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Original Article

Evaluation of the effect of vaccination and its consequences in patients with COVID-19 in western Iran

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Abstract

***Background & Aims*:** The confirmed cases of the new coronavirus disease (COVID-19) have increased not only in China but also in Iran and around the world. COVID-19 vaccination not only protects the individual but also safeguards those in the community who are unable to be vaccinated. Due to this concern, the present study was conducted to determine the relationship between vaccination and its consequences in patients with COVID-19.

***Materials & Methods*:** This descriptive study was conducted in Asadabad city, in western Iran. The data for this project were collected from the database and records of patients with COVID-19 in Asadabad Health Department. In fact, the sample size included all patients with a positive PCR diagnosis in the year 2022. Nine hundred fifty-one patients were included in the study. The tool used was a checklist based on patient records. SPSS software was used to analyze the data, and a significance level of less than 0.05 was considered.

***Results*:** The mean age of patients with a positive PCR test was 20.8 ± 42.9 years. Of these, 68.5% were vaccinated, and 31.5% were not vaccinated. Among the 951 patients, 30 patients with a positive PCR died, 19 of whom were not vaccinated. There was a significant relationship between the outcome of the disease (death or discharge) and the number of vaccine doses (p value = 0.001).

***Conclusion*:** Due to the effectiveness of COVID vaccination in reducing hospitalization and mortality, it is recommended to design educational interventions to encourage people to increase vaccination coverage.

***Keywords*:** COVID-19, Effect, Iran, Patients, Vaccination

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Introduction

Currently, the corona pandemic is one of the most important global health issues (1, 2). The initial cases of pneumonia in Wuhan, China, were linked to a local seafood shop, suggesting animal-to-human transmission. However, it was later observed that the disease can also spread from human to human, which increased its contagiousness and posed challenges in controlling the virus (3). Additionally, research has shown that older age is an independent risk factor for the susceptibility and mortality of COVID-19, even after considering comorbidity and gender. It is important to stay updated with reliable sources and follow recommended guidelines to mitigate the impact of the pandemic (4, 5).

The increasing prevalence of COVID-19 worldwide is indeed a significant health concern. As of the time of writing this study, the number of confirmed coronavirus cases globally has exceeded 250 million, with over five million reported deaths worldwide. In Iran specifically, the number of confirmed cases has surpassed 120,000 (6, 7). These numbers highlight the seriousness of the pandemic and the need for continued efforts to mitigate its impact. It is crucial to follow public health guidelines, such as practicing good hygiene, wearing masks, and getting vaccinated, to help reduce the spread of the virus and protect ourselves and others (8).

The first death associated with COVID-19 (February 19, 2020) was officially reported in Iran. COVID-19 shares a high genetic similarity with the SARS (severe acute respiratory syndrome) virus (72%) and the MERS (Middle East respiratory syndrome) virus (55%). This genetic resemblance suggests a connection between these viruses and provides insights into their potential similarities in terms of transmission and pathogenesis. The impact of COVID-19 extends beyond physical health, affecting individuals' psychological, social, and economic well-being (8). Since the outbreak, various preventive measures such as regular hand washing, social distancing, and quarantine have been implemented to curb the spread of the virus. However, it is important to note that these measures have had limited success in completely preventing COVID-19 infections. Given the high prevalence and severity of the disease, the most effective approach to combating COVID-19 is through disease control and prevention, specifically by breaking the chain of transmission. This requires a comprehensive plan that encompasses various strategies to control and prevent the spread of the virus. It is crucial to follow guidelines provided by health authorities and support ongoing efforts to mitigate the impact of the disease (9-11).

Effective vaccination is considered the best option for controlling COVID-19 and returning to a sense of normalcy. Public health practices emphasize the importance of vaccinating a sufficient number of people to effectively control an epidemic like COVID-19 (12, 13). The success of the vaccination program relies on the presence of qualified individuals in vaccination centers. However, it is unfortunate that a significant proportion of eligible candidates may not be present to receive the vaccine, indicating some reluctance to participate in the COVID-19 vaccination program (8, 14). It is important to note that COVID-19 vaccination not only protects the individual receiving the vaccine but also provides protection to those in the community who are unable to be vaccinated. Studies have demonstrated that vaccination reduces mortality rates among older age groups and significantly decreases mortality in individuals over 80 years of age. These findings highlight the importance of widespread vaccination efforts to protect vulnerable populations and reduce the overall impact of the virus. Encouraging participation in the COVID-19 vaccination program is crucial for achieving these goals and mitigating the effects of the pandemic (15, 16).

The study conducted by Yang et al. (2021) suggests that increasing perceived outcomes can positively influence people's willingness to receive vaccines (17). This highlights the importance of understanding the potential benefits of vaccination in promoting vaccine acceptance. The Centers for Disease Control and Prevention (CDC) acknowledges the need for further research to assess the risk of transmission from fully vaccinated individuals with SARS-CoV-2 infection to others, both vaccinated and unvaccinated (9). It is worth

noting that various types and brands of COVID-19 vaccines have been developed using different platforms. Some examples include killed virus vaccines like Sinopharm, Bharat, Sinovak, Kov Iran Barkat, Fakhra, and Nora; protein vaccines like Sobrana, pastocococcal, Razi, Kupars, and Spicogen; virus carrier-based vaccines like Sputnik V, AstraZeneca, and Jansen; and nucleic acid vaccines like Pfizer, Biontech, and Moderna. Based on the history of epidemic infectious diseases, obtaining vaccines with a low risk factor and high immunogenicity, along with implementing widespread vaccination programs globally, offers hope for controlling and eventually ending the COVID-19 pandemic. Given the importance of vaccination and the lack of similar studies in Asadabad city, future research is necessary to generate newer insights and results specific to Iran. The present study aimed to determine the relationship between vaccination and its consequences in patients with COVID-19, contributing to the existing knowledge in this area.

Materials & Methods

The study utilized data collected from the database and records of COVID-19 patients in the Asadabad Health Department. The sample size included 951 patients who had a positive PCR diagnosis within a one-year period. The data collection tool used was a checklist based on patient records. The checklist captured various information, including demographic details, history of underlying diseases, disease outcomes, history of COVID-19 vaccine administration, and the number of vaccine doses received. This study aims to provide valuable insights into the characteristics and outcomes of COVID-19 cases in Asadabad city.

Data analysis:

To describe the basic characteristics of the subjects in this study, descriptive statistics indicators such as mean and standard deviation will be utilized. Additionally, tables and graphs may be used to present the data visually. Analytical statistics will involve the use of independent t-tests and logistic regression. Modified logistic regression models will be employed to compare the likelihood of hospitalization and death based on the COVID-19 vaccine injection status. The study will take into account the history of COVID-19 vaccination, as well as potential confounding factors such as gender, age, hypertension, diabetes, chronic obstructive pulmonary disease (COPD), obesity, coronary artery disease, and heart failure. The data analysis will be conducted using SPSS software, and a significance level of less than 0.05 will be considered to determine statistical significance.

Results

The mean age of patients with a positive polymerase chain reaction (PCR) test was 20.8 ± 42.9 years. Fifty-two point two percent of this number were men, 47.8% were women, 68.5% were vaccinated, and 31.5% had no history of vaccination. The type of vaccine in people with a history of vaccination was 7.4% AstraZeneca vaccine, 52.6% Sinopharm vaccine, 2.4% Barekat vaccine, and 6.4% Sputnik vaccine. Out of 951 patients, 30 died with a positive PCR, of which 64% (19 patients) had no history of vaccination. Other details are shown in Table 1.

Table 1. Demographic characteristics of the participants in the study

Variable		Frequency	Percent
Sex	Male	496	52.2
	Female	455	47.8
Place	City	699	73.5
	Village	251	26.4
Job	Housewife	285	30.1

Variable		Frequency	Percent
	Employee	247	26
	Self- employed	145	15.9
	Worker	77	8.1
	Student	37	3.9
	Retired	76	8
	Other	84	8.8
Illness	No	726	76.3
	Yes	225	23.7
Vaccination	No	299	31.5
	Yes	652	68.5
Vaccine type	AstraZeneca	59	7.4
	Sinopharm	524	52.6
	Barecat	25	2.4
	Sputnik	46	6.4
Outcome	Death	30	3.1
	Survive	921	96.8
History of vaccination in deceased persons	No	19	64
	Yes	11	36

There was a significant relationship between the outcome of the disease (death or discharge) and the number of vaccine doses. The number of times the vaccine is injected predicts 56 % of the probability of a disease outcome (death or discharge). The results showed that injecting the first dose reduces the risk of death from COVID-19 disease by 21.1%, injecting the second dose by 27.3%, and injecting the third dose by 24.1%. (Table 2)

Table 2. Regression analyses and evaluation of the number of COVID-19 vaccine (Dose) injections and the outcome of the disease (death or hospitalization)

Dose	N	B	SE	*p* value	OR	R2
Dose 1	140	1.55	.751	.038	.211	
Dose 2	385	1.30	.449	.004	.273	0.056
Dose 3	129	1.47	.751	.050	.241	

The results of Table 3 show the prediction between the number of vaccine doses and hospitalization. The results showed that the injection of the first dose reduces the chance of hospitalization by 23%. There was no relationship between the second dose and the patient's chances of hospitalization (p value = 0.076). However, injecting a third dose reduces the risk of hospitalization by 28%. All types of vaccines had a significant

relationship with whether the patient was hospitalized or visited as an outpatient, so that AstraZeneca 36%, Sinopharm 59.8%, Barekat vaccine 34%, and Sputnik 17% predicted a decrease in hospitalization in patients (Table 4).

Table 3. Regression analyses and evaluation of the number of COVID-19 vaccine (Dose) injections and the outcome of the disease (hospitalization or outpatient visit)

Dose	B	SE	*p* value	OR	R2
Dose 1	.244	.751	.000	.229	
Dose 2	.155	.449	.076	.759	0.069
Dose 3	.243	.751	.000	.28	

Table 4. Vaccine type as predictor of the outcome of the disease (hospitalization or outpatient visit)

Vaccine type	B	SE	*p* value	OR	R2
AstraZeneca	-1.021	.293	.000	.360	
Sinopharm	-.515	.148	.001	.598	0.057
Barecat	-1.075	.489	.028	.341	
Sputnik	-1.788	.379	.000	.17	

Discussion

The purpose of the study mentioned is to investigate the relationship between vaccination and its consequences in patients with COVID-19. Since the beginning of the COVID-19 pandemic in January 2020, most countries have taken precautionary measures to control SARS-CoV-2 transmission with the hope of rapid production of safe and effective vaccines (18). In response, different vaccine candidates have been simultaneously developed, and only a few of them were authorized for emergency use authorization (19).

The results indicate that among the deceased individuals, 64% did not have a history of vaccination. Additionally, a study conducted by Yang et al. in 2021, titled "Influenza Vaccination and Hospitalization Among Adults with COVID-19," found that COVID-19 patients who did not receive the influenza vaccine were 2.44 times more likely to be hospitalized and 3.29 times more likely to be admitted to the intensive care unit (ICU) compared to those who were vaccinated. These findings suggest a potential benefit of influenza vaccination in reducing the severity of COVID-19 outcomes (20). It is important to note that further research and studies are needed to fully understand the relationship between vaccination and COVID-19 outcomes (17).

In addition, a study by Moghadas et al. (2021) showed that COVID-19 vaccination significantly reduced disease outcomes (18). In fact, vaccination reduced the risk of hospitalization in the intensive care unit (ICU) and mortality by 63.5% and 69%, respectively. In fact, the results of these studies indicate the effect of vaccination on the prevention of hospitalization and death. The results show that vaccination can have a significant effect on reducing the prevalence of COVID-19; however, continuous adaptation to non-pharmacological interventions is essential to achieve this effect (21). The results of US clinical trials have indicated that two weeks after receiving the second dose, the AstraZeneca COVID-19 vaccine demonstrated an effectiveness of 74% in protecting participants against COVID-19 (22). This finding highlights the potential of the vaccine in reducing the risk of infection. Additionally, a study conducted by Tehrani et al. showed that among unvaccinated individuals, the rates of infection,

hospitalization, and mortality per 1,000 population were 69.7, 12.1, and 1.04, respectively (23). In contrast, for those who received the COVID-19 vaccine, these rates were significantly lower at 3.9, 1.08, and 0.09, respectively, two weeks after the second dose. These findings suggest that vaccination can contribute to a significant reduction in the risk of infection, hospitalization, and mortality associated with COVID-19. It is important to note that vaccine effectiveness may vary based on factors such as age, underlying health conditions, and the presence of new variants. Therefore, it is crucial to follow the guidance of healthcare authorities and continue practicing preventive measures even after vaccination. Alhazmi et al. (20), Polack et al. (24), Voysey et al. (25), and Taherian et al. (26) also showed in their study that the side effects and effectiveness of vaccines are different based on the age of the person, their type, and dose.

The results of the present study indicate that receiving the first dose of the vaccine reduces the likelihood of hospitalization by 23%. However, there was no observed relationship between receiving the second dose and the patient's chances of hospitalization. Another study conducted by Tehrani et al. demonstrated that the effectiveness of the vaccine after the second dose, with a dose interval of 12 weeks or more, reached 82.4%. On the other hand, if the interval between the two doses was less than six weeks, the effectiveness dropped to 54.9% (20). It is worth noting that all types of vaccines examined in the study showed a significant association with whether the patient was hospitalized or visited as an outpatient. These findings emphasize the importance of receiving both doses of the vaccine and following the recommended dose intervals to maximize its effectiveness in preventing severe illness and hospitalization (27).

Based on the results of Bernal et al.'s study (28), the safety and efficacy of the AstraZeneca vaccine for the ages of 80 years and above are reported to be 70-89%. The safety of the AstraZeneca vaccine after 20 and 35 days was reported as 60 and 73%, respectively. Elderly people vaccinated with AstraZeneca were hospitalized 37 percent less often, which results show that the vaccine reduces the risk of hospitalization. The role of the vaccine in increasing the body's immune system is so impressive that other vaccines are also able to create immune levels against COVID-19. In fact, the success of the national vaccination process depends to some extent on people's perception of the benefits and risks of the vaccine, as well as the level of trust they have in their government and country.

Tehrani and BROSH studies for the Sputnik vaccine reduced the risk of infection, hospitalization, and death by 63.2%, 76.2%, and 82.6%, respectively. For other vaccines, AstraZeneca is more effective than Sinopharm and Sputnik vaccines, despite a longer dose interval. This means that COVID-19 infection is less likely. Information about the Barekat vaccine was incomplete due to its short duration. For those fully vaccinated with Sinopharm, AstraZeneca, and Sputnik, the median time between receiving the second dose and hospitalization was 45, 19, and 50 days, respectively (29). The results of the study by Sadighpour et al. showed that what is important is that vaccination should be accelerated with each of the above vaccines to achieve herd immunity during a shorter period because all three vaccines prevent 100% of severe COVID infection (19).

Of course, this point should be taken into account: vaccination does not provide complete immunity, and hygiene and social distancing measures should still be observed. In general, it can be acknowledged that all vaccines challenge the body's immune system and cause an increase in inflammatory markers within a few hours after vaccination. However, by examining the medical history, it can be said that the benefits of vaccination for society outweigh its disadvantages (30). Despite this being one of the few studies in Asadabad that has discussed the impact of vaccination and its outcomes in COVID-19 patients, our study has several limitations. The data were collected using a checklist, which should be approached cautiously regarding its generalizability. Due to the COVID-19 pandemic and the recommendation to continue social distancing and preventive measures in Asadabad, we chose to conduct this study using a checklist of recorded information to

ensure the safety of all study participants. Due to the non-use of random sampling, it is not possible to control some confounding factors. This study can serve as a foundational study for developing and implementing health education programs for COVID-19.

Conclusion

Effective vaccination represents the best option for controlling COVID-19 and allowing a country to return to normalcy. However, public health practices suggest that a sufficient number of people should be vaccinated to control an epidemic such as COVID-19. Due to the effectiveness of COVID vaccination in reducing hospitalization and mortality, it is recommended to design educational interventions to encourage people to increase vaccination coverage. A follow-up study on a larger population is necessary to investigate the effect of vaccination and its consequences in patients with COVID-19, as well as long-term side effects.

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Conflict of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Data availability

The raw data supporting the conclusions of this article are available from the authors upon reasonable request.

Ethical statement

The ethical approval for the study was obtained from the Research Ethics Committee of the Vice-Chancellor of Research and Technology of Asadabad School of Medical Sciences (IR.ASAUMS.REC.1400.027). Written informed consent was obtained from all individual participants included in the study.

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