



Evaluation of COVID-19 Vaccination In Healthcare Professionals

Sağlık Çalışanlarında COVID-19 Aşılmasının Değerlendirilmesi

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ABSTRACT

Aim: Vaccination is one of the most successful and cost-effective healthcare initiatives for preventing infectious diseases, and vaccines are of exceptional importance to control and prevent COVID-19.

Material and Method: In our study, the results of the COVID-19 vaccine applications, which started in healthcare workers after determining the priority groups, were evaluated. The study population, which was planned as a retrospective cohort study, consists of healthcare professionals working in Kayseri city center. 24.421 healthcare workers from file records were included in this study. This study consists of two independent phases. Only the retrospective registry was not scanned, and the demographic information, vaccination status, and source case information of the healthcare workers who were found positive were questioned by phone.

Results: The rates of PCR (+) healthcare workers in the pre-vaccination period were 5.96% and 2.53% in the post-vaccination period. Considering the vaccination status of all healthcare workers, 5.14% of the unvaccinated ones were found to be PCR (+), while 2.04% of those vaccinated were PCR (+) ($p < 0.001$).

Conclusion: The rate of protection against infection in the field of the inactivated vaccine administered to healthcare workers was found to be 52.86%. In our study, in which we evaluated the inactivated CoronaVac vaccine, it seems that the vaccine contributes to the service providers and the society in the fight against the epidemic, and it seems appropriate to be among the available vaccine options in line with the data obtained.

Keywords: COVID-19, inactive vaccine, healthcare workers

ÖZ

Amaç: Aşı uygulaması, bulaşıcı hastalıkları önlemek için en başarılı ve maliyet-etkin sağlık hizmeti girişimlerinden biridir ve COVID-19'u kontrol etmek ve önlemek için olağanüstü bir öneme sahiptir.

Gereç ve Yöntem: Çalışmamızda öncelik grupları belirlemek için sağlık çalışanlarında başlanan COVID-19 aşısı uygulamalarının sonuçları değerlendirilmiştir. Retrospektif kohort çalışması olarak planlanan çalışmanın evrenini Kayseri il merkezinde görev yapan sağlık çalışanları oluşturmaktadır. Dosya kayıtlarından 24.421 sağlık çalışanı bu çalışmaya dâhil edilmiştir. Bu çalışma iki bağımsız aşamadan oluşmaktadır. Sadece geriye dönük kayıt taranmamış, pozitif bulunan sağlık çalışanlarının demografik bilgileri, aşılanma durumları ve kaynak vaka bilgileri telefonla sorgulanmıştır.

Bulgular: Aşılanma öncesi dönemde PCR (+) sağlık çalışanı oranı %5,96 ve aşılanma sonrası dönemde %2,53 olarak gerçekleşti. Tüm sağlık çalışanlarının aşılanma durumuna bakıldığında aşı olmayanların %5,14'ünün PCR (+), aşı olanların ise %2,04'ünün PCR (+) olduğu saptandı ($p < 0,001$).

Sonuç: Sağlık çalışanlarına uygulanan inaktif aşının sahada enfeksiyondan koruma oranı %52,86 olarak bulundu. İnaktif CoronaVac aşısını değerlendirdiğimiz çalışmamızda aşının salgınla mücadelede hizmet sunucuları ve topluma katkı sağladığı, elde edilen veriler doğrultusunda mevcut aşı seçenekleri arasından yer almasının uygun olduğu görülmektedir.

Anahtar Kelimeler: COVID-19, inaktif aşı, sağlık çalışanları

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INTRODUCTION

The COVID-19 pandemic caused by SARS-CoV2 is the most important health problem of our century. The high contagiousness of the virus, its negative effects on countries' economies and health systems, and the lack of adequate treatments that affect the prognosis since the beginning of the epidemic have made it very important to develop an effective and safe vaccine against this disease. Vaccination is one of the most successful and cost-effective healthcare initiatives for preventing infectious diseases, and vaccines are of exceptional importance to control and prevent COVID-19 (1,2). Considering that the basic reproduction number for SARS-CoV-2 is 2.5-3.5 (R_0), it has been stated that 60-72% ($1 - 1 / R_0$) of the population should be vaccinated to prevent the spread of the virus and end the epidemic through community immunity (3).

The safety, tolerance, dosage, and vaccination scheme of the inactivated COVID-19 vaccine presented as a vaccine candidate by a company of Chinese origin were determined by the Phase 1/2 studies conducted in China with the approval of the Chinese National Medical Products Administration (NMPA) on 13.04.2020 and the information obtained has been published in a highly prestigious peer-reviewed journal (4-6). After the high seroconversion values were obtained, four independent Phase 3 studies were initiated in China, Turkey, Brazil, and Indonesia. As a result, authorities in Brazil declared that the safest vaccine among the five vaccines tested in Phase 3 studies is the inactivated vaccine of Chinese origin (CoronaVac) (4).

Although vaccine development studies continue, there are 13 vaccines in Phase 3, and according to the World Health Organization, there are 12 vaccines under development in Turkey (7). The COVID-19 vaccine, which was approved for emergency use by China in July 2020 and is in Phase 3 in our country, was started to be applied after obtaining emergency use approval following the agreement of the Ministry of Health for 50 million doses (4).

Four separate Phase 3 studies were carried out with 13,060 volunteers over the age of 18 in Brazil in July 2020, 1,620 volunteers aged 18-59 in Indonesia in August 2020, 13,000 volunteers aged 18-59 in Turkey in September 2020, and 1,040 volunteers over the age of 18 on 31 October in China (7). In studies on the efficacy of inactivated COVID-19 vaccine, it was determined that the vaccine reached sufficient antibody titers for immunization 14 days after the second dose. Furthermore, it has been reported that the vaccine provides 83.70% protection from medical intervention, the rate of preventing hospitalization is

85%-100%, and the rate of preventing deaths is 80% (8-11).

Phase 4 studies of vaccines administered will provide us soon with very important real data on the efficacy and safety of these vaccines. In this context, in our study, the results of the COVID-19 vaccine applications, which started in healthcare workers after determining the priority groups, were evaluated. In our study, the healthcare workers in Kayseri province, the vaccination rates of the workers in the process before the start of vaccination and after the application of the first-second doses of the vaccination, when they were vaccinated, the status and frequency of being infected with COVID-19 before and after vaccination were examined to evaluate the COVID-19 vaccination and its effects in healthcare workers.

MATERIAL AND METHOD

Study Design and Setting

The study population, which was planned as a retrospective cohort study, consists of healthcare professionals working in Kayseri city center.

24,421 healthcare workers are working in the province, and since all of them were planned to be included in the study, no sampling was made. In line with the instructions of the Ministry of Health of the Turkey, information such as the number of people vaccinated daily and weekly, the number of positive cases, the occupation of those who have been vaccinated are monitored and recorded in the electronic environment by the Provincial Health Directorate. Coronavirus vaccination in the province started on 14.01.2021 with healthcare workers.

Study Participants - Data Screening Process

This study consists of two independent phases:

The 1st phase covers the dates between 14.12.2020 and 15.04.2021. Information was scanned and evaluated retrospectively in the electronic environment. Also, healthcare workers who had or did not have the COVID-19 vaccine and those found to have PCR positivity before and after vaccination were examined with the data of the general provincial population.

In the second phase, information in the Public Health Management System (HSYS) of 1334 healthcare workers found positive as of 14.01.2021, the beginning of the vaccination calendar, was obtained by scanning daily records. Also, a phone call was made between 14.01.2021 and 22.02.2021. In this date range, 493 people found positive but whose vaccination status was unknown, who could be

reached, and whose verbal consents were obtained were included in the study. Also, age, gender, source case information, and vaccination status of positive healthcare workers were questioned.

Our study consisted of two independent phases because not all healthcare workers are vaccinated with the start of the vaccination calendar. Another reason is the continuation of the vaccination process. Therefore, only the retrospective registry was not scanned, and the demographic information, vaccination status, and source case information of the healthcare workers who were found positive were questioned by phone.

Statistical Analysis

The data obtained were analyzed in the computer by evaluating the sociodemographic characteristics of the participants, their vaccination status and their COVID-19 stories together. Numbers and percentages were used to represent frequency tables and graphs. Chi-square tests were used in the comparative analysis of categorical data, and relative risk calculation was used to compare the risk status for COVID-19 in vaccinated and unvaccinated individuals. To evaluate the vaccine's effectiveness while calculating the relative risk, the data after the second dose of vaccination 14 days and later were analyzed. A p-value<0.05 was considered statistically significant.

RESULTS

24,421 healthcare workers from file records were included in this study. Before vaccination, in the period 14.12.2020-13.01.2021, 8641 (21.68%) PCR (+) in the general population, 3028 (7.59%) PCR (+) in the period of the 1st dose of vaccine, 6057 (15.19%) PCR (+) in the period of the 2nd dose of vaccine, and after two doses of vaccination (14.03.2021-15.04.2021 period) 22318 (55.54%) PCR (+) cases were detected. While there were 515 (38.60%) PCR (+) cases in the pre-vaccination period in healthcare workers, 101 (7.57%) PCR (+) cases were detected during the first dose vaccination period, 132 (9.90%) PCR (+) cases during the second dose vaccination period, and 586 (43.93%) PCR (+) cases after two doses of vaccination. The rates of PCR (+) healthcare workers in the pre-vaccination period were 5.96% and 2.53% in the post-vaccination period. The ratio of vaccinated PCR (+) healthcare workers/vaccinated healthcare workers was 1.02%. Unvaccinated PCR (+) healthcare worker/Unvaccinated healthcare worker was 2.13% (Table 1) (Figure 1) (Figure 2). The first date of the second dose of vaccination is 11.02.2021. Fourteen days after this date, PCR results were evaluated based on the vaccination status between 25.2.2021-15.4.2021. Considering the vaccination status of all healthcare workers, 5.14% of the unvaccinated ones were found to be PCR (+), while 2.04% of those vaccinated were PCR (+) (p<0.001) (Table 2).

Table 1: Distribution of healthcare workers according to their vaccination status and COVID-19 PCR (+) status before and after vaccination

Parameter	Pre-Vaccination Period (14.12.2020-13.1.2021)	The period in which the 1st dose of vaccine was administered (14.1.2021-10.2.2021)	The period in which the 2nd dose of vaccine was administered (11.2.2021-13.3.2021)	Period After two doses of Vaccination (14.3.2021-15.4.2021)
Total PCR (+) Cases*	8641 (21,68%)	3028 (7,59%)	6057 (15,19%)	22138 (55,54%)
Total PCR (+) Healthcare Worker*	515 (38,60%)	101 (7,57%)	132 (9,90%)	586 (43,93%)
Total PCR (+) Healthcare Professional/ Total PCR (+) Case (%)	5,96	3,34	2,18	2,53
Number of Healthcare Workers Vaccinated**	0	17253 (70,65%)	16588 (67,93%)	17531 (71,79%)
Number of Non-vaccinated Healthcare Workers**	0	7168 (29,35%)	7833 (32,07%)	6890 (28,21%)
PCR (+) Healthcare Workers/Total Healthcare Workers (%)	2,11	0,41	0,54	1,33
Vaccinated Healthcare Workers/ Total Healthcare Workers (%)	0	70,65	67,93	71,79
Vaccinated PCR (+) Healthcare Workers/Vaccinated Healthcare Workers (%)	0	0,32	0,43	1,02
Non-Vaccinated PCR (+) Healthcare Workers/Non-Vaccinated Healthcare Workers (%)	0	0,64	0,70	2,13

PCR: Polymerase Chain Reaction
* : Row percentages are given
** : Their percentages in total healthcare workers (n=24,421) are given.

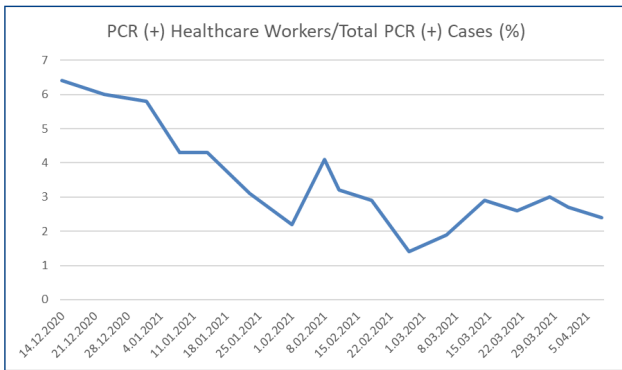


Figure 1: The rate of the change of PCR (+) healthcare workers to total PCR (+) cases (%) according to time

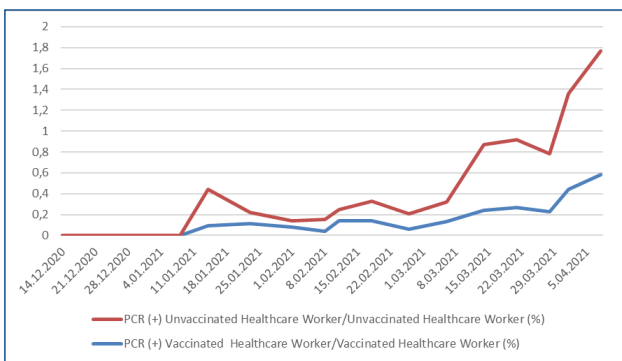


Figure 2: The ratio of vaccinated PCR (+) healthcare workers to vaccinated healthcare workers (%) and the ratio of unvaccinated PCR (+) healthcare workers to unvaccinated healthcare workers (%) according to time

	COVID RT-PCR*			RR (%95 GA)	p value
	Positive	Negative	Total		
Unvaccinated	326 (5,14%)	6011 (94,86%)	6337 (100,00%)	2,52 (2,18-2,92)	<0,0001
Vaccinated	356 (2,04%)	17180 (97,96%)	17457 (100,00%)		
Total	682 (2,87%)	23112 (97,13%)	23794 (100,00%)		

*: The data are according to the records between 25.2.2021-15.4.2021.
PCR: Polymerase Chain Reaction

In the second phase of the study, 493 PCR (+) healthcare workers were reached by phone. 309 (62.7%) of the participants were female, and 184 (37.3%) were male. The mean age was 34.88±9.3 years. The number of vaccinated healthcare workers is 247 (50.1%), while 246 (49.9%) healthcare workers are not vaccinated. When the source case is questioned, the source case of 397 (80.5) people is uncertain, and the source case of 98 (19.4) people is the home or workplace environment. Also, PCR (+) status after two vaccination doses was similar in gender (p:0.156). In addition, PCR (+) status was similar to groups younger than 40 and older (p:0.654).

Table 3: Comparison of the PCR (+) status of the healthcare professionals called after two doses of vaccination, according to age and gender characteristics

Characteristics	Rate of PCR (+) After 2 Doses of Vaccination *		Total	X2	P value
	Yes	No			
Under 40 years	121 (35,3%)	222 (64,7%)	343 (100%)	2,016	0,156
40 years and older	63 (42,0%)	87 (58,0%)	150 (100%)		
Total	184 (37,3%)	309 (62,7%)	493 (100%)		
	Yes	No	Total	X2	P value
Female	113 (36,6%)	196 (63,4%)	309 (100%)	0,201	0,654
Male	71 (38,6%)	113 (61,4%)	184 (100%)		
Total	184 (37,3%)	309 (62,7%)	493 (100%)		

*: Row percentages are given. PCR: Polymerase Chain Reaction

DISCUSSION

In our study, while the ratio of total PCR (+) healthcare workers to total PCR (+) cases was 5.96% before vaccination, this rate decreased to 2.81% after the second dose of vaccination. Therefore, the infection protection rate of the inactivated vaccine administered to healthcare workers was found to be 52.86% in the field.

COVID-19 vaccine studies continue in many centers at preclinical and clinical stages. The results of the studies conducted in different centers for the inactivated COVID -19 vaccine (CoronaVac) vary, and the results are as follows: In the Phase 3 results of the inactivated COVID-19 vaccine, it has been reported that the vaccine protects 50.65% from infection, 83.70% from medical intervention, and 100% from death and severe illness (8). In Phase 3 studies by Hacettepe University, the vaccine's effectiveness was determined as 83.5% and the rate of preventing hospitalization as 100% (9). A study conducted in Brazil showed that the effectiveness in preventing infection was 50.70% in Phase 3 studies (10).

In field studies conducted in Chile, it is known that the rate of protection against infection is 67%, and the rate of preventing hospitalization is 85% (11). In our study, when the rate of PCR (+) health care workers to total PCR (+) case numbers (%) changes according to time, the decrease in the number of cases in vaccinated healthcare workers suggests that the vaccine's protection is effective and overlaps with the literature.

In the Phase 3 studies of the inactivated COVID-19 vaccine, 25,000 participants in Brazil (8) and 10,216 participants in Turkey took part (9). Twelve thousand four hundred healthcare workers participated in the Phase

3 studies conducted by the Butantan Institute in Brazil (10). Furthermore, in studies conducted on 10.5 million people in the field in Chile, the vaccine's effectiveness was measured by comparing those who were vaccinated and those who did not (11). Our study determined that 17,253 of 24,421 healthcare workers serving in our province were administered inactive COVID-19 vaccine, and the number of evaluated patients was similar to the studies conducted.

The effect of the number of doses and the duration of administration between doses of the inactivated COVID-19 vaccine on protection is unclear. In the study of Palacios et al., the vaccination of the inactivated COVID-19 vaccine was administered to the participants with an interval of 14 days in the phase 3 studies, with an interval of 1 month in the study of Akova et al.. In another study involving only healthcare professionals, the vaccine was administered to the participants in two doses with an interval of 21 days (8–10). Although a 14-day interval between two doses of vaccine has been adopted in clinical studies, it is known that a 1-month interval between two doses in field applications increases the protection (12). Some authors also reported that the interval between two doses of more than 21 days increased the vaccine's efficacy rate to 62.3% (10). In the study, which included the results of vaccination studies carried out on 10.5 million people in the field in Chile, it was stated that the risk of contracting the disease was much higher in those who received a single dose of vaccine than those who received two doses (11). In our study, vaccination, which was done in 2 doses with one-month intervals, was evaluated following the calendar established by the Ministry of Health. While the ratio of PCR (+) healthcare workers to PCR (+) cases in the community was 5.6% in the pre-vaccination period, this rate decreased to 2.53% in the post-vaccination period. It is 3.34% at the time of the first dose and 2.31% at the time of the second dose, and it is similar to the studies done. It is thought that the increase in the PCR (+) case rate in the period after the administration of two doses of vaccine, compared to the period in which the second dose was administered, is due to a new peak of the COVID-19 epidemic in Turkey. In the study conducted by Bueno et al., it was emphasized that the low level of protection compared to the vaccine's effectiveness against mortal cases in clinical trials might be related to the severe second wave of the epidemic (11).

In the vaccination program carried out by Palacios on 12,396 registered health workers, 253 (2%) PCR (+) cases were detected at the end of the observation period (8). In our study, 586 (2.3%) PCR (+) cases were found out of 24,421 registered health workers at the end of the observation period, which is similar to our study (8).

57.8% of the study participants in Hacettepe on a healthy population were male, 42.2% were female,

and the median age was 45 years (9). In the second independent phase of our study, 62.7% of the healthcare professionals who were contacted by phone and whose PCR (+) was detected after the vaccination process started were female and 37.3% male. Katılımcıların ortalama yaşı 34,88±9,3'tür. We obtained different data from the literature, and this may be the questioning of health workers, who are a special group and have PCR (+).

While evaluating the effectiveness of the vaccine in vaccinated and unvaccinated groups, the continuation of the current vaccination process and the periodical changes in the policies to combat the epidemic are the limitations of our study. However, although it is a limitation that the first phase of our study was scanned through the records, the inclusion of 24,421 health workers is one of its strengths. Another strength of our study is that our study consists of two phases and that the information in the 2nd phase is obtained directly from the individuals.

CONCLUSION

In the fight against the COVID-19 virus, which has been in our lives since December 2019, it is clear that vaccination has an indispensable importance in addition to basic measures such as hygiene and maintaining social distance. In this context, it is important to evaluate the vaccines that have passed the clinical stages and are still in use. Our study, in which we evaluated a Turkey experience with inactive CoronaVac vaccine; It is revealed that positive results occur in the period of inactive COVID-19 vaccine in healthcare workers and it reduces the spread of the disease.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Karabuk University Non-Interventional Clinical Trials Ethics Committee (Date: 02/06/2021, Decision No: 2021/584).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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