



## Research

# Attitudes and Seropositivity Rates of Healthcare Workers for CoronaVac® During the COVID-19 Pandemic in a Pediatric Department

Bir Pediatri Departmanında COVID-19 Pandemisi Sırasında CoronaVac® Aşısı için Sağlık Çalışanlarının Tutumları ve Seropozitiflik Oranları

İD Nihal Akçay<sup>1</sup>, İD Mehmet Emin Menentoğlu<sup>1</sup>, İD Canan Baydemir<sup>2</sup>, İD Esra Şevketoğlu<sup>1</sup>

<sup>1</sup>University of Health Sciences Turkey, Bakırköy Dr. Sadi Konuk Training and Research Hospital, Clinic of Pediatric Intensive Care Unit, İstanbul, Turkey

<sup>2</sup>Kocaeli University Faculty of Medicine, Department of Biostatistics, Kocaeli, Turkey

### ABSTRACT

**Objective:** Healthcare workers (HCWs) are known to be at a high risk of transmission during the coronavirus disease-2019 (COVID-19) pandemic. The present study evaluated HCWs' attitudes toward COVID-19 vaccines, and COVID-19 serologic status before and after the vaccination.

**Methods:** This study is a prospective observational study. All participants completed a brief survey and were questioned about their intentions and hesitations about getting CoronaVac®. Before the CoronaVac® vaccine, the anti-body levels of all participants were checked. For those who agreed to get the vaccine, in the second step of the study, anti-body titers were checked twice: 1 month after the 1<sup>st</sup> and the 2<sup>nd</sup> doses of vaccination. In the last step of the study, COVID-19 surveillance was performed on all participants for 6 months.

**Results:** A total of 127 participants, 104 females, and 23 males, with a median age of 29 years were included in the study. A total of 43 HCWs had a positive history of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), the most affected group was physicians (41.8%) followed by nurses (27.6%). Among 43 participants who had COVID-19 history positive, 31 of them tested positive for anti-bodies, while 12 of them were negative. Anti-body levels were tested as positive in 4 of 84 participants who had no positive history of COVID-19. Seventy-six (59.8%) were vaccinated. The reasons for vaccine hesitancy were; a previous infection with the SARS-CoV-2 (n=15, 29.4%), and the belief in vaccine ineffectiveness (n=22, 43.1%). Anti-body response rates were 80.2% after 1<sup>st</sup> dose and 100% after 2<sup>nd</sup> dose. In the 6-month follow-up period, unvaccinated 7 (13.7%) HCWs and vaccinated 1 (1.3%) HCW had COVID-19 infections.

**Conclusion:** Vaccination is essential in terms of protection from COVID-19. CoronaVac® provides an adequate anti-body response rate among HCWs. Vaccine hesitancy against COVID-19 can be a barrier to ending the pandemic in communities. HCWs work also advocates for patients and the public. It is essential to make the HCWs competent with in-service training on vaccines, vaccination, and against vaccine hesitancy.

**Keywords:** CoronaVac®, COVID-19, healthcare workers, vaccine

### ÖZ

**Amaç:** Sağlık çalışanlarının (SÇ) koronavirüs hastalığı-2019 (COVID-19) pandemisi sırasında yüksek bulaşma riski altında oldukları bilinmektedir. Bu çalışmanın amacı, SÇ'nin COVID-19 aşılama yöntemlerine yönelik tutumlarını, aşılama öncesi ve sonrasında COVID-19 serolojik durumlarını değerlendirmektir.

**Gereç ve Yöntem:** Bu çalışma prospektif gözlemsel bir çalışmadır. Tüm katılımcılar gerekli anketi doldurdu, CoronaVac® alma konusundaki niyetleri ve tereddütleri hakkında sorgulandı. CoronaVac® aşısından önce tüm katılımcıların antikor seviyeleri kontrol edildi. Aşı olmayı kabul edenler, çalışmanın ikinci aşamasında, birinci ve ikinci doz aşısından 1 ay sonra olmak üzere iki kez antikor titreleri kontrol edildi. Çalışmanın son aşamasında tüm katılımcılara 6 ay boyunca COVID-19 sürveyansı yapıldı.

**Bulgular:** Çalışmaya 104'ü kadın ve 23'ü erkek olmak üzere, ortalama yaşı 29 olan toplam 127 katılımcı dahil edildi. Toplam 43 sağlık çalışanında pozitif şiddetli akut solunum sendromu koronavirüs-2 (SARS-CoV-2) enfeksiyonu öyküsü vardı; çok etkilenen grup doktorlar (%41,8) ve sonrasında hemşireler (%27). COVID-19 öyküsü pozitif olan 43 katılımcıdan 31'inin antikor testi pozitif, 12'si negatif çıktı. COVID-19 geçirme öyküsü

**Address for Correspondence:** Nihal Akçay, University of Health Sciences Turkey, Bakırköy Dr. Sadi Konuk Training and Research Hospital, Clinic of Pediatric Intensive Care Unit, İstanbul, Turkey  
Phone: +90 212 414 73 29 E-mail: drnihalakcay@gmail.com ORCID ID: orcid.org/0000-0002-8273-2226

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olmayan 84 katılımcıdan 4'ünün antikor pozitif bulundu. Tüm katılımcıların 76'sı (%59,8) aşılanmıştır. Aşı tereddüt nedenleri; geçirilmiş SARS-CoV-2 enfeksiyonu (n=15, %29,4) ve aşının etkisiz olduğunun düşünülmesi (n=22, %43,1) olarak bildirilmiştir. Antikor yanıt oranları, 1. doz aşından sonra %80,2 ve 2. doz aşından sonra %100 saptandı. Altı aylık takip döneminde, aşılanmamış 7 (%13,7) ve aşılı 1 (%1,3) sağlık çalışanı COVID-19 enfeksiyonu geçirdi.

**Sonuç:** COVID-19'dan korunmak için aşılama esastır. CoronaVac®, sağlık çalışanlarında yeterli antikor yanıtı sağlamaktadır. COVID-19'a karşı aşı tereddütü, toplumların pandemiyi sonlandırmasında bir engel olabilir. Sağlık çalışanları, hastalar ve halk için örnek teşkil etmektedirler. Sağlık çalışanlarının aşı, aşılanma ve aşı tereddütüne karşı hizmet içi eğitimlerle yetkin hale getirilmesi önemlidir.

**Anahtar Kelimeler:** CoronaVac®, COVID-19, sağlık çalışanları, aşı

## INTRODUCTION

Healthcare workers (HCWs) take an active role in the diagnosis, treatment, and monitoring stages of coronavirus disease-2019 (COVID-19). During the pandemic process, HCWs need extra care in vaccination from other occupational groups because they carry the risk of being infected, getting the disease, transmission, and even dying. The number of HCWs who have been diagnosed with this disease and lost their lives due to COVID-19 is increasing day by day worldwide (1). Rapid and safe protection of HCWs with vaccination is one of the most important elements in the control of an epidemic (2). Vaccination against the severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) in Turkey started for HCWs as a prioritized group, on January 14, 2021. Afterward, the risk groups were expanded and community vaccination was initiated (3). SARS-CoV-2 vaccines (COVID-19 vaccines) are considered the most promising approach to ending the pandemic. CoronaVac® (Sinovac, China), inactivated SARS-CoV-2 vaccine, in which the vast majority of HCWs are vaccinated in our country, is well-tolerated and induced an anti-body response in phase 1 and 2 studies (4).

We determined COVID-19 immunity among HCWs and their opinions on COVID-19 vaccines. We also assessed the seropositivity rates after CoronaVac® vaccination in the study group and the surveillance of the COVID-19 was performed among those for 6 months.

## METHODS

### Design and Setting

The study was approved by the University of Health Sciences Turkey, Bakırköy Dr. Sadi Konuk Training and Research Hospital Clinical Research Ethics Committee (decision no: 2021-03-14, date: 01.02.2021). This study is a prospective observational study, conducted to obtain the anti-body levels for SARS-CoV-2 before the CoronaVac® (Sinovac, China) vaccination of the people who are working as HCWs in the pediatric emergency room (PER) and pediatric intensive care unit (PICU) in Bakırköy Dr. Sadi Konuk Training and Research Hospital, İstanbul, Turkey. The

participants, including physicians, nurses, and other medical staff, were enrolled in the study between 1 and 14 January 2021. Participants were informed about all the steps of the study. Being a worker in the PER, PICU, and being 18 years and older were inclusion criteria. HCWs who had consent and were eligible for the study were included in the study. HCWs who had not worked in PICU and PER, or who did not give a written informed consent form were excluded. One hundred and sixty-eight HCWs were working in these departments and 127 HCWs were eligible to join the study (Figure 1).

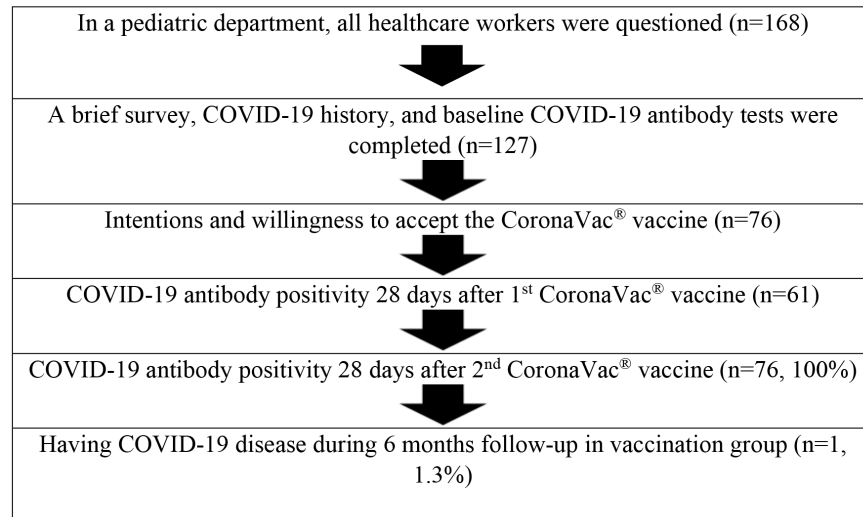
In the first step, all participants completed a brief survey, and a blood sample was obtained to detect the antibody levels against SARS-CoV-2. Survey data; included demographics, medical history, profession, experience in the profession, COVID-19 history, dates, and results of COVID-19 Polymerase Chain Reaction tests, and family diagnosis of COVID-19. Additionally, all participants were questioned about their intentions regarding COVID-19 vaccinations. HCWs who volunteered to be vaccinated were vaccinated with CoronaVac® (Sinovac, China) vaccine.

In the second step of the study, those who had CoronaVac®, anti-body titers were checked two more times: 1 month after 1<sup>st</sup> and the 2<sup>nd</sup> doses of vaccination. After all, vaccinations, the information about possible side effects was given and one week after each vaccination, appointments (by phone or face-to-face interview) were planned.

As strict infection control measures, HCWs were monitored for COVID-19 in pediatric department. In the last step of the study, COVID-19 surveillance was performed on all participants for 6 months (Figure 1).

### Serum Samples

Approximately 10 mL of venous blood was collected from the subjects included in the study. Serum was separated by centrifugation at 5,000 rpm for five minutes within two hours after blood collection. The serum samples were tested for anti-SARS-CoV-2 anti-bodies on the same day. Increased serum samples were stored in Eppendorf tubes at -20 °C as 1.5 mL aliquots. The same procedure was repeated 28 days after the 1<sup>st</sup> vaccine and 28 days after the 2<sup>nd</sup> vaccine in the vaccinated participants. The study flowchart is given in Figure 1.



**Figure 1.** Flowchart of the study  
COVID-19: Coronavirus disease-2019

### Serological Tests

All tests were performed at the Department of Laboratory Medicine, Bakırköy Dr. Sadi Konuk Training and Research Hospital, İstanbul, Turkey. Blood samples were processed and stored, as noted previously. Total anti-bodies against SARS-CoV-2 were detected using the Elecsys® anti-SARS-CoV-2 immunoassay (Roche Diagnostics International Ltd, Rotkreuz, Switzerland) on a Cobas e801 analyzer. A cut-off index >1 is positive.

In the case of positivity, a second test with Elecsys® anti-SARS-CoV-2 S immunoassay (Roche Diagnostics International Ltd, Rotkreuz, Switzerland) on a Cobas e801 analyzer for anti-bodies was performed to confirm the results. A cut-off index >0.8 is positive. Anti-body levels were performed using the Elecsys® anti-SARS-CoV-2 S immunoassay (Roche Diagnostics International Ltd, Rotkreuz, Switzerland) after the 1<sup>st</sup> and 2<sup>nd</sup> vaccinations of the vaccinated participants.

### Statistical Analysis

All statistical analyses were performed using IBM SPSS for Windows version 20.0 (IBM Corp., Armonk, NY, USA). Kolmogorov-Smirnov tests were used to test the normality of data distribution. Continuous variables were expressed as mean ± standard deviation, median (25<sup>th</sup>-75<sup>th</sup> percentiles), and categorical variables were expressed as counts (percentages). Differences between groups were tested with the Mann-Whitney U test for numerical variables that did not have a normal distribution also Pearson's, Yates chi-square Fisher Exact and Monte Carlo chi-square analyses were used for categorical variables. P<0.05 was considered statistically significant for significance.

## RESULTS

A total of 127 HCWs were enrolled in the study (Figure 1). In all, 104 (81.9%) of these responders were women, and 23 (18.1%) were men. The median age of HCWs was 29 years [Interquartile range (IQR): 27-34 years] and the median professional experience was 4 years (IQR: 3-7 years). Participants included 61 (48%) physicians, 49 (38.6%) nurses, 12 (9.4%) cleaning staff, and 5 (3.9%) secretaries. For health status, 26 (20.5%) of them reported having comorbidities, 22 (17.3) continually used medications and 36 (28.3%) of them reported tobacco usage. The median body mass index of HCWs was 23 kg/m<sup>2</sup> (IQR: 20.8-25.3 23 kg/m<sup>2</sup>). In all, 8 (6.2%) of them had obesity, 3 (2.3%) of them had morbid obesity, and 28 (22%) of them were overweight (Table 1). In terms of transportation, 59 (46.5%) HCWs used public transportation whereas 51 (40.2%) used private cars, and 17 (13.4%) came to the hospital by walking. Only 3 (2.4%) participants had a history of traveling to abroad. The median number of people living in the same house with HCWs was 2 (IQR: 2-4) (Table 1).

Previous COVID-19 history was detected among 43 (33.8%) participants. The history and seropositivity rates are given in Table 2. Among healthcare workers, physicians were the most affected group (n=18, 41.8%), followed by nurses (n=13, 27.6%). Of those who had COVID-19 history, 33 (76.7%) HCWs were the index cases in their houses. Anti-body levels were tested as positive in 4 (4.8%) of 84 participants who had no positive history of COVID-19. In all study groups, the CoronaVac® acceptance rate was 59.8%. The distribution of vaccination rates among different serological groups is given in Table 2.

**Table 1. Demographic characteristics of the participants**

	All participants (127)	COVID-19 history + participant (43)	COVID-19 history -participant (84)	p-value
Age, median years (IQR)	29 (27-34)	29 (27-36)	28.5 (27-33)	0.480
Gender, female, n (%)	104 (81.9)	39 (90.7)	65 (77.4)	0.109
<b>Specialty</b>				
Physician, n (%)	61 (48)	18 (41.8)	43 (51.2)	0.006
Nurse, n (%)	49 (38.6)	13 (27.6)	36 (42.8)	
Cleaning staff, n (%)	12 (9.4)	8 (18.6)	4 (4.8)	
Secretary, n (%)	5 (3.9)	4 (9.3)	1 (1.2)	
Professional experience median years (IQR)	4 (3-7)	5.5 (3-7)	4 (2-7.75)	0.167
Comorbidity, n (%)	26 (20.5)	11 (25.6)	15 (17.9)	0.430
Chronic medications, n (%)	22 (17.3)	8 (18.6)	14 (16.7)	0.980
BMI median (IQR)	23 (20.8-25.3)	23 (20.9-27)	22.7 (20.4-25)	0.434
BMI <18	5 (3.9)	2 (4.7)	3 (3.6)	0.664
18-24.99	84 (66.1)	26 (60.5)	58 (69)	
25-29.99	27 (21.3)	11 (25.6)	16 (19)	
30-39.99	8 (6.3)	2 (4.7)	6 (7.1)	
>40	3 (2.4)	2 (4.7)	1 (1.2)	
History of traveling abroad, n (%)	3 (2.4)	-	3 (3.6)	0.550
<b>How to reach the hospital?</b>				
Public transport, n (%)	59 (46.5)	20 (46.5)	39 (46.4)	0.778
Own car, n (%)	51 (40.2)	16 (37.2)	35 (41.7)	
Walking, n (%)	17 (13.4)	7 (16.3)	10 (11.9)	
Number of the people at the same home, median (IQR)	2 (2-4)	3 (2-4)	2 (2-3)	0.003
Number of the COVID-19 test (PCR), median (IQR)	5 (3-8)	6 (4-9)	5 (3-8)	0.032
<b>Will you get the COVID-19 vaccine?</b>				
Yes, n (%)	76 (59.8)	22 (51.2)	54 (64.3)	0.216
No, n (%)	51 (40.2)	21 (48.8)	30 (35.7)	
<b>Why don't you get the COVID-19 vaccine?</b>				
Have had a COVID-19 infection, n (%)	15 (11.7)	14 (32.5)	1 (1.1)	<0.001
Thinks the vaccine will be ineffective, n (%)	22 (17.3)	5 (11.6)	17 (20.2)	
Fear of side effects, n (%)	5 (3.9)	0 (0.0)	5 (5.9)	
Pregnancy or breastfeeding, n (%)	6 (4.6)	2 (4.6)	4 (4.7)	
Fear of allergies, n (%)	3 (2.3)	0 (0.0)	3 (3.5)	

BMI: Body mass index, COVID-19: Coronavirus disease-2019, IQR: Interquartile range, PCR: Polymerase chain reaction

The participants who refused vaccinations were questioned. The distribution of their reasons is given in Table 1. Fifteen (29.4%) HCWs expressed they already had the disease, 22 (43.1%) thought the vaccine was ineffective, and 5 (9.8%) of them expressed that they had concerns about its side

effects. Three (5.8%) HCWs had doubts about allergic reactions, and 6 (11.8%) women refused to get the vaccine because they were pregnant or breastfeeding.

The side effects seen in individuals who were vaccinated were as follows: pain at the injection site (n=21, 27.6%),

**Table 2. Summary of findings in the study**

Previous history of COVID-19 disease with PCR positivity	Yes (n=43)				No (n=84)			
	SARS-CoV-2 antibody (ab) results		SARS-CoV-2 antibody (ab) results		SARS-CoV-2 antibody (ab) results		SARS-CoV-2 antibody (ab) results	
CoronaVac® vaccine acceptance (1 <sup>st</sup> dose)	Yes (n=15)	No (n=16)	Yes (n=7)	No (n=5)	Yes (n=2)	No (n=2)	Yes (n=52)	No (n=28)
SARS-CoV-2 ab positivity 28 days after 1 <sup>st</sup> CoronaVac® vaccine, n (%)	15 (100%)	NA	6 (85.7%)	NA	2 (100%)	NA	38 (73%)	NA
SARS-CoV-2 ab positivity 28 days after 2 <sup>nd</sup> CoronaVac® vaccine, n (%)	15 (100%)	NA	7 (100%)	NA	2 (100%)	NA	52 (100%)	NA
Having COVID-19 disease during 6 months follow-up, n (%)	None	None	None	1 (20%)	1 (50%)	None	None	6 (21%)

COVID-19: Coronavirus disease-2019, PCR: Polymerase chain reaction, SARS-CoV-2: Severe acute respiratory syndrome coronavirus-2, NA: Not applicable

myalgia (n=12, 15.7%), fatigue (n=12, 15.7%), headache (n=4, 5.2%) and fever (n=3, 3.9%). No life-threatening side effects or allergic reactions were observed. COVID-19 antibody positivity rate was 80.2% among all participants 28 days later than the administration of the first vaccine. This rate exceeded 100% after the administration of the second CoronaVac® vaccine. The distribution of seropositivity rates is given in Table 2. During the 6-month follow-up period, 7 (13.7%) unvaccinated HCWs had COVID-19 infections. One of them had a history of previous COVID-19 infection. Only 1 (1.3%) HCW had COVID-19 after 2 doses of CoronaVac® when we investigated that case, she was working as a chief physician in PICU for longer hours than usual due to overload.

## DISCUSSION

In this study, we report the incidence of contracting COVID-19 infection, the attitudes, and seropositivity rates of HCWs for CoronaVac® in a pediatric department.

The rate of COVID-19 infections in HCWs is higher than that results in the general population (5,6). During the first 10 months of the pandemic, more than 30% of the HCWs who participated in our study had COVID-19 infection. In our study, among 127 participants, 43 (33.8%) of them had a positive history of SARS-CoV-2, and 4 (3.1%) of them had anti-body-positivity had a negative history of SARS-CoV-2 to the disease, some people can have the infection without any symptoms, but still they might spread it (7). Thus, the vaccination of HCW is essential in the control of the infection measures through the population (2).

When a new vaccine is introduced, vaccine hesitancy may raise (8). Indeed, the World Health Organization has considered the concept of vaccine hesitancy as one of the top ten threats to global health (9). In this study, it was observed that nearly 40% HCWs were vaccine-hesitant. A review examined the HCWs' vaccine perceptions, knowledge and vaccination practices in 34 countries. It was stated that HCW are vital advocates for patients and the public, but studies indicated a prevalence of provider hesitancy about inadequate knowledge, low vaccine confidence, and suboptimal uptake themselves (10). There are many studies that have compared vaccine acceptance in different populations. Vaccine acceptance rates differ between occupational groups. Physicians are the occupational group most likely to accept vaccination also nurses are less often vaccine acceptors than physicians (11,12). In a study, which was held online in France in February 2021, the acceptance of the COVID-19 vaccine was examined among HCWs. In the 1965 HCWs, 1436 (73.1%) declared vaccine acceptance, 453 (23.1%) had vaccine hesitations and 76 (3.9%) of them stated that they were against vaccination (13). In another study conducted in France, among 2,057 healthcare professionals (21% physicians, 24% pharmacists, 18% nurses, 10% assistant nurses, 27% other); 1,554 (76.9%) declared that they would have the COVID-19 vaccine. Nurses and assistant nurses were found to be less willing than doctors to accept the vaccine against COVID-19 (14). In Israel, 1,941 people participated in an online study to compare the attitudes between the general population and health workers against COVID-19 vaccines. It has been observed

that healthcare personnel caring for COVID-19-positive patients and individuals who consider themselves at risk of illness are willing to vaccinate with COVID-19 whenever possible. In contrast, parents, nurses, and HCWs who did not encounter SARS-CoV-2 positive patients expressed higher levels of vaccine hesitancy (11). In our study, the incidence of COVID infection among physicians was 29.5%, while it was 37.9% among non-physician HCWs. Although all participants were involved in the care of SARS-CoV-2-positive children, the vaccination rate was 72.1% among doctors, and 48.5% among non-physician HCWs. Efforts are recommended to inform healthcare professionals about the benefits of COVID-19 vaccines to maintain high vaccination rates. It is essential to make HCW competent with in-service training on vaccine education and their own vaccine acceptance (10).

According to the phase 3 results of CoronaVac® performed in Brazil, Chile, and Turkey, while no serious side effects were observed after vaccination, the most common side effects are fatigue, headache, myalgia, fever, chills, and pain at the injection site. It was reported that no life-threatening side effects were observed in the phase 2 data, all side effects were seen between 25 and 35% of the subjects in the groups, and the most common side effect was pain at the injection site (15-17). In our study, the most common side effect was pain at the injection site and no life-threatening side effects were observed. Since the protection of vaccines is due to the complex interaction of the innate humoral and cellular immune response, the anti-body response is considered an important indicator of the immune response, although it does not fully demonstrate the protection of the vaccine (18). In our study, the ability of CoronaVac® to produce anti-bodies was found to be 100% at least 28 days after the second vaccine.

There are some limitations to our study. Though the study was conducted in a certain occupational group, the results cannot be generalized to the population and all socioeconomic strata of society. The side effects were based on the reports of individuals. The humoral (neutralizing antibody) response of the vaccine was revealed with anti-body measurements; no information on cellular immunity was presented. Therefore, this study cannot provide sufficient evidence on the protection of individuals from COVID-19.

## CONCLUSION

In conclusion, vaccination of HCWs who are dealing with COVID-19 patients is essential to protect themselves and the population around them. Vaccine hesitancy against COVID-19 is a barrier to ending the pandemic in

communities. It is recommended to identify the groups where vaccine acceptance is low or hesitant and to take additional precautions for these groups.

## ETHICS

**Ethics Committee Approval:** The study was approved by the University of Health Sciences Turkey, Bakırköy Dr. Sadi Konuk Training and Research Hospital Clinical Research Ethics Committee (decision no: 2021-03-14, date: 01.02.2021).

**Informed Consent:** Written informed consent to publication has been obtained from all participants.

## Authorship Contributions

Surgical and Medical Practices: N.A., Concept: N.A., E.Ş., Design: N.A., E.Ş., Data Collection or Processing: N.A., M.E.M., Analysis or Interpretation: N.A., M.E.M., C.B., Literature Search: N.A., E.Ş., Writing: N.A., E.Ş.

**Conflicts of Interest:** The authors declared that they have no conflicts of interest.

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