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Araştırma Makalesi/ Research Article

Use of Personal Protective Equipment and Hand Hygiene Practices of a State Hospital Workers in the COVID-19 Pandemic: Observational Study

Bir Devlet Hastanesi Çalışanlarının COVID-19 Pandemisinde Kişisel Koruyucu Ekipman Kullanımı ve El Hijyeni Uygulamaları: Gözlemsel Çalışma

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ABSTRACT

Objective: This study aimed to observe the use of personal protective equipment and hand hygiene practices of healthcare personnel working in pandemic clinics.

Methods: It is a descriptive and observational study. The research was conducted in the clinics of a pandemic hospital between 01.10.2020 and 31.12.2020. Personal Protective Equipment Usage and Hand Hygiene Compliance Data Collection Form was used. Data were collected by researchers who were infection control nurses, and 171 healthcare workers were observed. Percentage calculation and chi-square test were used in the analysis of the data.

Results: In the patient care area, it was determined that personal protective equipment, excluding glasses/face protectors, was fully worn. 6.4% of employees did not remove goggles/face protectors, and 5.3% did not remove surgical masks/N95 masks when leaving the patient area. Practices in the pandemic intensive care unit (wearing the equipment correctly: 88.5%, correct removal: 85.2%) were more in line with guidelines than clinics (correct wearing: 64.5%, correct removal: 65.1%) (p=.001, p=.005). Compliance with hand hygiene is 69% before contact with the patient; 52.6% before aseptic procedure; 61.4% after contact with body fluid; 77.7% after contact with the patient; 73.1% after contact with the environment. Hand hygiene compliance was found to be moderate in pandemic units.

Conclusions: In our study, it was determined that personal protective equipment was available in the clinics, the use of goggles/face protection was inadequate, all personal protective equipment was not removed when leaving the patient area, and personal protective equipment was used more appropriately in intensive care units and hand hygiene practices were generally moderate level. In the pandemic process, institutions should conduct more frequent training and make more observations on the use of personal protective equipment and hand hygiene.
Keywords: Coronavirus, hand hygiene, healthcare workers, pandemic, personal protective equipment

ÖZ

Amaç: Bu araştırmada, Koronavirüs salgınında pandemi kliniklerinde çalışan sağlık personellerinin kişisel koruyucu ekipman kullanımı ve el hijyeni uygulamalarının gözlemlenmesi amaçlanmıştır.

Yöntem: Tanımlayıcı ve gözlemsel bir çalışmadır. Araştırma 01.10.2020-31.12.2020 tarihleri arasında bir pandemi hastanesinin kliniklerinde yapılmıştır. Kişisel Koruyucu Ekipman Kullanımı ve El Hijyeni Uyumu Veri Toplama Formu kullanılmıştır. Veriler enfeksiyon kontrol hemşiresi olan araştırmacılar tarafından toplanmış olup, 171 sağlık çalışanı gözlemlenmiştir. Verilerin analizinde yüzde hesaplaması ve ki kare testi kullanılmıştır.

Bulgular: Hasta bakım alanında gözlük/yüz koruyucu hariç kişisel koruyucu ekipmanların tam olarak giyildiği belirlendi. Çalışanların %6.4'ü gözlük/yüz koruyucu, %5.3'ü cerrahi maske/N95 maskesini hasta alanından ayrılırken çıkartmadığı saptandı. Pandemi yoğun bakım ünitesindeki uygulamalar (ekipmanları doğru giyinme: %88.5, doğru çıkarma: %85.2), kliniklere göre (doğru giyinme: %64.5, doğru çıkarma: %65.1) rehberlere daha uygundu (p=.001, p=.005). El Hijyenine uyum; hasta ile temas öncesi %69, aseptik işlem öncesi %52.6, vücut sıvısı ile temas sonrası %61.4, hasta ile temas sonrası %77.7, çevre ile temas sonrası %73.1'dir. Pandemi ünitelerinde el hijyenine olan uyum orta düzeyde bulundu.

Sonuç: Araştırmamızda kişisel koruyucu ekipmanların kliniklerde mevcut olduğu, gözlük/yüz koruyucu kullanımının eksik olduğu, hasta alanından ayrılırken tüm kişisel koruyucu ekipmanların çıkartılmadığı, yoğun bakımlarda kişisel koruyucu ekipmanların daha uygun kullanıldığı ve el hijyeni uygulamalarının genel olarak orta düzeyde olduğu belirlendi. Pandemi sürecinde kurumlar, kişisel koruyucu ekipman kullanımı ve el hijyeni konusunda daha sık eğitim gerçekleştirmeli ve daha fazla gözlem yapmalıdırlar.
Anahtar Kelimeler: El hijyeni, kişisel koruyucu ekipman, koronavirüs, pandemi, sağlık çalışanları

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Introduction

The coronavirus pandemic is a global epidemic that affects the whole world. Healthcare workers are susceptible to severe acute respiratory syndrome Coronavirus (COVID-19) infection from infected patients (WHOa, 2020). According to the statement made by the World Health Organization, approximately 14% of reported COVID-19 cases are healthcare workers (WHOb, 2020). It has been announced that more than 22,000 healthcare workers are infected in the world, but the exact number is unknown because systematic reporting could not be made (WHOe, 2020). In Turkey, the Ministry of Health announced that 120 thousand of 1 million 100 thousand health workers were infected with COVID-19 and 216 health workers lost their lives (Ministry of Health, 2020). Guidelines recommend that healthcare professionals wear Personal Protective Equipment (PPE) during patient care. This equipment are gown, overalls, gloves, surgical mask, N95/FFP2 or N99/FFP3 mask (to be used during aerosol-inducing aspiration, bronchoscopy and bronchoscopic procedures, intubation and respiratory tract sampling), goggles/face protector, bonnet, foot protector, hand antiseptic, soap (WHOc, 2020; CDCa, 2020).

PPE should be worn and removed in accordance with the commendations of the World Health Organization Guidelines. Equipment gown, mask, goggles/face protector, gloves (GMGG) should be worn in order, gloves, goggles/face protector, gown, mask (GGGM) should be taken off in that order. It is important to maintain hand hygiene (HH) while wearing and removing PPE. The mask should not be removed before leaving the patient's room (Ağalar and Engin, 2020; Malhotra et al., 2020; WHOc). During the SARS (severe acute respiratory syndrome) epidemic in Toronto, it was determined that personal protective equipment was not used appropriately, adequate infection control training was not received, and 87% of healthcare workers were not sure in which order to wear or remove PPE (Ofner-Agostini et al., 2006). The United States Centers for Disease Control and Prevention (CDC) reported that 55% of infected healthcare workers contracted the disease during one-on-one care with COVID-19 patients (CDCb, 2020). Therefore, compliance with infection control measures is very important in pandemic units. Keeping PPE ready in the clinics, using them in accordance with the recommendations of the guide, compliance with the HH rules, training on wearing and removing PPE and hand hygiene play an important role in preventing the disease from being transmitted to them (Ağalar and Engin, 2020; Conly et al., 020; El-Sokkary et al., 2020).

Compliance with infection control measures has gained importance with the increasing number of healthcare workers who have been diagnosed with this disease and lost their lives all over the World and in our country. In our study, we aimed to observe the use of PPE and HH practices of healthcare personnel working in the field of patient care during the Coronavirus (COVID-19) epidemic.

Method

Design and setting

This study is descriptive and observational.

Research Questions

1. Do healthcare professionals use PPE in accordance with the guidelines during the coronavirus pandemic?

2. Do healthcare personnel comply with hand hygiene rules in the coronavirus pandemic?

Participants

Health personnel who came to the clinic without wearing personal protective equipment were included in the study.

Sample size

The hospital we researched is a pandemic hospital and the number of beds is 340. There are 5 floors of services (306 beds) and 3 intensive care units (34 beds). An average of 300 health personnel work in pandemic services and intensive care units. For the study to be done, to determine the difference between the occupational groups in a statistically significant way, taking into account the previous studies (Demir et al., 2013); according to the chi-square test (4-1) *(2-1) = 0.277 effect size at 3 degrees of freedom, the inclusion of at least 156 people in the study was determined with 80% power and 5% type I error. (Taşdelen, 2017; Erdfelder et al., 1996). A total of 171 healthcare professionals, including 143 nurses, 8 physicians, 5 cleaning personnel and 15 clinical support personnel working in pandemic clinics, participated in our study. Health workers who did not want to participate in our study, who were included in the study before and who came to the unit wearing PPE were not included in the study. Ethics committee approval was received from Mersin University Rectorate Clinical Research Ethics Committee on 02.09.2020 and numbered 2020/617 to conduct the study. In addition, a work permit was obtained from the Ministry of Health and an institutional permit from the hospital where the research was conducted.

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Variables and measures

In the collection of data; The PPE and HH Compliance Data Collection Form of Hospital Workers in the COVID-19 Pandemic, which was prepared by the researcher as a result of the literature review and prepared according to the COVID-19 Infection Control and Isolation Guidelines published by the World Health Organization and the Ministry of Health, was used (WHOc, 2020; Ministry of Health, 2020). In the observation form created as a result of the literature review; There are 26 questions such as the unit where the nurses work, age, gender, profession, order of wearing and removing PPE, compliance with HH principles, use of PPE in social environments, in the hospital, and training for infection control.

Data collection procedures

Data were collected between 01.10.2020 and 31.12.2020 by two certified infection control nurses (researchers) during working hours on weekdays. Healthcare workers in pandemic wards and intensive care units were observed for approximately 90 minutes (256.5 hours in total) from putting on personal protective equipment until taking it off. Each healthcare worker was observed once. Each healthcare worker was observed individually. Data collection forms were filled out by the researchers. One-to-one observations were made by wearing appropriate personal protective equipment in pandemic clinics. Observations were made clearly and consent was obtained from the health personnel. Data collection forms were marked during observation.

Data Analysis

Data were recorded with appropriate statistical programs. In the evaluation of the data, descriptive statistics such as number, percentage, and Chi-square test were used in the analysis of categorical data. $p<0.05$ was considered significant.

Results

The research sample consisted of a total of 171 health workers and the data were collected from this group. 83% of the health workers participating in our research are women, 53.2% are 40-49 years old, 83.6% are nurses, and 64.3% are working in pandemic services. While all of the personnel participating in our study stated that they followed social distancing and wore masks, 7.6% of them stated that they ate together in the same room. 93% of them stated that they received training on wearing and removing PPE and HH. The distribution of the introductory characteristics of health workers is given in Table 1.

Table 1. Distribution of descriptive characteristics of healthcare workers (n=171)

Variable	n	%
Sex		
Female	142	83.0
Male	29	17.0
Age		
20-29	16	9.4
30-39	56	32.8
40-49	91	53.2
50+	8	4.6
Occupation		
Nurse	143	83.6
Doctor	8	4.7
Cleaning staff and Clinic support	20	11.7
Unit of Work		
Pandemic Clinics	110	64.3
Pandemic Intensive Care Unit	61	35.7
The situation of complying with social distancing and wearing a mask in the hospital		
Social distancing was followed, and the mask was worn	171	100
Social distancing was not followed, and no mask was worn	-	-
Eating in the same room		
Yes	13	7.6
No	158	92.4
Training on wearing and removing PPE – HH		
Yes	159	93.0
No	12	7.0

PPE; Personal Protective Equipment, HH; Hand Hygiene

95.9% of the healthcare professionals who participated in our study wore PPE when entering the patient care area. While all employees in the patient area wear gowns/overalls, surgical masks/N95 masks, and gloves, the rate of those who do not wear glasses/face protection is 4.1%. When leaving the patient area; the rate of those who did not remove their gloves was 1.2%, those who did not take off their goggles/face protection 6.4%, those who did not take off their gowns/overalls 0.6%, and 5.3% did not remove their surgical mask/N95 mask. PPE usage characteristics in pandemic units are shown in Table 2.

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Table 2. Distribution of PPE usage characteristics in pandemic units

Entering the patient area	**Yes**	**%**	**No**	**%**
PPE Full Wear	164	95.9	7	4.1
Wearing an gown/overall	171	100	0	0
Wearing a surgical mask /N95 mask	171	100	0	0
Wearing goggles /Face Protector	164	95.9	7	4.1
Wearing gloves	171	100	0	0
Leaving the patient area				
Removing gloves	169	98.8	2	1.2
Removing goggles/face protector	160	93.6	11	6.4
Removing gown/overall	170	99.4	1	0.6
Removing surgical mask/N95 mask	162	94.7	9	5.3

PPE; Personal Protective Equipment

The distribution of the times of hand hygiene practices in the pandemic units is given in Table 3. While the proportion of those who practiced hand hygiene before wearing PPE was 69.6%, 82.4% after removing the gloves, 67.8% after removing the goggles/face protector, 83% after removing the gown/overall, 84.2% after removing the surgical/N95 mask is. The HH compliance rate before contact with a pandemic patient is 69%, 52.6% before aseptic procedure, 61.4% after contact with body fluid, 77.7% after contact with the patient, and 73.1% after contact with the patient's environment.

Table 3. Distribution of hand hygiene practices in pandemic units
PPE; Personal Protective Equipment, HH; Hand Hygiene

Time for HH Practices	**Scrub**		**Wash**		**No**		**Not contacted**	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
PPE Before PPE being worn	90	52.6	29	17.0	52	30.4	-	-
After removing the glove	137	80.1	4	2.3	30	17.5	-	-
After removing the goggles/face protector	109	63.7	7	4.1	55	32.2	-	-
After removing the gown/overall	131	76.6	11	6.4	29	17.0	-	-
After removing surgical mask/N95 mask	102	59.6	42	24.6	27	15.8	-	-
Before contacting the patient	116	67.8	2	1.2	43	25.1	10	5.8
Before aseptic procedure	90	52.6	0	0	30	17.5	51	29.8
After contacting the patient's body fluid	100	58.5	5	2.9	18	10.5	48	28.1
After contact with the patient's body	129	75.4	4	2.3	28	16.4	10	5.8
After contact the patient's environment	119	69.6	6	3.5	37	21.6	9	5.3

Table 4 shows the distribution of PPE dressing orders. According to this table, there is a relationship between gender, a unit of work, occupation, and educational attainment. While 72.5% of women and 75.9% of men wore PPE in the correct order, 74.5% of women and 62.1% of men wore it in the correct order. There was no significant relationship between gender and correct wearing and removing order of PPE (p=.71, p=.17).

While 35.5% of health personnel working in the pandemic service wear PPE in the wrong order, this rate is 11.5% in intensive care units. The relationship between them is significant (p=.001). Likewise, while the rate of PPE false removal is 34.9% in wards, it is 14.8% in intensive care units. The relationship between them is significant (p=.005). While 28.7% of the nurses and 25% of the cleaning and clinical support personnel were dressed in the wrong order, all of the physicians were dressed in the eastern order. Looking at the order of extraction; 26.8% of the nurses, 50% of the physicians, 25% of the cleaning and clinical support

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personnel removed PPE in the wrong order. There was no significant relationship between occupation and wearing or removing PPE (p=.20, p=.34). While 71.7% of those who received training dressed in the correct order, 75% of those who did not take the training took off in the correct order. There was no significant relationship between them (p=.18, p=1.00).

Table 4. Distribution of PPE donning and stripping sequence

	Order of wearing PPE						Order of removing PPE					
	GMGG		Other				GGGM		Other			
	n	%	n	%	*P* Value	x^2	n	%	n	%	*P* Value	x^2
Sex					.71	0.13					.17	1.84
Female	103	72.5	39	27.5			105	74.5	36	25.5		
Male	22	75.9	7	24.1			18	62.1	11	37.9		
Unit of work					.001	11.4					.005	7.90
Pandemic clinics	71	64.5	39	35.5			71	65.1	38	34.9		
Pandemic Intensive Care Unit	54	88.5	7	11.5			52	85.2	9	14.8		
Occupation					.20	3.20					.34	2.12
Nurse	102	71.3	41	28.7			104	73.2	38	26.8		
Doctor	8	100	-	-			4	50.0	4	50.0		
Cleaning staff and Clinic support	15	75	5	25			15	75.0	5	25.0		
Status of receiving PPE and HH training					.18	2.26					1.0	0.04
Trained	114	71.7	45	28.3			114	72.2	44	27.8		
Not trained	11	91.7	1	8.3			9	75.0	3	25.0		

PPE; Personal Protective Equipment, HH; Hand Hygiene, x^2;Chi square, GMGG; Gown-Mask-Goggle-Glove, GGGM; Gloven-Goggle-Gown-Mask

Discussion

The United States Centers for Disease Control and Prevention (CDC) reported that 55% of infected healthcare workers contracted the disease during one-on-one care with COVID-19 patients (CDCb, 2020). Therefore, compliance with infection control measures is very important in pandemic units. Keeping PPE ready in the clinics, using them in accordance with there commendations of the guide, compliance with the HH rules, training on wearing and removing PPE and hand hygiene play an important role in preventing the disease from being transmitted to them (Ağalar and Engin, 2020; Conly et al., 2020; El-Sokkary et al., 2020). The majority of health workers participating in our research are nurses and women. While all healthcare professionals stated that they followed social distancing and wore masks while working in the hospital, 7.6% of them stated that they ate together in the same room. Ahmad et al. (2020) with 133 nurses and paramedics in Pakistan, it was stated that 52% of the participants in the study followed social distancing. All of the workers participating in our research stated that they follow social distancing and wear masks. This situation can be attributed to the training of the majority of health workers. In the same study, they found that during the pandemic, 67.6% of them provided PPE on time, 84.9% of them had sufficient equipment, and that healthcare workers who provided PPE on time were less likely to catch COVID-19. As can be seen, easy access to PPE reduces the risk of developing the disease. In a study investigating the availability and use of PPE in 6 public hospitals in Ethiopia; It was found that 77% of the hospitals did not have sufficient PPE, especially the N 95 mask was missing, while the use of N 95 masks was 9.1% before COVID-19, it could only increase to 21% during the pandemic (Deressa et al., 2021).

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In this study, the majority of the participants wore PPE when entering the patient rooms, and they did not experience any shortage of PPE. It is very important that the equipment is easily accessible and that the employees know the location of the equipment in terms of facilitating these processes. Ahmad et al. (2020) While the rate of participants in the training of wearing PPE, taking off, social distance and isolation was 57.1%, it was found to be higher in our study (Ahmad et al.,2020). In our hospital, training was given to all occupational groups at the beginning of the pandemic, and daily pandemic clinics were visited by infection control nurses in the following days, and on-site, practical training was provided to the employees. We think that the fact that the trainings were given was used in accordance with the PPE guidelines and improved our results.

It is important to use the equipment fully and in place when entering the patient rooms, as the COVID-19 disease is transmitted by contact, droplet and in some procedures, respiratory tract (Conly et al., 2020; Sommerstein et al., 2020). In our study, the rate of those who did not wear glasses was 4.1%. In a meta-analysis study, it was stated that when eye protection was used, COVID-19 infections were reduced by 78% (Chu et al.,2020). Therefore, it is important to wear glasses or a face protector. In our study, 6.4% of the employees did not remove their goggles/face protector and 5.3% did not remove their surgical mask/N95 mask when leaving the patient area. It made us think that this situation may cause the employees to become infected. The use of contaminated PPE may result in self-infection of healthcare workers. After the observation, on-site training was given to people who wore or did not take off PPE. In the study of Moreno-Casbas et al. (2020), the rate of those who wear PPE is 4.9%, those who do not wear FFP2, 5.3%, those who do not wear glasses/face protection 6.3%, those who do not wear gloves 1.2%, those who do not wear a gowns 4% (Moreno-Casbas et al., 2020). Wearing PPE is important in preventing transmission. Rivett et al. (2020), on the other hand, found that healthcare workers working in COVID-19 clinics are infected 3 times more than those who do not work in these clinics, despite wearing PPE (Rivet et al.,2020). For this reason, PPE should be removed when leaving the patient area, self-contamination should be prevented and hand hygiene should be followed.

Hand hygiene is the most important strategy to follow in preventing the transmission and spread of COVID-19 disease (Moore et al., 2021; Rundle et al.,2020). CDC recommends washing hands with soap and water for at least 20 seconds or rubbing hands with at least 60% ethanol or 70%isopropyl alcohol in the COVID 19 outbreak (CDCc,2020). Hand hygiene should be maintained before PPE is put on and after each piece of equipment is removed. In our study, full compliance with hand hygiene was not achieved after removal of PPE. The “5 moments rule” defined by WHO is an important rule that should also be applied when caring for a COVID-19 patient. Hand hygiene should be provided before and after contact with the patient, before a clean or aseptic procedure (when placing a peripheral vascular catheter, urinary catheter, intubation, etc.), after contact with body fluids and after touching the patient's environment (WHOd, 2020).

Even if PPE is fully worn, it is necessary to wash hands with soap and water or rub hands with alcohol-based hand antiseptics. Performing HH while removing the equipment allows the person to protect himself (Azap ve Erdinç, 2020). In our study, it was determined that the lowest compliance was before the aseptic procedure. Just before the aseptic procedure, after HH, aseptic operation should be done without touching anywhere. After HH is provided, the surfaces around the patient are touched and aseptic procedure is performed, and compliance rates decrease. Pre-contact compliance with the patient was 69.0%, and post-contact compliance was 73.1%. Israel et al. (2020) found that HH compliance increased from 28% to 79% before contact with the patient and from 65% to 100% after contact with the patient in the COVID-19 pandemic (Israel et al.,2020). Especially after contact with the patient, after contact with body fluid, after contact with the patient's environment, the high level of compliance is an important point in preventing transmission from the patient. Observing HH, which is one of the infection control measures, also in pandemic units, giving HH training periodically, and reporting the results of the observations to the hospital administration and related services on a monthly and quarterly basis will increase compliance.

No significant relationship was found between gender, occupation and education status and the correct order of wearing and removing PPE. According to the services in the pandemic intensive care units, it has been found that the equipment is put on and taken off in the correct order. This situation suggested that the frequent use of invasive procedures in intensive care units, the more frequent use of aerosol-inducing procedures such as

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aspiration, high-flow oxygen therapy, nebulizer therapy, intubation, and the greater attention paid to equipment, and also the fear of infecting the disease to themselves. In the city of Wuhan, China, 420 healthcare workers (116 healthcare workers and 304 nurses) used PPE correctly while providing healthcare to patients in hospital admissions and aerosol-producing procedures, and there was no healthcare personnel infected with SARS-CoV-2 infection. It was concluded that health systems should prioritize the supply and distribution of PPE, and health professionals should be trained on its use (Liu et al., 2020).

Conclusion and Recommendations

As a result, In the COVID-19 pandemic, it has been determined that PPE is available in clinics, the use of glasses/face protectors is insufficient, all PPEs are not removed after the procedure, PPEs are used more accurately in intensive care units and HH practices are insufficient. In case of an epidemic, availability of personal protective equipment in clinics, easy access of employees to this equipment, correct use of equipment, training of employees, and compliance with HH principles are important for the protection of both their own and public health. In case of an epidemic, behaviors compatible with infection control measures play a key role for healthcare professionals. Since this study is an observational study conducted in clinics where COVID-19-positive patients were followed during the COVID-19 pandemic, it is an important study that provides evidence for knowing the practices that include correct prevention measures in the pandemic. If the difficulties experienced at the time of the epidemic can be recognized and the deficiencies can be eliminated with this and similar studies, the health of health workers and the rate of contamination and patients will be protected by reducing the rate of contact. This study reveals the current situation and can be a guide for better and advanced applications.

Limitations of the Study

Nurses participated more in our study, and there were limitations in the observations because the physicians wore their PPE before coming to the clinic. Physicians are more observable. In another study, the use of PPE and HH practices and the infection status of employees who provide one-to-one care to a pandemic patient can be compared.

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Ethics Committee Approval: In order to carry out the study, an ethics committee decision was taken from the Clinical Research Ethics Committee of a university (Ethics Committee Decision dated 02/09/2020 and numbered 2020/617) prior to the study. Scientific Research Approval from the Ministry of Health of the Republic of Turkey and institutional permission were obtained from the research institution. Written informed consent for participation in the study was obtained from health personnel.
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What did the study add to the literature?

- The results of the study underlined the correct use of personal protective equipment for the protection of employee health during the epidemic period. In addition, increasing compliance with hand hygiene principles in clinical practice was the most important factor in reducing the risk of transmission.
- Using research results in clinical practice can benefit the safety and quality of care Worldwide. Additional studies are needed to understand other factors related to research use that influence patient and worker safety outcomes. Is personal protective equipment used correctly for pandemic patients? Are hand hygiene practices correct in pandemic clinics?

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