

# COVID-19 Vaccine Literacy and Vaccine Hesitancy Level Among Healthcare Professionals in Türkiye, Their Relationship and Influencing Factors: A Cross-Sectional Study

## Türkiye'deki Sağlık Çalışanları Arasında COVID-19 Aşısı Okuryazarlığı ve Aşısı Tereddütü Düzeyi, Birbirleriyle İlişkisi ve Etkileyen Etmenler: Kesitsel Bir Çalışma

İrem AKOVA<sup>a</sup>, Esmâ KILIÇ<sup>b</sup>, Mehmet Emin ÖZDEMİR<sup>c</sup>, Nagehan EKİCİ KOŞAROĞLU<sup>b</sup>,  
Öznur HASDEMİR<sup>d</sup>, Cem ÖZER<sup>d</sup>, Tuğrul KEKLİKÇİ<sup>d</sup>

<sup>a</sup>Department of Public Health, Sivas Cumhuriyet University Faculty of Medicine, Sivas, Türkiye

<sup>b</sup>İbn-i Sina Community Health Center, Sivas, Türkiye

<sup>c</sup>Provincial Health Directorate, Kayseri, Türkiye

<sup>d</sup>Provincial Health Directorate, Sivas, Türkiye

**ABSTRACT Objective:** Healthcare professionals (HP) play a role in vaccine acceptance as they influence people's decisions by sharing their personal experiences. The study was aimed to determine the coronavirus disease-2019 (COVID-19) vaccine literacy (VL) and vaccine hesitancy (VH) level among HP in Türkiye, their relationship and influencing factors. **Material and Methods:** This cross-sectional online study was applied to 1,111 HP between 15.02.2022-15.03.2022. The sociodemographic data form, COVID-19 Vaccine Literacy Scale (CVLS), and Vaccine Hesitancy Scale-long form (VHS) were used. Sociodemographic characteristics, questions about COVID-19 and COVID-19 vaccines were considered as independent variables, while VL and VH were considered as dependent variables. **Results:** Of the participants, 33.8% (n=376) were physicians, 25.2% (n=280) were nurses/midwives and 41.0% (n=455) were other HP. The CVLS functional mean score of HP was 2.6±0.7 and the interactive-critical mean score was 3.0±0.6. The VHS mean score was 44.6±16.3. Being a physician (p<0.001 for functional, p=0.002 for interactive-critical) and thinking that the origin of the coronavirus is a natural source from animals (p=0.029 for functional, p<0.001 for interactive-critical) were the factors that increased VL. Being a physician (p<0.001) and having high CVLS mean scores (p<0.001 for functional and interactive-critical) were the factors that decreased the VH. There was a weak negative correlation between VL and VH levels (r=-0.223 for functional, r=-0.323 for interactive-critical) (p<0.001). **Conclusion:** Considering that high VL level decreased VH level, it is obvious that the knowledge level of HP about COVID-19 vaccines should be increased.

**Keywords:** Health literacy; COVID-19 vaccine; vaccine hesitancy; medical staff

**ÖZET Amaç:** Sağlık çalışanları [healthcare professionals (HP)], aşı ile ilgili kişisel deneyimlerini paylaşarak insanların kararlarını etkiledikleri için aşının kabul edilmesinde rol oynarlar. Çalışma, Türkiye'deki HP'ler arasında koronavirüs hastalığı-2019 [coronavirus disease-2019 (COVID-19)] aşısı okuryazarlığı [vaccine literacy (VL)] ve aşısı tereddütü [vaccine hesitancy (VH)] düzeyi, birbirleriyle ilişkisi ve etkileyen etmenleri belirlemeyi amaçladı. **Gereç ve Yöntemler:** Bu kesitsel çevrim içi çalışma 15.02.2022-15.03.2022 tarihleri arasında 1.111 HP'ye uygulandı. Sosyodemografik veri formu, COVID-19 Aşısı Okuryazarlığı Ölçeği [COVID-19 Vaccine Literacy Scale (CVLS)] ve Aşısı Tereddüt Ölçeği-uzun formu [Vaccine Hesitancy Scale (VHS)] kullanıldı. VL ve VH bağımlı değişkenler olarak, sosyodemografik özellikler, COVID-19 ve COVID-19 aşısıyla ilgili sorular bağımsız değişkenler olarak kabul edildi. **Bulgular:** Katılımcıların %33,8'i (n=376) hekim, %25,2'si (n=280) hemşire/ebe ve %41,0'ı (n=455) diğer HP idi. HP'nin CVLS fonksiyonel ortalama skoru 2,6±0,7 ve interaktif-kritik ortalama skoru 3,0±0,6 idi. VHS ortalama skoru 44,6±16,3 idi. Hekim olmak (fonksiyonel için p<0,001, etkileşimli-kritik için p=0,002) ve koronavirüsün kaynağının hayvanlardan geldiğini düşünmek (fonksiyonel için p=0,029, etkileşimli-kritik için p<0,001) VL'yi artıran faktörlerdi. Hekim olmak (p<0,001) ve CVLS ortalama puanlarının yüksek olması (fonksiyonel ve etkileşimli-kritik için p<0,001) VH'yi azaltan faktörlerdi. VL ile VH düzeyleri arasında zayıf negatif bir ilişki vardı (fonksiyonel için r=-0,223, etkileşimli-kritik için r=-0,323) (p<0,001). **Sonuç:** Yüksek VL düzeyinin VH düzeyini azalttığı göz önünde bulundurulduğunda, HP'nin COVID-19 aşısı hakkındaki bilgi düzeyinin artırılması gerektiği açıktır.

**Anahtar Kelimeler:** Sağlık okuryazarlığı; COVID-19 aşısı; aşısı tereddütü; sağlık çalışanları

**Correspondence:** İrem AKOVA  
Department of Public Health, Sivas Cumhuriyet University Faculty of Medicine, Sivas, Türkiye  
E-mail: irem-007@hotmail.com



Peer review under responsibility of Türkiye Klinikleri Journal of Medical Sciences.

Received: 20 Jul 2022

Received in revised form: 08 Oct 2022

Accepted: 20 Nov 2022

Available online: 02 Dec 2022

2146-9040 / Copyright © 2023 by Türkiye Klinikleri. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Vaccine literacy (VL) is the state of individuals having the capacity to acquire, process and understand basic health information and services related to vaccines. In this way, individuals can make the right decisions about vaccines for their own health.<sup>1</sup> Information about vaccines tends to be complex and individuals with low VL can make it difficult to communicate information.<sup>2</sup>

Vaccination is one of the greatest achievements in public health.<sup>3</sup> Elimination of polio in many countries and eradication of smallpox all around the world is one of the most important contributions of vaccination.<sup>4</sup> On the other hand, hesitations about vaccines are increasing worldwide and it has turned into one of the most vital problems of public health. As a matter of fact, the World Health Organization also listed the vaccine hesitancy (VH) among the top ten warnings to global health in 2019.<sup>5</sup> The VH is a matter that will reduce vaccine distribution between humans; it is caused by security concerns, misinformation, and distrust of its effectiveness.<sup>6,7</sup>

Vaccination is the most important application for the control of the coronavirus disease-2019 (COVID-19) pandemic, which has affected the death of millions of humans today. However, as with other vaccines, there are hesitations for COVID-19 vaccines. Fears about the safety of COVID-19 vaccines, especially the rapid progress of the vaccine development process, are the main reason for hesitation.<sup>8</sup> In particular, receiving information about COVID-19 and vaccines from mass media causes individuals to believe incomplete and incorrect information.<sup>9</sup>

It is known that healthcare professionals (HP) are role models in the preference of the vaccine by individuals.<sup>10</sup> Because they can change people's choices by revealing their practices about the vaccine.<sup>10</sup> Health literacy applies to those who need knowledge and services, as well as HP and those who deliver vaccines.<sup>11</sup> While difficult, it has been recommended that it is still feasible to improve health literacy during the current pandemic.<sup>12</sup> Knowing the level of COVID-19 VL among HP will help produce a successful public health policy for COVID-19 management. In this study, it was aimed to determine the COVID-19 VL and VH level among HP in Türkiye, their relationship and influencing factors.

## MATERIAL AND METHODS

This cross-sectional study was applied to HP in Türkiye between 15.02.2022 and 15.03.2022. According to the 2021 data of the General Directorate of Health Services, the total number of HP in Türkiye is 1,142,469.<sup>13</sup> The minimum sample size was computed as 1067 utilizing the  $n = \frac{DEFF * Np(1-p)}{[(d^2/Z^2)_{1-\alpha/2} * (N-1) + p * (1-p)]}$  formula in the OpenEpi (Version 3) program [N=1.142.469, effect value d=3%, confidence interval (CI)=95%, p=50%]. In the OpenEpi program, it is stated that the p value should be taken as 50% if the prevalence is unknown. Since the prevalence of COVID-19 VL and VH among HP in Türkiye is unknown, the p value was taken as 50%. A selection was made among the 12 regions included in the Türkiye Statistical Regional Units Classification-1 (like 1.3.5), half of them were taken.<sup>13</sup> The total number of HP from each region to be contained in the sample was defined by dividing the number of HP in each region, which is considered as a stratum, by the number of samples (the minimum sample sizes were 175 HP for İstanbul region, 171 HP for Aegean region, 214 HP for West Anatolia region, 169 HP for Central Anatolia region, 183 HP for East Black Sea region, and 155 HP for Middle East Anatolia region).<sup>14</sup> From which region the participants were included in the study was questioned in the sociodemographic data form. The HP in the selected regions were also divided into strata according to their titles (physician, nurse, midwife, other health personnel), the number of HP in each title was proportioned to the sample number of the region, and the number of HP to be involved in the sample from each title was defined.<sup>14</sup>

Data collection instruments were distributed online [via e-mail and WhatsApp (Meta, Inc., USA) messenger] to HP in the designated regions using the Google Forms application. In each region where the study was conducted, HP whose e-mail and/or phone numbers were known by the researchers were reached and each participant was asked to share the data collection tools with other HP in this way. Of the approximately 3,000 HP invited, 1,111 (the response rate was nearly 37%) (179 HP for İstanbul region, 179 HP for Aegean region, 219 HP for West

Anatolia region, 179 HP for Central Anatolia region, 187 HP for East Black Sea region, and 158 HP for Middle East Anatolia region) decided to join in the study and their electronic informed consent was obtained. No exclusion criteria were applied. The study was completed in accordance with the Helsinki Declaration. Sivas Cumhuriyet University Non-Interventional Clinical Research Ethics Committee ethical approval (date: November 17, 2021, no: 2021-11/17) was taken.

Sociodemographic characteristics, questions about COVID-19 and COVID-19 vaccines were considered as independent variables, while VL and VH were considered as dependent variables. Sociodemographic Data Form, COVID-19 Vaccine Literacy Scale (CVLS), and Vaccine Hesitancy Scale-long form (VHS) were applied to acquire the study data.

In the sociodemographic data form, the participants' age, gender, marital status, number of children, place of residence, region of residence, presence of chronic diseases, occupation, professional years of work, health institution where they work and their views on COVID-19 and vaccines were questioned (17 questions in total). Since COVID-19 patients are being treated in public hospitals in Türkiye, the health institution was presented in three categories as primary health care, state hospital and university hospital.

The CVLS was applied to verify the COVID-19 VL levels. It was developed by Ishikawa et al. to evaluate health literacy in chronic diseases and adapted as CVLS by Biasio et al.<sup>11,15</sup> Turkish validity and reliability were made by Durmuş et al.<sup>16</sup> The scale consists of 12 items and two dimensions (functional and interactive-critical VL). Scale items were measured using a 4-point Likert scale. The interactive-critical dimension questions were rated as (1) Never, (2) Rarely, (3) Sometimes, (4) Often. Functional dimension expressions were rated as (4) Never, (3) Rarely, (2) Sometimes, (1) Often. The fact that the average of the scores obtained from the scale is close to 4 indicates a high level of VL. The scale's Cronbach's alpha values were determined as 0.915 for the interactive-critical dimension and 0.867 for the functional dimension.<sup>16</sup>

VHS was applied to verify the VH levels. It was developed by Kılınçarslan et al.<sup>17</sup> The long form of the scale, which consisted of 21 items, was used. The scale is 5-point Likert type. Each item is scored between 1 and 5 points. There is no calculated cut-off value. The higher the score, the greater the VH. The Cronbach alpha value for the long form was found to be 0.905.<sup>17</sup>

Study data were evaluated with the SPSS 22.0 (IBM Corp., Armonk, NY, USA) program. Mean and standard deviation were used for numerical variables, and numbers and percentages were used for categorical variables. Since the median age was calculated as 34, the age group was divided into two categories accordingly. The data's normality was checked with the Kolmogorov-Smirnov test. The data were analyzed by independent sample t-test and by F-test (ANOVA). Bonferroni tests for those meeting the homogeneity assumption and Tamhane's T2 tests for those who did not meeting the homogeneity assumption were used to determine which group differed from the others in the ANOVA. Pearson correlation analysis and binary logistic regression analysis were performed. The results of the correlation analysis were interpreted according to the values of the correlation coefficient (r):  $r < 0.2$  very weak,  $0.2 < r < 0.4$  weak,  $0.4 < r < 0.6$  moderate,  $0.6 < r < 0.8$  high,  $0.8 < r < 1$  very high relationship.<sup>18</sup> While performing the binary logistic regression analysis, the mean scores calculated in our study for the dependent variables (CVLS functional, interactive-critical, and VHS) were taken as cut-off values. Parameters found to be significant in univariate analyzes were included in the regression model. Hosmer-Lemeshow test results ( $p > 0.05$ ) revealed that the model-data fit was good enough. Reliability analysis of the scales used was performed. The Cronbach's alpha values of the scales were 0.798 for the functional CVLS, 0.845 for the interactive-critical CVLS, and 0.937 for the VHS.  $p < 0.05$  was considered significant.

## RESULTS

### DESCRIPTIVE STATISTICS OF THE HP

A total of 1,111 HP participated in the study. Of the participants, 33.8% (n=376) were physicians, 25.2%

(n=280) were nurses/midwives and 41.0% (n=455) were other HP. The majority were women (59.6%). The mean age of participants was 34.3±9.2 years. Of the participants, 56.3% had been in contact with COVID-19 patients, 64.4% had been diagnosed with COVID-19 (self or a family member), and 22.4% had lost a family member due to COVID-19. 46.4% of them believed the coronavirus was man-made and part of a conspiracy plan. 63% of them declared that they prefer mRNA vaccines. While of the participants, 68.4% thought that COVID-19 vaccines are safe, 53.6% reported that children should not be vaccinated against COVID-19 (Table 1).

#### COVID-19 VL LEVEL AMONG HP AND ITS DISTRIBUTION BY SOCIODEMOGRAPHIC CHARACTERISTICS

The CVLS functional mean score of HP was 2.6±0.7 and the interactive-critical mean score was 3.0±0.6. CVLS functional mean score was higher in physicians (2.8±0.7) than in nurse/midwife (2.6±0.7) (p=0.002 for post hoc test) or other HP (2.5±0.7) (p<0.001 for post hoc test). CVLS interactive-critical mean score was higher in female (3.0±0.6) (p=0.001), in physicians (3.1±0.6) [compared to other HP (2.8±0.7)] (p<0.001 for post hoc test), in nurses/midwives (3.1±0.6) [compared to other HP (2.8±0.7)] (p<0.001 for post hoc test), in metropolitan employees (3.2±0.5) [compared to city (2.9±0.6) (p<0.001) or county employees (2.9±0.7) (p=0.001)], and in those with chronic diseases (3.1±0.6) (p=0.009) (Table 2).

#### HP'S COVID-19 VL LEVEL DISTRIBUTION BY QUESTIONS RELATED COVID-19 AND COVID-19 VACCINES

The CVL functional mean score was higher in those who thought that the coronavirus originated from animals as a natural source (2.8±0.7) (p<0.001), that the COVID-19 vaccines are safe (2.7±0.7) (p<0.001), and that children should be vaccinated against COVID-19 (2.7±0.7) (p<0.001). Interactive-critical mean score was higher in those who were in contact with COVID-19 patients (3.1±0.6) (p<0.001), in those who preferred the mRNA vaccine (3.0±0.6) [compared to virus-like particle (2.7±0.6)] (p=0.012), in those who thought that the coronavirus originated

from animals as a natural source (3.2±0.5) (p<0.001), that the COVID-19 vaccines are safe (3.1±0.6) (p<0.001), and that children should be vaccinated against COVID-19 (3.1±0.6) (p<0.001) (Table 3).

#### VH LEVELS OF HP AND ITS DISTRIBUTION BY SOCIODEMOGRAPHIC CHARACTERISTICS

The VHS mean score of HP was 44.6±16.3. VHS mean score was higher in those under 34 years (46.2±15.4) (p=0.002), in single or widow (47.1±17.1) (p<0.001), in nurses or midwives (46.3±15.8) [compared to physicians (36.9±13.4)] (p<0.001), in other HP (49.9±16.4) (compared to physicians or nurses/midwives) (p<0.001), without children (46.3±16.3) (p=0.003), in those who work for 5 years or less (47.2±15.5) (compared to those who work more than 11 years) (p=0.016 for 11-15 years, p<0.001 for ≥16 years), in those who work for 6-10 years (45.6±17.0) [compared to those who work more than 16 years (41.7±15.7)] (p=0.038), in those who work in a public hospital (47.9±16.1) [compared to those who work at primary healthcare (43.9±16.3) (p=0.001) or university hospital (40.7±15.2) (p<0.001)], in those who work in primary healthcare (compared to those who work at university hospital) (p=0.042), in city employees (45.5±16.6) [compared to metropolitan employees (39.6±15.3)] (p<0.001), and in county employees (46.8±15.3) (compared to metropolitan or city employees) (p<0.001) (Table 2).

#### THE RELATIONSHIP BETWEEN HP'S COVID-19 VL AND VH

There was a weak negative correlation between HP's CVL functional mean score and VHS score (r=-0.223, p<0.001). There was a weak negative correlation between CVL interactive-critical mean score and VHS score (r=-0.323, p<0.001).

#### FACTORS AFFECTING COVID-19 VL AND VH IN HP

Being a physician [odds ratio (OR)=1.8, 95% CI=0.3-2.4, p<0.001] and thinking that the origin of the coronavirus is a natural source from animals (OR=1.5, 95% CI=1.1-2.0, p=0.029) were the factors that increased the CVLS functional mean score. Being a physician (OR=1.7, 95% CI=1.2-2.3, p=0.002) or nurse (OR=1.6, 95% CI=1.2-2.2, p=0.010), being in contact with COVID-19 patients (OR=1.5, 95%

**TABLE 1:** Descriptive statistics of the healthcare professionals (n=1,111).

		n (%)
Gender	Female	662 (59.6)
	Male	449 (40.4)
Age (years)	$\bar{X}\pm SD=34.3\pm 9.2$	
	<34	513 (46.2)
	$\geq 34$	598 (53.8)
Marital status	Single+Widow	396 (35.6)
	Married	715 (64.4)
Occupation	Physician	376 (33.8)
	Nurse/Midwife	280 (25.2)
	Other HP	455 (41.0)
	Health officer	107 (23.5)
	Emergency medical technician	100 (22.0)
	Paramedic	89 (19.6)
	Lab technician	83 (18.2)
	Physiotherapist	76 (16.7)
Number of children	None	460 (41.4)
	At least one	651 (58.6)
Total working time (years)	$\leq 5$	349 (31.4)
	6-10	237 (21.3)
	11-15	228 (20.5)
	$\geq 16$	297 (26.7)
Health institution	Primary healthcare	586 (52.7)
	Public hospital	332 (29.9)
	University hospital	193 (17.4)
Place of the residence	Metropolitan	217 (19.5)
	City	689 (62.0)
	County	205 (18.5)
Presence of chronic disease	No	898 (80.8)
	Yes	213 (19.2)
Contact with COVID-19 patients	No	486 (43.7)
	Yes	625 (56.3)
Have you or someone in your family been diagnosed with COVID-19 before?	No	396 (35.6)
	Yes	715 (64.4)
Have you lost a family member due to COVID-19 before?	No	862 (77.6)
	Yes	249 (22.4)
What is your opinion on the origin of the coronavirus?	No idea	265 (23.9)
	Natural source from animals	330 (29.7)
	Man-made virus and part of a conspiracy plan	516 (46.4)
Based on the technology with which it is made, which of the COVID-19 vaccines do you prefer most?	mRNA vaccine	700 (63.0)
	Adenovirus viral vector vaccine	19 (1.7)
	Inactivated vaccine	350 (31.5)
	Virus-like particle	42 (3.8)
Do you think current COVID-19 vaccines are safe?	No	351 (31.6)
	Yes	760 (68.4)
Do you think children should be vaccinated against COVID-19?	No	595 (53.6)
	Yes	516 (46.4)

SD: Standard deviation; HP: Healthcare professionals.

CI=1.1-1.9,  $p=0.005$ ), thinking that the origin of the coronavirus is a natural source from animals

(OR=2.5, 95% CI=1.8-3.6,  $p<0.001$ ) or man-made virus and part of a conspiracy plan (OR=1.8, 95%

**TABLE 2:** Distribution of the CVLS mean score and the VHS mean score according to healthcare professionals' sociodemographic characteristics (n=1,111).

Characteristics	CVLS functional mean score		CVLS interactive-critical mean score		VHS mean score	
	$\bar{X}\pm SD$	Test, p	$\bar{X}\pm SD$	Test, p	$\bar{X}\pm SD$	Test, p
Total	2.6±0.7		3.0±0.6		44.6±16.3	
Gender						
Female	2.6±0.7	t=-0.419, 0.675	3.0±0.6	t=3.278, <b>0.001</b>	44.0±15.8	t=-1.433, 0.152
Male	2.6±0.7		2.9±0.7		45.4±16.9	
Age (years)						
<34	2.6±0.7	t=0.018, 0.986	3.0±0.6	t=0.630, 0.529	46.2±15.4	t=3.056, <b>0.002</b>
≥34	2.6±0.7		3.0±0.6		43.2±16.9	
Marital status						
Single/widow	2.6±0.7	t=-0.743, 0.458	2.9±0.6	t=-1.459, 0.145	47.1±17.1	t=3.867, <b>&lt;0.001</b>
Married	2.6±0.7		3.0±0.6		43.1±15.6	
Occupation						
1. Physician	2.8±0.7	F=18.721, <b>&lt;0.001</b>	3.1±0.6	F=37.538, <b>&lt;0.001</b>	36.9±13.4	F=77.621, <b>&lt;0.001</b>
2. Nurse/Midwife	2.6±0.7		3.1±0.6		46.3±15.8	
3. Other HP	2.5±0.7		2.8±0.7		49.9±16.4	
<i>Post hoc test results</i>	1>2, 1>3	1>3, 2>3	2>1, 3>1, 3>2			
Number of children						
None	2.6±0.7	t=0.724, 0.469	3.0±0.6	t=-1.521, 0.129	46.3±16.3	t=2.972, <b>0.003</b>
At least one	2.6±0.7		3.0±0.6		43.3±16.2	
Total working time						
1. ≤5 years	2.6±0.7	F=0.517, 0.671	2.9±0.6	F=2.641, 0.051	47.2±15.5	F=7.148, <b>0.001</b>
2. 6-10 years	2.5±0.7		3.0±0.6		45.6±17.0	
3. 11-15 years	2.6±0.7		3.0±0.7		43.1±16.7	
4. ≥16 years	2.6±0.7		3.0±0.6		41.7±15.7	
<i>Post hoc test results</i>			1>3, 1>4, 2>4			
Health institution						
1. Primary healthcare	2.6±0.7	F=1.998, 0.136	3.0±0.7	F=2.152, 0.117	43.9±16.3	F=13.362, <b>&lt;0.001</b>
2. Public hospital	2.5±0.7		3.0±0.6		47.9±16.1	
3. University hospital	2.6±0.7		3.1±0.6		40.7±15.2	
<i>Post hoc test results</i>			2>1, 1>3, 2>3			
Place of the residence						
1. Metropolitan	2.6±0.7	F=0.073, 0.929	3.2±0.5	F=10.955, <b>&lt;0.001</b>	39.6±15.3	F=13.425, <b>&lt;0.001</b>
2. City	2.6±0.7		2.9±0.6		45.5±16.6	
3. County	2.6±0.8		2.9±0.7		46.8±15.3	
<i>Post hoc test results</i>		1>2, 1>3	2>1, 3>1, 3>2			
Presence of chronic disease						
No	2.6±0.7	t=0.239, 0.811	3.0±0.6	t=-2.632, <b>0.009</b>	44.7±15.8	t=0.658, 0.511
Yes	2.6±0.7		3.1±0.6		43.8±18.0	

CVLS: COVID-19 Vaccine Literacy Scale; VHS: Vaccine Hesitancy Scale; SD: Standard deviation; t: Independent samples t-test; HP: Healthcare professionals; F: One-way ANOVA.

CI=1.3-2.4,  $p<0.001$ ), thinking that the current COVID-19 vaccines are safe (OR=1.5, 95% CI=1.1-2.1,  $p=0.008$ ), and thinking that the children should be vaccinated against COVID-19 (OR=1.5, 95% CI=1.1-2.0,  $p=0.007$ ) were the factors that increased the CVLS interactive-critical mean score. Having worked for 5 years or less in total (OR=2.5, 95% CI=1.4-4.3,  $p=0.001$ ), or having worked for 6-10 years in total (OR=1.6, 95% CI=1.1-2.6,  $p=0.047$ ),

and working in a public hospital (OR=1.8, 95% CI=1.2-2.8,  $p=0.008$ ) were the factors that increased the VHS mean score. On the other hand, being a physician (OR=0.2, 95% CI=0.1-0.3,  $p<0.001$ ), having a high CVLS functional mean score (OR=0.6, 95% CI=0.5-0.8,  $p<0.001$ ), and having a high CVLS interactive-critical mean score (OR=0.5, 95% CI=0.4-0.6,  $p<0.001$ ) were the factors that decreased the VHS mean score (Table 4).

**TABLE 3:** Distribution of healthcare professionals' CVL Scale mean score by questions related COVID-19 and COVID-19 vaccines (n=1,111).

Questions	CVL functional mean score		CVL interactive-critical mean score	
	$\bar{X}\pm SD$	Test, p	$\bar{X}\pm SD$	Test, p
<b>Related COVID-19</b>				
Contact with COVID-19 patients				
No	2.6±0.7	t=-1.515, 0.130	2.9±0.7	t=-5.366, <0.001
Yes	2.6±0.7		3.1±0.6	
Have you or someone in your family been diagnosed with COVID-19 before?				
No	2.6±0.7	t=0.515, 0.607	2.9±0.7	t=-1.853, 0.064
Yes	2.6±0.7		3.0±0.6	
Have you lost a family member due to COVID-19 before?				
No	2.6±0.7	t=0.609, 0.542	3.0±0.6	t=-0.198, 0.843
Yes	2.6±0.7		3.0±0.7	
What is your opinion on the origin of the coronavirus?				
1. No idea	2.6±0.7	F=15.123, <0.001	2.8±0.7	F=32.199, <0.001
2. Natural source from animals	2.8±0.7		3.2±0.5	
3. Man-made virus and part of a conspiracy plan	2.5±0.7		3.0±0.6	
Post hoc test results	2>1, 2>3	2>1, 3>1, 2>3		
<b>Related COVID-19 vaccines</b>				
Based on the technology with which it is made, which of the COVID-19 vaccines do you prefer most?				
1. mRNA vaccine	2.6±0.7	F=0.476, 0.699	3.0±0.6	F=3.417, 0.017
2. Adenovirus viral vector vaccine	2.6±0.7		3.0±0.5	
3. Inactivated vaccine	2.6±0.7		3.0±0.6	
4. Virus-like particle	2.5±0.6		2.7±0.6	
Post hoc test results		1>4		
Do you think current COVID-19 vaccines are safe?				
No	2.4±0.7	t=-5.683, <0.001	2.8±0.6	t=-5.860, <0.001
Yes	2.7±0.7		3.1±0.6	
Do you think children should be vaccinated against COVID-19?				
No	2.5±0.7	t=-4.508, <0.001	2.9±0.6	t=-4.764, <0.001
Yes	2.7±0.7		3.1±0.6	

CVL: COVID-19 Vaccine Literacy; SD: Standard deviation; t: Independent samples t-test; F: One-way ANOVA.

## DISCUSSION

This study is one of the first to evaluate the COVID-19 VL level among HP. Studies available in the literature have determined the VL level of the general population (and one study family carers').<sup>11,16,19-21</sup>

In the study of Biasio et al., who adapted the VL scale for COVID-19, "limited" VL is defined as score value  $\leq 2.50$ .<sup>11</sup> So, in our study, participants' functional and interactive-critical COVID-19 VL levels (2.6 and 3.0, respectively) were relatively high (score value  $> 2.50$ ). As a matter of fact, it was not surprising that the COVID-19 VL levels of the general population (2.5±0.6) in a study conducted in Türkiye were found to be lower than the findings in our study.<sup>16</sup> On the other hand, it is surprising that in a

study conducted in Italy before the start of COVID-19 vaccinations, the VL levels in the general population (2.9±0.7 for functional VL, 3.3±0.5 for interactive critical VL) were higher than the findings in our study.<sup>11</sup> In the same study, the association among VL and occupation status was examined, and the highest score was found in healthcare workers, as expected for both functional and interactive-critical scales (VL functional score was 3.2; interactive critical score was 3.5).<sup>11</sup> Moreover, considering that our study was conducted at a period when COVID-19 vaccines were actively used and applied in Türkiye, this situation is thought-provoking. In a study conducted in Croatia before the COVID-19 vaccinations, the VL levels of the general population (2.3±0.5) were found to be lower than in our study.<sup>20</sup> In studies

**TABLE 4:** Regression analysis predicting factors affecting COVID-19 vaccine literacy and vaccine hesitancy in healthcare professionals (n=1,111).

	CVLS functional mean score (≥2.6) (Ref C; <2.6) ORa (95% CI), p	CVLS interactive-critical mean score (≥3.0) (Ref C; <3.0) ORa (95% CI), p	VHS mean score (≥44.6) (Ref C; <44.6) ORa (95% CI), p
Gender (Ref C=Male)			
Female	Not included	1.1 (0.9-1.5), 0.368	Not included
Age (Ref C=≥34)			
<34	Not included	Not included	1.1 (0.7-1.6), 0.788
Marital status (Ref C=Married)			
Single+Widow	Not included	Not included	1.5 (0.9-2.2), 0.089
Occupation (Ref C=Other healthcare worker)			
Physician	1.8 (0.3-2.4), <0.001	1.7 (1.2-2.3), 0.002	0.2 (0.1-0.3), <0.001
Nurse	1.3 (0.9-1.8), 0.102	1.6 (1.1-2.2), 0.010	0.9 (0.6-1.2), 0.341
Number of children (Ref C=At least one)			
None	Not included	Not included	0.9 (0.6-1.4), 0.589
Total working time (years) (Ref C=≥16 years)			
≤5 years	Not included	Not included	2.5 (1.4-4.3), 0.001
6-10 years	Not included	Not included	1.6 (1.1-2.6), 0.047
11-15 years	Not included	Not included	1.3 (0.9-1.9), 0.223
Health institution (Ref C=University hospital)			
Primary healthcare	Not included	Not included	0.9 (0.6-1.4), 0.645
Public hospital	Not included	Not included	1.8 (1.2-2.8), 0.008
Place of the residence (Ref C=County)			
Metropolitan	Not included	0.9 (0.6-1.5), 0.829	0.9 (0.6-1.5), 0.850
City	Not included	0.8 (0.6-1.2), 0.294	1.3 (0.9-1.8), 0.220
Presence of chronic disease (Ref C=No)			
Yes	Not included	1.4 (0.9-1.9), 0.073	Not included
Contact with COVID-19 patients (Ref C=No)			
Yes	Not included	1.5 (1.1-1.9), 0.005	Not included
Opinion on the origin of the coronavirus (Ref C=No idea)			
Natural source from animals	1.5 (1.1-2.0), 0.029	2.5 (1.8-3.6), <0.001	Not included
Man-made virus and part of a conspiracy plan	0.9 (0.7-1.3), 0.690	1.8 (1.3-2.4), <0.001	Not included
Most preferred COVID-19 vaccines (Ref C=Virus-like particle)			
mRNA vaccine	Not included	1.3 (0.6-2.5), 0.488	Not included
Adenovirus viral vector vaccine	Not included	1.6 (0.5-5.3), 0.414	Not included
Inactivated vaccine	Not included	1.5 (0.8-3.1), 0.219	Not included
Thinking that the current COVID-19 vaccines are safe (Ref C=No)			
Yes	1.3 (0.9-1.8), 0.107	1.5 (1.1-2.1), 0.008	Not included
Thinking that the children should be vaccinated against COVID-19 (Ref C=No)			
Yes	1.2 (0.9-1.6), 0.188	1.5 (1.1-2.0), 0.007	Not included
CVLS Functional mean score	Not included	Not included	0.6 (0.5-0.8), <0.001
CVLS Interactive-critical mean score	Not included	Not included	0.5 (0.4-0.6), <0.001

CVLS: COVID-19 Vaccine Literacy Scale; VHS: Vaccine Hesitancy Scale; ORa: Adjusted odds ratio; CI: Confidence interval; Ref C: Reference category.

conducted with family carers in Japan (2.7±0.6) and more recently with parents in Israel (3.0±0.4 for very/somewhat likely to vaccinate their children, 2.9±0.5 for very unlikely/definitely not to vaccinate their children), participants' VL levels were similar to

the results in our study.<sup>19,21</sup> Since we could not find any other study evaluating the COVID-19 VL levels of HP, we could not make a one-to-one comparison with HP. However, due to their position, the VL levels of the HP would be expected to be higher than the



levels of other individuals in the society in any case. Because it has been reported that many individuals continue to rely more on HP as a source for accurate and up-to-date health information.<sup>22</sup> On the other hand, it has been shown that providing accurate information to the population can reduce VH, thus increasing compliance with the COVID-19 vaccine.<sup>23</sup>

In our study, COVID-19 VL levels were higher in female (in interactive-critical VL), those living in the metropolis (in interactive-critical VL), those with any chronic disease (in interactive-critical VL), and physicians. While there are studies that did not find a difference between COVID-19 VL levels and gender, there are also studies that found a difference. However, in the study by Biasio et al., the functional VL level of female participants was found to be lower than that of males ( $p < 0.05$ ).<sup>11</sup> In addition to the fact that our study was carried out only with HP, the fact that female HP were mostly nurses may have caused this. Because in our study, the interactive-critical VL score of the nurses was higher than the other HP ( $p < 0.001$ ). There are also differences between age and COVID-19 VL level in studies; while a previous study in Türkiye and a study in Croatia reported higher VL levels of young participants, a study in Italy reported higher interactive-critical VL levels of those aged 31-65.<sup>11,16,20</sup> On the other hand, the highly educated and employed participants had higher COVID-19 VL levels.<sup>11,20</sup> As a matter of fact, the fact that physicians had higher COVID-19 VL levels in our study also supports this. Contrary to the results we found in our study, Gusar et al. stated that the functional VL value was higher in those without chronic disease.<sup>20</sup> Since our study was conducted with HP, it may be expected that those with any chronic disease should evaluate vaccines from an interactive-critical perspective.

In this study, there was no difference between the VL levels of those who were previously diagnosed with COVID-19 compared to those who did not. The study conducted in Croatia also supports our findings ( $t = 0.776$ ;  $p = 0.437$ ).<sup>20</sup> Less than half of the HP in our study thought that children should be vaccinated against COVID-19, and HP who thought this way had higher COVID-19 VL levels. Indeed, it was reported that education level didn't directly change

parents' intention to vaccinate their children.<sup>24</sup> This result, which we found in our study, may show us that the most important thing in the intention of parents to vaccinate their children is the level of VL rather than the education level of the individuals. As in our study, those who think that COVID-19 vaccines are safe and that children should also be vaccinated have been reported to have higher COVID-19 VL levels in other studies.<sup>11,19,20</sup>

HP are defined as "engaged" rather than "hesitant" about vaccination, and studies have found that HP were >30 times more likely to be vaccinated.<sup>25</sup> There were differences in the studies conducted between the VH and sociodemographic characteristics of HP.<sup>26</sup> Hesitancy for vaccination was higher in HP, in our study, who were young, single/widow, had no children, had less work history, worked in a public hospital or in rural areas. Although there was no gender difference in our study, female HP were generally more likely to recommend vaccination.<sup>27,28</sup> Like our study, some studies have found that older HP with more experience or more years of work history showed positive vaccination behaviour.<sup>29,30</sup> However, there are also studies reporting that HP over 50 were less likely to recommend vaccination.<sup>30</sup> On the other hand, we observed that the VH levels of the physicians were significantly lower, and some studies support this finding.<sup>29,31</sup> It has also been reported that primary care providers have positive associations with accepting or recommending vaccines, like our study.<sup>28</sup>

Many studies have revealed that many HP have insufficient knowledge about vaccines or their use.<sup>32,33</sup> It has been shown that inadequate vaccine education may also cause HP not to recommend vaccination.<sup>34</sup> It has been reported that having sufficient and reliable information supports vaccine advocacy.<sup>35</sup> Supporting this view, we found that as the VL level of the HP increased, the VH decreased. Similarly, in the study of Biasio et al., a significant correlation was reported between VL scales and more positive beliefs about the vaccine.<sup>11</sup>

The limitations of this study were; the fact that the entire target population could not be reached because an online questionnaire was applied, there was

no comparison with a control group without HP, and finally, it was a cross-sectional study whose results could not provide causal relationships and represented a certain limitation in the interpretation of the data collected. On the other hand, as far as we know, that is the first study to evaluate the COVID-19 VL level of HP. And other strengths of this study can be listed as follows; evaluating the attitudes of HP towards not only COVID-19 vaccines but also other vaccines and revealing the relationship between VL and VH.

## CONCLUSION

In our study, we observed that the VL level of HP was above the average, but not at a sufficient level compared to the VL levels found in studies conducted in the general population in the literature. We also found that both functional and interactive-critical VL levels were higher who thought that COVID-19 vaccines are safe and that children should also be vaccinated, and in physicians. The VH was higher in HP who were young, single/widowed, had no children, had less work history, worked in a public hospital or in rural areas, and was lower in physicians. Being a physician and thinking that the origin of the coronavirus is a natural source from animals were the factors that increased VL. Being a physician and having high CVLS mean scores were the factors that decreased the VH. There was a weak negative correlation between VL and VH levels. Considering that high VL level decreased VH level, it is obvious that the knowledge level of HP about COVID-19 vaccines should be increased as a guide for the society in the field of health.

## Source of Finance

*During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.*

## Conflict of Interest

*No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.*

## Authorship Contributions

**Idea/Concept:** İrem Akova, Esma Kılıç, Mehmet Emin Özdemir, Nagehan Ekici Koşaroğlu; **Design:** İrem Akova, Esma Kılıç; **Control/Supervision:** İrem Akova, Esma Kılıç, Mehmet Emin Özdemir, Nagehan Ekici Koşaroğlu, Öznur Hasdemir, Cem Özer, Tuğrul Keklikçi; **Data Collection and/or Processing:** İrem Akova, Esma Kılıç, Mehmet Emin Özdemir, Nagehan Ekici Koşaroğlu, Öznur Hasdemir, Cem Özer, Tuğrul Keklikçi; **Analysis and/or Interpretation:** İrem Akova, Esma Kılıç, Mehmet Emin Özdemir, Nagehan Ekici Koşaroğlu; **Literature Review:** İrem Akova, Esma Kılıç; **Control/Supervision:** İrem Akova, Esma Kılıç, Mehmet Emin Özdemir, Nagehan Ekici Koşaroğlu, Öznur Hasdemir, Cem Özer, Tuğrul Keklikçi; **Writing the Article:** İrem Akova; **Critical Review:** İrem Akova, Esma Kılıç, Mehmet Emin Özdemir, Nagehan Ekici Koşaroğlu, Öznur Hasdemir, Cem Özer, Tuğrul Keklikçi; **References and Findings:** İrem Akova, Esma Kılıç, Mehmet Emin Özdemir, Nagehan Ekici Koşaroğlu, Öznur Hasdemir, Cem Özer, Tuğrul Keklikçi; **Materials:** İrem Akova, Esma Kılıç, Mehmet Emin Özdemir, Nagehan Ekici Koşaroğlu, Öznur Hasdemir, Cem Özer, Tuğrul Keklikçi.

## REFERENCES

- Ratzan SC. Vaccine literacy: a new shot for advancing health. *J Health Commun.* 2011;16(3):227-9. [Crossref] [PubMed]
- Biasio LR. Vaccine literacy is undervalued. *Hum Vaccin Immunother.* 2019;15(11):2552-3. [Crossref] [PubMed] [PMC]
- Centers for Disease Control and Prevention (CDC). Ten great public health achievements--United States, 2001-2010. *MMWR Morb Mortal Wkly Rep.* 2011;60(19):619-23. [PubMed]
- Greenwood B. The contribution of vaccination to global health: past, present and future. *Philos Trans R Soc Lond B Biol Sci.* 2014;369(1645):20130433. [Crossref] [PubMed] [PMC]
- World Health Organization [Internet]. © 2022 WHO [Cited: January 18, 2022]. Ten threats to global health in 2019. Available from: [Link]
- Kennedy J. Vaccine hesitancy: a growing concern. *Paediatr Drugs.* 2020;22(2):105-11. [Crossref] [PubMed]
- Verger P, Dubé E. Restoring confidence in vaccines in the COVID-19 era. *Expert Rev Vaccines.* 2020;19(11):991-3. [Crossref] [PubMed]
- Wouters OJ, Shadlen KC, Salcher-Konrad M, Pollard AJ, Larson HJ, Teerawattananon Y, et al. Challenges in ensuring global access to COVID-19 vaccines: production, affordability, allocation, and deployment. *Lancet.* 2021;397(10278):1023-34. [Crossref] [PubMed] [PMC]
- Rowlands G. Health literacy. *Hum Vaccin Immunother.* 2014;10(7):2130-5. [Crossref] [PubMed] [PMC]
- Shekhar R, Sheikh AB, Upadhyay S, Singh M, Kottewar S, Mir H, et al. COVID-19 vaccine acceptance among health care workers in the united states. *Vaccines (Basel).* 2021;9(2):119. [Crossref] [PubMed] [PMC]
- Biasio LR, Bonaccorsi G, Lorini C, Pecorelli S. Assessing COVID-19 vaccine literacy: a preliminary online survey. *Hum Vaccin Immunother.* 2021;17(5):1304-12. [Crossref] [PubMed] [PMC]
- Geldsetzer P. Use of rapid online surveys to assess people's perceptions during infectious disease outbreaks: a cross-sectional survey on COVID-19. *J Med Internet Res.* 2020;22(4):e18790. [Crossref] [PubMed] [PMC]
- Başara Bora B, Aygün A, Soyutun Çağlar İ, Kulali B. Sağlık İstatistikleri Yıllığı. 2020 Haber Bülteni. T.C. Sağlık Bakanlığı Sağlık Bilgi Sistemleri Genel Müdürlüğü; 2021. Erişim tarihi: 18 Ocak 2022. Erişim linki: [Link]
- Başara Bora B, Aygün A, Soyutun Çağlar İ, Kulali B. T.C. Sağlık Bakanlığı. Sağlık İstatistikleri Yıllığı 2019 Haber Bülteni. Sağlık Bilgi Sistemleri Genel Müdürlüğü; 2020. Erişim tarihi: 18 Ocak 2022. Erişim linki: [Link]
- Ishikawa H, Takeuchi T, Yano E. Measuring functional, communicative, and critical health literacy among diabetic patients. *Diabetes Care.* 2008;31(5):874-9. [Crossref] [PubMed]
- Durmuş A, Akbolat M, Amarat M. COVID-19 Aşı Okuryazarlığı Ölçeği'nin Türkçe geçerlilik ve güvenilirliği [Turkish validity and reliability of COVID-19 Vaccine Literacy Scale]. *Cukurova Med J.* 2021;46(2):732-41. [Crossref]
- Kılınçarslan MG, Sarıgül B, Toraman Ç, Şahin EM. Development of Valid and Reliable Scale of Vaccine Hesitancy in Turkish Language. *Konuralp Tıp Derg.* 2020;12(3):420-9. [Crossref]
- Şen S. Korelasyon [Internet]. [Access date: 09 Feb 2023]. [Link]
- Gendler Y, Ofri L. Investigating the influence of vaccine literacy, vaccine perception and vaccine hesitancy on Israeli parents' acceptance of the COVID-19 vaccine for their children: a cross-sectional study. *Vaccines (Basel).* 2021;9(12):1391. [Crossref] [PubMed] [PMC]
- Gusar I, Konjevoda S, Babić G, Hnatešen D, Čebohin M, Orlandini R, et al. Pre-vaccination COVID-19 vaccine literacy in a croatian adult population: a cross-sectional study. *Int J Environ Res Public Health.* 2021;18(13):7073. [Crossref] [PubMed] [PMC]
- Costantini H. COVID-19 Vaccine literacy of family carers for their older parents in Japan. *Healthcare (Basel).* 2021;9(8):1038. [Crossref] [PubMed] [PMC]
- Smith D. Health care consumer's use and trust of health information sources. *J Commun Healthc.* 2011;4(3):200-10. [Crossref]
- Gallè F, Sabella EA, Roma P, De Giglio O, Caggiano G, Tafuri S, et al. Knowledge and acceptance of COVID-19 vaccination among undergraduate students from central and southern Italy. *Vaccines (Basel).* 2021;9(6):638. [Crossref] [PubMed] [PMC]
- Zhang KC, Fang Y, Cao H, Chen H, Hu T, Chen YQ, et al. Parental acceptability of COVID-19 vaccination for children under the age of 18 years: cross-sectional online survey. *JMIR Pediatr Parent.* 2020;3(2):e24827. [Crossref] [PubMed] [PMC]
- Kassianos G, Kuchar E, Nitsch-Osuch A, Kyncl J, Galev A, Humolli I, et al. Motors of influenza vaccination uptake and vaccination advocacy in healthcare workers: a comparative study in six European countries. *Vaccine.* 2018;36(44):6546-52. [Crossref] [PubMed]
- Lin C, Mullen J, Smith D, Kotarba M, Kaplan SJ, Tu P. Healthcare providers' vaccine perceptions, hesitancy, and recommendation to patients: a systematic review. *Vaccines (Basel).* 2021;9(7):713. [Crossref] [PubMed] [PMC]
- Almughais ES, Alfarhan A, Salam M. Awareness of primary health care physicians about human papilloma virus infection and its vaccination: a cross-sectional survey from multiple clinics in Saudi Arabia. *Infect Drug Resist.* 2018;11:2257-67. [Crossref] [PubMed] [PMC]
- Power ML, Leddy MA, Anderson BL, Gall SA, Gonik B, Schulkin J. Obstetrician-gynecologists' practices and perceived knowledge regarding immunization. *Am J Prev Med.* 2009;37(3):231-4. [Crossref] [PubMed]
- Esteves-Jaramillo A, Omer SB, Gonzalez-Diaz E, Salmon DA, Hixson B, et al. Acceptance of a vaccine against novel influenza A (H1N1) virus among health care workers in two major cities in Mexico. *Arch Med Res.* 2009;40(8):705-11. [Crossref] [PubMed] [PMC]
- Ye L, Chen J, Fang T, Cui J, Li H, Ma R, et al. Determinants of health-care workers' willingness to recommend the seasonal influenza vaccine to diabetic patients: a cross-sectional survey in Ningbo, China. *Hum Vaccin Immunother.* 2018;14(12):2979-86. [Crossref] [PubMed] [PMC]
- Torun SD, Torun F. Vaccination against pandemic influenza A/H1N1 among healthcare workers and reasons for refusing vaccination in Istanbul in last pandemic alert phase. *Vaccine.* 2010;28(35):5703-10. [Crossref] [PubMed]
- Ferrara P, Stromillo L, Albano L. Awareness, attitudes, and practices toward meningococcal b vaccine among pediatricians in Italy. *Medicina (Kaunas).* 2018;54(6):100. [Crossref] [PubMed] [PMC]
- Abi Jaoude J, Khair D, Dagher H, Saad H, Cherfan P, Kaafarani MA, et al. Factors associated with Human Papilloma Virus (HPV) vaccine recommendation by physicians in Lebanon, a cross-sectional study. *Vaccine.* 2018;36(49):7562-7. [Crossref] [PubMed]
- Glavier M, Puyade M, Roblot F, Rammaert B. Vaccination of cancer patients treated with chemotherapy: a survey among general practitioners. *Med Mal Infect.* 2019;49(8):586-92. [Crossref] [PubMed]
- Pelullo CP, Della Polla G, Napolitano F, Di Giuseppe G, Angelillo IF. Healthcare workers' knowledge, attitudes, and practices about vaccinations: a cross-sectional study in Italy. *Vaccines (Basel).* 2020;8(2):148. [Crossref] [PubMed] [PMC]