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The Role of COVID-19 Vaccine Literacy in The Effect of e-Health Literacy on Vaccine Attitude

Rukiye Aslan [1,4,a,*], Ebrar Ilıman Yaltagil [2,b], Aysel Arslan[3,c], Ahmet Alim[4,d]

[1] *Department of Medical Services and Techniques, Vocational School of Health Services, Sivas Cumhuriyet University, 58140, Sivas, Türkiye*
[2] *Department of Health Tourism, Vocational School of Social Sciences, Sivas Cumhuriyet University, 58140, Sivas, Türkiye*
[3] *Department of Educational Sciences, Faculty of Education, Sivas Cumhuriyet University, 58140, Sivas, Türkiye*
[4] *Department of Medical Microbiology, Faculty of Medicine, Sivas Cumhuriyet University, 58140, Sivas, Türkiye*
**Corresponding author*

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ABSTRACT

Immunization is one of the most successful practices for the maintenance of public health. With the emergence pandemic, distant health services, in other words the e-Health concept, has gained importance. It was aimed to develop the COVID-19 vaccine attitude scale and to determine the effect of e-Health literacy on the impact of people's COVID-19 vaccine literacy levels on their vaccine attitudes, in this study. The COVID-19 vaccine attitude scale was developed by the researchers. The scale development process of the research started with the literature review. This process continued with creating an item pool, receiving expert opinions, piloting, and finalizing the scale. As a result of the research, the Cα value of the COVID-19 vaccine attitude scale was found to be 0.745. The total variance explanatory power of the scale was determined as 56,972. Confirmatory factor analysis was determined as χ2/sd = 4.902. In this context, the construct validity of the scale was confirmed. As a result of the research, it was determined that 90,4% of the participants had been vaccinated. It was concluded that the e-Health literacy of the participants was at a medium level (37.38±7.90), while their COVID-19 vaccine literacy was at a low level (30.88±7.34). It was concluded that the participants' attitudes towards vaccination were positive. It has been determined that the increase in the e-Health and COVID-19 vaccine literacy levels of the participants caused a positive increase in their attitudes toward the vaccine.

Keywords: COVID-19, Vaccine, Vaccine Literacy, e-Health, e-Health Literacy.

[a] raslan@cumhuriyet.edu.tr https://orcid.org/0000-0001-5843-626X
[b] ebrar@cumhuriyet.edu.tr https://orcid.org/0000-0002-5255-8482
[c] ayselarslan@cumhuriyet.edu. https://orcid.org/0000-0002-8775-1119
[d] ahmetalim@cumhuriyet.edu.tr https://orcid.org/0000-0001-9577-5965

Introduction

The discovery of the vaccine has been one of the turning points in the history of medicine. The first studies on vaccination were developed against smallpox in the 16th century. For this purpose, scabs were ground and snuffed into the nose in smallpox. This method has started to be used for vaccination purposes. This practice was discovered to generate protective immunization in humans. Modern vaccine studies were developed by Edward Jenner in 1976 against smallpox [1].

Immunization is one of the most successful practices for the maintenance of public health. The preventive immunization process is carried out with the vaccine. Vaccines are biological preparations that provide humoral or cellular immunity, which, when given to the organism in the right way, form specific antibodies against the disease-causing antigen by stimulating the immune system cells [2]. Due to the vaccine and vaccination, the mortality and morbidity rates of many infectious diseases have been reduced, and the continuation of public health throughout the world has been ensured. In this context, many diseases such as Smallpox, Measles, Rubella, Tetanus, Diphtheria, Poliomyelitis, Malaria, and Tuberculosis have been controlled by immunization. According to the World Health Organization (WHO), it is stated that an average of the 3 million people survive each year using vaccination. In addition to protection from infectious diseases, vaccination also contributes to public health and the country's economy, such as preventing antibiotic resistance, reducing the incidence of some cancer diseases, protecting against bioterrorism, and reducing health care costs [3].

Literacy is people's understanding of the meanings of certain symbols and their interpretation in life [4]. Health literacy is defined by WHO as the ability of people to access accurate and reliable health information sources and services to understand basic health information, protect and improve their well-being, and make correct health decisions by understanding this information [5]. Vaccine literacy is the period of accessing and processing basic health information and services, which are necessary for people to get the correct information about vaccines and make the right decisions about vaccination. It is the understanding and transfer of accurate information about vaccines to other people [6]. e-Health is the use of information and communication technologies with all its functions to improve the medical condition of people and increase openness to medical

services to provide efficient health services to all people in the health sector [7].

People advocated that the internet is the easiest and fastest way to access information, and it has a significant influence on understanding health-related topics. There are many studies in the literature that express the people researching and understanding the internet of health-related topics [8,9]. Insufficient levels of health literacy and vaccine literacy; cause the limitation of accessing and using the health services, irrational drug use, increase in incidence, morbidity, and mortality rates of diseases, spreading of infectious diseases, and disruption of public health order [10].

According to WHO data, 1.5 million people die every year from diseases that can be prevented by vaccination [11]. Negative attitudes towards vaccines occur in people due to many reasons, such as concerns about the content of vaccines, possible side effects of vaccines, religious beliefs, and information pollution on social media and the internet [11]. For the protection of public health, it is very important for people to have a sufficient vaccination literacy level. It is difficult for people who do not have sufficient health literacy and e-Health literacy levels to reach accurate and reliable information about vaccines due to reasons such as confusion of information about vaccines, unlimited sources of vaccine information on the internet and websites, and information pollution about vaccines in social media. The attitudes of these people towards vaccination are changing.

Although the vaccine provides the continuation of public health in terms of individual and social aspects, serious public health problems occur with the decrease in the rate of vaccination in the community as a result of vaccine hesitancy which is commonly encountered during the Coronavirus disease-19 (COVID-19) pandemic too. Today, the importance of e-Health literacy is a stubborn fact to easily access, understand, process, and evaluate correct and reliable information from today's electronic/digital sources for both COVID-19 vaccines and all vaccines.

When the literature in this context was examined, "*vaccine, attitude towards vaccines, anti-vaccination, vaccine acceptance, and health literacy*" studies had been conducted in the world and Türkiye, and no study had been found on attitudes toward e-Health literacy, and COVID-19-vaccines.

The COVID-19 pandemic, which started to be seen in 2019 and is thought to decrease in the middle of 2022, has affected the whole world and continues to affect it. On the other hand, not only this contagious disease but also the vaccines developed for the disease have become very important all over the world, and these issues have not been clarified. With the emergence of this pandemic, distant health services, in other words, the e-Health concept, has gained importance. In this context, it is important for people to be conscious.

The aim of this study is developing the COVID-19 vaccine attitude scale. Also, measuring people's e-Health and vaccine literacy levels and evaluate the impact of these concepts on people's attitudes toward vaccines and determine the effect of e-Health literacy on the impact of people's COVID-19 vaccine literacy levels on their vaccine attitudes. The research model and hypotheses developed in this direction are as follows:

H_1: The level of e-Health literacy has a positive effect on vaccination attitude.

H_2: The level of e-Health literacy has a positive effect on the COVID-19 vaccine literacy level.

H_3: The COVID-19 vaccine literacy level has a positive effect on the vaccine attitude.

H_4: The COVID-19 vaccine literacy level has an effect on the effect of e-Health literacy level on vaccination attitude.

Parallel to the purpose of the research, the research model that was developed is given in Figure 1.

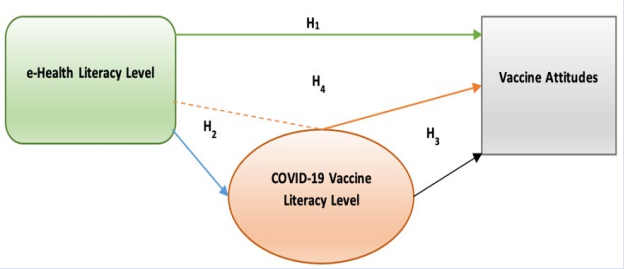

Figure 1. Research Model

Material and Methods

In this study, which was conducted with a quantitative research method, a valid and reliable scale was developed to determine the attitudes of patients towards medical practice errors. The scale development process started with a theoretical literature search. Studies on this subject have been examined in the literature. Finally, it has been determined that there is a gap in the literature on this subject. A research pattern was created in line with the studies and theoretical frameworks. In the second stage of scale development, İn order to create an item pool, all studies in the related literature were tried to be examined. After a comprehensive review of the entire literature, a 20-item pool was created to develop a scale measuring COVID-19 vaccine attitude. While creating the item pool, the items were prepared in such a way as to provide variety in the answers of the participants. While creating the item pool, it was decided to use a 5-point Likert scale (*strongly agree, agree, undecided, disagree, strongly disagree*) for the answers of the participants. Expert opinions were taken according to Davis technique for the content validity of the scale. Four-point ratings were requested as "*appropriate*", "*item should be slightly revised*", "*item should be seriously reviewed*" and "*item not appropriate*". In addition, whether there was any item they deemed necessary to be added to experts. In this context, the opinions of 15 people from different fields of expertise, including biostatisticians, health care workers, academics, and doctors, were taken. In the

fourth step of the scale development process, the items shaped in line with expert opinions were converted into a draft survey. After the formal structure of the scale in the draft survey was completed, the items were revised. A pilot study was conducted with a draft questionnaire on 50 people. At the end of the pilot study, the Cronbach's alpha value for the total reliability of the scale was checked, and it was decided to exclude two items from the form as they lowered the reliability coefficient value. Finally, the Cronbach's alpha value of 18 items was measured as 0.75, and this value gave a preliminary idea that the scale was reliable. After the pilot study, there was no problem with the form detected. Only two items were eliminated. Using this form, it was decided to start the actual data collection process.

In this study, face-to-face and online survey methods were preferred as data collection method. In this context, 1000 people were reached from many different parts of the world by using the convenience sampling method. In the study, three different scales were used. Inspired by Norman and Skinner (2006) [8], the "*e-Health Literacy Scale*" consists of 10 items and one sub-dimension. The Turkish validity and reliability of the scale were conducted by Coşkun and Bebiş in 2015 [12] and by Tamer-Gencer in 2017 [13]. The "*COVID-19 Vaccine Literacy scale*", developed by Ishikawa et al. [14] and adapted into Turkish by Durmuş et al. [15], consists of 12 items and two sub-dimensions. The scale was adapted as COVID-19 vaccine literacy by Biasio et.al. (2021) [16]. The first factor is called "*functional skills*" (FS) and consists of 4 items. The second factor is called "*critical skills*" (CS). The vaccine attitude scale, which was compiled from the studies of Kwok et al. 2020 [17]; Betsch et al. 2018 [18]; Nath et al. 2021 [19] and finalized by the researchers after taking specialist opinions, consists of 18 items and three sub-dimensions. The first dimension of the scale, which is 'belief in the usefulness of the vaccine', consists of seven judgment statements. The second dimension of the scale, which is 'vaccination rejection' and includes negative attitude, consists of seven judgment statements. The third dimension of the scale, which is the 'vaccine preference criteria', consists of four judgment statements. Ethical committee approval for this study; received from Sivas Cumhuriyet University Scientific Research and Publication Ethics Social and Human Sciences ethics committee on 29.04.2022 with the number 159562.

Results

In this part of the study, the findings obtained for the purpose of the study are presented. Approximately 2/3 of the people participating in the research are women, and more than half are single. The age range of the participants is between 16-37. It has been determined that the participants mostly work in the health and education sector, and the other participants are mostly students. Half of the people who responded to the survey stated that they had a low-income level. 45.7% of the participants are from different countries such as Netherlands, Germany, France, Qatar, Syria, and Afghanistan. Internet usage time of the participants mostly exceeds 2 hours a day, but the rate of participants doing health-related research on the internet is low. The demographic data of participants are given in Table 1.

Table 1. Demographic Data

Gender	**f**	**%**	**Age**	**f**	**%**
Women	654	65.4	16-26	525	52.5
Men	346	34.6	27-37	255	25.5
Marriage status			38-48	165	16.5
Single	582	58.2	49-59	55	5.5
Married	418	41.8	**Occupation**		
Country			Health Sector	153	15.3
Türkiye	543	54.3	Education Sector	240	24.0
Other	457	45.7	Student	354	35.4
Level of income			Housewife	51	5.1
Low	511	51.1	Retired	16	1.6
Middle	165	16.5	Self-employment	96	9.6
High	324	32.4	Unemployed	53	5.3
Internet usage time			Other	37	3.7
More than 2 hours a day	716	71.6	**Testing the health status in the last week**		
Average 1-2 hours a day	195	19.5	Yes	349	34.9
Every 2-3 days	68	6.8	No	651	65.1
Average 1-2 hours per week	21	2.1	**Total**	**1000**	**100.0**

According to the data obtained from the research, it was determined that 90.4% of the participants had been vaccinated. It was determined that the reasons for getting vaccinated by the participants were mostly because they thought it necessary to be vaccinated. The fact that vaccination is a state policy is the second reason why the participants are vaccinated. Table 2 shows vaccination status and reasons of the participants.

It was determined that the reliability levels of the scales used in the study were high and they came from a normal distribution. When the scale averages were examined; the mean score of the COVID-19 Vaccine Literacy Scale was determined to be low level, with a

score of 30.00; e-Health Literacy scale was determined to be moderate level with a score of 37.38; and the mean score of the Vaccine Attitude Scale was determined to be positive with a score of 58.

Table 2. Vaccination Status and Reasons

Reason for vaccination	f	%
Obligation (Government policy)	288	28.8
Social pressure	76	7.6
Because I thought it necessary	540	54.0
Total	**904**	**90.4**

Reason for not getting vaccinated	f	%
I'm afraid of the side effects of the vaccine	26	2.6
I don't trust the vaccine	50	5.0
I am against vaccination	6	0.6
I don't believe in vaccine protection	14	1.4
Total	**96**	**9.6**

Since the vaccine attitude scale was rearranged by the researchers, the EFA (Exploratory Factor Analysis) and CFA (Confirmatory Factor Analysis) analyzes were separately performed and reported. In addition, confirmatory factor analyzes of all the scales used in the study were performed again. It was seen that all scales were also confirmed for the valid sample. Table 3 shows the results related to the scales used in the study.

After this step firstly, a path analysis was conducted that measures the relationship between e-Health literacy and vaccination attitude. Subsequently, the COVID-19 vaccine literacy scale was added to the model as a mediator variable. The analysis results related to the models are presented in order.

Table 3. Results Related to the Scales Used in the Study

	n	Min	Max	Mean	Std. D.	Ca	Skewness		Kurtosis	
EHL Total	1000	10.00	50.00	37.38	7.90	.90	-.340	.077	-.351	.155
VL Total	1000	12.00	60.00	30.88	7.34	.86	-.314	.077	.518	.155
FC	1000	4.00	16.00	9.38	2.95	.78	.090	.077	-.405	.155
CS	1000	8.00	32.00	21.49	5.54	.86	-.331	.077	-.013	.155
VA Total	1000	18.00	90.00	58.47	9.63	.75	.012	.077	.743	.155
VBB	1000	7.00	35.00	23.62	6.95	.89	-.402	.077	-.308	.155
VR	1000	6.00	30.00	17.38	5.27	.80	-.184	.077	-.331	.155
VPC	1000	4.00	20.00	14.54	3.34	.70	-.244	.077	-.307	.155

Vaccination Attitude EFA

The factor loads of the expression's result of the factor analysis of 18 variables in the scale are between 0.54 and 0.83. It was determined that the scale consists of three dimensions with the TVA 56.972% ratio.

Table 4. EFA Results of the COVID-19 Vaccine Attitude Scale

Question Expression	The codes	Factors: Belief in Vaccine Benefit	Vaccine Rejection	Vaccine Preference Criteria	Factor Explanatory	Reliability
1	VA-1	.743			30.350	.893
2	VA-2	.769				
3	VA-3	.820				
4	VA-4	.830				
15	VA-15	.538				
16	VA-16	.614				
17	VA-17	.808				
5	VA-5		.748		18.698	.801
6	VA-6		.818			
7	VA-7		.764			
8	VA-8		.658			
9	VA-9		.699			
14	VA-14		.475			
18	VA-18		.590			
10	VA-10			.667	7.914	.703
11	VA-11			.745		
12	VA-12			.629		
13	VA-13			.702		

* TVA: 56.972; KMO Test: 0.849; Bartlett Test (χ2: 7234.970; sd: 136; p: 0.000). (Cα: 0.745)

* * TVA (Total Variance Explanation), KMO (Kaiser-Meyer-Olkin), df (degree of freedom)

Therefore, the overall reliability of the scale was determined as 0.745. These results probably indicate that the data were analyzed correctly (Table 4).

Vaccination Attitude CFA

After testing the structural validity with exploratory factor analysis, the first-level multi-factor CFA model was used to test the suitability of the scale used for the sample. The Vaccine Attitude Scale's model fit values are given in Table 5, the regression coefficients are given in Table 6, and the model fit diagram is given in Figure 2.

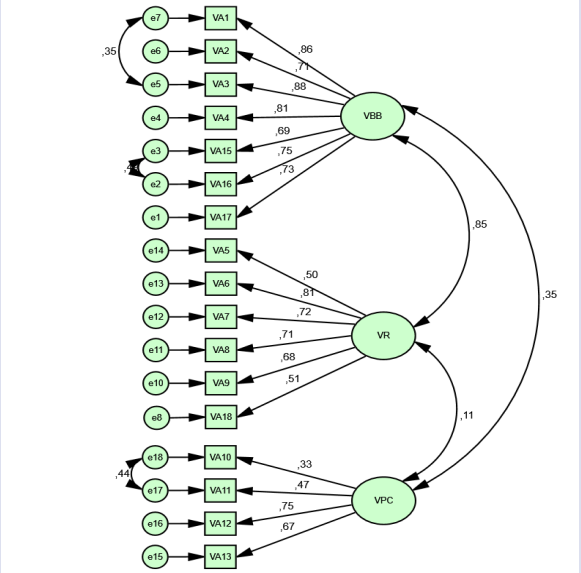

Figure 2. DFA Diagram of the Vaccine Attitude Scale

Table 5. Measuring Model Fit Indexes of Vaccine Attitude Scale

Measuring Model	p	χ2/sd	GFI	AGFI	NFI	IFI	TLI	RMSEA
Reference Values		≤ 5	≥ 0.850	≥ 0.850	≥ 0.900	≥ 0.900	≥ 0.900	≥0.080
Vaccine Attitude Scale Values (With modification)	0.000	4.902	0.906	0.863	0.901	0.920	0.912	0.084

When the vaccine attitude scale values goodness-of-fit indexes are examined, it can be said that after the modified DFA, the model is an acceptably fit since all values are at reference values. Table 5 shows measuring model fit indexes of vaccine attitude scale.

Table 6 shows parameter values of the measurement model of vaccination attitude. When Table 6 containing the parameter values of the measurement model is examined, it is seen that the SRA values vary between 0.332 and 0.883, and therefore, there is no SRA value below 0.30. In this context, no variables were removed from the model. In addition, it was determined that the paths representing the relationships among all latent variables were significant ($p<0.05$).

Table 6. Parameter Values of the Measurement Model of Vaccination Attitude

			Prediction	SRA	SH	T	p
VA17	<---	VBB	1.000	.728			0.000
VA16	<---	VBB	.999	.752	.056	17.811	0.000
VA15	<---	VBB	.904	.686	.053	16.924	0.000
VA4	<---	VBB	1.063	.811	.057	18.783	0.000
VA3	<---	VBB	1.374	.883	.066	20.958	0.000
VA2	<---	VBB	1.114	.714	.067	16.698	0.000
VA1	<---	VBB	1.312	.856	.070	18.615	0.000
VA18	<---	VR	1.000	.512			0.000
VA14	<---	VR	.946	.365	.102	11.870	0.000
VA9	<---	VR	1.395	.678	.123	11.345	0.000
VA8	<---	VR	1.447	.708	.128	11.266	0.000
VA7	<---	VR	1.251	.724	.107	11.665	0.000
VA6	<---	VR	1.522	.813	.128	11.918	0.000
VA5	<---	VR	.865	.503	.094	9.160	0.000
VA13	<---	VPC	1.000	.670			0.000
VA12	<---	VPC	1.187	.754	.134	8.860	0.000
VA11	<---	VPC	.932	.473	.177	5.259	0.000
VA10	<---	VPC	.771	.332	.173	4.456	0.000

In the 18-item vaccine attitude precursors within the scope of the research model, the latent variables "Belief in Vaccine Benefit" (VBB) with 7 items, "Vaccine Rejection" (VR) with 7 items, and "Vaccine Preference Criteria" (VPC) with 4 items were handled and examined as the first level multifactor model in the CFA process. When the factor loads of the variables in the vaccination attitude scale were examined, it was determined that the factor loads of all items varied between 0.33 and 0.88. It was determined that there were no problematic items in any of the sub-dimensions of the scale. When the results obtained from the study were evaluated together, it was found that the scale was reliable and valid (Table 5,6; Figure 2).

Testing the Structural Equation Models

In our research for model building, two types of statistical models were designed: measurement model (CFA) and structural model that tests the relationship between variables (SEM). The CFA models were statistically validated for the sake of compatibility with the data. Statistical Validation Tests of the developed SEM model are given in this section.

SEM Model of the Relationship between e-Health Literacy and Vaccination Attitude

The SEM results that were developed to test the H1 hypothesis are presented below. Model fit values are given in Table 7. Regression coefficients are given in Table 8. The model fit diagram is shown in Figure 3.

Table 7. Fit Indexes of the Effect of e-Health Literacy on Vaccination Attitude

Measuring Model	p	χ2/sd	GFI	AGFI	NFI	IFI	TLI	CFI	RMSEA
Reference Values		≤ 5	≥ .850	≥ 0.850	≥ 0.900	≥ 0.900	≥ 0.900	≥ 0.950	≥ 0.080
Model 1 Values (With modification)	0.000	4.441	0.853	0.851	0.917	0.936	0.912	0.952	0.079

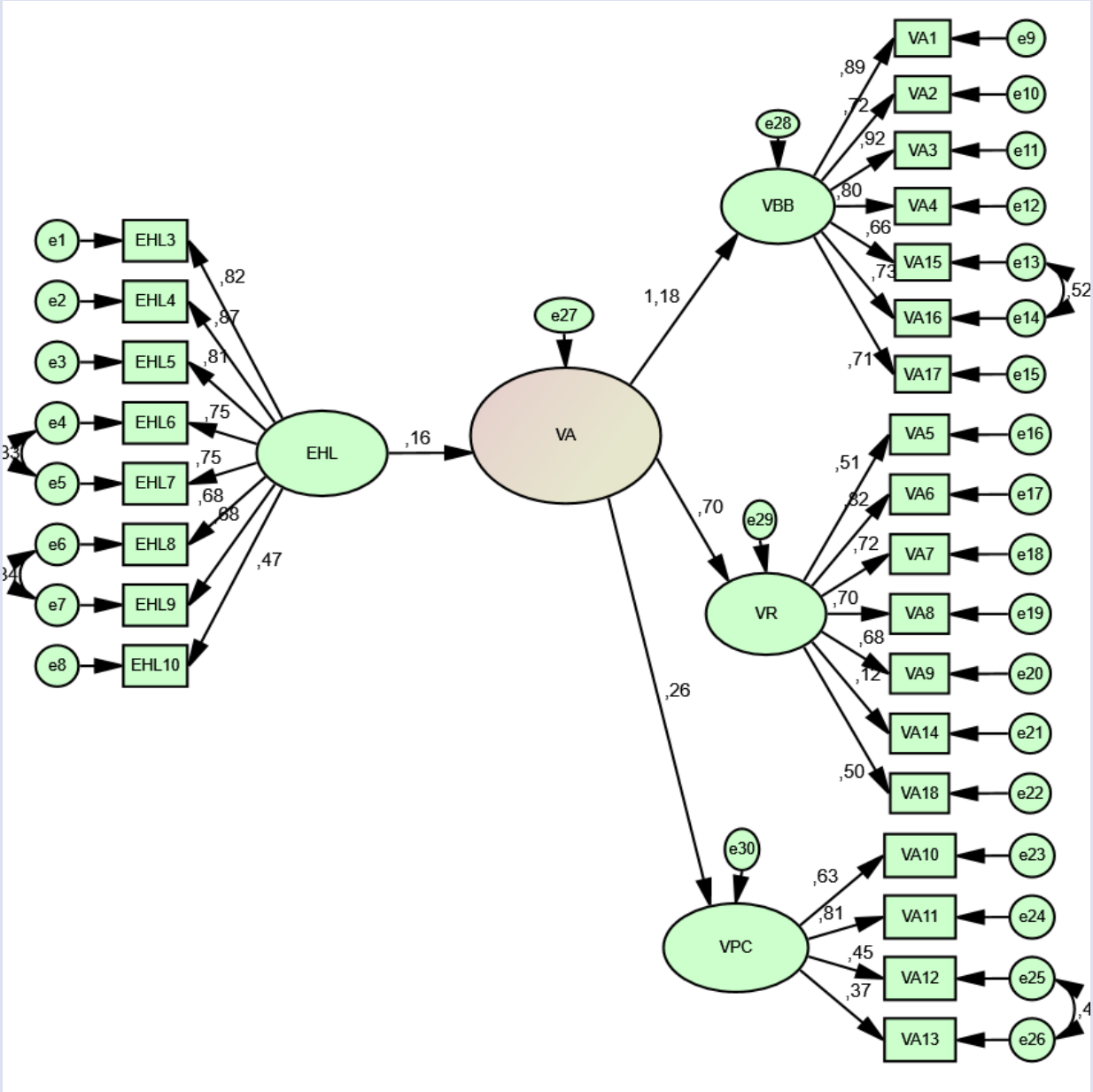

Figure 3. The Effect of e-Health Literacy on Vaccination Attitude Diagram

It was determined that the variables in the model were in acceptable threshold values after the modification. Therefore, the Model adjusts well to the data. Model parameter values are given in Table 8.

When the data in Table 8 are analyzed, it is seen that the relationships between factor loadings and latent variables are significant since the *p* values are less than *0.01* in all relationships.

In order to test the H1 (*The level of e-Health literacy has a positive effect on vaccination attitudes*) hypothesis, the implicit variable structural model in which e-Health literacy is an exogenous variable and vaccine attitude is an endogenous variable was tested. When the data in Figure 3 and Table 8 are analyzed, it was determined that e-Health literacy predicted vaccination attitude (ß=.16; *p<.01*) as a result of the path coefficient (ß) showing the total effect without the mediating variables. Therefore, the H1 hypothesis was accepted.

Table 8. Model 1 Parameter Values

			Prediction	SRA	SH	T	p
VA	<---	EHL	.296	.164	.069	4.317	0.000
VBB	<---	VA	1.000	1.183			0.000
VR	<---	VA	.283	.702	.053	5.362	0.000
VPC	<---	VA	.139	.256	.037	3.764	0.000
EHL3	<---	EHL	1.000	.816			0.000
EHL4	<---	EHL	1.118	.871	.047	23.780	0.000
EHL5	<---	EHL	.974	.808	.045	21.468	0.000
EHL6	<---	EHL	.959	.753	.049	19.422	0.000
EHL7	<---	EHL	.858	.751	.044	19.351	0.000
EHL8	<---	EHL	.816	.684	.047	17.197	0.000
EHL9	<---	EHL	.838	.678	.049	17.006	0.000
EHL10	<---	EHL	.619	.472	.056	11.140	0.000
VA1	<---	VBB	1.000	.889			0.000
VA2	<---	VBB	.839	.719	.041	20.494	0.000
VA3	<---	VBB	1.061	.918	.033	32.481	0.000
VA4	<---	VBB	.797	.802	.032	24.675	0.000
VA15	<---	VBB	.661	.663	.036	18.131	0.000
VA16	<---	VBB	.721	.726	.035	20.842	0.000
VA17	<---	VBB	0.725	0.714	0.036	20.298	0.000
VA5	<---	VR	1.000	0.505			0.000
VA6	<---	VR	1.751	0.819	0.149	11.741	0.000
VA7	<---	VR	1.345	0.722	0.121	11.108	0.000
VA8	<---	VR	1.643	0.704	0.150	10.973	0.000
VA9	<---	VR	1.514	0.681	0.140	10.794	0.000
VA14	<---	VR	0.259	0.123	0.097	2.673	0.000
VA18	<---	VR	1.102	0.503	0.122	9.022	0.000
VA10	<---	VPC	1.000	0.632			0.000
VA11	<---	VPC	1.100	0.814	0.124	8.847	0.000
VA12	<---	VPC	0.637	0.448	0.077	8.247	0.000
VA13	<---	VPC	0.502	0.366	0.073	6.909	0.000

Mediated Structural Model

The SEM results developed to test the $H_{2\text{-}3\text{-}4}$ hypotheses are presented below.

Model fit values are given in Table 9. Regression coefficients are given in Table 10. The model fit diagram is shown in Figure 4. It was determined that the variables in the model were in acceptable threshold values after the modification. Therefore, the Model adjusts well to the data. Mediated structural model parameter values are given in Table 10.

When the data in Table 10 are analyzed, it is seen that the relationships between factor loadings and latent variables are significant since the *p* values are less than *0.01* in all relationships. The path analysis test based on the bootstrap method was conducted to test whether COVID-19 vaccine literacy has a mediating role in the effect of e-Health literacy on vaccine attitude through mediated structural model analysis. According to the bootstrap results, it can be said that the indirect effect of e-Health literacy on vaccine attitude is significant (ß=.16) even after adding the COVID-19 vaccine literacy mediator variable. Therefore, it can be stated that the H4 hypothesis is accepted (ß=.16, 95% CI [.016, 1.05]).

Table 9. Mediated Structural Model Fit Index

Measuring Model	p	χ2/sd	GFI	AGFI	NFI	IFI	TLI	CFI	RMSEA
Reference Values		≤ 5	≥ 0.850	≥ 0.850	≥ 0.900	≥ 0.900	≥ 0.900	≥ 0.950	≥ 0.080
Model 2 Values (With modification)	0.000	4.389	0.874	0.862	0.917	0.912	0.916	0.952	0.079

Table 10. Parameter Values of the Mediated Structural Model

			Prediction	SRA	SH	T	p
Vaccination Literacy	<---	e-Health Literacy	.124	.326	.032	3.864	0.000
Vaccine Attitude	<---	e-Health Literacy	.381	.394	.043	8.927	0.000
Vaccine Attitude	<---	Vaccination Literacy	.413	.162	.081	5.108	0.000
VBB	<---	Vaccine Attitude	.810	.663	.078	10.382	0.000
VR	<---	Vaccine Attitude	-.372	-.383	.048	-7.797	0.000
VPC	<---	Vaccine Attitude	1.000	1.023			0.000
FB	<---	Vaccination Literacy	1.000	.403			0.000
EB	<---	Vaccination Literacy	2.740	1.302	.648	4.226	0.000
EHL3	<---	e-Health Literacy	1.000	.713			0.000
EHL4	<---	e-Health Literacy	1.124	.793	.047	23.723	0.000
EHL5	<---	e-Health Literacy	1.057	.777	.045	23.276	0.000
EHL6	<---	e-Health Literacy	1.112	.805	.046	24.073	0.000
EHL7	<---	e-Health Literacy	1.065	.793	.045	23.723	0.000
EHL8	<---	e-Health Literacy	.925	.700	.044	20.962	0.000
EHL9	<---	e-Health Literacy	.862	.637	.045	19.077	0.000
EHL10	<---	e-Health Literacy	.789	.542	.048	16.300	0.000
VA1	<---	VBB	1.000	.687			0.000
VA2	<---	VBB	1.002	.682	.045	22.391	0.000
VA3	<---	VBB	1.133	.771	.041	27.312	0.000
VA4	<---	VBB	1.026	.759	.049	21.010	0.000
VA15	<---	VBB	.877	.691	.046	19.199	0.000
VA16	<---	VBB	.947	.747	.046	20.615	0.000
VA17	<---	VBB	.973	.744	.047	20.670	0.000
VA5	<---	VR	1.000	.591			0.000
VA6	<---	VR	1.259	.726	.075	16.683	0.000
VA7	<---	VR	1.175	.714	.071	16.522	0.000
VA8	<---	VR	1.078	.620	.072	15.067	0.000
VA9	<---	VR	1.120	.660	.071	15.715	0.000
VA14	<---	VR	.850	.487	.068	12.554	0.000
VA18	<---	VR	.788	.497	.062	12.769	0.000
VA10	<---	VPC	1.000	.607			0.000
VA11	<---	VPC	.899	.596	.063	14.225	0.000
VA12	<---	VPC	1.081	.695	.069	15.667	0.000
VA13	<---	VPC	.800	.542	.060	13.280	0.000
VL4	<---	FB	1.000	.734			0.000
VL3	<---	FB	.779	.614	.046	16.907	0.000
VL2	<---	FB	1.006	.778	.050	20.064	0.000
VL1	<---	FB	.773	.621	.045	17.083	0.000
VL12	<---	EB	1.000	.663			0.000
VL11	<---	EB	1.043	.658	.058	17.929	0.000
VL10	<---	EB	1.058	.663	.059	18.042	0.000
VL9	<---	EB	1.145	.735	.058	19.639	0.000
VL8	<---	EB	1.124	.663	.062	18.034	0.000
VL7	<---	EB	1.049	.690	.056	18.611	0.000
VL6	<---	EB	.832	.552	.055	15.264	0.000
VL5	<---	EB	.913	.579	.057	16.055	0.000

Likewise, the direct effect of COVID-19 vaccine literacy on vaccine attitude appears to be significant in this model. (ß=.198; *p<.05*). In addition, according to the results of mediated structural model analysis, to which all variables were added, it was determined that the overall effect of e-Health literacy level on vaccination attitude was significant and 0.39 (ß=.394; *p<.01*). Also, the overall effect on the mediating variable COVID-19 vaccine literacy was found to be significant and 0.33 (ß=.326; *p<.01*). Hence, the $H_{2\text{-}3}$ hypotheses were accepted.

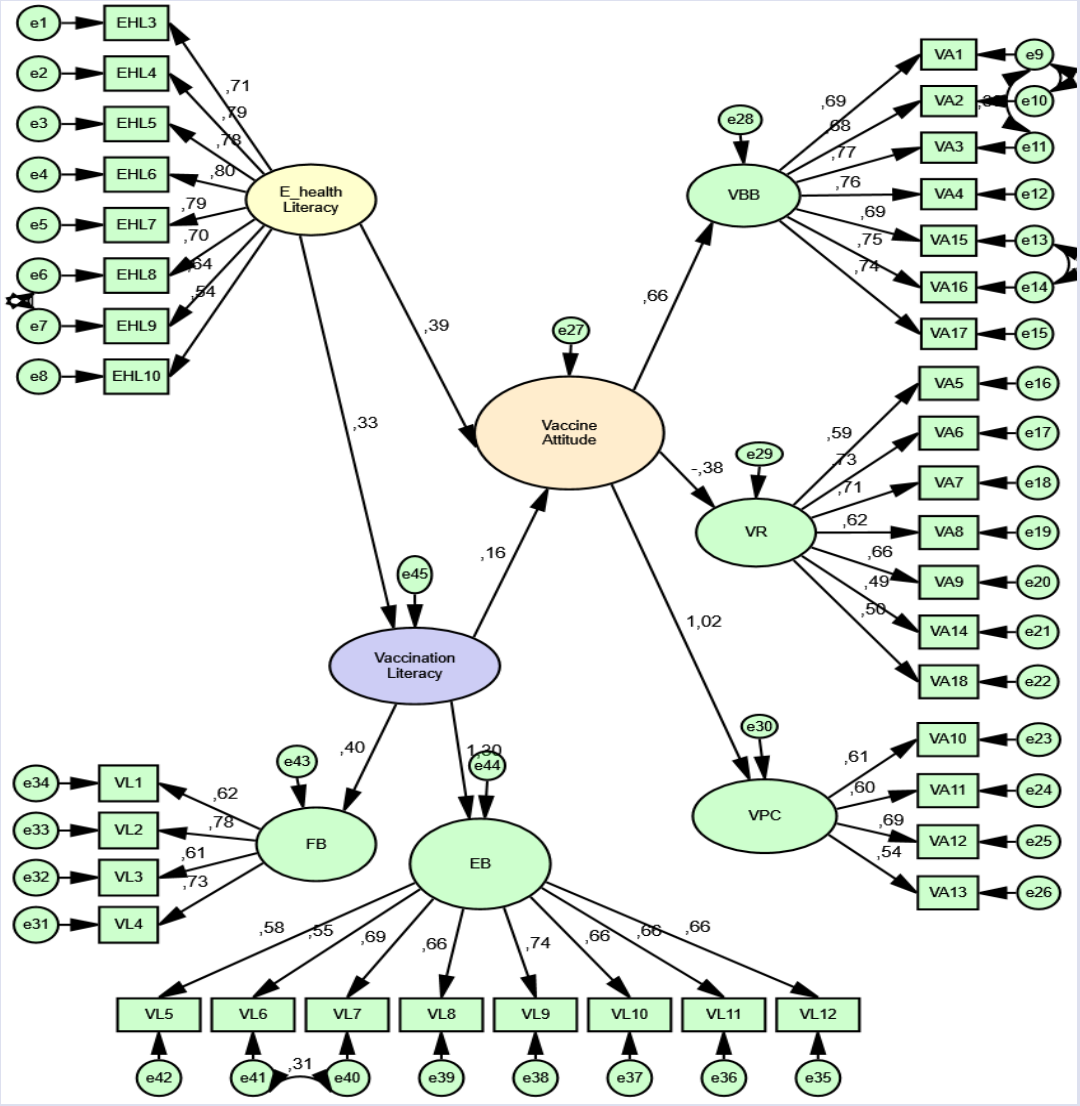

Figure 4. Mediated Structural Model Diagram

Discussion

In this study, which was conducted to develop the COVID-19 vaccine attitude scale, a scale consisting of 18 items and 3 factors was developed. As a result of the statistical analyzes, it was determined that the scale was valid and safe. As a result of this research, which was conducted to determine the COVID-19 vaccine literacy has a role in the effect of e-Health literacy on vaccine attitude, it was defined that almost all of the participants were vaccinated. It was determined that the e-Health literacy of the participants was at a moderate level, and their COVID-19 vaccine literacy was at a low level. It was concluded that the participants' attitudes towards the vaccine were positive. It was determined that the increase in e-Health and COVID-19 vaccine literacy levels of the participants caused their attitudes towards vaccines to increase positively. Also, it was determined the role of COVID-19 vaccine literacy level in the effect of e-Health literacy level against vaccine attitude.

When the literature is examined, it has been noticed that in societies with low health literacy levels, the reason for this situation is related to the lack of knowledge and inadequacy in hygiene. As a result, it has been determined that there is an increase in the rate of people being affected by infectious diseases and a decrease in the response to the treatment applied. In addition, due to chronic diseases, it has been determined that the high economic burden on health institutions, due to the increase in hospitalization rates and morbidity and mortality rates [20].

Vaccine rejection has become one of the notable issues today. Many parameters were effective among the reasons for the hesitations about the vaccine experienced in the COVID-19 pandemic, such as inadequacy of individual health literacy, the inadequacy of prophylaxis, doubts about the vaccines developed due to time constraints, and the inadequate information of vaccines' side effects. The importance of these factors should not be overlooked in the decisions affecting the vaccination attitude. It is very momentous to examine the relationship between these factors and health

literacy. The increase in health literacy should not be accepted as an increase in the positive attitude toward vaccines. This should be understood as people knowing to protect their health interests. However, the correct determination of the reasons for vaccine hesitancy will pave the way for the formation of the right strategies while making new vaccination plans [21]. In the study conducted by Nath, Imtiaz, Nath, and Hasan (2021) [19], they examined the impact of young adults' vaccine hesitancy, e-health literacy, and vaccine literacy levels on getting a COVID-19 vaccine. It was determined that the most effective predictor of the participants being vaccinated is vaccination hesitancy, in the results. In addition, a positive association between e-Health literacy and vaccine acceptance was determined. It has been stated that the announcing the current developments regarding vaccine safety through official and secure channels is effective in eliminating the hesitations of young adults about vaccination.

People's attitudes toward the COVID-19 vaccine affect their decisions about whether or not to get vaccinated [22]. Wilson and Wiysonge (2020) [23] detected that social media posts highly affect vaccination attitudes. Since COVID-19 vaccines are still being developed, the lack of a clear balance of benefit and harm can be a determining factor, especially for autoimmune patients.

Gendler and Ofri (2021) [24] investigated the thinking of parents' to vaccinate their children" in their study in Israel. It was determined in the study that the vaccination literacy of the parents was at a moderate level. Also, it was found that as the vaccination literacy level of the parents increased, they experienced less hesitance about vaccination. Vaccine hesitancy for the COVID-19 vaccine can be overcome by scientific evidence, consistent and clearly presented information, healthy communication, and raising the health literacy of those who provide and demand information. Despite the efforts of scientists and medical experts regarding the COVID-19 pandemic, the low level of health literacy and negative vaccination attitudes in the general population present a serious obstacle to the campaigns carried out all over the world on this regard. In the study conducted by Gusar et al. (2021) [25], it was determined that the vaccine literacy of the participants was at a moderate level.

Another study conducted to understand vaccine hesitancy and determine the level of health literacy was carried on in the United States by Willis et al. (2021). It was determined that approximately one-fifth of the participants had hesitations about vaccination. There is no trust in vaccines in general, university graduates have more hesitations about vaccination, fear of infection, and the belief that vaccination will increase existing health inequalities were among the other findings.

In the study conducted by Costantini (2021) [26], the vaccination status and vaccination literacy levels of elderly people in Japan were examined. It has been determined that the people who care for their elderly-parents have a lower level of vaccination literacy than their health literacy.

While vaccination is an effective way to combat COVID-19, vaccine hesitation is also seen to be a hindering factor in the fight against the disease. The findings obtained in the studies conducted indicate that behavior that reveals vaccine rejection is not a simple decision that can be expressed as acceptance or rejection; there are many different factors, such as lack of information, negative perception about vaccines, conspiracy theories, and religious reservations. In the study conducted by Harada and Watanabe (2022) [27], it was concluded that the psychological and emotional states of people, such as anxiety and risk perception affect the vaccination attitude.

In the study conducted by Turhan et al. (2021) [28], it was determined that not relying on vaccination affects vaccination hesitancy. It was concluded that people with a low level of health literacy and low trust in the health system experience a higher level of vaccination hesitancy. In a study conducted by students by Çetin et al. (2021) [29], it was determined that students' hesitations about vaccination are high. It is noteworthy that hesitancy about vaccination is high, especially among students studying in the branches of health. Because it is the health workers who need to raise awareness of the public about vaccination. In this context, it is substantial to revise the course contents of health education departments in universities and to raise awareness among students about vaccines.

Conclusion

WHO defined vaccine hesitancy as a major threat to global health due to the resurgence of vaccine-preventable diseases, although there have been great advances in vaccines in the last century. Vaccine hesitancy should not be perceived only as a concept related to the COVID-19 vaccine; it should not be overlooked that it has become widespread concerning many vaccines. Social media posts about anti-vaccination increase vaccine hesitancy. Globally, access to technology and social media platforms is increasing. Social media users not only have easy access to information but also create content themselves. Public confidence in the future development of vaccines for new pathogens such as SARS-CoV-2 is being shaken, due to significant public health concerns, which are fueled by anti-vaccine messages on social media [30]. The emergence of vaccine rejection in the COVID-19 pandemic has led to an increase in deaths related to this disease. It is necessary to develop different and innovative strategies to overcome vaccine hesitation. In the prevention of anti-vaccine movements, the development of vaccines with proven safety, strict implementation of vaccine control, and inclusion of compensations for the victims who suffered as a result of vaccination are important. Many different solutions need to be developed for those who fully accept the vaccine,

the responses for those who hesitate, and those who reject all vaccines completely [2].

Conflict of Interest

The authors stated that did not have conflict of interests.

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