

EVALUATION OF THE PREVALENCE AND TRANSMISSION ROUTES OF COVID-19 IN HEALTHCARE PERSONNEL WORKING IN THE HOSPITAL

Hastanede Çalışan Sağlık Personelinde COVID-19 Görülme Sıklığı ve Bulaş Yollarının Değerlendirilmesi

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ABSTRACT

ÖZ

Objective: This study was conducted to evaluate the prevalence and transmission routes of COVID-19 in healthcare personnel working in the hospital and the compliance with control measures.

Material and Methods: In this study, hospital employees who were tested positive for COVID-19 between April 2 and September 30, 2020, were included. Out of the 1100 employees in the hospital, 80 were tested positive for COVID-19. A face-to-face survey was conducted with 66 healthcare workers that had COVID-19 positive PCR test results but returned to work only after their test results became negative.

Results: The prevalence of COVID-19 among the hospital employees was calculated as 7.3% (80/1100). In the study, 66 healthcare workers who were found to be positive for COVID-19, were included. The mean age of the employees was found to be 39.1 ± 8.3 (Min-Max: 23-57) and 71.2% of them were male. COVID-19 was detected most in nurses, emergency room workers (12.1%) and polyclinic workers (12.1%). It was determined that 30.3% (n=20) of COVID-19 positive employees had contact with infected colleagues in the hospital and 19.7% (n=13) had contact with infected household members. 78.7% of the employees had never worked in areas designated for COVID-19. Among employees, the level of compliance with measures of wearing a mask (94%) and ensuring hand hygiene (92%) was found high, while the level of compliance with 1.5-meters social distance (59%) was found low.

Conclusion: In a short period of time like the first six months of the pandemic, 7.3% of the hospital workers were infected with COVID-19. Among employees, the level of compliance with the social distance rule was found low. It was determined that 78.7% of the infected employees had never worked in units designated for COVID-19. This shows that areas that are not designated for COVID-19 should not be ignored.

Amaç: Bu çalışma, hastanede çalışan sağlık personelinde COVID-19 sıklığını belirlemek, kontrol önlemlerine uyum ve bulaş yollarını değerlendirilmek amacıyla yapılmıştır.

Gereç ve Yöntemler: Bu araştırmaya 2 Nisan-30 Eylül 2020 tarihleri arasında, hastanede çalışan ve COVID-19 testi pozitif çıkan çalışanlar dahil edildi. 1100 kişinin çalıştığı hastanede 80 kişide COVID-19 testi pozitif olduğu saptanmıştır. COVID-19 PCR testi pozitif olup, ancak testi negatif eştikten sonra göreve dönen 66 sağlık çalışanına yüz yüze anket uygulanmıştır.

Bulgular: Hastane çalışanlarında COVID-19 görülme sıklığı %7.3 (80/1100) olarak hesaplanmıştır. Çalışma, COVID-19 olduğu tespit edilen 66 sağlık çalışanı kapsamaktadır. Çalışanların yaş ortalaması 39.1 ± 8.3 (Min-Max: 23-57) olup, %71.2'si (n=47) erkektir. COVID-19 en çok hemşirelerde tespit edildi. COVID-19 en fazla acil serviste (%12.1) ve poliklinik alanında (%12.1) çalışanlarda tespit edildi. COVID-19 pozitif çalışanların %30.3'ünün (n=20) hastanedeki enfekte iş arkadaşlarıyla temasta bulunduğu, %19.7'sinin (n=13) ise enfekte hane halkı üyeleriyle temas ettiği belirlendi.

Çalışanların %78.7'si COVID-19 için belirlenmiş alanlarda hiç çalışmamıştır. Çalışanlar hastane içerisinde çalışırken maske (%94) ve el hijyeni (%92) kuralına uyumları yük-sek bulunurken, 1.5 metrelik sosyal mesafe (%59) kuralına uyumları düşük bulundu.

Sonuç: Pandeminin ilk altı ayı gibi kısa bir sürede hastane çalışanlarının %7.3'ü COVID-19 ile enfekte olmuştur. Çalışanların sosyal mesafe kuralına uyumları düşük bulunmuştur. Enfekte çalışanların %78.7'sinin COVID-19 için belirlenmiş servislerde hiç çalışmadığı tespit edildi. Bu durum COVID-19 dışı alanların göz ardı edilmemesi gerektiğini göstermektedir.

Keywords: COVID-19, healthcare worker, hospital, transmission

Anahtar Kelimeler: COVID-19, sağlık çalışanı, hastane, bulaşma



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INTRODUCTION

The World Health Organization (WHO) China Country Office reported cases of pneumonia of unknown etiology in Wuhan, China's Hubei province, on December 31, 2019. On January 7, 2020, the agent was identified as a new corona-virus (2019-nCoV) that had not previously been detected in humans. Later, the name of the 2019-nCoV disease was accepted as COVID-19, and the cause was determined to be SARS-CoV-2. WHO classed the COVID-19 outbreak as an "international public health emergency" on January 30, 2020, and dened it as a pandemic on March 11. Since it is transmitted from person to person, the source of COV-ID-19 is COVID-19 positive people (1, 2). Current evidence shows that COVID-19 is transmitted by close contact and droplet infection between people (3). The incubation period varies between 2 and 14 days (median 5 days). In the past 20 years, two more outbreaks have occurred, each caused by the betacoronavirus. In the rst outbreak, which mostly affected people in China and Hong Kong between 2002-2003, the fatality rate was reported as 11% (SARS epidemic); and in the second, the fatality rate was reported as 34% (MERS-CoV epidemic in Saudi Arabia in 2012) (4). According to the COVID-19 report by WHO regarding the People's Republic of China, the fatality rate was reported as 3.8%. As of May 2, 2020, the fatality rate in Turkey was reported as 2.6%. The entire society is susceptible to COV-ID-19. Healthcare workers (HCWs) are the occupational group that is at the highest risk in terms of encountering the agent (1). Protection and control measures should be taken during a pandemic. These measures are generally for resource control, routes of transmission and protection of healthy individuals (5). In a meta-analysis including 97 studies, all of which were published in 2020, the reverse transcription-polymerase chain reaction (PCR) analysis was conducted on the samples of healthcare employees and the estimated prevalence of COVID-19 infection was found to be 11% (95% condence interval: 7-15%). HCWs are at the forefront of the COVID-19 response and are at high risk of contracting the disease and subsequently exposing patients and other individuals to it (6). Therefore, it is clear that there is a need for a detailed examination of the status of healthcare professionals affected by and infected with COVID-19 (7).

This study was conducted to determine the prevalence of COVID-19 in healthcare personnel working in the hospital and evaluate the transmission routes and the compliance with control measures.

MATERIALS AND METHODS

In this cross-sectional descriptive research, employees of the Children's Hospital who were tested positive for COVID-19 in the PCR (Polymerase Chain Reaction) test between April 2, 2020 and September 30, 2020 were included. Ethics committee approval was obtained from the Health Sciences University, Diyarbakır Gazi Yaşargil Training and Research Hospital (Date: 16.10.2020, Approval number: 599). Hospital Occupational Health and Safety Unit records were reviewed retrospectively in order to identify HCWs who had COVID-19. There were approximately 1.100 employees in the hospital. First COVID-19 cases in Turkey were detected on March 11,

2020 (1). Among the employees of our hospital, the rst COVID-19 case was detected on April 02, 2020. COVID-19 was detected in 80 hospital employees between April 2, 2020 and September 30, 2020. The prevalence was found by dividing the total number of COVID-19 (+) people by the total number of staff working in the hospital during the specied period. People who were clinically and radiologically compatible with COVID-19, but had a negative COVID-19 PCR test result were excluded from the study. It was planned to include all employees with COVID-19 positive PCR test result in the study. However, since six people did not agree to participate in the study and 8 people were employed in dierent institutions, a total of 14 people were excluded from the study. A face-to-face survey was conduct-ed with 66 HCWs that had COVID-19 positive PCR test results within the specied time frame but returned to work only after their test results became negative, who agreed to participate in the study. The survey included questions about sociodemographic characteristics, masks, distance, hygiene and transmission routes. Written informed consent was obtained from the survey participants. Survey questions consisted of demographic characteristics, use of personal protective equipment (PPE) and contamination. The data obtained were loaded into the software program and the mean and percentage were calculated. Chi-square and Fisher's Exact tests were used for statistical analysis. $p < 0.05$ was considered statistically significant.

RESULTS

The COVID-19 prevalence in employees in the rst 6 months was calculated as 7.3% (80/1100). The study included 66 HCWs, who were found to have COVID-19. The mean age of the employees was 39.1 ± 8.3 (Min- Max: 23-57) and 71.2% (n=47) of them were male. In terms of educational status, 59.1% (n=39) of them were university graduates, while 24.2% (n=16) were high school graduates. 18.2% (n=12) of the infected HCWs had chronic diseases such as hypertension, heart diseases and diabetes. The mean number of people living in the house where the patients were living was found to be 4.1 ± 1.8 (Min-Max: 1-13). One of the employees was treated in the hospital, while the others were treated in isolation at home. COVID-19 was detect-ed most among nurses (n=22; 33.3%), security personnel (n=11, 16.7%), cleaning personnel (n=9; 13.6%) and automation personnel (n=6; 9.1%) (Table 1).

It was determined that, 78.7% (n=52) of the healthcare professionals had never worked in the hospital areas designated for COVID-19 patients. Besides that, 30.3% (n=20) of the HCWs reported that they had contact with other employees who were found positive for COVID-19 in the PCR test in the hospital within 14 days before they got the disease, 19.7% (n=13) were in close contact with COVID-19 positive family members at home, and 7.6% (n=5) were in contact with COVID-19 positive people outside.

Furthermore, 48.5% (n=32) of them stated that some of their colleagues working at the same unit were tested positive for COVID-19 within 14 days after they got COVID-19 (Table 2).

Table 1: Demographic Characteristics of Healthcare Workers with COVID-19 (+) PCR Test Result (n=66)

		Number	%
Age (Mean ± SD)		39.1±8.3 (Min- Max:23-57)	
Sex	Male	47	71.2
	Female	19	28.8
Education Status	Primary School- Secondary School	11	16.7
	High School	16	24.2
	University	39	59.1
Profession	Nurse	22	33.3
	Security	11	16.7
	Cleaning staff	9	13.6
	Automation Staff	6	9.1
	Technical staff *	6	9.1
	Cook-waiter	5	7.6
	Officer	4	6.1
	Other**	3	4.5
Working Units	Security Unit	9	13.6
	Emergency	8	12.1
	Polyclinic	8	12.1
	Medical and Domestic Waste	7	10.6
	Bed Service	6	9.1
	Kitchen	5	7.6
	Intensive care	5	7.6
	Technical Unit	4	6.1
	Other Medical Fields ***	7	10.6
	Administrative units ****	6	9.1
	COVID-19 Service	1	1.5

*: Technician, Technician, Technical Engineer, and Servant

** : Doctor, Biologist, and Psychologist

***: Operating Room, Laboratory, Home Health Care etc.

****: Trusteeship, Warehouses, and Archive etc.

Table 2: Disease, Contact and Isolation Characteristics of Healthcare Workers with COVID-19 (+) PCR Test Result (n=66)

		Number	%
Signs of Illness	Yes	65	98.5
	No	1	1.5
Pre-disease COVID-19 PCR test positive contact history	At the hospital	20	30.3
	In the house where they live	13	19.7
	Outside the house where they live	5	7.6
	No contact history	28	42.4
Working in areas designated for COVID-19	Yes	14	21.2
	No	52	78.8
Did any personnel have positive Covid-19 PCR test result in the unit you worked within 14 days after the illness?	Yes	32	48.5
	No	34	51.5
Isolation measure	Home isolation	65	98.5
	Inpatient in the hospital	1	1.5

Male employees (n=17; 36.2%) reported that they had close contact with other patients with positive COVID-19 PCR test results, while female employees reported that they had close contact with COVID-19 positive people outside the hospital (n=8; 42.1%). However, a significant portion of both male employees (n=20; 42.5%) and female employees (n=8; 42.1%) had no history of close contact (p> 0.05).

In terms of commuting to the hospital, male employees stated that they were using public transportation (n=30; 63.8%), while female employees stated that they were using their own vehicles (n=10; 52.6%) (p<0.05) (Table 3).

Among the employees working in the hospital; 25.8% (n=17) reported that they were not adequately trained on how to use protective equipment against COVID-19 while performing their duties, 13.6% (n=9) used to come to the hospital without a mask and wearing a mask just before entering the hospital, 40.9% (n=27) were in contact with other employees in the same unit who did not maintain 1.5-meters distance, 6.1% (n=4) stated that they did not comply with the mask and distance rules when participating in events such as funerals and weddings (Table 4)

The behaviors of employees with COVID-19 (+) test results regarding the use of masks, maintaining distance and ensuring hand hygiene was compared in terms of gender and contact history. There was no statistically significant difference (p> 0.05)

Table 3: The Comparison of Transportation and Contamination Sites of Healthcare Workers who had COVID-19 (+) PCR Test Result by Gender (n = 66)

		Sex*		P
		Male n (%)	Female n (%)	
Infection site	At the hospital	17 (36.2)	3 (15.8)	P>0.05
	At home	7 (14.9)	6 (31.6)	
	Outside the house	3 (6.4)	2 (10.5)	
	No contact history	20 (42.5)	8 (42.1)	
Transportation from home to the hospital	By public transport	30 (63.8)	4 (21.1)	P=0.004
	With my own vehicle	14 (29.8)	10 (52.6)	
	Other**	3 (6.4)	5 (26.3)	

*The column percentage is given.

**On foot, by shared vehicle.

Table 4: Behaviors of Healthcare Workers with COVID-19 (+) PCR Test Result Regarding Mask, Distance and Hand Hygiene (N = 66).

	Yes (%)	Partially (%)	No (%)
I was informed about how to use the protective equipment while on duty in the hospital.	74.2	16.7	9.1
I do not work without a mask in the hospital.	94.0	3.0	3.0
I come to the hospital without a mask, but I wear a mask at the entrance to the hospital.	3.0	10.6	86.4
I obey the rule of maintaining at least a 1.5-meters distance between other employees in the unit where I work.	59.1	33.3	7.6
I clean my hands with a disinfectant after touching any place or patient in the hospital.	92.4	7.6	-
When I leave the house, I use a mask outside.	93.9	6.1	-
When I attend another home, funeral or wedding event, I follow the mask and 1.5-meters distance rules.	92.4	6.1	1.5

DISCUSSION

The number of HCWs affected by COVID-19 is substantial. Among different groups, HCWs are considered to have the highest potential to be affected by future pandemics (7). In this study, 7.3% of healthcare employees working in the hospital were found positive for COVID-19 in the PCR test in the first 6 months of the pandemic. In a meta-analysis study, it was shown that the rate of HCWs who were SARS-CoV-2 positive was 10.1% of all COVID-19 patients (8). In a study conducted by Gómez-Ochoa et al., COVID-19 positivity in the PCR test was found to be 11% (95% CI: 7 to 15%) among HCWs (6). In the study of Dzinamarira et al., COVID-19 positivity in the PCR test was found to be 11% (95% CI: 7 to 16%) among healthcare workers (9). It was announced that 29,865 HCWs (10.9% of all cases) had been infected with COVID-19 until September 2, 2020 in Turkey (10,11). In our study, the prevalence of COVID-19 in HCWs was found to be lower than in other studies. This may be due to the fact that our study population was limited to the HCWs in a children's hospital. COVID-19 is less common in pediatric patients than in adult population (less than 2% of all patients) (12).

Therefore, the transmission rate from pediatric patients to HCWs may have been low.

In a systematic study conducted worldwide, it was shown that infection predominantly affected women (71.6%) and nurses (38.6%), but deaths were reported most in men (70.8%) and doctors (51.4%) (13). In a study conducted in a hospital in London, COVID-19 test positivity was found to be 10% in men and 5% in women. In terms of profession, physicians had the highest rate of COVID-19 positivity (11%), followed by nurses (7%) and healthcare assistants (6%) (14).

In our study, it was found that 71.2% of the employees who had COVID-19 positive PCR test result were male. Although similar results can be found in the literature, in contrast with most studies around the world, COVID-19 positivity was found to be higher in male employees in our study. In terms of profession, nurses had the highest rate of COVID-19 positivity (33%), followed by security personnel (16.7%), cleaning personnel (13.6%) and automation personnel (9.1%). Only one person was diagnosed with COVID-19 among physicians, who were expected to be the highest risk group.

In our study, in terms of profession, COVID-19 positivity was detected most in nurses, which was consistent with the literature. Although in the literature, the second most common group that had test positivity was physicians, in our study, only one physician was found positive for COVID-19. In our study, COVID-19 positivity was detected most in non-clinical personnel after nurses. The reason for this was thought to be the fact that frontline clinical staff, especially physicians, were considered to be the highest risk group when the COVID-19 pandemic began, and that there was a global concern about the sufficiency of PPE (14). Since the procedures that require intensive contact such as mouth and nose examinations are performed by physicians, they were given the priority in terms of using PPE such as N95 masks and safety glasses. In addition, subjecting patients with COVID-19 symptoms such

as fever to polyclinic tri-age and the fact that the patients were children, who were in the low-risk group, were considered to be the reasons for the low rate of COVID-19 positivity among physicians (3,12).

Security personnel working in the waiting areas of the hospital and automation personnel working in the patient registration unit were the first to come into contact with patients. In addition, it was thought that cleaning personnel might have been at risk in terms of infection due to contact with infected medical waste. The results would therefore indicate that other employees of the hospital that do not provide health care services should not be ignored.

The prevalence of severe diseases in HCWs (9.9%) was found to be lower than the prevalence among all COVID-19 positive patients (29.4%) (8). Similarly, the mortality rate among HCWs (0.3%) was found to be lower compared to all patients (2.3%) (8,9). By September 2, 2020, 29.865 HCWs in Turkey (10.9% of all cases) had been infected with COVID-19 and 52 HCWs (mortality rate 0.2%) were reported to have died (11,15). In our study, similar to previous studies, most of the patients (98.5%) had a mild illness and were treated in isolation at home. Nobody died due to COVID-19 infection.

HCWs who are in close contact with people infected with SARS-CoV-2 due to their work are very likely to have their illnesses caused by their work environment. This situation can be determined more easily, especially in the early period of a pandemic, when the virus is less prevalent in the general population and when HCWs work closely with infected individuals. However, in the later period of a pandemic, the identification of the source will be more difficult as exposure levels across the general population are higher (16). In a study conducted in the USA, it was shown that most of the secondary infections were among household contacts and the secondary attack rate was 10.5% (17,18). In the Ministry of Health guidelines, it was stated that if the close contact history of a positive case cannot be determined, other households in contact with the external environment should be screened in order to determine the possibility of asymptomatic domestic cases (3). In our research, we determined that, 78.8% of the HCWs had never worked in areas designated for COVID-19. No close contact with a positive case was indicated by 42.4% of the cases with positive COVID-19 PCR test.

While male employees reported a history of close contact mostly within the hospital (36.2%), 63.8% of them were using public transportation to commute to work. On the other hand, female employees reported a history of close contact mostly at home (31.6%), while 52.6% of them were commuting to the hospital with their own vehicle. This suggests that a significant proportion of healthcare professionals may have been infected by family contact and exposure outside the hospital.

In our study, 25.8% of the HCWs with COVID-19 positive PCR test result stated that they did not receive training on how to use PPE, while 40.9% stated that they either partially or not at all maintained the 1.5-meters distance with other employees in the unit they worked in. Until effective immunization with vaccination is provided, the best way for HCWs to protect

themselves while providing care to COVID-19 patients is to ensure hand hygiene and use PPE correctly (19). Although WHO considers a distance of 1 meter to be sufficient to prevent infection, there are some guidelines who recommend maintaining a social distance of 1.5 meters (20,21).

Limitations of the study: Not all HCWs in the hospital were tested for COVID-19. Only the HCWs who were in contact with people who were suspected to have COVID-19 or people who were COVID-19 positive, were tested. The results cannot be generalized due to the fact that this study is a single-center study, in which the employees who had not been tested for COVID-19 and those who had negative PCR test results were not included.

CONCLUSION

In a short period of time like the first six months of the pandemic, 7.3% of the hospital workers were infected with COVID-19. Among employees, the level of compliance with measures of wearing a mask and ensuring hand hygiene was found high, while the level of compliance with 1.5-meters social distance was found low. It was determined that 78.7% of the infected employees had never worked in units designated for COVID-19. This showed that protective measures were not sufficiently followed in areas that were not designated for COVID-19 in the hospital. Therefore, in order to prevent transmission among HCWs, protective and control measures should be taken regarding the sources of infection and routes of transmission in all service areas of the hospital, including non-clinical areas.

It is important to make the necessary arrangements regarding distance in the unit where HCWs work, to provide training and updates periodically on the use of protective equipment, and to train all employees on medical waste disposal, especially the cleaning personnel, in terms of protection from infection.

In addition, until the vaccines of the HCWs are provided, providing transport vehicles to the workers who have been using public transport will reduce the transmission.

Conflict of Interest: The authors declare that there is no conflict of interest.

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REFERENCES

1. Sağlık Bakanlığı. Covid-19 (SARS-CoV-2 Enfeksiyonu) Genel Bilgiler, Epidemioloji ve Tanı. Bilim Kurulu Çalışması. Accessed date: 03 January 2021: <https://covid19.saglik.gov.tr/>.
2. Chou R, Dana T, Buckley DI, Selph S, Fu R, Totten AM. Epidemiology of and risk factors for coronavirus infection in health care workers: A living rapid review. *Ann Intern Med.* 2020;173(2):120-36. doi: 10.7326/M20-1632.
3. Sağlık Bakanlığı. Covid-19 (SARS-CoV-2 Enfeksiyonu) Temaslı Takibi, Salgın Yönetimi, Evde Hasta İzlemi ve Filyasyon. Bilim Kurulu Çalışması. Accessed date: 03 January 2021: <https://covid19.saglik.gov.tr/>.
4. Singhal T. A review of coronavirus disease-2019 (COV-ID-19). *Indian J Pediatr* 2020;87(4):281-6.
5. Gökçek MB, Aslaner H, Çetin A, Yıldız S, Benli AR. Medical surveillance: Filiation. *Jour Turk Fam Phy* 2021;12(1):40-9.
6. Gómez-Ochoa SA, Franco OH, Rojas LZ, Raguindin PF, Roa-Díaz, ZM, Wyssmann BM et al. COVID-19 in healthcare workers: A living systematic review and meta-analysis of prevalence, risk factors, clinical characteristics, and outcomes. *American journal of epidemiology.* 2021;190(1):161-175.
7. Çalışkan-Pala S, Metintas S. COVID-19 pandemisinde sağlık çalışanları. *ESTÜDAM Halk Sağlığı Dergisi.* 2020;5:156-68.
8. Sahu AK, Amrithanand VT, Mathew R, Aggarwal P, Nayer J, Bhoi S. COVID-19 in health care workers - A systematic review and meta-analysis. *Am J Emerg Med.* 2020;38(9):1727-31.
9. Dzinamarira T, Murewanhema G, Mhango M, Iradukun-da PG, Chitungo I, Mashora M et al. COVID-19 prevalence among healthcare workers. A systematic review and meta-analysis. *Int J Environ Res Public Health.* 2021;19(1):146.
10. The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team. The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) - China, 2020[J]. *China CDC Weekly.* 2020;2(8):113-22.
11. Sağlık Bakanlığı. Bakan Koca, koronavirüse ilişkin son durumu değerlendirdi. Accessed date: 01 March 2021: <https://www.saglik.gov.tr/TR,68676/bakan-koca-korona-viruse-iliskin-son-durumu-degerlendirdi.html>.
12. Alsohime F, Temsah MH, Al-Nemri AM, Somily AM, Al-Subaie S. COVID-19 infection prevalence in pediatric population: Etiology, clinical presentation, and outcome. *J Infect Public Health.* 2020;13(12):1791-96.
13. Bandyopadhyay S, Baticulon RE, Kadhum M, Alser M, Ojuka DK, Badereddin Y et al. Infection and mortality of healthcare workers worldwide from COVID-19: A systematic review. *BMJ Glob Health.* 2020;5(12):e003097.
14. Zheng C, Hafezi-Bakhtiari N, Cooper V, Davidson H, Habibi M, Riley P et al. Characteristics and transmission dynamics of COVID-19 in healthcare workers at a London teaching hospital. *J Hosp Infect.* 2020;106(2):325-9.
15. Sağlık Bakanlığı. COVID-19 Bilgilendirme Platformu. Accessed date: 01 March 2021: <https://covid19.saglik.gov.tr/TR-66935/genel-koronavirus-tablosu.html>.
16. COVID-19 pandemisi'nde meslek hastalığı tanı kılavuzu. Accessed date: 02 December 2021: https://korona.hasud-er.org.tr/wp-content/uploads/Mesleksel-COVID_19_Tan%C4%B1_Rehberi_2020.pdf.
17. Burke RM, Midgley CM, Dratch A, Fenstersheib M, Haupt T, Holshue M et al. Active monitoring of persons exposed to patients with conrmed COVID-19 - United States, January-February 2020. *MMWR Morb Mortal Wkly Rep.* 2020;69(9):245-6.
18. İşsever H, İşsever T, Oztan G. Epidemiology of COVID19. *Sağlık Bilimlerinde İleri Araştırmalar Dergisi.* 2020;3(Sup-pl.1):1-13.
19. Bayhan GI, Bedir-Demirbag T. Personnel protective equipment for healthcare professionals during COVID-19 pandemic. *Turkish J Pediatr Dis.* 2020;14(suppl):15-7.
20. World Health Organization. What to do to keep yourself and others safe from COVID-19. Accessed date: 09 March 2021: <https://www.who.int/emergencies/diseases/nov-el-coronavirus-2019/advice-for-public>.
21. Department of Health (Australian Government). Protect yourself and others from COVID-19. Accessed date: 19 May 2022: <https://www.health.gov.au/health-alerts/covid-19/protect-yourself-and-others>.