
Archives of Razi Institute Journal

Volume 80, NO. 3, 2025

Journal homepage: https://archrazi.areeo.ac.ir

Original Article

Effectiveness of COVID-19 Vaccines in Mahabad, Iran: A Cohort Study

Nasrin Parsa[1], Shaker Salarilak[1], Mohammad Heidari[1*]

1.Department of Epidemiology and Biostatistics, School of Medicine, Urmia University of Medical Sciences, Urmia, Iran.

Article Info:

Received: 12 January 2024
Revised: 7 July 2024
Accepted: 9 July 2024

Keywords:

COVID-19 Vaccines,
Vaccine Efficacy,
Risk Assessment, Risk Ratio,
Iran.

ABSTRACT

The COVID-19 pandemic has demonstrated the seriousness of infectious diseases , underscoring the critical role of vaccination in preventing such outbreaks . The aim of study was to examine the effectiveness of the vaccines against COVID-19 in city of Mahabad in the northwestern region of Iran. This retrospective cohort study compared 1077 vaccinated employees of the Mahabad city health department (the exposed group) with 1338 unvaccinated employees from other departments (the unexposed group). Demographic details, vaccination dates, types, and outcomes were extracted from the local health system. Data on cases came from the disease unit, and hospitalization came from the Medical Care Monitoring Center (MCMC). Attributable fractions for the exposed group and relative risks with 95% confidence intervals were calculated for each vaccine dose, stratified by sex, age group, and exposure level. Data analysis was conducted using STATA16, with a p-value < 0.05 was considered statistically significant. The overall efficacy of COVID-19 vaccines in preventing the disease is 51%, with 26% effectiveness in preventing hospitalization. When stratified by vaccine type, AstraZeneca exhibits an 81% efficacy (95% CI: 0.61–0.91) in preventing infection. This is followed by Sputnik at 41% efficacy (95% CI: 0.086–0.62) and Sinopharm-Baharat at 10% efficacy (95% CI: 0.50–0.46). Similarly, AstraZeneca demonstrates a 79% efficacy (95% CI: 0.083–0.95), Sputnik demonstrates 29% efficacy (95% CI: 0.77–0.71), and Sinopharm–Bharat at 44% efficacy (95% CI: 0.63–0.81) in preventing hopitalization. Notably the efficacy of preventing both disease and hospitalization is higher in men than women. The AstraZeneca vaccine is the most effective at preventing both disease and hospitalization, followed by Sputnik. Analyzing vaccine effectiveness across age groups reveals the lowest efficacy in individuals below 30 years old, and the highest efficacy individuals above 51 years. Despite challenges of selecting and administering vaccines in a timely manner in Iran, our findings demonstrate that three doses of COVID-19 vaccines are over 75% effective at preventing hospitalization and death, underscoring the vital role of vaccination as a primary preventive measure against infectious disease outbreaks. These results highlight the importance of proactive preparation and investment in robust vaccination programs for effective epidemic control.

Corresponding Author:
heidari.m@umsu.ac.ir

https://orcid.org/0000-0001-7955-9891

How to cite this article: **Parsa N, Salarilak S, Heidari M. Effectiveness of COVID-19 Vaccines in Mahabad, Iran: A Cohort Study. *Archives of Razi Institute*. 2025;80(3):685-692.** DOI: 10.32592/ARI.2025.80.3.685

1. Introduction

In December 2019, cases of pneumonia caused by an unknown virus were reported in association with a seafood wholesale market in Wuhan City, Hubei Province, China. First, this disease referred to as a mysterious respiratory disease in china, and then World Health Organization named it as "Covid-19" (1). On January 30, 2020, the World Health Organization declared the COVID-19 pandemic a public health emergency of international concern (2). On March 11, 2020, WHO declared the disease a pandemic to emphasize its importance and prevalence (1, 3).

Following the emergence of the disease in late December 2019 in China and its subsequent global spread, scientists began their research to develop a vaccine (4). The causative agent of Covid-19 is the SARS-CoV-2 coronavirus. The presence of spike protein on the surface of the SARS-CoV-2 coronavirus is one of the most important structural features of this virus (5).The spike protein directly binds to the ACE2 receptor on the surface of human alveolar epithelial cells, facilitating the virus's entry and replication (6). The covid-19 disease has imposed a huge burden on the world. After about three years since the beginning of the covid-19 pandemic (until February 19, 2023), there have been more than 670 million confirmed cases and more than 6 million deaths worldwide. In the Islamic Republic of Iran2023, the number of infected individual reached 7,500,000 with 145,000 (7) deaths by February 19, 2023. Non-pharmacological interventions, such as social distancing, mask use and contact tracing, have been the mainstay of health policy strategies to reduce the spread of the virus and limit the demand for healthcare (8). In order to prevent Covid-19 as the emerging disease of the century and the most difficult health challenge, it is necessary to discover an effective vaccine (4). Vaccines are the most important tool to prevent infection and severe disease caused by SARS-Covid-19 (9). Vaccinating and immunizing the people worldwide against diseases is known as one of the greatest public health achievements. Immunization programs have significantly reduced the mortality and prevalence of infectious diseases, including the eradication of polio worldwide (10). In order to succeed in reducing the prevalence and treatment of vaccine-preventable diseases, immunization programs must be integrated into national vaccination process, with coverage reaching reach over 70% (11). Nowadays, most vaccines are made based on the weakened infectious agent or messenger RNA, which can induce the cellular and humoral immune system to produce antibodies in order to reduce the possibility of death and severe complications in case of exposure to the infectious agent (4). The presence of the spike protein on the surface of the coronavirus is one of the most important structural features, making spike protein a suitable target for the preparation of various types of vaccines against the Covid-19 disease, which has attracted the attention of many scientists (5). Until August 2021, more than 150 vaccines have been developed in different stages of research and clinical trials to combat this pandemic. Most of these vaccines are based on weakened infectious agent or messenger RNA, which can induce the cellular and humoral immune system to produce antibodies, reducing the possibility of death and severe complications in case of exposure to SARS-CoV-2 (4). With the introduction of the first effective vaccine against Covid-19 by an American-German company called Pfizer BioNTech in December 2019, i.e. 11 months after the first recorded case of infection with Covid-19 , scientists were able to shorten the multi-year process of developing a new vaccine to less than a year and the hopes of returningto normal life become stronger (12). Since then, other reputable companies around the world introduced vaccines, including Moderna, Johnson & Johnson, AstraZeneca-Oxford, Sputnik V, Quaxin, Novavax, Sinovac, and Sinopharm. Of course, none of these vaccines had received final approval from reputable organizations such as the World Health Organization and the Food and Drug Organization when they were used. In this regard, Iran has also made efforts to make and develop a vaccine. As of January 11, 2023, 12.7 billion doses of the Covid-19 vaccine had been administered worldwide, and 67.9% of the world's population had received at least one dose. According to official reports of national health agencies, 4.19 million vaccines were administered daily at that time. However, only 22.3% of people in low-income countries had received at least the first vaccine by September 2022 (1). The major challenge for these vaccines is the diverse mutations of SARS-CoV-2, which lead to the creation of new species. However, scientific efforts to develop and improve vaccines are ongoing (4). Clinical controlled trials and clinical studies in real conditions from some countries have shown clear evidence of the vaccines' effectiveness (6). Many studies have been conducted on the effectiveness of different covid-19 vaccines in different countries, providing according to the real environmental conditions under which the vaccines are used. Due to new mutations and different strains globally, understanding the effectiveness of different vaccines against different strains has become the main priority worldwide (6, 13, 14). In Iran, the Ministry of Health chose and implemented universal vaccination as a suitable solution to achieve collective safety and reduce the risk of transmission of infection, disease, and its consequences. Since February 21, 2019, the country has been administering the Sputnik vaccine nationwide, which is made in Russia. Due to the high chance of exposure to this virus, , the vaccination of healthcare workers began on March 10, 2019, in Mahabad city .This was followed by the administration of the covaxin (Bharat), Sinopharm and AstraZeneca vaccines. Iran has experienced eight waves of the corona epidemic, and West Azarbaijan province and Mahabad city, in this province, have been one of the main centers of this

disease during several waves. Therefore, this study useda retrospective cohort method to evaluate the effectiveness of different covid-19 vaccines in preventing covid-19 disease, hospitalization and covid-19-related death among employees working in the health department of Mahabad city.

2. Materials and Methods

This longitudinal retrospective research cohort to evaluate the effectiveness of different vaccines in preventing covid-19 disease, hospitalization , death due to the SARS-COVID-19 virus in employees working in various health and treatment departments in Mahabad city. Mahabad city located in Northwest of Iran in West Azerbaijan province (Figure 1).

2.1. Sample size

We used the power and sample size analysis tools in STATA 15 to determine the necessary sample size for this cohort study. Our goal was to achieve a power of 90% to detect a relative risk of 0.83 with an alpha level of 0.01. Based on these parameters, the analysis yielded a final sample size of approximately 2,100. Between April 22, 2021 and the end of August 2021 We included 1077 employees working in the health and treatment department of Mahabad city in the study. we received approval an approval code from the ethics committee of Urmia University of Medical Sciences. Then, we coordinated data collection with the officials of the health and treatment network of Mahabad City. The exposed group included employees working in the health and treatment department of Mahabad city who received the Covid-19 vaccine from April 22, 2021 to the end of August 2021. In this study, individuals were considered as exposed (vaccinated) if received at least two doses of the same type of vaccine. The control group was selected from the among employees working in petrochemicals, education and banks in Mahabad city who had no history of receiving vaccines between April 22, 2021 and the end of August 2021. Entry criteria for the exposure group included employment in Mahabad city's health and treatment sector ,, and for the control group, employment in Mahabad city's health and treatment, petrochemical, education, and banking sectors.

2.2. The exclusion criteria included the following people

1. Those who had a history of being infected with Covid-19, hospitalization, or death before the start of vaccination or within 14 days before receiving the second dose iftheir test result were positive.
2. People who did not receive the second dose of the vaccine.
3. Those who were not vaccinated with two doses of the same vaccine.
4. People were vaccinated with uncommon vaccines in the country.After selecting the exposure group and the control group, the necessary information for the exposure group (vaccine recipients) was prepared in an Excel file. This file included national code data, age, sex, occupation, type of vaccine, and the dates the first and second doses were received from the SIB system of the health center. The infection-related data included the infection date. The time interval between receiving the vaccine and becoming infected, the outcome of the infection (Covid-19 disease, hospitalization, or death) from the city disease unit's database of positive cases, hospitalization data from the hospital's medical records department, and data on death cases was extracted from the environmental health unit due to access to all deceased cases. The data of the control group was prepared after receiving the national code of the employees from the relevant department. This data included national code, age, genders, occupation from the Apple system, as well as the data related to the disease from the database of positive cases of the disease from the city health center headquarters. Data related to the hospitalization status was extracted from the medical records department, and the data on deceased cases was extracted from the environmental health unit due to access to all the deceased cases.

Figure 1. Geographical location of Mahabad City in West Azarbaijan Province in Iran.

Bank employees were chosen because they were among the groups with a high level of exposure to the virus, like medical staff. Many of them were infected with the Covid-19.Teachers were chosen because they were among the occupations with a large statistical population for comparison and were exposed to the virus in various ways.

2.3 The job groups were leveled based on exposure as follows

2.3.1. Exposure level 1

(people at high risk): Doctors and nurses in the corona department, laboratory workers, midwives in the delivery department, paramedics. In the control group, it includes bank employees and Level 1 health workers who received the vaccine within the specified time frame. These individuals have not received the vaccine.

2.3.2. Exposure level two

(people at moderate risk): Doctors and nurses from other departments, health workers, health midwives, emergency, radiology, and operating room experts; and attendants. In the control group, this includes teachers and level two employees. These individuals did not receive the vaccine within the specified time period.

2.3.3. Exposure level 3

(people at low risk): Employees of administrative and health headquarters and hospitals; guards and transport workers.The control group includes petrochemical workers and level 3 health workers who received the vaccine in the specified time frame. In this study, the risk of infection, relative risk and effectiveness of vaccines in general (all vaccines) and by type of vaccine (Astrazenka, Sputnik, Sinopharm-Bharat) were calculated on health workers. Age and gender were controlled as confounders using stratification technique in the data analysis.

2.4. The sources of the Data

1. SIB system (integrated health system) which can be used to extract demographic information (e.g., age, sex), type of vaccine, and the dates the first and second doses were received, vaccine and underlying disease used.
2. An Excel spreadsheet of the positive cases of the disease unit in Mahabad city to identify positive cases based on age, gender, occupation, and underlying disease.
3. The hospital's MCMC system was used to extract the information about people hospitalized due to the disease of covid-19 and the outcome, whether discharged or deceased.
4. To obtain information on people who died due to the covid-19 disease, Excel spreadsheet of death cases of the diseases and Environmental Health unit of Mahabad city were used.

2.5 Vaccine effectiveness

It indicates the percentage of people who wouldn't be infected if there were vaccination. The attributable risk formula was used to calculate the vaccine's effectiveness in the exposure group, which is written as follows:

Vaccine Efficacy = (Risk of Disease in Unvaccinated Group - Risk of Disease in Vaccinated Group) /Risk of Disease in Unvaccinated GroupWilson's formula was used to calculate the confidence interval, which is obtained as follows:

Attributable Fraction $AF = (Pe - Pu) . Pe$

95% Confidence Interval $CI = AF \pm (Z\alpha.2 * SE)$

Standard Error $SE = sqrt((Pe . Ne) * (1 - Pe . Ne))$

Analyzes were performed in Stata-16 software, and a significance level of 0.05 was considered

3. Results

Table 1 shows the distribution of disease frequency, deaths, exposure levels, hospitalizations, sex, type of vaccine, underlying disease, age and follow-up period in the exposed group (vaccine group) and the control group (non-vaccine group). The table shows that the rate of disease is higher in the control group than the exposure group (10.6<5.1). The occurrence of death in the exposure and control groups is zero. The control group has the largest number of people with a medium exposure level, and the exposure group has the largest number of people with a high exposure level. The hospitalization rate is higherin the control group than in the exposure group (2%<1.5%). In the control group, males are most frequent with 54.8%,while in the exposure group, females are most frequent with 53.9%. Sputnik vaccine recipients comprise the largest group in the exposure group,while Bharat recipients have the lowest number in the exposure group. The median age in both groups is 36 years,and the follow-up period is longer in the control group than the exposure group (30.79<18.43).

Table 1: frequency distribution by type of exposure. As shown in Table 2, out of 2415 participants in the study, 1077 people received vaccine as exposure group ,while 1338 people did not receive vaccine as control group. The highest number of vaccine recipients is related to Sputnik vaccine with 414 people and the lowest is related to Bharat vaccine with 125 people. The infection rate for with control group is 10.6%. Among those received the vaccine, the highest infection rate is related to the recipients of Sino pharm vaccine, and the lowest is related to Astra Zeneca. The highest percentage of hospitalization is related to Bharat vaccine. The most common type of vaccine injected in women was related to Sino pharm vaccine with 66.7% and in men related to Sputnik vaccine with 50.8%. The rate of underlying disease is higher among those who have received sino pharm vaccine. Table 3 shows the vaccine's effectiveness in preventing the disease by dose for both sexes The relative risk is higher for the second dose, and the overall relative riskis 0.48% in both sexes. The vaccine's effectiveness is 0.51% with a confidence interval (0.34-0.64) and the second dose is generally more effective than the first. Table 4 shows

Table 1. Frequency distribution by type of

	Groups	Control		Exposed		P_value
		Unvacinated		Vaccinated		
		N	%	N	%	
Covid_19	Not infected	1196	89.4	1022	94.9	<0.001
	Infected	142	10.6	55	5.1	
Death	No	1338	100	1077	100	0.007
	Yes	0	0	0	0	
Exposure level	High	442	33	637	59.1	<0.001
	Moderate	586	43.8	359	3.33	
	Low	310	23.2	81	7.5	
Hospitalization	No	1311	98	1061	98.5	0.32
	Yes	27	2	16	1.5	
Sex	Female	605	54.2	580	53.9	<0.001
	Male	733	54.8	497	46.1	
Type of Vaccine	No_recived	1338	100	0	0	<0.001
	Sputnik	0	0	413	38.3	
	AstraZeneca	0	0	404	37.5	
	Sinopharm	0	0	135	12.5	
	Baharat	0	0	125	11.5	
Underlying Disease	No	1316	98.4	1062	98.6	0.16
	yes	22	1.6	15	1.4	
Age (Mean±Sd)		36.83	7.74	36.86	9.97	<0.001
Follow up Time (Mean±Sd)		150.96	30.79	158.57	18.43	<0.001

Table 2. Frequency distribution based on the type of vaccine received.

	Groups	Sputnik		AstraZeneca		Sinopharm		Baharat		P_value
		413		404		135		125		
		N	%	N	%	N	%	N	%	
Covid_19	Not infected	378	93.7	396	98	124	91.9	115	92	<0.001
	infected	26	6.3	8	2	11	8.1	10	8	
Death	No	413	100	404	100	135	100	125	100	0.12
	yes	0	0	0	0	0	0	0	0	
Hospitalization	No	406	98.3	402	99.5	131	97	122	97.6	0.23
	yes	7	1.7	2	0.5	4	3	3	2.4	
Sex	Female	203	49.2	223	55.2	90	66.7	64	51.2	<0.001
	Male	210	50.8	181	44.8	45	33.3	61	48.8	
Underlying Disease	No	405	98.1	402	99.5	132	97.8	123	98.4	0.42
	Yes	8	1.9	2	0.5	3	2.2	2	1.6	
Age (Mean±Sd)		38.5	10.9	35.4	8.8	34.8	10.1	38.1	8.7	<0.001
Follow up Time (Mean±Sd)		158.8	16.3	159.7	16.5	155.7	25.3	156.6	21.4	<0.001

Table 3. Frequency distribution based on the type of vaccine received.

Vaccine Dose	Groups	Positive	Negative	Relative Risk (95% CI)	Effectiveness (95% CI)	P_Value
First Dose	Vaccinated	13	1064	0.39 (0.28_0.55)	0.25 (-0.65_0.65)	0.45
	Control	12	1326			
Second Dose	Vaccinated	42	1035	1.34 (0.64_2.93)	0.60 (0.44_0.71)	<0.001
	Control	131	1207			
Total	Vaccinated	55	1022	0.48 (0.35_0.65)	0.51 (0.34_0.64)	<0.001
	control	141	1197			

Table 4. Effectiveness of vaccines in preventing hospitalization due to covid-19 disease according to male and female gender.

Sex	vaccine	positive	Negative	Relative Risk	effectiveness	P_Value
Male	Vaccinated	5	492	0.38 (0.149_1.05)	0.61 (0.32_0.85)	0.05
	Control	19	714			
Female	Vaccinated	11	569	1.43 (0.58_3.54)	0.30 (-0.70_0.71)	0.43
	Control	8	597			
Total	Vaccinated	16	1061	0.73 (0.39_1.35)	0.26 (-0.35_0.60)	0.32
	Control	27	1311			

the effectiveness of vaccines in preventing hospitalization due to the covid-19 disease according to male and female gender. The vaccine is more effectiveness in preventing hospitalization in males than in females. It is 0.61 in men, with a confidence interval of 0.32 to 0.85, and 0.30 in women. The vaccine's effectiveness in preventing hospitalization in both sexes is low and 0.26. Table 5 shows the effectiveness of the vaccine in preventing the infection of Covid-19 by age groups. The overall effectiveness of the vaccines is 0.81% in the over-51 years age group ,with a confidence interval of 0.93-0.43. The relative risk is highest in the under -30 age group compared to all other age groups. They have the lowest effectiveness.

4. Discussion

In addition to demonstrating the vaccine's the effectiveness of in clinical trials, showing its effectiveness in real-world environments plays an essential role in strategic planning and control of infectious diseases in society. This study investigated the effectiveness of different covid-19 vaccines among health workers of Mahabad city. Health workers who received the vaccine were compared to employees in other departments who did not receive the vaccine in a 19-week follow-up period. The Sputnik vaccine, made in Russia, was the most widely used, with 413 people, while the Bharat vaccine, made in India, was the least used, with only 125 recipients. This difference may be due to embargo, importation restrictions, and distribution limitations. Health workers from across the country did no longer enter the country, and the Sinopharm, AstraZeneca, and Iranian-made, such as Co- Iran Barkat, Spycogen, etc. were used. Frequency distribution analysis of the relationship between gender and the incidence of covid-19 disease showed that the rate of covid-19 infection and hospitalization in men is more than women (< 2.6). Also, people with underlying disease is more affected by covid-19 than other people. In general, effectiveness of the vaccine based on the level of exposure showed that level one exposure was the most effective, while level three exposure was the least effective. The effectiveness of AstraZeneca, Sputnik, and Sinopharm-Bharat vaccines in preventing covid-19 disease after two doses is 0.81, 0.41 and 0.10%, respectively. This indicates the high effectiveness of the AstraZeneca and the Sputnik vaccine. The effectiveness of the vaccines in preventing the disease in those who have revived the vaccine is 0.41% for AstraZeneca and low for Sinopharm and Bharat. Additionally, the effectiveness of the vaccines in preventing hospitalization after receiving both doses is 0.79%, 0.29%, and 0.44% for AstraZeneca, Sputnik, and Sinopharm-Bharat, respectively. Here the AstraZeneca vaccine is more effective. . The effectiveness of AstraZeneca, Sputnik, Sinopharm-Bharat vaccines in preventing the disease after receiving both doses is higher in males than in females. The effectiveness of AstraZeneca and Sputnik vaccines in preventing hospitalization after receiving both doses is greater in males than in females, but in Sinopharm-Bharat is more effective in females. A study by Lee and his colleagues in Guangzhou, China investigated of the

Figure 5. Effectiveness of covid-19 vaccines in preventing infection by age groups.

Age group	Groups	positive	Negative	Relative Risk	effectiveness	P_Value
Under 30 years	Vaccinated	16	345	0.84 (0.46_1.43)	0.15 (-0.66_0.56)	0.63
	Control	16	290			
31_40 years	Vaccinated	18	312	0.59 (0.35_1.00)	0.40 (-0.008_0.60)	0.46
	Control	55	548			
41_50 years	Vaccinated	17	244	0.40 (0.24_0.67)	0.59 (-0.33_0.75)	<0.001
	Control	60	311			
Over 51 years old	Vaccinated	4	121	0.18 (0.06_0.56)	0.81 (0.43_0.93)	<0.001
	Control	10	48			

effectiveness of the Sinopharm vaccine and showed that it is more in women than in men (15). Gunzans et al. demonstrated that the Sputnik vaccine is 78.9% effective in preventing SARS-CoV-2 infection, 87.6% effective in preventing hospitalization, and 84.7% effective in preventing mortality (1). Alireza Mirahmad and his colleagues at Shiraz University of Medical Sciences demonstrated that the Sputnik vaccine is 74.8% effective in preventing infection and 67.5% effective in preventing hospitalization (6). The current study found that the Sputnik vaccine is 41% effective in preventing covid-19 disease = and 29% in preventing hospitalization. Gunzans et al demonstrated that the Sputnik vaccine is 78.9% in preventing of Covid-19, 87.6% effective in preventing hospitalization, and84.7% effective in preventing mortality (1). Alireza mirahmad and his colleagues at Shiraz University of Medical Sciences demonstrated that the Sputnik vaccine is 74.8 % effective in preventing infection the Covid-19 disease and 67.5% effective in preventing hospitalization (6).

Abtin Heydarzadeh and his colleagues' study stated the Sputnik vaccine's maximum effectiveness of the in preventing hospitalization is 0.93 (16). Examining the effectiveness of vaccines in preventing disease by age group after receiving both doses, the highest effectiveness is 81% in the age group above 51 years, and the lowest is 15% in the age group below 30 years. Investigation the effectiveness of vaccine in preventing infection by type of vaccine in different age subgroups after receiving both doses showed that the AstraZeneca vaccine is the most effective in of 41-50 years age group, Sputnik and Sinopharm-Bharat are the most effective in the over 51 years age group, and Sinopharm-Bharat is the most effective in the under 30 age group. The AstraZeneca vaccine is least effective in the 31-40 age group, while Sputnik and Sinopharm-Bharat are least effective in the below 30 age group. In Mirahmadizad's study (6) and his colleagues of the effectiveness of different vaccines for Covid-19 in Shiraz University of Medical Sciences, a significant decrease in attenuation rate (95%) was observed in all age groups except 18 to 44 and 64 and above. Examining the effectiveness by different levels of exposure in general in both genders showed the most effectiveness in preventing infection at exposure level 1 and in preventing hospitalization at exposure level 2. A study was conducted in France on the effectiveness of the vaccines used in that country (Pfizer, AstraZeneca, etc.) versus hospitalization. The study found that the AstraZeneca vaccine was more than 90% after two doses (17). A Canadian study on the effectiveness of vaccines used in that country (Pfizer, Astra Zeneca, etc.) against symptomatic covid-19 disease and severe disease outcomes (hospitalization and death) showed 91%efficacy) after the first dose. AstraZeneca is effective exists against it. French and Canadian studies showed that the AstraZeneca vaccine is highly effective in preventing infection and hospitalization (9).

A study conducted in Shiraz, Iran, examined the effectiveness of vaccines used in preventing infection, hospitalization and death. The results showed that two doses of Sinopharm, AstraZeneca, Sputnik V and CO_ Iran Barkat are effective in reducing hospitalization. AstraZeneca's results were similar to our study, but the results for Sputnik were higher than our findings. Also, the effectiveness of the Sinopharm vaccine in our study is not consistent with the results of the Shiraz University study. This inconsistency may be due to the small size of our sample and the fact that we used health workers as the vaccinated group, who are a high-risk group compared to the general population. The Shiraz University study examined a large portion of the general population (6). The Gilan University study (16) investigated the effectiveness of the vaccine in preventing temporary and permanent hospitalization and death on hospitalized patients. The results showed that the Sinopharm vaccine was most effective in preventing temporary hospitalization (95%), followed by permanent hospitalization (85%) and death (56%). The maximum effectiveness of the AstraZeneca vaccine in preventing hospitalization and deathwas 98% and 92%, respectively, and the maximum effectiveness of the Co_ Iran Barkat vaccine in preventing hospitalization was 95% and 89%. The results of the study on the AstraZeneca vaccine are similar to our study, but the results of Sinopharm vaccine are different and more than our study. In a country experiencing vaccine shortage due to many factors (i.e. delay in supply, sanctions), this study and two other studies (Shiraz and Gilan University of Medical Sciences) have shown that the implementation of an extensive vaccination program, even with vaccines such as Sputnik V and Bharat, for which there is limited information on their effectiveness and impact, significantly reduces cases of and hospital admissions for and deaths fromCovid-19. Another study at the biggest hospital in West Azerbaijan province showed that the Sputnik vaccine's side effects was not persistent (18). This information is relevant to public health and encourages health authorities to quickly achieve a critical mass of vaccinated population to control the disease across the country. Differences in population characteristics, study design, study timeline, type of vaccines, and effectiveness calculation method, as well as the presence of effectiveness adjustment and health system capacities, etc., can strongly affect studies, hence, efficacy values should be interpreted subjectively.

Acknowledgment

We are thankful to the Clinical Research Development Unit of Imam Khomeini Hospital, Urmia University of Medical Sciences, Urmia, Iran, for their help.

Authors' Contribution

Study concept and design: M H, Sh S, N P.
Gathering and coding the data: N P.

Analysis and interpretation of data: M H, Sh S, N P.
Drafting of the manuscript: N P, M H.
Revision of the manuscript: N P & M H.

Ethics

The study was conducted after receiving approval fromthe Ethics Committee of Urmia University of Medical Sciences

Conflict of Interest

The authors declare they have no conflict of interest.

Funding

This research is a result of Master thesis in epidemiology in Urmia University of medical sciences but received no fund.

Data Availability

The data that support the findings of this study are available on request from the corresponding author.

References

1. Wu D, Wu T, Liu Q, Yang Z. The SARS-CoV-2 outbreak: what we know. International journal of infectious diseases. 2020;94:44-8.
2. Sohrabi C, Alsafi Z, O'neill N, Khan M, Kerwan A, Al-Jabir A, et al. World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). International journal of surgery. 2020;76:71-6.
3. Maghded HS, Ghafoor KZ, Sadiq AS, Curran K, Rawat DB, Rabie K, editors. A novel AI-enabled framework to diagnose coronavirus COVID-19 using smartphone embedded sensors: design study. 2020 IEEE 21st international conference on information reuse and integration for data science (IRI); 2020: IEEE.
4. Jalali Farahani A, Ashourzadeh Fallah S, Khashei Z, Heidarzadeh F, Sadeghi F, Masoudi P, et al. Available effective vaccines in preventing COVID-19: a narrative review. Journal of Marine Medicine. 2021;3(4):153-62.
5. Gao Q, Bao L, Mao H, Wang L, Xu K, Yang M, et al. Development of an inactivated vaccine candidate for SARS-CoV-2. Science. 2020;369(6499):77-81.
6. Mirahmadizadeh A, Heiran A, Bagheri Lankarani K, Serati M, Habibi M, Eilami O, et al., editors. Effectiveness of coronavirus disease 2019 vaccines in preventing infection, hospital admission, and death: a historical cohort study using Iranian registration data during vaccination program. Open forum infectious diseases; 2022: Oxford University Press US.
7. Florez H, Singh S. Online dashboard and data analysis approach for assessing COVID-19 case and death data. F1000Research. 2020;9:570.
8. Jara A, Undurraga EA, González C, Paredes F, Fontecilla T, Jara G, et al. Effectiveness of an inactivated SARS-CoV-2 vaccine in Chile. New England Journal of Medicine. 2021;385(10):875-84.
9. Nasreen S, Chung H, He S, Brown KA, Gubbay JB, Buchan SA, et al. Effectiveness of COVID-19 vaccines against symptomatic SARS-CoV-2 infection and severe outcomes with variants of concern in Ontario. Nature microbiology. 2022;7(3):379-85.
10. Ittefaq M, Baines A, Abwao M, Shah SFA, Ramzan T. "Does Pakistan still have polio cases?": Exploring discussions on polio and polio vaccine in online news comments in Pakistan. Vaccine. 2021;39(3):480-6.
11. Wong L, Wong P, AbuBakar S. Vaccine hesitancy and the resurgence of vaccine preventable diseases: the way forward for Malaysia, a Southeast Asian country. Human vaccines & immunotherapeutics. 2020;16(7):1511-20.
12. Oliver SE. The advisory committee on immunization practices' interim recommendation for use of Pfizer-BioNTech COVID-19 vaccine—United States, December 2020. MMWR Morbidity and mortality weekly report. 2020;69.
13. Silva-Valencia J, Soto-Becerra P, Escobar-Agreda S, Fernandez-Navarro M, Moscoso-Porras M, Solari L, et al. Effectiveness of the BBIBP-CorV vaccine in preventing infection and death in health care workers in Peru 2021. Travel Medicine and Infectious Disease. 2023;53:102565.
14. Li X-N, Huang Y, Wang W, Jing Q-L, Zhang C-H, Qin P-Z, et al. Effectiveness of inactivated SARS-CoV-2 vaccines against the Delta variant infection in Guangzhou: a test-negative case–control real-world study. Emerging microbes & infections. 2021;10(1):1751-9.
15. González S, Olszevicki S, Salazar M, Calabria A, Regairaz L, Marín L, et al. Effectiveness of the first component of Gam-COVID-Vac (Sputnik V) on reduction of SARS-CoV-2 confirmed infections, hospitalisations and mortality in patients aged 60-79: a retrospective cohort study in Argentina. EClinicalMedicine. 2021;40.
16. Heidarzadeh A, Moridani MA, Khoshmanesh S, Kazemi S, Hajiaghabozorgi M, Karami M. Effectiveness of COVID-19 vaccines on hospitalization and death in Guilan, Iran: a test-negative case-control study. International Journal of Infectious Diseases. 2023;128:212-22.
17. Nguyen LBL, Bauer R, Lesieur Z, Galtier F, Duval X, Vanhems P, et al. Vaccine effectiveness against COVID-19 hospitalization in adults in France: A test negative case control study. Infectious Diseases Now. 2022;52(1):40-3.
18. Varghaei A, Heidari M, Daneshyar C, Nouri A, Mikaeilvand A. Side Effects of Sputnik V Vaccine in the Medical Staff of Dedicated COVID-19 Hospital. Iranian Journal of Medical Sciences. 2023;48(4):430.