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RESEARCH ARTICLE

Evaluation of Knowledge, Attitude, and Satisfaction after COVID-19 Vaccination among Healthcare Workers at Mashhad University of Medical Sciences

Kiavash Hushmandi¹, Seyed Saeed Tabatabaee², Sam Saghari³, Khaled Samiee Roudi⁴ and Rasoul Raesi^{5,*}

¹Department of Food Hygiene and Quality Control, Division of Epidemiology and Zoonoses, Faculty of Veterinary Medicine, University of Tehran, Tehran, Iran

²Social Determinants of Health Research Center, Mashhad University of Medical Sciences, Mashhad, Iran

³Department of Health Services Management, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran

⁴Department of Health Education, School of Health, Mashhad University of Medical Science, Mashhad, Iran

⁵Department of Health Services Management, Mashhad University of Medical Sciences, Mashhad, Iran

Abstract:

Aim:

This study aimed to evaluate the knowledge, attitude, and satisfaction of healthcare workers at Mashhad University of Medical Sciences regarding COVID-19 vaccination.

Background:

Vaccination skepticism and refusal to be vaccinated against infectious diseases have been recognized by the World Health Organization to be among the top 10 threats in 2019. Understanding the knowledge, attitude, and satisfaction levels of the healthcare personnel following COVID-19 vaccination can impact societal perceptions of the vaccine and serve as a valuable indicator of public acceptance.

Methods:

This was a cross-sectional study of an analytical type that was undertaken over three months. A total of 313 eligible healthcare workers were recruited by the census method. A research-made electronic questionnaire was utilized to collect the required data, which were subsequently analyzed using SPSS 22 statistical software. The statistical tests of chi-square, one-sample t, independent t, and one-way analysis of variance (ANOVA) were employed for analysis.

Results:

Of the participants, 88 (28.1%) were health staff, whereas 225 (71.9%) were care personnel. The highest frequencies were associated with females (53%) and the age range of 36-40 years (27.2%). The mean knowledge score of health staff was significantly higher than that of care personnel ($p = 0.03$). In comparison, the mean attitude score of care personnel was significantly larger than that of health workers ($p < 0.001$). There was no significant difference between health and medical staff in terms of satisfaction ($p = 0.36$).

Conclusion:

Healthcare workers' knowledge, attitude, and satisfaction following vaccination against COVID-19 were above average. Therefore, nationwide notification regarding the levels of knowledge, attitude, and satisfaction with the COVID-19 vaccine is essential to maximize vaccination coverage.

Keywords: COVID-19, Knowledge, Attitude, Satisfaction, Vaccine, Healthcare workers.

Article History

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1. INTRODUCTION

Prevention over treatment has long been a concern throughout the global health system. The sudden outbreak of the COVID-19 crisis reaffirmed this priority, as the failure to

manage the disease can put a great deal of strain on the care systems of the affected countries in terms of diagnosing the infection, distributing medication, and providing treatment. The COVID-19 infection is a new phenomenon that has affected every element of the lives of billions of people throughout the planet [1]. The disease has imposed numerous costs and consequences on the economies of countries,

* Address correspondence to this author at the Department of Health Services Management, Mashhad University of Medical Sciences, Mashhad, Iran;
E-mail: raesi.br881@gmail.com

including a decline in GDP, a slower rate of economic growth, an increased rate of unemployment, and an increase in security, prevention, and defense issues such as bioterrorism. The profound impact of this epidemic on the global economy and health has intensified the urgent need for vaccines to prevent and effectively respond to this crisis, highlighting the importance of vaccine production technology in the 21st century [2 - 4].

A nationwide vaccination strategy must complement immunization programs to reduce the prevalence of vaccine-preventable illnesses and successfully treat them. In addition to providing direct protection for vaccinated individuals, an immunization rate of nearly 70 percent can provide indirect protection for non-vaccinated community members. However, immunization cannot be assured even with public access to safe vaccinations, as there might be reluctance toward vaccination [5]. Indeed, earlier research has demonstrated that vaccine compliance is variable and inconsistent and that intensive education about the safety and efficacy of various vaccines is required to win public acceptability [6].

According to Karakose *et al.* (2021), the COVID-19 pandemic has caused substantial changes in personal and familial lifestyles, as well as in the interpersonal conduct of healthcare providers. These changes bolster the need for preventive measures and vaccination in managing COVID-19 [7].

People's perceptions of the benefits and risks of a particular vaccine and their level of trust in their respective governments impact the success of the global vaccination program. Researchers believe a lack of knowledge and awareness regarding the safety of the vaccination process contributes to vaccine refusal and postponement [8, 9]. In this regard, Shekhar *et al.* [6] investigated the acceptance of the COVID-19 vaccine among the general public. The results indicated that 36% of respondents wanted the COVID-19 vaccine immediately. Despite having access to the vaccine, 56 percent were skeptical and awaited additional findings. Only 8% of the population was unvaccinated. The acceptance rate of the COVID-19 vaccine was found to have a significant positive correlation with age, education, and income. Following vaccination, the most common concerns were achieving the optimal level of immunity, the vaccine's effectiveness against COVID-19 mutations, and the possibility of side effects.

Factors affecting COVID-19 vaccine acceptance were similarly examined by Bono *et al.* [10]. According to the research findings, the acceptance rates for vaccines that provide 90 percent and 95 percent immunity were 76.4% and 88.8%, respectively. Among the countries surveyed, only Brazil had a low acceptance rate for the COVID-19 vaccine. Age, income, and education were among the factors that contributed to the increased acceptance of the COVID-19 vaccine. The COVID-19 vaccine was met with reluctance and resistance due to fear of life-threatening complications (42.2%) and uncertainty regarding the vaccine's effectiveness (15.1%).

The attitude toward the COVID-19 vaccine is a crucial factor in determining its acceptance. Indeed, it is imperative to consider this issue before implementing vaccination programs

in any country. A worldwide survey indicated that 48% of the participants were reluctant to receive the COVID-19 vaccine. A study conducted in China revealed that a mere 54% of participants intended to receive the vaccine, indicating a concerning low rate of willingness to get vaccinated [11].

Governments have made considerable efforts to control and eradicate the disease through measures such as public education, social exclusion policies, screening tests, and vaccine development [12]. Vaccination is currently one of the most crucial global strategies for controlling the COVID-19 epidemic. It is the most effective method for preventing communicable infectious diseases, particularly in high-risk populations. In addition to promoting health, decreasing injuries and casualties, and ensuring public health, vaccination reduces medical and drug costs, resulting in economic benefits [13].

Many countries prioritize vaccination of high-risk populations such as the elderly and those at risk, including medical staff, in the early stages of COVID-19 disease vaccination [14]. As an official body, the World Health Organization has declared three important ethical principles for the COVID-19 vaccine: 1) The vaccine should inflict the least amount of physical harm while delivering an acceptable financial return: A vaccine should lower mortality, disease, and socioeconomic issues; 2) Prioritize vulnerable populations: Some groups are more at risk than others due to age, occupation, socioeconomic standing, and medical conditions. 3) Respect those who have been prioritized for vaccination: People who are unable to obtain vaccines due to inequity or vulnerability should be eligible for a fair vaccination opportunity [15].

Kunno *et al.* found that healthcare service providers reported higher levels of satisfaction with COVID-19 vaccination compared to the general population. Raising public awareness regarding healthcare providers' satisfaction with the COVID-19 vaccine can be an effective strategy to promote vaccination acceptance and achieve herd immunity [16].

Research on COVID-19's prevalence indicates that people with chronic diseases, the elderly, and medical staff are at risk of infection and death from the virus and should be among the first groups to receive the vaccine [17 - 19].

Iran's nationwide immunization program began on February 12, 2020, with healthcare personnel being the priority group [20]. The knowledge, attitude, and satisfaction of the first immunized group can influence the opinions of others in the community on the COVID-19 vaccine. Their attitudes can be seen as a valuable indicator of the vaccine's public acceptance. Given the lack of previous research in this area, this study was designed to measure the knowledge, attitude, and satisfaction of Mashhad University of Medical Sciences health workers regarding the COVID-19 vaccine.

2. METHODOLOGY

This analytical cross-sectional study was conducted from December 22, 2021, to March 21, 2022. We used the census method to recruit 313 Mashhad University of Medical Sciences (MUMS) healthcare workers who had received at least two

doses of COVID-19 vaccines.

The study's inclusion criteria comprised a minimum of two COVID-19 vaccine injections, the ability to read and write, the availability of a computer system or smartphone to access the electronic questionnaire link, and willingness to participate. Incomplete questionnaire completion was the exclusion criterion.

The sample size that was required to estimate the proportion of the population with 95% confidence, a standard deviation of 0.5, and a margin of error of +/-5% was calculated using the following formula. As such, the sample size was 385 people. Given the attrition in participants, 313 completed questionnaires were eventually collected.

$$n = \frac{z^2 p(1 - p)}{d^2}$$

$$n = \left(\frac{(1.96)(0.5)}{0.05} \right)^2 = \frac{0.9604}{0.0025} = 384.16$$

The data collection instrument was a 43-item, four-part electronic questionnaire constructed by the researcher based on relevant articles [11, 21 - 24], current library studies, and related Internet content and topics. For data collection, the university's research deputy forwarded the link to the electronic questionnaire to all affiliated healthcare workers.

The first section of the questionnaire consisted of 12 questions regarding the respondents' characteristics (age, gender, marital status, residence, education, occupation, monthly income level, source of COVID-19 news, daily COVID-19 news follow-up, history of COVID-19 infection among first-degree relatives, history of COVID-19 infection in the respondent and their first-degree relatives, and death of first-degree relatives due to COVID-19). The second section comprised 15 items assessing knowledge of COVID-19 vaccination. The third section contained 10 questions concerning attitudes toward COVID-19 vaccine injection. Finally, the fourth section featured five questions related to satisfaction with the COVID-19 vaccine.

The researcher-made questionnaire employed a 5-point Likert scale, with scores ranging from 1 (completely agree) to 5 (completely disagree). The knowledge items 1, 3, and 6, the attitude items 1, 6, and 10, and the satisfaction items 1 and 2

were scored inversely. Scores ranging from 1 to 5 were assigned to indicate maximal degrees of disagreement or agreement, respectively. Items 4 and 5 of the satisfaction section were scored using a 3-point Likert scale, with scores of 1, 3, and 5 representing low, moderate, and high satisfaction levels, respectively.

Ten experts in the field assessed the face and content validity of the questionnaire, with the latter being confirmed using the content validity ratio and index. The total value of the questionnaire was 0.93, according to the content validity ratio formula. In addition, the content validity indices for relevance, clarity, and simplicity were 0.86, 0.91, and 0.88, respectively. The indices are acceptable, given that their values are greater than 0.79. Furthermore, the questionnaire's reliability was calculated using the test-retest method. In this regard, Cronbach's alpha coefficient for the instrument was 0.91.

Data were analyzed using SPSS 22 statistical software. The statistical tests comprised a chi-square test to compare the frequency distribution of demographic characteristics in the two groups and a one-sample t-test to determine knowledge, attitude, and satisfaction levels. An Independent t-test was utilized to compare the mean values of variables in the two groups per gender, place of residence, monthly income, daily follow-up of news, history of COVID-19 infection, history of hospitalization, and death of relatives. Additionally, a one-way analysis of variance was utilized to compare the mean values of variables according to age, marital status, education level, and source of news follow-up. The significant level was set to $\alpha = 0.05$.

3. RESULTS

This study examined 313 healthcare personnel affiliated with Mashhad University of Medical Sciences, of whom 88 (28.1%) were health personnel and 225 (71.9%) were care personnel. There was no significant difference ($p > 0.05$) in the frequency distributions of gender, age, marital status, place of residence, daily COVID-19 news follow-up, and death of first-degree relatives due to COVID-19 between health and care groups. The variables of education level, monthly income level, source of COVID-19-related news, history of COVID-19 infection in oneself or first-degree relatives, and history of hospitalization due to COVID-19 of oneself or first-degree relatives showed significant differences ($p < 0.05$) as presented in Table 1.

Table 1. Comparison of demographic characteristics of health and care personnel.

Personnel Variables		Health	Care	P-value Statistical Test
		Frequency (percent)	Frequency (percent)	
Gender	Male	36 (40.9)	111 (49.3)	0.18
	Female	52 (59.1)	114 (50.7)	
Age (year)	≤ 30	14 (15.9)	48 (21.3)	0.63
	31-35	19 (21.6)	43 (19.1)	
	36-40	27 (30.7)	58 (25.8)	
	41-45	20 (22.7)	47 (20.9)	
	> 45	8 (9.1)	29 (12.9)	
Marital status	Single	24 (27.3)	66 (29.3)	0.28
	Married	58 (65.9)	131 (58.2)	
	Divorced/Spouse deceased	6 (6.8)	28 (12.4)	

(Table 1) contd....

Personnel Variables		Health	Care	P-value Statistical Test
		Frequency (percent)	Frequency (percent)	
Education	Primary/Secondary	3 (3.4)	25 (11.1)	<0.001
	High school	12 (13.6)	12 (5.3)	
	Associate	28 (31.8)	37 (16.4)	
	Bachelor's	38 (43.2)	111 (49.3)	
	Master's	7 (8)	40 (17.8)	
Place of residence	Urban	56 (63.6)	127 (56.4)	0.25
	Rural	32 (36.4)	98 (43.6)	
Monthly income level (million tomans)	5-10	88 (100)	210 (93.3)	0.01
	10-15	0 (0)	15 (6.7)	
COVID-related news source	TV	26 (29.5)	25 (11.1)	0.001
	News websites	9 (10.2)	22 (9.1)	
	Social media	44 (50)	156 (69.3)	
	People around	5 (5.7)	18 (8)	
	Newspapers	4 (4.5)	4 (1.8)	
Daily COVID-19 news follow-up	None	38 (43.2)	92 (40.9)	0.71
	Within 1 hour	50 (56.8)	133 (59.1)	
History of COVID-19 infliction of oneself or first-degree relatives	No	26 (29.5)	95 (42.2)	0.04
	Yes	62 (70.5)	130 (57.8)	
History of COVID-19 hospitalization of oneself or first-degree relatives	No	47 (53.4)	84 (37.3)	0.01
	Yes	41 (46.6)	141 (62.7)	
COVID-19-caused death of first-degree relatives	No	72 (81.8)	180 (80)	0.72
	Yes	16 (18.2)	45 (20)	

Table 2. Comparison of the healthcare personnel's mean scores of knowledge, attitude, and satisfaction after the COVID-19 vaccination with the average theoretical score.

Group	Variables	Mean	Standard Deviation	Mean Difference	The Value of t	P-Value	Normality of Data Distribution	
							Skewness	Kurtosis
Health personnel	Knowledge	3.40	0.24	0.40	15.78	<0.001	-0.31	-0.29
	Attitude	3.31	0.26	0.31	11.20	<0.001	-0.49	-0.87
	Satisfaction	3.73	0.37	0.73	18.49	<0.001	0.24	-0.24
Care personnel	Knowledge	3.31	0.37	0.31	12.51	<0.001	-0.20	-0.77
	Attitude	3.47	0.34	0.47	20.91	<0.001	-1.03	1.06
	Satisfaction	3.68	0.52	0.68	19.43	<0.001	-0.46	0.37

Skewness and kurtosis coefficients were measured to assess data normality. The variables of knowledge, attitude, and satisfaction were found to have a normal distribution based on their coefficients falling within the range of [-2, 2]. A one-sample t-test was utilized to assess the knowledge, attitude, and satisfaction levels of the healthcare personnel. The average theoretical score was considered to be the middle value of the range of scores for the questions, which was 3 on a scale of 1 to 5. The study found that health and care personnel had significantly higher mean scores in knowledge, attitude, and satisfaction after receiving the COVID-19 vaccine than the theoretical average score of 3 ($p < 0.001$). The knowledge, attitude, and satisfaction levels of healthcare personnel following COVID-19 vaccination were above average. (Table 2).

The independent t-test in Table 3 revealed that the mean knowledge score of health personnel was significantly lower than that of care personnel ($p=0.03$). Conversely, the mean attitude score of care personnel was significantly higher than that of health personnel ($p < 0.001$). No significant difference was observed in the mean satisfaction score among health and care personnel after receiving the COVID-19 vaccination

($p=0.36$). (Table 3)

The study found a significant difference in the mean scores of knowledge, attitude, and satisfaction between male and female health personnel, with males scoring higher. The mean knowledge and satisfaction scores of male care personnel were significantly higher than those of female care personnel ($p < 0.05$). There was a significant difference ($p < 0.05$) in the mean scores of knowledge and satisfaction among health personnel and the mean scores of attitude and satisfaction among care personnel based on age, education level, and history of hospitalization due to COVID-19 infection in oneself or first-degree relatives. A statistically significant difference was observed in the mean attitude score of health personnel based on their marital status. Similarly, a significant difference was found in the mean attitude and satisfaction scores of care personnel per marital status, place of residence, and history of hospitalization due to COVID-19 infection in oneself or first-degree relatives ($p < 0.001$). A disparity existed in the satisfaction scores of care personnel based on their monthly income levels. Significant differences were observed in the mean scores of knowledge, attitude, and satisfaction among health personnel and the mean scores of knowledge and

satisfaction among care personnel based on the source of COVID-19 news ($p < 0.01$). Health personnel's mean scores of knowledge and satisfaction varied significantly based on daily follow-up of COVID-19-related news. Additionally, their mean scores of knowledge and attitude varied based on the death of first-degree relatives caused by COVID-19. A significant difference ($p < 0.05$) was found in the attitude scores of care

personnel based on their own or their first-degree relatives' history of COVID-19 infection. Likewise, there was a significant difference in their mean knowledge scores based on the death of first-degree relatives due to COVID-19 infection. The mean scores for knowledge, attitude, and satisfaction did not differ significantly based on other demographic variables ($p > 0.05$), as shown in Table 4 .

Table 3. Comparison of the mean scores of knowledge, attitude, and satisfaction after COVID-19 vaccination among health and care personnel.

Group Variable	Health Personnel	Care Personnel	T-value	P-value
	Mean ± SD	Mean ± SD		
Knowledge	3.00±40.24	3.00±31.37	2.13	0.03
Attitude	3.00±31.26	3.00±47.34	4.11	<0.001
Satisfaction	3.00±73.37	3.68±0.52	0.92	0.36

Table 4. Comparison of the mean scores of knowledge, attitude, and satisfaction after COVID-19 vaccination in health and care personnel per demographic characteristics.

Personnel Variables		Health			Care		
		Knowledge	Attitude	Satisfaction	Knowledge	Attitude	Satisfaction
		Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Gender	Male	3.0±46.17	3.0±48.11	3.0±92.41	3.0±36.30	3.0±44.34	3.0±89.47
	Female	3.0±36.27	3.0±19.27	3.0±60.28	3.0±36.42	3.0±51.33	3.0±47.49
P-value related to independent t-test		0.05	<0.001	<0.001	0.04	0.12	<0.001
Age (year)	≤ 30	3.0±13.25	3.0±20.30	3.0±63.27	3.0±28.44	3.0±53.20	3.0±64.33
	31-35	3.0±36.11	3.0±27.35	4.0±2.18	3.0±35.18	3.0±52.38	3.0±42.64
	36-40	3.0±36.19	3.0±33.23	3.0±59.42	3.0±26.31	3.0±42.28	3.0±66.60
	41-45	3.0±66.15	3.0±33.18	3.0±54.20	3.0±33.49	3.0±37.45	3.0±74.32
	> 45	3.0±43.09	3.0±46.11	4.0±18.27	3.0±35.34	3.0±57.30	4.0±3.49
P-value related to the ANOVA test		<0.001	0.19	<0.001	0.66	0.03	<0.001
Marital status	Single	3.0±43.07	3.0±14.20	3.0±73.26	3.0±32.28	3.0±44.33	3.0±42.56
	Married	3.0±38.28	3.0±38.23	3.0±75.40	3.0±33.40	3.0±44.36	3.0±88.40
	Divorced/Spouse deceased	3.0±46.20	3.0±32.38	3.0±57.48	3.0±18.40	3.0±69.16	3.0±31.47
P-value related to the ANOVA test		0.63	<0.001	0.51	0.14	0.001	<0.001
Education level	Primary/Secondary	3.00±0.00	3.0±60.00	3.0±20.00	3.0±20.48	3.0±59.31	3.0±58.79
	High school	3.00±50.15	3.0±31.24	3.0±93.10	3.0±12.23	3.0±58.24	4.0±17.24
	Associate	3.0±41.25	3.0±24.27	3.0±55.26	3.0±26.29	3.0±49.22	3.0±68.55
	Bachelor's	3.0±34.21	3.0±32.26	3.0±88.41	3.0±35.39	3.0±40.39	3.0±58.39
	Master's	3.0±64.18	3.0±40.14	3.0±54.25	3.0±34.31	3.0±56.29	3.0±84.57
P-value related to the ANOVA test		<0.001	0.16	<0.001	0.14	0.02	0.002
Residence	Urban	3.0±43.28	3.0±31.21	3.0±68.37	3.0±29.38	3.0±35.37	3.0±79.53
	Rural	3.0±35.10	3.0±31.32	3.0±81.37	3.0±33.35	3.0±63.20	3.0±53.47
P-value related to independent t-test		0.12	0.97	0.16	0.50	<0.001	<0.001
Monthly income (million tomans)	5-10	3.0±40.24	3.0±31.26	3.0±73.37	3.0±32.37	3.0±47.34	3.0±65.51
	10-15	-	-	-	3.0±15.27	3.0±53.32	4.0±7.52
P-value related to independent t-test		-	-	-	0.08	0.52	0.002
COVID-related news source	TV	3.0±37.29	3.0±9.28	3.0±85.09	3.00±0.26	3.0±45.31	4.0±20.46
	News websites	3.0±9.18	3.0±56.09	3.0±29.18	3.0±33.47	3.0±35.11	3.0±71.35
	Social media	3.0±48.17	3.0±39.18	3.0±71.37	3.0±38.30	3.0±48.36	3.0±57.53
	People around	3.0±27.00	3.0±10.00	3.0±40.01	3.0±21.63	3.0±66.32	3.0±78.23
	Newspapers	3.0±53.00	3.0±50.00	4.0±60.00	3.0±21.00	3.0±30.00	3.0±80.00
P-value related to the ANOVA test		<0.001	<0.001	<0.001	<0.001	0.06	<0.001
Daily COVID-19 news follow-up	None	3.0±49.28	3.0±28.22	3.0±88.32	3.0±34.31	3.0±52.26	3.0±75.63
	Within 1 hour	3.0±33.16	3.0±33.28	3.0±62.37	3.0±29.40	3.0±44.38	3.0±63.43
P-value related to independent t-test		0.001	0.46	0.001	0.31	0.06	0.08
History of COVID-19 infliction of oneself or first-degree relatives	No	3.0±32.23	3.0±25.28	3.0±82.45	3.0±29.34	3.0±58.24	3.0±71.55
	Yes	3.0±43.24	3.0±33.25	3.0±70.33	3.0±32.39	3.0±39.38	3.0±65.50
P-value related to independent t-test		0.06	0.17	0.17	0.50	<0.001	0.38

(Table 4) contd.....

Personnel Variables		Health			Care		
		Knowledge	Attitude	Satisfaction	Knowledge	Attitude	Satisfaction
		Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
History of COVID-19 hospitalization of oneself or first-degree relatives	No	3.0±55.16	3.0 ± 22.23	3.0±76.37	3.0±29.36	3.0±55.33	3.0±46.67
	Yes	3.0±23.19	3.0±40.26	3.0±70.38	3.0±32.38	3.0±43.34	3.0±80.36
P-value related to independent t-test		<0.001	0.001	0.49	0.60	0.01	<0.001
COVID-19-caused death of a first-degree relative	No	3.0±44.23	3.0 ±26.26	3.0±76.36	3.0±33.38	3.0±45.36	3.0±69.44
	Yes	3.0±23.20	3.0±53.07	3.0±60.39	3.0±21.29	3.0±55.24	3.0±60.76
P-value related to independent t-test		0.001	<0.001	0.12	0.05	0.07	0.31

4. DISCUSSION

The advantages of vaccination for society have been demonstrated throughout medical history to outweigh the disadvantages. Given the numerous physical, social, economic, cultural, and psychological benefits of the COVID-19 vaccination, it appears vital to increase public awareness of its advantages. The significance of COVID-19 immunization as a health priority can be elevated through increased awareness, a positive shift in attitude, and recognition of the level of satisfaction with the coronavirus vaccine. As a variation from past studies, we assessed the level of knowledge, attitude, and satisfaction following COVID-19 vaccination among MUMS healthcare workers. Since efforts to produce the COVID-19 vaccine were announced, several surveys have been conducted to assess public perception and acceptance of the vaccine. The majority of surveys have targeted the general population. Healthcare workers were among the priority categories of the Iranian populace to gain access to the vaccine due to the limited availability of the vaccines.

It is expected that healthcare workers will serve as a primary source of information on vaccines for the general public. Consequently, it is essential to evaluate their knowledge, attitude, and satisfaction with the coronavirus vaccine. Indeed, knowing the knowledge, attitude, and satisfaction of the first group vaccinated against COVID-19 can influence the views of other community members and be considered a valuable criterion for the vaccine's public acceptance.

The present investigation revealed that the mean scores of knowledge, attitude, and satisfaction following COVID-19 vaccination were considerably higher than the average theoretical values among both health and care staff. In other words, it is concluded that the levels of knowledge, attitude, and satisfaction among healthcare staff following COVID-19 immunization are above average.

Various factors can impact an individual's knowledge, attitude, and satisfaction regarding vaccination. Factors such as underestimation of disease risk, ease of access to vaccination (including availability, cost-effectiveness, and convenient access), and reliability of the vaccine (including safety, effectiveness, and healthcare system capability regarding vaccination) influence knowledge, attitude, and satisfaction with COVID-19 vaccination.

Therefore, this research finding can be explained by noting that the high acceptance and desirable satisfaction of healthcare professionals with the COVID-19 vaccine influences the opinions of other community members regarding the

COVID-19 vaccine, which can lead to widespread public acceptance of the vaccine and maximum vaccination coverage. Targeted information, understanding the causes of low vaccine acceptance, and resource allocation are all necessary for achieving a high vaccination rate.

In line with the present study, Shekhar *et al.*'s study entitled "COVID-19 vaccine acceptance among healthcare workers in the United States" discovered that, altogether, only eight percent of healthcare workers refused the COVID-19 vaccine, demonstrating a high rate of vaccine acceptance in this group [25]. Studies indicate that immunized healthcare professionals are more likely to recommend the vaccine to their friends, family members, and patients [26 - 28].

The present study results revealed that the mean score of knowledge in the health personnel was significantly higher than that of the care personnel. Conversely, the care personnel attained a significantly higher mean attitude score than the health staff. The mean satisfaction score after COVID-19 vaccination was not significantly different between health and care personnel. According to this study's findings, the care staff are at the vanguard of the fight against COVID-19 and are more prone to be infected with the coronavirus infection. Consequently, the working conditions and the unique function of care personnel in the treatment of COVID-19 disease may explain the significantly higher score of attitude toward the COVID-19 vaccine in this group.

Consistent with the present study, Shekhar *et al.* revealed that vaccine acceptance was greater among direct patient care providers [25]. Alamer's study on the general population of Saudi Arabia found that nearly two-thirds of respondents had a favorable attitude toward the existing COVID-19 vaccines, which is congruent with the findings of the present study [29]. In contrast to these investigations, a study conducted in Nigeria revealed that the health workers' willingness and attitude to receive the COVID-19 vaccines were lower than desired [30]. Differences in attitudes across the aforementioned studies can be related to the fact that they were conducted at various times. Indeed, the establishment of extensive campaigns to promote the coronavirus vaccine has increased community-level trust over time.

According to the studies by Aguilar-Daz *et al.* [31] and Kwok *et al.* [32], the acceptance rates of influenza and coronavirus vaccines were poor among clinic-based nurses, as opposed to the current investigation results. In practice, the absence of a pandemic in Aguilar-Daz *et al.*'s study and the varied times and places of this study and Kwok *et al.*'s study contributes to the variance in results.

Male health personnel exhibited significantly higher mean scores in knowledge, attitude, and satisfaction compared to their female counterparts. Likewise, the mean knowledge and satisfaction scores of male care personnel were considerably higher than those of female care staff.

Several factors influence knowledge, attitude, and satisfaction regarding the COVID-19 vaccine, which can be used to explain this research result. Therefore, it is important to comprehend the cognitive, psychological, social, demographic, and cultural factors to affect such parameters.

Consistent with our study's findings, Tavousi *et al.* [33] reported that men have a 1.3 times higher likelihood of having a positive attitude toward receiving the COVID-19 vaccine compared to women. Keshmiri *et al.* found that males demonstrated higher levels of acceptance and satisfaction with COVID-19 vaccination among individuals aged 18 years and above in Bushehr [34]. El-Elimat's study in Jordan found that men had a 2.5% higher likelihood of receiving the COVID-19 vaccine compared to women [35]. Freeman *et al.* [36] discovered a correlation between gender and vaccine hesitancy in their UK-based research. Conducted in urban and rural communities in Tamil Nadu, India, Danabal's study found that women exhibited high levels of distrust toward the COVID-19 vaccine and had lower levels of attitude and satisfaction toward COVID-19 vaccination compared to men [37].

This study found significant differences in the mean scores of knowledge and satisfaction among health personnel and attitude and satisfaction among care personnel based on age, education level, and one's own or a first-degree relative's history of hospitalization due to COVID-19. Higher age and education levels among health and care personnel are associated with increased knowledge, positive attitudes, and greater satisfaction with the COVID-19 vaccine. Health and care personnel who had been hospitalized due to COVID-19, or those whose first-degree relatives had been hospitalized, exhibited higher mean scores in knowledge, attitude, and satisfaction toward the COVID-19 vaccine.

This finding of the current study can be explained by noting that the prevalence of underlying diseases increases with age and is higher in older people than in younger people [38]. This study highlights the significance of the COVID-19 vaccine among this age group and its potential to alter their knowledge and attitude, resulting in increased satisfaction with the vaccine. Higher education is associated with increased health literacy [39], which in turn may lead to higher mean scores in knowledge, attitude, and satisfaction with the COVID-19 vaccine. A greater understanding of COVID-19 vaccine mechanisms and efficacy is associated with more positive attitudes and higher satisfaction with the vaccine.

The higher mean level of knowledge, attitude, and satisfaction with the COVID-19 vaccine in health and care personnel who had a history of COVID-19 infection, hospitalization, or death of a first-degree relative can be attributed to their increased perception of the risks associated with COVID-19. The perception of increased risk can motivate individuals to engage in self-care and preventive measures. Greater awareness of the risks associated with COVID-19 has

resulted in the prioritization of preventive measures, including vaccination, among certain individuals. This may contribute to enhanced knowledge, attitudes, and satisfaction regarding the COVID-19 vaccine within this population.

Consistent with our study, Faezi *et al.* [40] found that various factors, including education level, age, and knowledge, impact vaccination knowledge, and attitudes. In line with this finding of the present study, Danabal *et al.* found that the knowledge and attitude of individuals with an educational background below that of a high school diploma were approximately 25% less favorable toward the COVID-19 vaccine than those with a university education. The study demonstrated a positive correlation between higher education levels and increased confidence in COVID-19 vaccines [37]. A study found that individuals with lower education levels expressed more vaccine hesitancy than those with higher education [41]. Another internationally conducted study investigating attitudes toward the COVID-19 vaccine on social media found a positive correlation between higher education levels and increased knowledge and belief scores regarding the vaccine.

This study found a significant difference in care personnel's mean attitude and satisfaction scores based on their marital status and monthly income level. Marriage can create a sense of responsibility toward family members. Married individuals may prioritize self-care and preventive measures, such as COVID-19 vaccination, to safeguard their own and their family's health. This may contribute to a positive attitude and greater satisfaction among this demographic. The mean score of attitude and satisfaction among healthcare personnel increases with higher monthly income levels. This can be attributed to the correlation between knowledge, attitude, and satisfaction toward the COVID-19 vaccine and demographic factors, such as family income [40]. Higher-income levels are associated with greater engagement in self-care and preventive behaviors, as well as more positive attitudes and satisfaction regarding the COVID-19 vaccine.

Consistent with our study's findings, Faezi *et al.* [40] reported that individuals with higher family incomes had a 1.6 times more favorable attitude toward receiving the COVID-19 vaccine than those with very low family incomes. Freeman *et al.* [36] noted a correlation between lower income and vaccine skepticism. Lastly, Danabal *et al.*'s study in Tamil Nadu, India, revealed that individuals from low-income backgrounds exhibited a high level of vaccine hesitancy [37].

The evaluation of knowledge, attitude, and satisfaction following COVID-19 vaccination among healthcare workers was a strength of the present study. Knowing the knowledge, attitude, and satisfaction of the first group vaccinated against COVID-19 might influence the opinions of others in the community about the vaccine and be considered a valuable criterion for public acceptance of the vaccine.

The following can be mentioned as the limitations of the present research.

1. This study was limited in its ability to compare results with other related studies. The limitation is attributed to a scarcity of relevant resources and research.

2. An electronic questionnaire was utilized to collect data in this study. Some participants may have provided inaccurate responses.

3. The study was conducted using a cross-sectional design. As a result, it is difficult to conclude causality.

4. The study's findings apply to healthcare staff at Mashhad University of Medical Sciences. The current research findings have limited generalizability; thus, caution should be exercised when applying the results to other contexts.

5. This study was conducted on vaccinated individuals who had received a minimum of two doses of the COVID-19 vaccine and possessed a good level of education. Consequently, the findings cannot be applied to society at large.

CONCLUSION

The results indicated that the levels of knowledge, attitude, and satisfaction following vaccination against COVID-19 are above average among healthcare personnel. Before deciding on a personalized vaccination, healthcare workers await further data. Nevertheless, they proved satisfied and positive after immunization against COVID-19. Vaccination of healthcare workers is required to protect them from infectious diseases, and given their vital role in public health as key leaders in the fight against COVID-19 epidemics and other infectious diseases, it is necessary to evaluate their knowledge, attitude, and satisfaction with COVID-19 vaccine.

However, the knowledge, attitude, and satisfaction of the vaccine among healthcare providers are different based on individual factors such as age, gender, marital status, education level, family income status, risk of contracting Corona, *etc.* To improve awareness, attitude, and satisfaction in this regard, necessary and appropriate interventions should be designed and implemented with a greater focus on these variables, which requires extensive and accurate measures to improve the awareness of different population groups. Because knowledge is often the basis of upgrading and improving attitude and satisfaction. Therefore, the officials should increase public awareness about the benefits of vaccines along with transparency and clarity about the possible side effects, and provide public access to corona vaccines (along with the variety of access to their types) for the people.

Therefore, nationwide notification of the level of knowledge, attitude, and satisfaction with the COVID-19 vaccine injection is required to maximize vaccination coverage and eliminate barriers to vaccination.

AUTHORS' CONTRIBUTION

K.H. and S.S.T. participated in the conceptualization, design, literature search, data collection, and manuscript drafting. S.S. and K.S.R. contributed to statistical analysis and manuscript drafting. R.R. reviewed the manuscript and performed the interviews. The final manuscript was read and approved by all authors.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

In terms of ethical considerations, the present study was ethical in two respects: first, all participants volunteered to participate in the study, and secondly, keeping in mind the principles of confidentiality and secrecy, participants were assured that all information would remain confidential and that the results would be reported in a general manner. All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. This study was approved by the Biomedical Research Ethics Committee of Mashhad University of Medical Sciences issued the study's code of ethics (IR.MUMS.REC.1400.287.).

HUMAN AND ANIMAL RIGHTS

No animals were used for the studies that are the basis of this research. All human procedures followed were per the guidelines of the Helsinki Declaration of 1975.

CONSENT FOR PUBLICATION

To comply with the ethical considerations in this research, the information of the participants was kept confidential and other people were not able to access this information. The names and surnames of the participants were not used for data collection, and data collection was done after obtaining the code of ethics from Mashhad University of Medical Sciences.

STANDARDS OF REPORTING

STROBE guideline has been followed.

AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of the article is available in the Zenodo Repository at <https://openpublichealthjournal.com/availability-of-data-materials.php>.

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CONFLICT OF INTERESTS

The authors declare no conflict of interest, financial or otherwise.

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