

Evaluation of the Effect of COVID-19 Vaccine in Preventing COVID-19 Infection in Hemodialysis Patients

Mobina Kaviani¹, Nasrin Rasoulzadeh¹, Fatemeh Keshavarz², Fatemeh hosseinzadeh³, Rana Haddadi⁴ 

¹Department of Medical-Surgical Nursing, School of Nursing and Midwifery, Tehran University of Medical Sciences, Tehran, Iran

²Department of Nursing, Darab branch, Islamic Azad University, Darab, Iran. Islamic Azad University of Darab, Sardararan Square, Daneshgah Blv., Darab, Fars, Iran.

³Sina Hospital, Kerman University of Medical Sciences, Zarand, Iran

⁴Department of Anesthesia, Faculty of Allied Medicine, Kerman University of Medical Sciences, Kerman, Iran

Abstract

Article history:

Received: 10 Nov 2024
Accepted: 27 Feb 2025
Available online: 26 Apr 2025

Keywords:

Vaccine willingness
COVID-19
Hemodialysis patients

Introduction: The COVID-19 disease caused a global pandemic in a short period of time. One of the reasons for the high prevalence of this disease, especially in Iran, was the lack of a vaccine to prevent the disease. Because, due to the drugs used and the hemodialysis method, these patients were more susceptible to COVID-19 disease. Therefore, this study was conducted with the aim of "Evaluation of the Effect of COVID-19 Vaccine in Preventing COVID-19 Infection in Hemodialysis Patients. **Methodology:** This cross-sectional descriptive study was conducted on 240 hemodialysis patients referred to hospitals of Tehran University of Medical Sciences in 2023 using cluster sampling. The data collection tool was a checklist of vaccination history, type of vaccine, number of vaccine doses, and history of COVID-19 infection. The information was collected through self-reporting and entered into SPSS21 statistical software. Descriptive statistics (table, mean, standard deviation) and inferential statistics (Fisher's test) were used for data analysis. **Results:** 2.39% of hemodialysis patients contracted COVID-19. The infection rate was lower in those who had received a full vaccine dose. 35.4% of patients had received the AstraZeneca vaccine. The effectiveness of the Sputnik vaccine was lower than other vaccines. **Conclusion:** Given that hemodialysis patients are considered to be a susceptible and high-risk group in terms of contracting COVID-19, completing the COVID vaccine dose is considered essential. In this group of patients, the type of vaccine should be selected based on the patient's antibody level, as recommended by a physician.

Cite this article as: Kaviani M, Rasoulzadeh N, Keshavarz F, Hosseinzadeh F, Haddadi R. Evaluation of the Effect of COVID-19 Vaccine in Preventing COVID-19 Infection in Hemodialysis Patients. *J Emerg Health Care. 2025;14(1):20.* <https://doi.org/10.22034/jehc.14.1.20>.

Introduction

More than four years have passed since the emergence of the COVID-19 pandemic. Undoubtedly, this disease will be recorded in history as one of the most devastating tragedies of the modern era (1). COVID-19 originated in Wuhan, China in 2019 (2). In a short period, it caused a global pandemic (3, 4). Iran was among the countries where the outbreak of this disease

was confirmed very early and rapidly (4, 5). The spread and dynamics of this disease were very high and unpredictable (6). One of the reasons for the high prevalence of this disease in Iran was the lack of a vaccine to prevent it (7). Because throughout the recent centuries, safe and effective vaccines have played an important role in controlling and ending epidemics (8).

Correspondence:

Rana Haddadi

E-mail: Rana.hadadi1373@gmail.com



This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0) which allows users to read, copy, distribute and make derivative works for non-commercial purposes from the material, as long as the author of the original work is cited properly.

Fortunately, the unprecedented and coordinated efforts of world governments, scientific institutions, and the private sector have led to tremendous responses to this widespread attack. Approximately one year after the emergence of the pandemic, dozens of COVID-19 vaccines were in various stages of clinical evaluation, human clinical trials, or final testing (1). Therefore, the rapid development and global distribution of COVID-19 vaccines is considered a significant achievement in biomedical research (9). Hence, vaccination is considered the most important method of preventing COVID-19 infection (10).

The World Health Organization-approved vaccines for COVID-19 are the AstraZeneca, Moderna, Janssen, Sputnik V, Pfizer, Sinopharm, and Bharat Biotech vaccines (11, 12).

Vaccination of hemodialysis patients against COVID-19 disease is of particular importance, as these patients are at high risk of severe infection, hospitalization and death from COVID-19 due to immunodeficiency and underlying diseases (13). Vaccination of hemodialysis patients is one of the most important ways to reduce the risk of COVID-19 infection and its complications. These patients should follow their vaccination schedule in accordance with the new recommendations of health organizations and be under the supervision of a doctor to create the best immunity against the virus (14, 15).

While mistrust and hesitancy towards vaccination are influenced by confidence in vaccine safety and efficacy, they can also be affected by various socio-economic and cultural factors, such as religious beliefs, fake news and misinformation about vaccines, and the general public's health literacy (16, 17). Furthermore, previous research has shown that compliance and acceptance of vaccines are variable and inconsistent, achieving widespread acceptance requires extensive education regarding the safety and efficacy of various vaccines (18). Few studies have been conducted on the effectiveness of the Covid-19 vaccine (19). Therefore, in this study, the researchers set out to conduct a study entitled "Investigating the willingness to receive the Covid-19 vaccine and related factors in hemodialysis patients."

Methods

This descriptive cross-sectional study was conducted on 240 hemodialysis patients admitted to the hemodialysis ward of hospitals affiliated with Tehran University of Medical Sciences in 2023. Inclusion criteria for this study included all patients with an admission record undergoing hemodialysis 2 to 3 times a week, with a duration of kidney disease and hemodialysis of more than 1 year. All research units were aware of the time and place, and had the ability to establish verbal and visual communication.

The sample size of this study was calculated to be 240 people based on this formula

$$n = \frac{(z_{1-\alpha/2} + z_{1-\beta})^2}{w^2} + 3$$

The sampling method in this study was cluster sampling. First, a list of hospitals in Tehran was selected. Two centers were randomly selected. Then a list of research units was prepared, and patients who met the research conditions were selected by simple random sampling. The data collection tool in this study was a demographic checklist including age, gender, duration of dialysis, dialysis frequency per week, vaccine type, number of vaccine doses, underlying cause, and history of COVID-19 infection. This project, after approval by the Ethics Committee of Tehran University of Medical Sciences with the number (IR.TUMS.FNM.REC.1400.098), was carried out. After obtaining permission from hospital authorities and explaining the research objectives to the participating units, the researcher assured them of the safety and anonymity of their data. All research units were also given the option to withdraw from the study if they wished. After obtaining informed consent from the research units, data were collected through self-reporting. The data were analyzed using SPSS21 statistical software with descriptive statistics (tables, mean, standard deviation) and inferential statistics (chi-square, Fisher's exact test) at a significance level of 0.05.

Results

The average age of the research units was 52.25 + 8.97 years. In terms of gender, 40.4% (97 individuals) were male and 59.6% (142 individuals) were female. The duration of the kidney disease was 9.05 + 2.11 years. 80.81% (194 individuals) underwent hemodialysis three times a week, and 19.2% (46 individuals) underwent it twice a week. 39.2% (n=94) had a prior history of COVID-19 infection. 87.1% (209 individuals) had received three doses of the COVID-19 vaccine, and 12.9% (31 individuals) had received two doses. Regarding the type of vaccine, 35.4% (85 individuals) received the AstraZeneca vaccine, 22.5% (66 individuals) received the Sinopharm vaccine, 22.5% (54 individuals) received the Sputnik vaccine, and 3.3% (8 individuals) received the Barekat vaccine (Table 1).

Fisher's exact test showed a significant difference between the type of COVID-19 vaccine and the incidence of COVID-19 disease ($P < 0.01$). The incidence of COVID-19 disease was higher in the Sputnik vaccine (Table 2).

The Fisher exact test showed a significant difference between the number of vaccine doses and COVID-19 disease. 2 doses of vaccine provide little immunity (Table 3).

Table 1: Absolute and Relative Frequency Distribution of COVID-19 Vaccination in Hemodialysis Patients

| Factors Influencing COVID-19 Vaccination | | |
|--|-------------|-------------|
| History of COVID-19 infection | Yes | 94 (39.2%) |
| | No | 146 (60.8%) |
| Number of COVID-19 vaccine injection doses | 2 times | 31 (12.9%) |
| | 3 times | 209 (87.1%) |
| COVID-19 vaccine type | Sinopharm | 54 (22.5%) |
| | AstraZeneca | 85 (35.4%) |
| | Sputnik | 27 (11.3%) |
| | Bharat | 8 (3.3%) |
| | Barekat | 66 (27.5%) |

Table (2) Relationship between COVID-19 infection and vaccination type in hemodialysis patients

| COVID-19 infection \ Vaccination type | Yes | No | The percentage of infection | P_Value |
|---------------------------------------|-----|-----|-----------------------------|---------|
| Sinopharm | 21 | 33 | 38.88% | P=0/01 |
| Astrazeneca | 19 | 47 | 38.35% | |
| Sputnik | 47 | 38 | 55.29% | |
| Bharat | 0 | 8 | 0% | |
| Barekat | 7 | 20 | 25.92% | |
| total | 94 | 146 | 39.2% | |

Table 3: Correlation of COVID Vaccine Dose Number with COVID-19 infection in Hemodialysis Patients

| COVID-19 infection \ Vaccine Dose | Yes | No | P_Value |
|-----------------------------------|-----|-----|---------|
| 2 doses of vaccine | 31 | 0 | P=0/01 |
| 3 doses of vaccine | 61 | 146 | |

Discussion

The study results indicated that 39.2% of hemodialysis patients had contracted COVID-19. Patients with chronic kidney disease (CKD) on dialysis have a weaker immune response compared to healthy individuals, placing them at a higher risk of severe COVID-19 complications. Therefore, vaccination is considered a supportive preventive measure in hemodialysis patients (15, 20, 21).

Although studies have shown that education plays a significant role in improving health and preventing diseases (22-24), preventative measures such as vaccination are crucial to ensure protection for dialysis patients against illnesses. However, successful protection through vaccination can be challenging in these individuals, as impaired immune responses to infections are also associated with reduced immune responses to vaccines (13).

COVID-19 poses a major threat to patients with chronic kidney disease. It significantly increases their risk of mortality. In these patients, in addition to therapeutic interventions, vaccination can be very helpful. However, the severity of kidney disease and also

the concurrent administration of immunosuppressive drugs can affect the efficacy of SARS-CoV-2 vaccines (25).

This study demonstrated that despite vaccination, the incidence of COVID-19 remained higher in patients with kidney disease. Like other vaccines used throughout history, the COVID-19 vaccine, while offering good individual protection, does not have 100% efficacy, and at best, can prevent up to 95% of COVID-19 infections. Therefore, there is still a small chance of infection, and this small probability should be reduced by using all preventive methods. Also, preliminary data suggest that vaccines may be less effective against some variants (26).

The results of this study showed that the injection of two doses of the vaccine provided less immunity in patients. It can be said that the effectiveness of the vaccine has been shown in completing the vaccination dose. According to the studies conducted, completing the vaccination program and injecting three doses of the vaccine leads to more immunity (27). Adherence to the injection of two vaccinations plays an important role in

the prevention of infectious diseases and the exacerbation of chronic diseases (19).

Therefore, high acceptance and coverage rates are considered crucial for the success of immunization programs (28). In addition to vaccination, educational methods and patient empowerment in self-care should be utilized (29, 30).

The results indicated that the highest percentage of research units had used the AstraZeneca vaccine. According to articles published on February 15, 2019, the AstraZeneca vaccine was introduced as a safe vaccine in preventing COVID-19 (27). The effectiveness of the AstraZeneca vaccine has been shown to be greater than other vaccines (18). However, it can be said that the tendency to accept the vaccine is associated with factors such as age, belief in fatalism, average household expenditure, and socio-economic status (28). In this study, the highest incidence of COVID-19 disease was in the Sputnik vaccine injection. This is despite the fact that studies have reported the effectiveness of this vaccine to be 96% (31). The high humoral and cellular immune response of this vaccine is associated with good tolerance, immunogenicity, and efficacy (32). However, the Sputnik vaccine should be injected in patients with high antibody levels. This is because in patients with low antibody levels, the side effects of this vaccine are greater (33). The Sputnik vaccine has more side effects than other vaccines (34).

It can be said that the effectiveness of vaccines may vary depending on differences in demographic characteristics and the type of disease. In general, the small sample size of the study can be mentioned as one

of its limitations. In future studies, a similar study can be conducted on a larger sample size.

Conclusion

The results of this study showed that, due to their lower level of immunity, hemodialysis patients are more susceptible to COVID-19. In patients who did not complete the vaccination dose, the rate of infection was higher. Also, the protective effect of the Sputnik vaccine was lower, which requires further investigation of this vaccine in hemodialysis patients. Therefore, it is necessary for managers and health system officials, by raising awareness among patients, not to rely solely on vaccination in the prevention of the disease.

Patients undergoing hemodialysis utilize the COVID-19 sputnik vaccine. The rate of COVID-19 infection is higher. The use of the Sputnik vaccine in hemodialysis patients had fewer effects. It can be said that the injection of this vaccine in patients with lower immune systems has a lower antibody titer, which is less effective.

Acknowledgement

In conclusion, the researcher wishes to express sincere gratitude to the research units whose cooperation and assistance were invaluable to this study.

Conflict of Interest

In the conduct of this research, no conflict of interest was observed.

References:

- Ahmed LA, Mansour HH, Elshennawy SI, Ramadan MA, Kamal MA, Mohamed SS, et al. Two versus three doses of COVID-19 vaccine and post-vaccination COVID-19 infection in hemodialysis patients. *Infection Prevention in Practice*. 2024;6(1):100338.
- Rezaie A, Taghadosi M, Molayi F, Asgarian FS, Raygan F, Sehat M. Cardiovascular complications in patients hospitalized with COVID-19: A cross-sectional study. *Journal of Nursing Advances in Clinical Sciences*. 2024;1(2):71-7.
- Ke R, Sanche S, Romero-Severson E, Hengartner N. Fast spread of COVID-19 in Europe and the US suggests the necessity of early, strong and comprehensive interventions. *MedRxiv*. 2020.
- Rezaei M, Borzou SR, Solgi S, Hojjatoleslami S. Spiritual health and death anxiety in nursing students during COVID-19 pandemic: A cross-sectional study. *Journal of Nursing Advances in Clinical Sciences*. 2024;1(Issue 1):16-23.
- Nakhaeizadeh A, Mohammadi S. Assessing the level of engagement in preventive behaviors and COVID-19 related anxiety in Iranian adults. *Avicenna Journal of Nursing and Midwifery Care*. 2021;29(2):160-70.
- Imanipour M, Shahmari M, Azizi Mahkooyeh S, Ghobadi A, Sanjari P. Reflections on health information sources in epidemics in synchrony with the COVID-19 pandemic: A scoping review. *Journal of Nursing Advances in Clinical Sciences*. 2024;1(Issue 1):43-50.
- Bai Y, Yao L, Wei T, Tian F, Jin D-Y, Chen L, et al. Presumed asymptomatic carrier transmission of COVID-19. *Jama*. 2020;323(14):1406-7.
- Mafinezhad S, Rashidi Fakari F, Talebzadeh M, Namdar Ahmadabad H, Bayani G. Investigating the factors related to the acceptance of the Covid-19 vaccine by the parents of children aged 5 to 12 years. *Avicenna Journal of Nursing and Midwifery Care*. 2024;32(2):150-61.
- Arman BY, Clarke R, Bharucha T, Fernandez LG, Walsby-Tickle J, Deats M, et al. Identifying falsified COVID-19

- vaccines by analysing vaccine vial label and excipient profiles using MALDI-ToF mass spectrometry. *NPJ Vaccines*. 2025;10(1):19.
10. Asadi M, Kiani A, Azimi L, Gharibi Z. COVID-19 related anxiety and self-care behaviors in students based on demographic characteristics: A cross-sectional study. *Journal of Clinical Psychology*. 2021;13(Special Issue 2):169-80.
 11. Xia S, Zhang Y, Wang Y, Wang H, Yang Y, Gao GF, et al. Safety and immunogenicity of an inactivated SARS-CoV-2 vaccine, BBIBP-CorV: a randomised, double-blind, placebo-controlled, phase 1/2 trial. *The Lancet infectious diseases*. 2021;21(1):39-51.
 12. Tse LV, Meganck RM, Graham RL, Baric RS. The Current and Future State of Vaccines, Antivirals and Gene Therapies Against Emerging Coronaviruses. *Front Microbiol*. 2020;11:658.
 13. Roupheal N, Bausch-Jurken M. COVID-19 vaccination among patients receiving maintenance renal replacement therapy: immune response, real-world effectiveness, and implications for the future. *The Journal of Infectious Diseases*. 2023;228(Supplement_1):S46-S54.
 14. Selvanathan DK, Parthasarathy R, Rohit A, Venkataramanan S, Dsouza C. Neutralizing Anti-SARS-CoV-2 Antibody Response to COVID-19 Vaccines-ChAdOx1-nCoV-19 and BBV152 Among Hemodialysis Patients. *Indian J Nephrol*. 2025;35(1):82-4.
 15. Alcantara Sanchez L, Alvarez Guerra E, Li D, King SM, Hilchey SP, Zhou Q, et al. Antibody Response to SARS-CoV-2 Vaccines in Transplant Recipients and Hemodialysis Patients: Data from the Dominican Republic. *Vaccines*. 2024;12(12):1312.
 16. Simone L, Vagni M, Gnagnarella C, Bersani G, Pajardi D. Mistrust and Beliefs in Conspiracy Theories Differently Mediate the Effects of Psychological Factors on Propensity for COVID-19 Vaccine. *Front Psychol*. 2021;12:683684.
 17. Karlsson LC, Lewandowsky S, Antfolk J, Salo P, Lindfelt M, Oksanen T, et al. The association between vaccination confidence, vaccination behavior, and willingness to recommend vaccines among Finnish healthcare workers. *PLoS One*. 2019;14(10):e0224330.
 18. Bagheri Sheykhgafshe F. COVID-19 Vaccination: Challenges and Opportunities. *RUMS_JOURNAL*. 2022;20(11):1289-94.
 19. Singh C, Naik BN, Pandey S, Biswas B, Pati BK, Verma M, et al. Effectiveness of COVID-19 vaccine in preventing infection and disease severity: a case-control study from an Eastern State of India. *Epidemiol Infect*. 2021;149:e224.
 20. Lürken K, Meinecke A, Manthey LA, Cossmann A, Stankov MV, Klawonn F, et al. Impaired Hepatitis B and COVID-19 vaccination responses show strong concordance in hemodialysis patients with end stage renal disease. *European Journal of Medical Research*. 2025;30(1):34.
 21. Karjalian F, Momennasab M, Kordi Yoosfinejad A, Ezzatzadegan Jahromi S. Effect of manual acupuncture (points SP6, SP10, ST36, and LI11) on the uremic pruritus and quality of life in hemodialysis patients: A parallel, randomized controlled trial. *Journal of Nursing Advances in Clinical Sciences*. 2024;1(Issue 4):211-8.
 22. Khezerlou Z, Aghakhani N, Cheraghi R, Alinejad V. Effect of self-care education via distance learning and the reversal method on self-care behaviors and quality of life in patients with heart failure: A quasi-experimental study. *Journal of Nursing Advances in Clinical Sciences*. 2024;2(Issue 2):63-70.
 23. Motahari Niya H, Hojjati H. The impact of General Psychological Training on the self-efficacy of Mothers whose Children Undergoing Surgery in Taleghani Pediatrics Hospital in Gorgan, Iran. *Journal of Research Development in Nursing and Midwifery*. 2019;16(1):43-50.
 24. Habibi K, Alimohammadzadeh K, Hojjati H. The Effect of Group Reality Therapy on the Coping of Spouses of Veterans with Post-traumatic Stress Disorder. *jhpmir*. 2018;6(6):1-7.
 25. Hassanshahi J. Vaccination in Patients with Kidney Disorders in the period of Corona Disease: Point of View. *RUMS_JOURNAL*. 2022;21(4):478-80.
 26. Aghaei M, Yunesian M. The Necessity to Keep Taking Health Protocols in People Receiving the Covid-19 Vaccine. *ssu-mshsj*. 2021;6(2):83-6.
 27. Razazian N, Sahraian M-A, Eskandarieh S, Jafari N, Rezaei M, Fakhri N. Outcomes of AstraZeneca vaccine for relapse and Covid-19 infection in people with multiple sclerosis. *Tehran-Univ-Med-J*. 2022;80(6):462-9.
 28. Salimi Y, Paykani T, Ahmadi S, Shirazikhah M, Almasi A, Biglarian A, et al. Covid-19 Vaccine Acceptance and Its Related Factors in the General Population of Tehran and Kermanshah. *irje*. 2021;16(5):1-9.
 29. Davoodi R, Alijani Renani H, Moradi Kalboland M, Saki Malehi A. The prevalence of high-risk behaviors in the second year of public high school students based on demographic variables: A cross-sectional study. *Journal of Nursing Advances in Clinical Sciences*. 2024;2(Issue 1):40-5.
 30. Rahgoi A, Sobhanifar F, Ahmadi Jirandeh R, Javanbakht S. Effect of the 5A self-care model on chronic diseases in Iran: A systematic review. *Journal of Nursing Advances in Clinical Sciences*. 2024;2(Issue 1):46-52.
 31. Tavakkoli S, Moradian F, Sobhani A, Rostami Nejad M. Association Between ABO Blood Types and the Side Effects of the First and Second Doses of COVID-19 Vaccination: a Cross-Sectional Study at Shahid Beheshti University of Medical Sciences. *SOREN Student Sports & Health Open Researches e-Journal: New-Approaches*. 2022;3(2).
 32. Ataei YS. Covid-19: Investigation of Important Mutations and their Effect on Vaccine Efficacy. *SSU_Journals*. 2024;31(10):107-70.

33. Zomorodi Zare F, Khosravi Shadmani F, Safari Faramani R, Torkamasadi F, Rezaei Y, Najafi F. Evaluating the Effectiveness of the COVID-19 Vaccines on Infection Indicators and Severe Outcomes in Hamadan Province (2021-2022). *irje*. 2024;20(1):35-44.
34. Vera-Lastra O, Mora G, Lucas-Hernández A, Ordinola-Navarro A, Rodríguez-Chávez E, Peralta-Amaro AL, et al. New Onset Autoimmune Diseases after the Sputnik Vaccine. *Biomedicines*. 2023;11(7).