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Vaccine hesitancy and acceptance among hemodialysis patients: a cross-sectional study in Turkey

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Abstract

Background Vaccine hesitancy remains a significant issue threatening public health. The study aimed to determine the vaccination status of patients undergoing hemodialysis for chronic kidney disease and to analyze their levels of vaccine hesitancy.

Methods This cross-sectional analytical study was conducted in hemodialysis centers located in Ankara, the capital of Turkey. Data collection involved a structured questionnaire capturing sociodemographic details, comorbidities, vaccination history, and hesitancy levels, coupled with the Vaccine Hesitancy Scale (VHS), a 9-item tool validated in Turkish that measures trust in vaccines and perceived risks.

Results Among the 548 participants (mean age: 60.4 ± 12.9 years, range: 18–93; 57.8% male), 38.9% had a high school education or higher, and 52.7% reported income below their expenses. Despite 92.7% having received at least one vaccine during adulthood, knowledge about vaccines was limited, with only 7.7% answering all vaccine-related questions correctly. Influenza (73.4%) and hepatitis B (58.4%) were the most administered vaccines. The median VHS score was 32 (range: 11–45), with 84.7% scoring above 25, reflecting low overall hesitancy. Participants who identified physicians (76.6%) and healthcare workers (57.5%) as trusted sources of vaccine information tended to have lower hesitancy scores ($p < 0.001$). No significant associations were found between hesitancy and gender, education, income level, or general health perception.

Conclusions While vaccination rates among hemodialysis patients are relatively high, critical gaps in knowledge persist, emphasizing the need for targeted educational programs. The active involvement of healthcare professionals is crucial to reduce hesitancy and enhance vaccine confidence in this vulnerable population.

Keywords Vaccine hesitancy, Hemodialysis patients, Immunization, Health education, Vaccine acceptance, Turkey

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Introduction

Vaccination is a cornerstone of modern public health, significantly reducing morbidity and mortality associated with infectious diseases and saving millions of lives globally. Regardless of income level, vaccination is a cost-effective approach that prevents approximately 5 million deaths annually. It is estimated that increasing global vaccination coverage could prevent an additional 1.5 million deaths each year [1]. Beyond protecting individuals, vaccination reduces the spread of pathogens through herd immunity, indirectly safeguarding unvaccinated populations [2]. The success of widespread vaccination efforts is evident in achievements such as the eradication of smallpox and the elimination of polio in many regions [3, 4].

Despite these remarkable successes, vaccine hesitancy has emerged as a growing global concern in recent years and is considered one of the top ten global health threats [5]. The World Health Organization (WHO) defines vaccine hesitancy as "the delay in acceptance or refusal of vaccines despite the availability of vaccination services" [6]. In Turkey, as in many parts of the world, vaccine hesitancy spans a spectrum ranging from delayed acceptance of certain vaccines to outright refusal of all vaccines [7]. Vaccine hesitancy arises from a wide array of interconnected sociocultural, psychological, and systemic factors. Doubts about vaccine safety, mistrust in healthcare systems, health professionals, and vaccine manufacturers, as well as misinformation spread through various media platforms, contribute to hesitancy in different societal groups [3, 4, 8].

Effective strategies to combat vaccine hesitancy include tailored educational interventions, leveraging trusted healthcare professionals to communicate the benefits and safety of vaccines, employing reminders for both patients and providers, addressing missed vaccination opportunities, and minimizing logistical barriers to vaccination [4, 8].

Vulnerable populations, particularly immunocompromised individuals, are disproportionately affected by vaccine hesitancy. People with weakened immune systems due to chronic illnesses, cancer, HIV, organ transplants, hemodialysis (HD) treatment, or autoimmune diseases are at heightened risk for vaccine-preventable diseases. For these individuals, complications from vaccine-preventable diseases can be life-threatening, making vaccination critically important. Due to their compromised immunity, these individuals may exhibit suboptimal responses to vaccines, making them dependent on herd immunity. However, increasing societal vaccine hesitancy exacerbates the infection risks faced by these vulnerable groups [9–11].

Patients undergoing HD treatment are at a high risk for vaccine-preventable infections due to their weakened immune systems and frequent medical interventions. Consequently, vaccinations such as influenza, tetanus, pneumococcus, and hepatitis are recommended for these individuals. Chronic kidney disease (CKD), distinct from other chronic conditions, is also classified as an immunosuppressive disease. Thus, higher doses or more frequent vaccine schedules, such as double doses of hepatitis B vaccine in advanced stages, are recommended to elicit adequate immune responses [10, 12].

Understanding the vaccination status and vaccine hesitancy levels among HD patients with CKD, as well as the factors influencing these behaviors, is essential for planning interventions aimed at increasing vaccine acceptance and protecting patients from preventable infections. The objective of this study is to determine the vaccination status of HD patients with CKD and analyze their levels of vaccine hesitancy.

Materials and methods

Study design

This cross-sectional analytical study was conducted between December 1, 2024, and January 15, 2025, in hemodialysis (HD) centers located in Ankara, the capital of Turkey. The study adhered to the principles of the Declaration of Helsinki and received ethical approval from the Istanbul Faculty of Medicine Ethics Committee. Furthermore, necessary institutional permissions were secured from the relevant HD centers, and informed consent was obtained from all participants.

Study population

A meta-analysis study on vaccine hesitancy covering all population groups in Turkey was utilized [7]. For sample size calculation, the vaccine hesitancy rate was taken as 20.4% based on the findings of this meta-analysis. Assuming a type I error of 5% and a power of 80%, the minimum required sample size was calculated as 473 using the G*Power program.

A convenience sampling technique was used for recruitment. The study population consisted of 548 patients aged 18 years and older who had been undergoing HD treatment for at least six months, had no communication barriers, and consented to participate in the study. Since all eligible patients were included, no sampling procedure was applied.

Data collection tool

Data were collected through structured face-to-face interviews using a questionnaire. For literate participants, responses were provided under observation. Regarding illiterate participants, data collection was conducted by researchers who verbally presented the questions, and participants' responses were recorded accordingly. The questionnaire used in this study was developed by the authors, guided by a thorough review of the relevant

literature, in addition to the validated and reliable scales employed. An English version of the questionnaire is provided as a supplementary file. The questionnaire covered sociodemographic characteristics, comorbidities, health status, perceptions about vaccines, vaccination history, vaccine knowledge, and the Vaccine Hesitancy Scale.

- Vaccination Status: Self-reported vaccination history was considered.
- Vaccine Knowledge: Assessed using a questionnaire designed to evaluate participants' understanding of vaccination. Participants were asked to respond to each statement by selecting "true," "false," or "I don't know." This questionnaire was not a standardized tool but was developed by the researchers based on vaccine-related information provided to the public on the Turkish Ministry of Health's official website. The evaluation was conducted based on the number of correctly answered questions. The questionnaire consisted of 10 items, scored from 0 to 10, with higher scores indicating greater vaccine knowledge. The Cronbach's alpha for the questions was calculated as 0.709, indicating acceptable internal consistency.
- Vaccine Hesitancy: Measured using the "Vaccine Hesitancy Scale," developed by the SAGE Working Group and adapted by Luyten et al. (2019) to assess hesitancy toward all vaccines. The scale was validated in Turkish by Yılmaz et al. (2021), with a reported Cronbach's alpha of 0.874 [13, 14]. In our study, the Cronbach's alpha for the scale was calculated as 0.915. This scale includes nine items across two subdimensions: trust deficit (7 items) and risk perception (2 items). Responses are recorded on a 5-point Likert scale: "strongly agree," "agree," "neutral," "disagree," and "strongly disagree." The total score ranges from 9 to 45, with no established cutoff point. Higher scores indicate lower vaccine hesitancy.

Data analysis methods

Descriptive statistics for continuous variables are presented as mean, standard deviation, median, and minimum-maximum values, while categorical variables are reported as frequencies and percentages.

The Kolmogorov-Smirnov test was used to assess the normality of data distribution. Comparisons of continuous variables between groups were performed using the Mann-Whitney U test. The relationship between vaccine hesitancy and vaccine knowledge was examined using Spearman correlation analysis. Correlation coefficients were interpreted as follows: 0.00–0.29 (weak), 0.30–0.49 (moderate), and ≥ 0.50 (strong). A p-value of < 0.05 was considered statistically significant. Data analysis was performed using SPSS 21.0 software.

Results

Sociodemographic characteristics

The mean age of the 548 participants was 60.4 ± 12.9 years (range: 18–93), with 57.8% ($n = 317$) being male. Nearly half of the patients ($n = 213$) had a high school education or higher. The majority (74.5%, $n = 408$) reported being married, and 52.7% ($n = 289$) stated that their income was lower than their expenses. Most participants (94.2%, $n = 516$) lived in urban areas, and approximately one-third (32.7%, $n = 179$) had a household member under 6 years old or over 65 years old.

Regarding smoking habits, 20.8% ($n = 114$) were current smokers, while 20.3% ($n = 111$) had quit smoking. Among comorbid conditions, diabetes was the most common (51.6%, $n = 283$), followed by hypertension (42.9%, $n = 235$). When asked to assess their health status, 56.5% ($n = 310$) described their health as good, very good, or excellent (Table 1).

Perceptions about vaccines and vaccination status

When evaluating participants' responses to questions about vaccines, 72.4% ($n = 397$) indicated that vaccines are necessary for infants, 68.8% ($n = 377$) for the elderly, 66.1% ($n = 362$) for patients, and 32.1% ($n = 176$) for pregnant women. In contrast, fewer participants (18.8%, $n = 103$) believed that healthy adults should also be vaccinated.

Regarding the vaccines deemed necessary, the most frequently mentioned were influenza (81.4%, $n = 446$) and hepatitis B (73.2%, $n = 401$). When asked about their vaccination history during adulthood, 92.7% ($n = 508$) of participants stated they had received at least one vaccine after the age of 18. The most frequently administered vaccines were influenza (73.4%, $n = 402$), hepatitis B (58.4%, $n = 320$), and COVID-19 (20.4%, $n = 112$) (Table 2).

Among those who had not been vaccinated ($n = 40$), the main reasons for avoiding vaccination included fear of side effects (30.0%, $n = 12$), believing in the natural course of the disease (17.5%, $n = 8$), thinking that vaccines are not effective (15.0%, $n = 6$), and not perceiving themselves to be at risk (12.5%, $n = 5$).

Knowledge levels and information sources regarding vaccines

In total 82.8% ($n = 454$) of the participants reported receiving information about vaccines from at least one source. The most common sources of vaccine informatio were doctors (76.6%, $n = 420$) and other healthcare profeccionals (57.5%, $n = 315$), followed by resources from the Ministry of Health (22.3%, $n = 122$) and pharmacists (15.1%, $n = 83$).

Table 1 Sociodemographic characteristics, habits, and comorbidities of Hemodialysis patients

Category		Number	Percentage
Sex	Male	317	57.8
	Female	231	42.2
Marital Status	Married	408	74.5
	Single	88	16.1
	Divorced	26	4.7
	Widowed	26	4.7
Education Status	Illiterate	51	9.3
	Literate	20	3.6
	Primary School	186	33.9
	Middle School	78	14.3
	High School	126	23.0
	University	87	15.9
Perceived Income Level	Income lower than expenses	289	52.7
	Income equal to expenses	207	37.8
	Income higher than expenses	52	9.5
Place of Residence	Rural Area-District-Village	32	5.8
	Urban Area	516	94.2
Household Members (age < 6 and/or > 65)	Present	179	32.7
	Absent	369	67.3
Smoking Status	Former Smoker	111	20.3
	Current Smoker	114	20.8
	Never Smoked	323	58.9
Chronic Disease*	DM	283	51.6
	HT	235	42.9
	Cardiovascular Disease	39	7.1
	Respiratory System Disease	13	2.4
	Cancer	10	1.8
General Health Status	Poor	28	5.1
	Fair	210	38.4
	Good	255	46.6
	Very Good	50	9.2
	Excellent	4	0.7

* Each disease presence was analyzed individually, and each was evaluated based on the total sample size of $n = 548$

The median score on the 10-item test assessing participants' knowledge about vaccines was 5.0 (range, 0.0–10.0). Only 7.7% ($n = 42$) of participants answered all the questions correctly, while 8.6% ($n = 47$) did not answer any questions correctly.

The most correctly answered questions were "Vaccines are administered to healthy individuals to protect them from diseases" (69.9%), "There are free vaccines for adults in our country" (65.7%), and "Vaccines are necessary for individuals over 18 years old" (64.8%). The least known statements were "Vaccines do not cause rheumatic diseases" (52.0%), "Vaccines used in our country do not contain pork-devided products" (51.6%), and "There is no link between vaccines and autism" (49.3%) (Fig. 1).

Results of the vaccine hesitancy scale

The median score of all participants on the "Vaccine Hesitancy Scale" was 32 (range: 11–45). For the subdimensions of the scale, the median score was 27 (range: 7–35) in the trust subdimension and 5 (range: 2–10) in the risk subdimension.

A total of 84.7% ($n = 465$) of participants scored above 25, indicating that their hesitancy, as assessed by the total score, was below 50.0%, reflecting relatively low overall levels of hesitancy (Fig. 2). When examining the distribution of responses to the scale items, the most hesitated topics were identified as "I am worried about serious side effects of vaccines," "New vaccines carry more risks than older vaccines," and "All vaccines included in the state-provided immunization program are beneficial." Conversely, the items with the least hesitancy were identified as "Getting vaccinated is important for the health of others," "Vaccines are effective," and "Vaccines are important for my health." The distribution of responses to the scale items is shown in Fig. 3.

Table 2 Distribution of vaccines deemed necessary and administered during adulthood (18 years and older)

		Number*	Percentage
Vaccines Deemed Necessary	Influenza	446	81.4
	Hepatisis B	401	73.2
	Tetanus-Diphtheria	172	31.4
	Pneumococcal	130	23.7
	MMR	116	21.2
	Varicella	115	21.0
	Hepatisis A	114	20.8
	Rabies	98	17.9
	HPV	80	14.6
	Pertussis	63	11.5
	Meningococcal	57	10.4
	Shingles	50	9.1
	Hib	35	6.4
Vaccines Administered	Influenza	402	73.4
	Hepatisis B	320	58.4
	COVID-19	112	20.4
	Tetanus	35	6.4
	Pneumococcal	27	4.9
	Hepatisis A	20	3.6
	MMR	17	3.1
	Varicella	12	2.2
	Hib	7	1.3
	Rabies	4	0.7
	Pertussis	2	0.4
	HPV	1	0.2

* Multiple responses were allowed

Vaccine hesitancy scale scores and influencing factors

No statistically significant differences were observed in VHS scores based on gender ($p = 0.066$), marital status ($p = 0.097$), education level ($p = 0.216$), perceived income level ($p = 0.29$), place of residence ($p = 0.099$), presence of household members under 6 years old and/or over 65 years old ($p = 0.817$), or general health perception ($p = 0.077$). Additionally, there were no differences in VHS scores between those who had been vaccinated during adulthood and those who had not ($p = 0.168$). In univariate analyses, no significant association was found between vaccine hesitancy and potential confounding variables such as age, gender, education and income level. Consequently, multivariate analysis was not conducted.

Participants who received vaccine information from any source tended to have lower hesitancy scores ($p < 0.001$), with the lowest scores observed among those who obtained information from a doctor ($p = 0.001$) or another healthcare professional ($p = 0.04$). However, there was no difference in hesitancy levels when the information source was the Ministry of Health ($p = 0.294$) or a pharmacist ($p = 0.915$).

As vaccine knowledge levels increased, hesitancy decreased, with a weak correlation observed between the two variables ($r = 0.142$, $p = 0.001$).

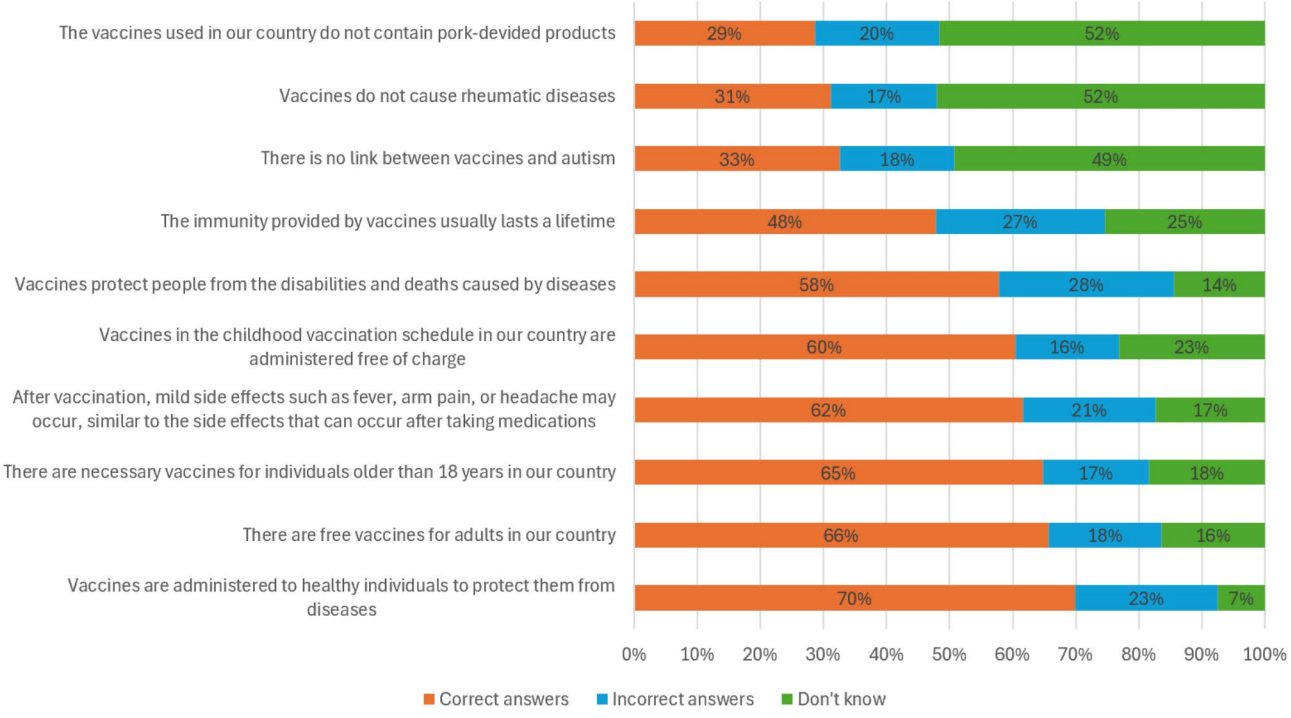

Fig. 1 Distribution of participants' responses to Vaccine Knowledge Questions

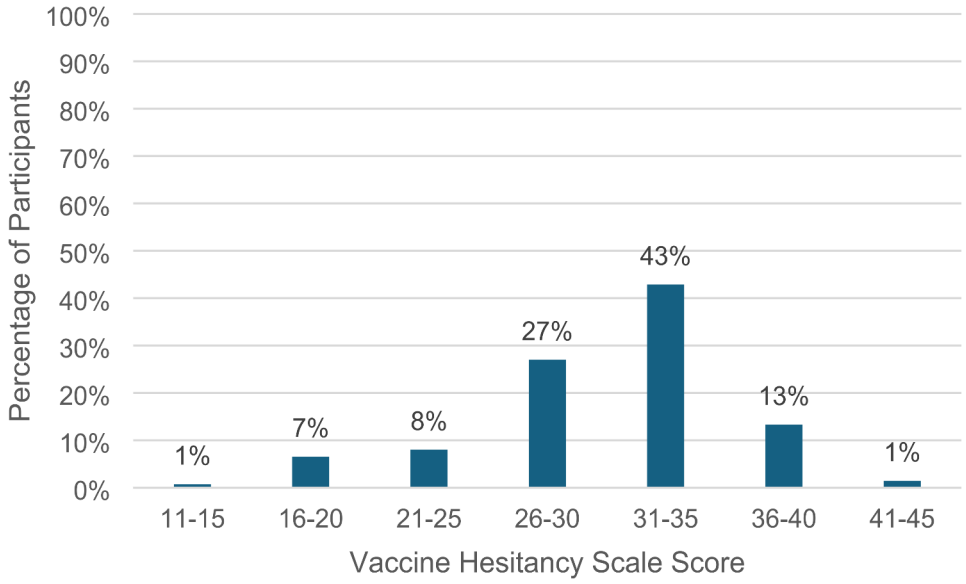

Fig. 2 Distribution of Vaccine Hesitancy Scale scores among hemodialysis patients

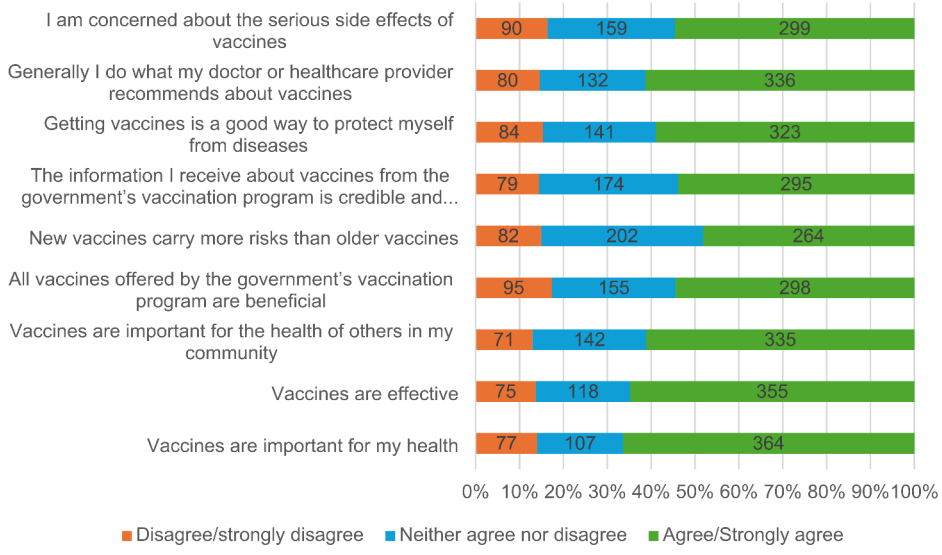

Fig. 3 Distribution of participants' responses to each item on the vaccine hesitancy scale

Discussion

This study provides detailed insights into vaccine hesitancy/refusal and vaccination status among hemodialysis patients, offering valuable information on the subject.

Sociodemographic characteristics and vaccine hesitancy

The findings of this study indicate that most participants were older adults with a predisposition to multiple chronic diseases, particularly diabetes (51.6%) and hypertension (42.9%). HD patients are more vulnerable to infections due to immunosuppression and comorbidities such as diabetes, hypertension, and cardiovascular diseases. From this perspective, vaccine hesitancy or refusal could have serious adverse consequences for these patients' health.

In general, age, chronic disease presence, and education level are known to be key determinants of vaccine hesitancy [15]. However, some studies suggest that advanced age does not always increase vaccine acceptance and may even reinforce hesitancy due to concerns about side effects or misinformation [16]. In this study, no significant differences in vaccine hesitancy levels were observed among HD patients based on sociodemographic variables. Hesitancy levels did not differ between vaccinated and unvaccinated adults, which is notable. Although significant associations between education and

vaccine hesitancy have been reported in general population samples [17–19], it is possible that the burden of chronic illness and the necessity for regular medical follow-ups among HD patients may lead to different motivations or attitudes toward vaccination. Particularly in intensive medical management scenarios such as HD, the direct guidance of healthcare professionals likely plays a crucial role in shaping individuals' attitudes toward vaccines.

Perceptions about vaccines, vaccination status, and vaccine hesitancy

In our study, participants strongly supported vaccination for infants, the elderly, and patients; however, they were less convinced of its necessity for pregnant women and healthy adults. The World Health Organization (WHO) and other international organizations emphasize the critical importance of vaccinating individuals across all age groups, not just children, to maintain immune system protection and controlling infectious diseases. Vaccination of healthy adults is essential for both individual and community immunity [20].

Participants perceived influenza and hepatitis B vaccines as the most necessary, likely due to their widespread use and public awareness. For example, the influenza vaccine provides seasonal protection, particularly for the elderly, those with chronic diseases, and immunocompromised individuals [21]. In Turkey, both the influenza and hepatitis B vaccines are available and administered under the general health insurance coverage for all individuals aged 65 and older, as well as those with chronic illnesses [12]. The influenza vaccine is recommended annually for high-risk groups. Hepatitis B vaccination, included in the national immunization schedules of many countries, including Turkey, is recommended in early childhood as well as for adults and high-risk groups [12, 22].

The data revealed that 92.7% of participants had received at least one vaccine after the age of 18, which is a positive finding regarding adult vaccination. The influenza vaccine (73.4%) was the most commonly administered, reflecting both the accessibility and perceived benefit in Turkey and the high perceived threat of seasonal influenza [21]. Hepatitis B vaccination (58.4%) was also relatively common among adults who had been vaccinated. However, the rate of COVID-19 vaccination (20.4%) was lower than for other vaccines. This may be due to the survey timing and pandemic conditions. Although many individuals were vaccinated, concerns about side effects and the novelty of COVID-19 vaccines may have contributed to the lower post-pandemic uptake [7, 15, 23].

Knowledge about vaccines and vaccine hesitancy

The study found that most participants (~83.0%) had access to at least one source of vaccine information, which played a key role in shaping their perceptions. Doctors and healthcare workers were the most cited sources, emphasizing their critical role in vaccine communication [3].

In contrast, the lower preference for Ministry of Health resources and pharmacists as information sources may be influenced by factors such as accessibility, familiarity, and trust. This finding aligns with the observation that participants who obtained information from healthcare professionals (76.6% from doctors and 57.5% from other healthcare workers) had lower hesitancy scores, while information from other sources (e.g., the Ministry of Health or pharmacists) did not result in a significant difference. These results, consistent with the literature, emphasize the importance of reliable and targeted communication strategies [17, 24].

A median score of 5 on the 10-item test, with only 7.7% answering all items correctly, indicates a significant knowledge gap and the presence of misinformation. This finding reflects the persistent need for accurate public education on vaccines, as frequently highlighted in the literature [25]. Misunderstandings about vaccine ingredients and their relationship with chronic diseases further exacerbate these challenges. Similar to findings in the literature, the study observed that increased vaccine knowledge correlates with reduced hesitancy, suggesting that targeted educational initiatives could be effective in addressing vaccine hesitancy [19].

The median score of 32 (range: 11–45) on the Vaccine Hesitancy Scale suggests a moderate level of vaccine hesitancy among participants. Subdimension analyses revealed a median score of 27 (range: 7–35) for the "trust" subdimension, indicating significant concerns about the reliability of vaccines. In contrast, the median score for the "risk" subdimension was 5 (range: 2–10), suggesting a relatively lower perception of risk. These results suggest that while agreement with statements such as "vaccines are safe" was relatively low, agreement with statements such as "the risk of harm from vaccines is very high" was also comparatively low. Notable concerns were observed regarding side effects and the perceived risks associated with new vaccines. Similar concerns have been identified in large-scale studies conducted in other countries [14, 18, 24, 26–28]. Similar studies conducted in other regions report varying levels of vaccine hesitancy among HD patients. In a study conducted in Saudi Arabia, 78.2% of hemodialysis patients expressed willingness to receive a COVID-19 booster dose, while 21.8% were hesitant or resistant [29]. Similarly, a study from Egypt categorized patients as vaccine acceptant (58.3%), hesitant (26.5%), and resistant (15.2%) [30]. Despite healthcare system

differences, vaccine hesitancy remains a global concern in HD patients. Addressing safety concerns and misinformation through tailored strategies is essential to increase vaccine acceptance in this vulnerable population.

Despite these concerns, participants acknowledged the societal benefits of vaccination and its role in protecting the health of others. Studies emphasizing the importance of community protection corroborate these findings [26–28]. This suggests that, despite lingering worries, participants possess a fundamental understanding of the importance of vaccination, offering a meaningful starting point for intervention efforts.

However, the study has several limitations. Its cross-sectional design limits the ability to establish causal relationships for vaccine hesitancy. Conducting the study exclusively in hemodialysis centers in Ankara restricts the generalizability of the findings to the broader Turkish population. Additionally, reliance on self-reported data for vaccination status and hesitancy introduces the risk of reporting bias.

Conclusion

This study, conducted with a large sample of hemodialysis patients, provides detailed insights into vaccine hesitancy/refusal and vaccination status, offering significant findings. Its focus on immunosuppressed individuals such as hemodialysis patients sheds light on a critical area of public health. The findings indicate that, despite advanced age and multiple chronic conditions, vaccine hesitancy may be more closely associated with factors such as patients' interactions with healthcare professionals, information sources, and perceptions of trust, rather than solely with sociodemographic characteristics.

A substantial proportion of participants acknowledged the societal benefits of vaccination and its role in protecting others' health. The relatively high rates of vaccination after the age of 18 indicate that hemodialysis patients do not entirely reject vaccination. In high-intensity medical care settings like hemodialysis, misinformation or lack of information may contribute to increased hesitancy, and healthcare professionals appear to play a key role in shaping attitudes toward vaccination. Therefore, ongoing and reliable information sharing by healthcare providers, along with personalized risk communication strategies and trust-building efforts, could help address vaccine hesitancy. However, broader public health strategies beyond the role of healthcare professionals are also necessary to address vaccine hesitancy. Community-based education programs can enhance vaccine literacy, particularly among populations with limited access to healthcare services. Additionally, combating misinformation through verification initiatives, social media interventions, and collaboration with trusted public figures can help correct vaccine-related misconceptions. When combined with the active involvement of healthcare professionals, these approaches can provide a more comprehensive framework for increasing vaccine acceptance in high-risk groups such as hemodialysis patients.

In conclusion, reducing vaccine hesitancy among hemodialysis patients requires a multidimensional approach. These should include strengthening patient-healthcare provider communication to address misunderstandings, improving public health campaigns targeting high-risk groups, and expanding educational programs to enhance vaccine literacy. Additionally, future research should explore the impact of structured educational programs and policy changes on potential improvements in vaccination rates in this vulnerable population.

Abbreviations

HD Hemodialysis
CKD Chronic kidney disease

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-025-22206-4.

Supplementary Material 1

Acknowledgements

Not applicable.

Author contributions

FBSK, SC, and MMÖÇ conceptualized and designed the study. FBSK and HÖ collected the study data. MMÖÇ and ARD conducted the data analysis. MMÖÇ, ARD, and SC interpreted the study results and drafted the manuscript and HÖ prepared the figures. All authors read and approved the final version of the manuscript.

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Data availability

The datasets generated and analyzed in this study are not publicly available as they are part of a larger ongoing research project. However, they can be obtained from the corresponding author upon reasonable request. This research is part of a broader project titled 'Assessment of Vaccine Hesitancy, Vaccination Status, Hepatitis B Prevalence, and Quality of Life in Hemodialysis Patients'.

Declarations

Ethics approval and consent to participate

The study was approved by the Ethics Committee of the Istanbul Faculty of Medicine (approval number: 3093073). All participants had to provide informed consent before completing the questionnaire.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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