms while examining a	Medical mask, Gown, Gloves, Eye protection (goggles or face shield)	21	30	16	25	
	Medical mask, Gown, Gloves	14	20	21	33	
patient without respiratory symptoms:	PPE according to standard precautions and risk assessment	32	45	18	29	0.76
	No PPE required	4	6	8	13	
5. In Ambulance or transfer vehicles, while transferring covid-19 patients to the referral health care facility	Medical mask, Gown, Gloves, Eye protection (goggles or face shield)	51	72	38	60	0.25
	Medical mask, Gown, Gloves	9	13	8	13	
	PPE according to standard precautions and risk assessment	11	16	17	27	
	No PPE required	0	0	0	0	

There was no significant difference between males and females in knowledge about correct usage of PPE while providing care for a Covid-19 patient and doing Aerosol-generating procedures (P = 0.602); most of male and females (85%, 83% respectively) use respirator N95/FFP2 standard, or equivalent and gown, gloves, eye protection and apron. Also there were no significant differences between males and females in knowledge about correct usage of PPE in outpatient facilities in consultation rooms while examining a patient with or without (P = 0.073, 0.076 respectively) respiratory symptoms; a higher percentage of both of them using PPE when examine examining a patient with respiratory symptoms comparing to patient without respiratory symptoms.

There was also no significant difference between males and females in knowledge about correct usage of PPE in Ambulance or transfer vehicles, while transferring covid-19 patients to the referral health care facility (P = 0.25); 72% of males and 60% of females use medical mask, gown, gloves and eye protection (goggles or face shield).

Discussion

Medical resident's level of knowledge and awareness towards personal protective equipment has crucial role during COVID-19 pandemic as it is considered one of the most important determinants of safety for both medical residents and other healthcare workers fighting the pandemic.

The main aim of this study was to assess knowledge and attitude about of Personal Protective Equipment PPE among KSMC Family Medicine Residents. Also to compare between different levels of residency training (senior versus junior residents) knowledge and attitudes regarding PPE and to compare between male and female residents knowledge and attitudes regarding PPE.

In the current study most of respondents were males and

within the age group of less than thirty years old. Regarding the marital status of the respondents; about two thirds of them were single. Nearly half of the medical residents were in the second level of residency training and one third of them were in the third level. The vast majority of them worked in frontline specialty during the pandemic and most of them were exposed to suspected Covid-19 patients.

Regarding the general knowledge level senior residents were found to be more knowledgeable than junior residents but the knowledge gab between them was not wide in most aspects of comparison.

Regarding knowledge about hand hygiene practice among senior and junior residents 86% of junior and 90% of senior residents received formal training in hand hygiene in the last three years and these percentages are considered to be high when compared to other study which conducted in Egypt showing only 60% of residents willing to have or had training regarding hand washing practice [12].

In a comparison between rub hands washing with soap and water and alcohol-based hand most of junior and senior residents agreed that hand rubbing is quicker for hand cleaning than hand washing and also most of them agreed on that hand rubbing causes skin dryness more than hand washing and both of them are recommended to be performed in sequence also alcohol-based hand washing preference among healthcare workers during COVID-19 pandemic was found in other study in India [13].

Concerning knowledge about alcohol concentration in alcohol-based hand washing solutions; higher percentage of senior selected 60-70% alcohol concentration compared to junior and most of the junior residents selected the concentration of 75%-90%. Higher concentrations of alcohol in alcohol based hand sanitizers are highly recommended as it will increase the effectiveness of its mechanism of action which is mainly through dissolving the lipid membranes of microbes and the recommended concentrations are better to be between 70-90% as demonstrated by other study which conducted in Malaysia [14].

About 63% of junior residents and 66% of senior residents stated that health center environment or surfaces is the most frequent source of germs responsible for health-care associated infections and this mostly due to shedding of infectious microbes from infected person on other surfaces like glass, copper and plastic and the amount of surface contamination is significantly associated with microbial load within the infected patient the same finding was found in other study which conducted by John D. CoPPEn *et al.* in USA [15].

In this study we found that higher percentage of female residents using PPE when compared to males and this finding was also found in other parallel study which conducted in Poland showing females with much higher adherence to PPE and hand washing practices [16]. Higher percentage of both of them using PPE when examine examining a patient with respiratory symptoms comparing to patient without respiratory symptoms but this behavior should be changed to constant usage of PPE when examining patients with or without respiratory symptoms as demonstrated in other study which conducted in Australia which stated that usage of PPE should be for any symptoms as COVID-19 symptoms may evolve or change also patient with other complain may have a symptomatic infection [17].

Attitude toward usage of PPE was compared among senior and junior residents. There was no statistically significant difference between junior and senior residents about wearing surgical masks by suspected patients whilst in common areas or throughout the consultation and this was in contradiction to other study which conducted in India showing significant association between junior residents and senior residents and their practices regarding the use of PPE [13].

There was no significant difference between junior and senior residents in cleaning their hands before each consultation, while higher percentage of juniors cleaning their hands after each consultation compared to seniors.

Regarding knowledge and attitude association or difference between male and female residents; there was significant difference between them about that hand washing and hand rubbing are recommended to be performed in sequence with higher percentage of females agreed on that hand washing and hand rubbing are recommended to be performed in sequence compared to males. There is no statistically significant difference between males and females residents about wearing surgical masks by suspected patients whilst in common areas or throughout the consultation.

There was a significant difference between males and females residents in their knowledge about the main route of cross-transmission of potentially harmful germs between patients in a health-care facility and similar finding was found in parallel study which conducted by Abdurrahman *et al.* in Saudi Arabia [18].

There was significant association between them in regards to knowledge about correct usage of PPE in infection room when a patient confirmed to have Covid-19 with females having higher percentage of using PPE when compared to males.

No significant difference between males and females regarding knowledge about correct usage of PPE in Ambulance or transfer vehicles, while transferring covid-19 patients to the referral health care facility.

Conclusion

At the time of the study, most medical residents were knowledgeable, had a positive attitude, and good level of awareness was observed regarding PPE as it prevent their infection when they are fighting COVID-19 pandemic. Despite these findings, there was few gaps in resident's knowledge in certain situations and this need to be addressed through more training courses regarding PPE and this which will significantly raise the level of knowledge and also will set better attitude and practices regarding PPE.

References

1. WHO. Director-General's opening remarks at the media briefing on COVID-19 2020. https://www.who.int/dg/speeches/detail/who-director-general-s-opening- remarks-at-the-media- briefing-on-covid-19 --11-march-2020.
2. Remuzzi A, Remuzzi G. COVID-19: Protecting health-care workers - The Lancet 2020. Retrieved February 5, 2020,from https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30644-9/fulltext?dgcid=raven_jbs_etoc_email
3. Alsofayan YM, Althunayyan SM, Khan AA, *et al.* Clinical characteristics of COVID-19 in Saudi Arabia: A national retrospective study 2020. Retrieve 2020,

from https:// www.sciencedirect.com/science/article/pii/S1876034120304925#!
4. Wang J, Zhou M, Liu F. Reasons for healthcare workers becoming infected with novel coronavirus disease 2019 (COVID-19) in China. J Hosp Infect 2020;105(1):100-101. Doi: 10.1016/ j.jhin.2020.03.002.
5. Center for Disease and Control Prevention (CDC). Interim guidance on infection control measures for 2009 H1N1 influenza in healthcare settings, including protection of healthcare personnel; 2010. https://www.cdc.gov/h1n1flu/ guidelines infection control.htm. [Accessed 15 March 2018].
6. World Health Organization. Infection prevention and control guidance for care of patients in health- care settings, with focus on Ebola. Interim guidance 2014. http://www.who.int/csr/resources/ publications/ebola/filovirus infection control/en/. [Accessed 15 March 2018].
7. World Health Organization. Emergencies preparedness, response. Summary of probable SARS cases with onset of illness from 1 2002 to 31 July 2003. http://www.who.int/csr/sars/country/table2004 04 21/en/. [Accessed 4 February 2018].
8. Balkhy HH, El-Saed A, Sallah M. Epidemiology of H1N1 (2009) influenza among healthcare workers in a tertiary care center in Saudi Arabia: a 6-month surveillance study. Infect Control Hosp Epidemiol 2010;31:1004-10.
9. Obaghe Edeghere, Tom Fowler, Fay Wilson, Richard Caspa, Smitri Raichand, Edna Kara *et al.* Knowledge, attitudes, experience and behaviour of frontline health care workers during the early phase of influenza A(H1N1) pandemic, Birmingham, UK 2009, 19
10. Ali Alfahan MD, Samia Alhabib FMD, MPH PhD, Imad Abdulmajeed MBBS, MPH Saeed Rahman, MD MPH. In the era of corona virus.
11. Jin Y, Huang Q, Wang Y *et al.* Perceived infection transmission routes, infection control practices, psychosocial changes, and management of COVID-19 infected healthcare workers in a tertiary acute care hospital in Wuhan: a cross-sectional survey. Military Med Res 2020;7:24. https://doi.org/ 10.1186/s40779-020-00254-8.
12. Asmaa Ahmed Sayed, Marwa Mostafa Ahmed, Inas Talaat Elsayed, Soliman Saeed, Alsallout Inas, Elfazary Nouran *et al.* Preparedness and attitude toward personal protective equipment among house officers during COVID-19 pandemic in Egypt, Journal of Public Health 2021, fdab078. https://doi.org/10.1093/pubmed/fdab078.
13. Badgujar JV, Sharma GM, Relwani NR, Rohondia OS, Patole TD, Puntambekar AS. Knowledge, attitude and practices regarding the use of personal protective equipment during COVID-19 pandemic among health care workers at a tertiary health care center. Int J Community Med Public Health 2021;8:2321-30.
14. Jing Jane Lee Jia *et al.* Hand Sanitizers: A Review on Formulation Aspects, Adverse Effects, and Regulations. International journal of environmental research and public health 2020;17(9):3326. Doi: 10.3390/ijerph17093326
15. Choi H, Chatterjee P, CoPPEn JD *et al.* Current understanding of the surface contamination and contact transmission of SARS-CoV-2 in healthcare settings [published online ahead of print, 2021 Feb 11]. Environ Chem Lett 2021, 1-10. Doi: 10.1007/s10311-021-01186-y
16. Guzek Dominika *et al.* Analysis of Gender-Dependent Personal Protective Behaviors in a National Sample: Polish Adolescents' COVID-19 Experience (PLACE-19) Study. International journal of environmental research and public health 2020;17(16):5770. Doi: 10.3390/ijerph17165770.
17. Peters Micah DJ *et al.* Policies and procedures for personal protective equipment: Does inconsistency increase risk of contamination and infection. International journal of nursing studies 2020;109:103653. Doi: 10.1016/j.ijnurstu.2020.103653.
18. Bazaid AS, Aldarhami A, Binsaleh NK, Sherwani S, Althomali OW. Knowledge and practice of personal protective measures during the COVID-19 pandemic: A cross-sectional study in Saudi Arabia. PLoS one 2020;15(12):e0243695. https:// doi.org/10.1371/journal.pone.0243695.