



# Investigate Complications of COVID-19 Vaccination Among Health Care Workers in Chaharmahal and Bakhtiari, Iran: A Cross-Sectional Study

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## Abstract

**Background:** The COVID-19 pandemic has posed significant challenges to health systems and the global economy. As a result, effective vaccines against Coronavirus disease 2019 (COVID-19) are necessary to reduce the enormous burden of SARS-CoV-2 deaths. However, vaccination may cause side effects (SE) that threaten individuals' lives.

**Objectives:** This study aimed to evaluate the vaccination status and factors associated with COVID-19 vaccine complications among healthcare workers (HCWs) in Chaharmahal and Bakhtiari province, Iran.

**Methods:** This cross-sectional study was conducted in 2022 on 739 HCWs in Chaharmahal and Bakhtiari province. Healthcare workers were selected by cluster sampling, and their information was collected using a demographic questionnaire and disease history. The data were analyzed using binary logistic regression analysis.

**Results:** Most HCWs (712, 96.3%) were vaccinated. About half of them reported complications after vaccination. More complications were reported in those vaccinated with the Oxford/AstraZeneca vaccine. Male gender, contact with suspected or confirmed COVID-19 patients, COVID-19 history, and type of vaccine were risk factors significantly associated with COVID-19 vaccine complications ( $P < 0.05$ ).

**Conclusions:** This study aimed to investigate vaccination status and factors associated with COVID-19 vaccine complications among HCWs. The Oxford/AstraZeneca vaccine had the most SE, while the BIVI-Cove-Iran vaccine had the fewest SE after the first dose. Additionally, men experienced fewer vaccine SE than women. Healthcare workers have a higher likelihood of facing complications from the COVID-19 vaccine if they have been exposed to infected individuals and have previously contracted the virus.

**Keywords:** COVID-19, Health Care Workers, Vaccination, Complications

## 1. Background

The respiratory disease caused by SARS-CoV-2 is called Coronavirus disease 2019 (COVID-19) (1). The symptoms associated with COVID-19 vary from asymptomatic cases to a wide spectrum of symptoms such as fever, cough, tiredness, loss of taste or smell, and even death (2, 3). Epidemiological evidence suggests that the infection can spread through an infected patient's respiratory secretions during speaking, coughing, or sneezing. Consequently, the World Health Organization (WHO) has recommended public use of masks, isolation, avoiding crowded spaces, social distancing, hand

hygiene, room ventilation, and vaccination as necessary measures to control COVID-19 (3, 4). Effective vaccines for COVID-19 are crucial to reducing the enormous burden of SARS-CoV-2-related deaths (5). Given the ineffective treatments against COVID-19, vaccination has become one of the most important approaches to limit the epidemic (6). Vaccination is essential to prevent the COVID-19 pandemic and mitigate its adverse effects on public health (7).

The elderly, individuals with underlying conditions like cancer, cardiovascular disease, diabetes, and chronic respiratory disease, healthcare workers (HCWs), children, and pregnant women are more vulnerable to

COVID-19 and are prioritized for receiving the vaccine. Among these groups, HCWs are particularly susceptible to the disease due to their high-risk exposure (3, 8-10). According to Chinese health centers, in 2020, 3,387 HCWs died of COVID-19 due to direct contact with infected patients in China and Wuhan (11). In this pandemic situation, access to personal protective equipment (PPE) for HCWs is crucial, but a shortage of PPE has disproportionately affected these groups (12). In Iran, HCWs, especially nurses, are the most exposed to coronavirus infection. Despite their higher knowledge, they have lower protection against the disease (13). For example, some did not use masks, gloves, or PPE, highlighting the necessity of improving protective measures for this susceptible group (14).

Globally, many types of vaccines have been produced, but evidence of their safety and potential side effects (SE) has not yet been fully confirmed (15). Therefore, it is critical to study vaccine complications during the general immunization stage. Additionally, because of the genetic diversity in different populations around the world, it is necessary to study the factors associated with COVID-19 vaccine complications in various populations. Certain signs and symptoms, such as injection site pain, headache, muscle pain, fatigue, fever, chills, and diarrhea, may occur after receiving the COVID-19 vaccination (16). Vaccine SE play a crucial role in the community's perception of the vaccination process.

Studies in Iran have shown that the most common SE were reported with the Sputnik, Oxford/AstraZeneca, and Covax vaccines. Muscle pain, fatigue, fever, and headache were the most common complaints among HCWs, and these SE were related to age and gender (5, 17, 18). The Sinopharm vaccine has relatively few adverse SE in Iran, while Sputnik's adverse effects, often after the second dose, included injection-site pain, hyperthermia, headache, asthenia, and joint pain (19). The SE of the AstraZeneca injection at the second dose were lower than those of the first dose, with the most prevalent complaints being headache, fever, muscle pain, fatigue, and joint pain (20). However, so far, few studies have been conducted on the factors associated with COVID-19 vaccine complications in Iran, making it necessary to conduct this study.

## 2. Objectives

This study aimed to evaluate the vaccination status and the associated factors in COVID-19 vaccine complications, including Sputnik V (Gamaleya Research Institute, Russia), Oxford/AstraZeneca vaccine (AstraZeneca, British-Swedish), Covaxin (Bharat Biotech,

India), Sinopharm (National Pharmaceutical Group, China), Cov Iran Barekat (Barkat Pharmaceutical Group, Iran), and SpikoGen (CinnaGen and Vaxine, Iran-Australia) among HCWs in Chaharmahal and Bakhtiari province, Iran.

## 3. Methods

### 3.1. Population and Sample

This cross-sectional study was conducted from January to February 2022 in Chaharmahal and Bakhtiari province. Using the cluster sampling method, five cities, including Kuhrang, Saman, Borujen, Ardal, and Lordegan, were randomly selected out of a total of 10. The sample size was estimated based on the formula with a prevalence of 0.93 for vaccine complications (21), a 95% confidence interval (CI), and a mean estimation error (d) of 0.064, resulting in the inclusion of 739 HCWs. Individuals who had at least one year of occupational experience in a health care center and were willing to participate were selected.

$$N = \frac{(Z_{1-\alpha/2} \times \delta)^2}{d^2}$$

### 3.2. Measuring Instruments

The information collected included age, sex, marital status, education and degree, work history, employment status, workplace status, underlying disease, history of coronavirus infection, history of hospitalization due to coronavirus, duration of hospitalization, availability of PPE, experience of COVID-19 infection, and history of vaccination against coronavirus and its complications. This data was gathered using a checklist.

### 3.3. Statistical Analyze

Continuous data are presented as mean  $\pm$  standard deviation (SD), while categorical data are expressed as frequencies (%). To assess factors associated with vaccine complications, binary logistic regression was used to estimate the odds ratio (OR) and its 95% CI. Additionally, the OR was adjusted for age, gender, underlying disease, COVID-19 history, and vaccine type. A P-value of less than 0.05 was considered significant. All analyses were performed using SPSS software version 22.

## 4. Results

The mean  $\pm$  SD age of HCWs was  $38.78 \pm 8.51$  years. Additionally, the majority of HCWs (65.90%) were female. Approximately 43% of participants held a

**Table 1.** Demographic Characteristics of Participants (N = 739)<sup>a</sup>

Variables	Values
<b>Demographic Characteristics</b>	
<b>Age</b>	38.78 ± 8.51
<b>Gender</b>	
Female	487 (65.90)
Male	252 (34.10)
<b>Marital status</b>	
Single	176 (23.80)
Married	550 (74.40)
Divorced	9 (1.30)
Widow	1 (0.50)
<b>Educational level</b>	
Illiterate	-
Elementary	9 (2.1)
Diploma and under-diploma	197 (26.7)
Associate degree	138 (18.7)
Bachelor	319 (43.2)
Master's degree and higher	76 (10.3)
<b>Occupational Characteristics</b>	
<b>Employment status</b>	
Informal	378 (51.2)
Formal	361 (48.80)
<b>Work experience</b>	
Under 5 years	233 (31.50)
5 to 9 years	122 (16.50)
10 to 15 years	147 (19.90)
15 to 24 years	144 (19.50)
25 years and above	93 (12.60)
<b>Workplace status</b>	
Urban	422 (57.10)
Rural	317 (42.90)
Usually contact (most of the days of in a week) at work with suspected or confirmed COVID-19 patients.	600 (81.20)
Appropriate personal protective equipment (PPE) to protect against Coronavirus disease 2019 (COVID-19) in the workplace	520 (70.40)

<sup>a</sup> Values are expressed as No, (%) or mean ± SD.

bachelor's degree, and 19.90% had 10 to 15 years of work experience (Table 1).

Nearly 90% of HCWs had underlying diseases. Approximately half of the participants (370; 50.1%) had a history of COVID-19. The primary mode of COVID-19 transmission was reported to be the provision of services to an infected person at the workplace (Table 2).

Among vaccinated HCWs (712, 96.34%), nearly half (48.45%) did not report any complications after vaccination. The highest number of complications (176; 67.96%) was reported among those who received the Oxford/AstraZeneca vaccine, while the lowest number of complications (6; 35.29%) was reported among those vaccinated with the BIVI-CovIRAN vaccine. Information

on complications after the COVID-19 vaccination is detailed in Table 3.

After controlling for the effect of other variables, the odds of vaccine complications were 55% lower in men than in women ( $P = 0.001$ ). Typically, frequent contact (most days of the week) at work with suspected or confirmed COVID-19 patients significantly increased the odds of COVID-19 vaccine complications ( $OR = 2.01$ ,  $P = 0.021$ ). A history of COVID-19 more than doubled the odds of vaccination complications ( $P = 0.001$ ). The odds of experiencing vaccination complications were 2.32 times higher in HCWs who received Sputnik V compared to those who received Oxford/AstraZeneca ( $P = 0.002$ ). In contrast, the odds of vaccination complications were

**Table 2.** Coronavirus Disease 2019 (COVID-19) Transmission Ways in the Participants and Their Relatives

Variables	No. (%)
<b>Transmission ways</b>	
Providing service to an infected person at work	172 (48.46)
Contacting an infected colleague at work	48 (12.97)
Contacting an infected family member at home	87 (23.52)
Public and crowded places	18 (4.87)
Travel	3 (0.81)
Unknown	42 (11.35)
<b>History of being hospitalized due to COVID-19</b>	27 (3.7)
<b>Hospitalization duration</b>	
A week or less	12 (44.44)
1 - 2 weeks	13 (48.14)
Two weeks to a month	2 (7.41)

**Table 3.** The History of Complications After the Coronavirus Disease 2019 (COVID-19) Vaccination by the Type of Vaccine <sup>a</sup>

Type of Vaccine	Values	No Complications	After the First Vaccination	After the Second Vaccination	After Both Vaccination
<b>Oxford/AstraZeneca</b>	259 (36.37)	83 (32.04)	109 (42.09)	19 (7.33)	48 (18.54)
<b>Sputnik V</b>	183 (25.70)	89 (48.63)	36 (19.67)	12 (6.56)	46 (25.14)
<b>BBIBP-CorV</b>	218 (30.61)	143 (65.60)	31 (14.22)	16 (7.34)	28 (12.84)
<b>BBV152</b>	34 (4.77)	18 (52.94)	6 (17.65)	3 (3.82)	7 (50.59)
<b>BIVI-CovIran</b>	17 (2.38)	11 (64.71)	4 (23.53)	-	2 (11.76)
<b>COVAX-19</b>	1 (0.01)	1 (100)	-	-	-
<b>All vaccines</b>	712 (96.34)	345 (48.45)	186 (26.12)	50 (7.02)	131 (18.39)

<sup>a</sup> Values are expressed as No. (%).

58% lower in individuals who received BBIBP-CorV compared to those who received AZD-1222 ( $P = 0.001$ ) (Table 4).

## 5. Discussion

According to the results of this study, the highest vaccine complications were reported with Oxford/AstraZeneca, while the lowest were with BIVI-CovIran after the first dose. Additionally, vaccine SE were lower among men than women. Contact with an infected patient, a history of COVID-19 infection, and hospitalization for two weeks within a month were risk factors for COVID-19 vaccine complications. The majority of participants reported SE after the first dose, which aligns with previous studies. In a Turkish study, 62.5% of HCWs reported at least one SE after vaccination (22, 23).

The Oxford/AstraZeneca vaccine was associated with the highest prevalence of SE following the first dose (42.09%). In the studies by Babaee et al. and Babamahmoodi et al., Sputnik had more SE after the first dose than the second (15, 17). This inconsistency could be

due to different sample sizes and study designs. However, Abu-Hamed et al. in Jordan conducted a study on vaccine SE among HCWs and found that the Oxford/AstraZeneca vaccine had more complications than Sinopharm and Pfizer at the first dose (24). In a cross-sectional study on the SE of the AstraZeneca COVID-19 vaccine, the prevalence of SE after the first dose was higher than after the second dose, consistent with our findings (20).

Among the three major vaccines in this study, BBIBP-CorV had the lowest complications after the first and both doses. A study in Jordan investigated Oxford-AstraZeneca, Pfizer-BioNTech, and Sinopharm SE among HCWs and showed that Sinopharm had the lowest SE, similar to our study (24). In the B.Q. study in the United Arab Emirates, participants experienced higher SE with the first dose of the Sinopharm vaccine than with the second dose; however, their participants were not HCWs (25). Another study showed that the adverse effects of the Oxford/AstraZeneca vaccine among HCWs were higher than those among non-HCWs after the first dose. This could be related to their workplace environment

**Table 4.** Binary Logistic Regression Model for the Associated Factors into the Coronavirus Disease 2019 (COVID-19)<sup>a, b</sup>

Variables	Odds Ratio (Confidence Interval)	
	Crude	Adjusted
Age	0.99 (0.97 - 1.1)	0.99 (0.97 - 1.01)
Gender (male)	0.56 (0.41 - 0.77) <sup>c</sup>	0.45 (0.32 - 0.64) <sup>c</sup>
Usually contact (most of the days in a week) at work with suspected or confirmed Coronavirus disease 2019 (COVID-19) patients.	2.12 (1.42 - 3.17) <sup>c</sup>	2.01 (1.30 - 3.11) <sup>c</sup>
Appropriate personal protective equipment (PPE) to protect against COVID-19 in the workplace	0.90 (0.64 - 1.26)	0.94 (0.65 - 1.35)
Underlying diseases	1.01 (0.64 - 1.58)	0.97 (0.57 - 1.64)
Experienced COVID-19 infection	1.62 (1.20 - 2.18) <sup>c</sup>	2.03 (1.46 - 2.82) <sup>c</sup>
History of being hospitalized due to corona	0.36 (0.15 - 0.84) <sup>c</sup>	0.52 (0.21 - 1.30)
<b>Hospitalization duration</b>		
A week or less	1	1
One to two weeks	1.66 (0.29 - 9.44)	1.12 (0.15 - 8.11)
Two weeks to a month	2.66 (0.12 - 57.62)	3.02 (0.12 - 72.27)
<b>Type of vaccine</b>		
Oxford/AstraZeneca	1	1
Sputnik V	2.00 (1.35 - 2.96) <sup>c</sup>	2.32 (1.53 - 3.50) <sup>c</sup>
BBIBP-CorV	0.49 (0.33 - 0.74) <sup>c</sup>	0.42 (0.27 - 0.64) <sup>c</sup>
BBV152	0.51 (0.18 - 1.45)	0.38 (0.13 - 1.10)
BIVI-CovIran	0.84 (0.40 - 1.75)	0.66 (0.31 - 1.42)

<sup>a</sup> Odds ratio was estimated using binary logistic regression.<sup>b</sup> Odds ratio was adjusted based on age, sex, underlying disease, and history corona disease and vaccine type.<sup>c</sup> P-value considered significant if < 0.05.

and educational background, as HCWs have clearly reported the SE of this vaccine (26).

Some studies have shown that SE are associated with young age, being female, and having comorbidities as independent factors for adverse events following immunization (5, 27). In our study, the relationship between SE, age, and underlying diseases was not significant, but SE was related to the female gender. Side effects is more common and intense in females due to a stronger immune response compared to males (28). Evidence confirms that women are at a higher risk of vaccine-related adverse events than men, which could be caused by the estrogen hormone triggering a robust immune response (29). Additionally, theories related to adaptive immunity, sex steroids, and innate immunity support this difference (30). The incidence of adverse events based on gender and contact history could be attributed to the type of population studied. Moreover, the type and immunogenicity of the vaccine may be linked to the symptoms of complications (31, 32).

In a cross-sectional study by Kadali et al., HCWs with a prior history of COVID-19 (PHC) had higher and more severe SE than those without PHC (33). Similarly, in the

Mathioudakis study, the risk of any SE in patients with PHC infection was increased (34). These results align with our study. The number of HCWs with a PHC needing to take time off work increased, possibly related to vaccine SE. This may be connected to individual immune responses, with higher antibody titers after vaccination compared to those without a prior COVID-19 infection (35, 36).

In this study, COVID-19 vaccine SE increased if participants had previous exposure to infected patients. In Riad et al.'s study in the Czech Republic among HCWs, vaccine SE like injection site swelling, muscle pain, joint pain, and fever were more prevalent in HCWs exposed to infected cases (21). This may be due to the antibody response to COVID-19 in HCWs previously exposed to the virus through contact with infected patients (37).

### 5.1. Limitations

Healthcare workers were reluctant to participate in the study due to heavy workloads and the number of questions to answer. Filling out an online questionnaire may lead to information bias.

## 5.2. Conclusions

This study found that after receiving the COVID-19 vaccine, nearly half of the HCWs in Chaharmahal Bakhtiari experienced some complications. The Sputnik vaccine caused the most complications. Authorities should be alert and pay attention to the vaccines that have been imported.

## Footnotes

**Authors' Contribution:** All of the authors contributed equally.

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**Data Availability:** The dataset presented in the study is available on request from the corresponding author during submission or after publication.

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