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COVID-19 Vaccine from the Perspective of a Chronic Neurological Disease: The Case of Epilepsy

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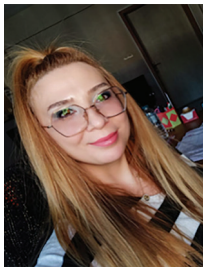

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Abstract

Objective: The study aimed to determine the attitude of individuals with epilepsy towards the coronavirus disease-2019 vaccine and to determine its relationship with socio-demographic characteristics, disease duration, seizure frequency, and medication use.

Methods: The study had a descriptive, cross-sectional design and was conducted between June and November 2025 among 180 individuals with epilepsy who presented to neurology outpatient clinics in northern and eastern Türkiye. Study data were collected using a personal information form and the vaccine hesitancy scale in pandemics.

Results: Individuals with epilepsy showed a lower level of confidence (a sub-dimension of the vaccine hesitancy scale in pandemics) in pandemics. The mean score was determined as 21.41±6.45, the mean score for the risk sub-dimension was 6.08±2.09, and the mean total scale score was 27.49±7.49. Significant differences were found in the sub-dimensions of the vaccine hesitancy scale in pandemics according to individuals' marital status, income level, seizure frequency, and medication use status ($p<0.05$).

Conclusion: The results imply that individuals with epilepsy had low levels of overall vaccine hesitancy and lack of confidence in pandemics. The potential vaccine-related risk levels were found to be moderate. Vaccine hesitancy in individuals with epilepsy was associated with sociodemographic and epilepsy-specific characteristics, such as marital status, income level, and medication use. In the regression analysis, perceived income level, seizure type, medication use, and vaccination status were identified as significant predictors of vaccine hesitancy levels during the pandemic. Considering that individuals with epilepsy, especially those with difficult seizure control and those using multiple medications (polypharmacy), have higher vaccine hesitancy and greater perception of potential vaccine risks, strengthening one-on-one counseling, risk/benefit assessment, and post-vaccination follow-up practices by healthcare professionals is of great importance.

Keywords: Epilepsy, COVID-19, vaccine, attitude

INTRODUCTION

Epilepsy is among the chronic neurological diseases that negatively affect the quality of life of patients.[1,2] On a global scale, coronavirus disease-2019 (COVID-19) infections reached pandemic status in March 2020, and the process that followed the declaration of the pandemic led to an atmosphere of uncertainty among people.[3] As COVID-19 cases increased, in-person schooling was suspended, face-to-face mass events and sports competitions were restricted, many businesses in the public and private sectors were temporarily closed, and international entry and exit were halted. Although Türkiye was among the countries in which the virus spread later, the numbers of cases and deaths increased over time. According to the Ministry of Health's COVID-19 information platform, the total number of COVID-19 cases in Türkiye was 17.042.722 in November 2022, while the total number of deaths was 101.492.[4] Individuals with chronic diseases are at increased risk of adverse outcomes from COVID-19. Although COVID-19 infection does not pose a direct risk to individuals with epilepsy, factors such as infection-related fever, stress, or sleep deprivation have been reported to negatively affect seizure control.[5-7]

Vaccination has been the most effective method for controlling many infectious diseases that have emerged throughout history.[7] A mass immunization program has been considered the best way to slow the pandemic, and the COVID-19 vaccine has been reported to be safe for the vast majority of people.[8-10]

In recent years, anti-vaccination or vaccine hesitancy movements have emerged in many countries, particularly in Europe and the United States.[11,12] Vaccine hesitancy, which arises from distrust or opposition to vaccines, is a significant public health problem that jeopardizes global health. Vaccine hesitancy is associated with individuals refusing or delaying vaccination for various reasons, such as their religious beliefs, lifestyles, socioeconomic conditions, political views, or distrust of the health system.[13] A study conducted in Italy indicated that attitudes toward vaccines are not affected by sociodemographic characteristics but rather by individuals' health status and psychological factors. In particular, personality traits such as low conscientiousness, high self-centeredness, and maladjustment have been associated with negative attitudes toward vaccines.[4] A global study examining reasons for not getting the COVID-19 vaccine identified the three most frequent: concerns about side effects, belief that the vaccine is ineffective, and low perceived personal risk.[14]

Previous studies have reported that vaccines developed with messenger RNA technology, in particular, cause concern among vaccine-hesitant individuals about their long-term and potential side effects. Studies of vaccine hesitancy have reported that individuals who are hesitant about vaccines tend to exhibit higher levels of neuroticism and control-oriented personality traits.[15,16] Individuals with epilepsy are not at higher risk of contracting COVID-19 than those with other chronic diseases. However, COVID-19 infection in individuals with epilepsy may predispose them to seizures because of high fever or sleep disturbances. For this reason, such infectious diseases are important contributors to the disruption of seizure control in individuals with epilepsy.[17] Studies examining the relationships between epilepsy and COVID-19 in the literature generally focused on various parameters such as medication adherence and stigmatization,[18] psychological effects of the pandemic,[19] anxiety and depression levels,[20] quality of life,[21] seizure frequency,[22,23] impacts on women of the pandemic,[24] COVID-19 fear and sleep quality,[25] and the effects on social life.[26]

Studies examining attitudes and hesitancy towards the COVID-19 vaccine in individuals with epilepsy are limited, and those that exist focus on seizure frequency and vaccination safety.[27-30] However, the causes, determinants, and public health implications of vaccine hesitancy have not been sufficiently investigated

Individuals with epilepsy are more likely to experience severe COVID-19 because of their chronic illnesses; therefore, vaccination is essential for this group. However, understanding the reasons for vaccine hesitancy among individuals with epilepsy and addressing knowledge gaps in this area are critical for individuals and public health. Although the literature on COVID-19 vaccine hesitancy has rapidly increased in the post-pandemic period, studies investigating vaccine hesitancy and influencing factors in individuals with chronic neurological diseases such as epilepsy appear to be limited. Concerns about seizure control, drug interactions, and vaccine safety may differ between individuals with epilepsy and the general population. The study provides a unique contribution to the literature on vaccine hesitancy by including data from individuals with epilepsy residing in two geographically distinct regions. This study was designed to determine the attitudes of individuals with epilepsy living in the northern and eastern regions of Türkiye towards the COVID-19 vaccine and the factors influencing these attitudes. This research is expected to contribute to identifying vaccine hesitancy and concerns among individuals with epilepsy and to developing targeted education and counseling programs for healthcare professionals.

The study results are anticipated to provide a scientific basis for planning future vaccination campaigns during pandemics and for strengthening public health policies. The study offers unique scientific and social value both in filling a gap in the literature and in contributing to an understanding of the attitudes of individuals with epilepsy towards vaccination.

MAIN POINTS

- This study is one of the few that examine the attitudes of individuals with epilepsy toward the coronavirus disease-2019 vaccine.
- Individuals with epilepsy have low levels of vaccine skepticism.
- Individuals with epilepsy have moderate perceptions of the risks associated with vaccination.
- The level of vaccine hesitancy among individuals with epilepsy is affected by sociodemographic and clinical factors, such as marital status, income level, place of residence, seizure frequency, and medication use.

METHODS

Participants

The study was conducted between June and November 2025 in the neurology clinics of two hospitals that met the inclusion criteria, located in the northern and eastern regions of Türkiye. The sample size of the study was calculated using the G*Power 3.1.9 program. During the calculations, the mean effect size was set at 0.25, the margin of error at 0.05, and the power at 0.80 for parameters specified according to the type of test.[31] As a result of the calculation, the minimum number of participants was determined to be 159. The study enrolled 180 participants with epilepsy, exceeding the minimum sample size.

Inclusion Criteria

- Being 18 years of age or older,

- Being followed for at least six months with a diagnosis of epilepsy,

- Having no communication problems.

Exclusion Criteria

- Having a cognitive or psychological health problem that would prevent communication,

- Incomplete data collection forms,

- Refusal to participate in the study.

Data Collection

The data were collected through face-to-face interviews, each lasting approximately 10-15 minutes, using the personal information form (prepared by the researcher) and the vaccine hesitancy scale in pandemics.

Personal Information Form

Prepared by the researcher in line with the literature data,[16,18,23] the form consisted of 14 questions aimed at determining the age, gender, marital status, education, place of residence, occupation, income level, duration of epilepsy, frequency of seizures, medication use, COVID vaccine status, and experience of vaccine-related side effects.

Vaccine Hesitancy Scale in Pandemics

The vaccine hesitancy scale in pandemics, whose Turkish validity and reliability study was conducted by Çapar and Çınar,[16] consists of 10 items and two sub-dimensions. The first sub-dimension of the scale, lack of confidence, consists of eight items (I1-T, I2-T, I3-T, I4-T, I5-T, I6-T, I7-T, I8); items marked with the letter "T" are reverse-scored. High scores in this sub-dimension indicate increased individual distrust of vaccines during pandemics. The second sub-dimension, risk, consists of two items (I9 and I10). High scores on the sub-dimension indicated that individuals perceived the potential risks of vaccines to be high during pandemics. The overall reliability of the scale was high (Cronbach's alpha=0.901).[16] The Cronbach's alpha coefficients for this study are as follows: lack of confidence sub-dimension, 0.86; risk sub-dimension, 0.93; total scale, 0.86.

Ethical Issues

Prior to conducting the study, approval was obtained from the Atatürk University Non-Interventional Clinical Research Ethics Committee (approval no: 18, date: 02.05.2025). Institutional permission was also obtained from the relevant hospitals. Furthermore, patients were informed, and their verbal and written consent was obtained before data collection. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics 27.0 (IBM Corp., Armonk, NY, USA). To examine the relationship between the scores obtained by individuals with epilepsy on the sub-dimensions and total score of the vaccine hesitancy scale during pandemics and their personal information, independent-samples t-tests were used for comparisons between two groups, and one-way analysis of variance (ANOVA) was used for comparisons among three or more groups. Tukey tests were used for multiple comparisons because the data showed a homogeneous distribution. Pearson product-moment correlation analysis was used to examine the relationships between continuous variables and scale scores.

RESULTS

Participants' Characteristics

The average age of epilepsy patients was 41.57±13.84, the average duration of epilepsy was 16.48±11.31 years, 51.7% of them were female, 66.7% were married, 47.8% had completed secondary education, 48.9% lived in the district, 70% were unemployed, 68.9% had income less than expenses, 35.6% experienced a seizure once a year, 48.3% had generalized tonic-clonic seizures, and 60% had multiple drug use (polypharmacy). Eighty-four point four percent of the individuals with epilepsy were vaccinated during the pandemic, with 40.8% receiving Sinovac and 59.2% receiving BioNTech vaccines; 71% of those vaccinated reported no vaccine-related side effects (Table 1).

Table 1 shows the mean scores of individuals with epilepsy on the sub-dimensions and the total score of the vaccine hesitancy scale in pandemics, according to their demographic characteristics. The mean scores of the risk sub-dimension of the vaccine hesitancy scale in pandemics differed significantly by marital status ($p<0.05$); married individuals had higher scores than single individuals. The mean scores of the lack of confidence sub-dimension and the total scores of the vaccine hesitancy scale in pandemics differed significantly by perceived income level ($p=0.001$), seizure type ($p<0.05$), and medication use status ($p<0.05$). Those whose income exceeded their expenses had higher average scores than others; those with generalized tonic-clonic seizures had higher average scores than those with partial seizures; and those using monopharmacy or polypharmacy had higher average scores than those not using any medication. There was a significant relationship between vaccination status during the pandemic and the average scores on the confidence sub-dimension ($p<0.001$), the risk sub-dimension ($p<0.01$), and the total score ($p<0.05$) of the vaccine hesitancy scale in pandemics. Those who were not vaccinated had a higher average score than those who were vaccinated (Table 1).

The regional differences from the separate evaluations of the two cities are shown in Table 2. Education level, perceived income level, seizure type, and age differed significantly by city of residence ($p<0.001$, $p<0.01$, $p<0.05$). The two-way ANOVA test was used to assess differences in these personal characteristics (Table 2).

The distributions of the sub-dimension scores and of the total score of the vaccine hesitancy scale in pandemics used in the study are presented in Table 3. The mean score of the lack of confidence sub-dimension of the vaccine hesitancy scale in pandemics for epilepsy patients was 21.41±6.45, the mean score of the risk sub-dimension was 6.08±2.09, and the mean total scale score was 27.49±7.49. According to this result, the mean scores of the lack of confidence sub-dimension and the total scale are below the attainable average score, while the mean score of the risk sub-dimension is at the attainable average level (Table 3).

Table 4 compares the mean scores of patients with epilepsy on the sub-dimensions and total scores of the pandemic vaccine hesitancy scale across interactions between education level and city of residence, perceived income level and city of residence, and seizure type and city of residence.

The vaccine hesitancy scale's lack of confidence sub-dimension and total score averages were found to differ significantly according to education level*city of residence, and seizure type*city of residence ($p<0.001$, $p<0.01$). When examining the mean scores on the "lack of trust" subscale of the vaccine hesitancy scale in pandemics according to the groups' educational levels, it was observed that the average score of primary school graduates in Giresun was higher than that in Erzurum. However, the situation was reversed among those who were illiterate, those who were literate with secondary education, and those with a bachelor's degree or above; the averages in Erzurum were higher than those in Giresun. When examining the average total scores on the vaccine hesitancy scale during pandemics according to the groups' educational levels, the average score in Giresun was higher than

Table 1. The comparison of the mean scores on the sub-dimensions and total scores of the vaccine hesitancy scale in pandemics in individuals with epilepsy, based on demographic characteristics (n=180)

Demographic characteristics		n	%	Vaccine hesitancy scale in pandemics		
				Lack of confidence	Risk	Total
				$\bar{X}$ ± SD	$\bar{X}$ ± SD	$\bar{X}$ ± SD
Sex	Female	93	51.7	21.26±5.89	6.05±1.78	27.31±6.53
	Male	87	48.3	21.57±7.03	6.11±2.38	27.69±8.43
	Testing and significance			t=-0.326[a], p=0.745	t=-0.194[a], p=0.846	t=-0.335[a], p=0.738
Marital status	Married	120	66.7	21.36±6.71	6.33±2.07	27.69±7.49
	Single	60	33.3	21.52±5.94	5.58±2.05	27.10±7.53
	Testing and significance			t=-0.155[a], p=0.877	t=2.300[a], **p=0.023**	t=0.499[a], p=0.619
Educational status	1. Illiterate/literate	11	6.1	21.00±7.36	6.45±2.54	27.45±9.17
	2. Primary education	52	28.9	20.85±7.23	6.10±1.85	26.94±7.53
	3. Secondary education	86	47.8	22.14±5.52	6.09±2.04	28.23±6.95
	4. Bachelor's degree and above	31	17.2	20.48±7.21	5.90±2.48	26.39±8.37
	Testing and significance			F=0.723[b], p=0.539	F=0.192[b], p=0.902	F=0.595[b], p=0.619
Residence	Provincial center	70	38.9	20.87±6.57	6.39±2.39	27.26±7.64
	District	88	48.9	21.70±6.75	5.97±1.79	27.67±7.74
	Village	22	12.2	21.95±4.76	5.59±2.11	27.55±6.17
	Testing and significance			F=0.411[b], p=0.663	F=1.494[b], p=0.227	F=0.059[b], p=0.942
Working status	Not working	126	70.0	22.24±7.28	6.08±2.23	28.32±7.63
	Working	54	30.0	21.52±7.03	6.31±2.11	27.83±7.85
	Testing and significance			t=1.391[b], p=0.230	t=2.119[b], p=0.065	t=1.788[b], p=0.118
City of residence	Giresun	102	56.7	21.68±4.73	6.00±1.89	27.68±5.96
	Erzurum	78	43.3	21.06±8.20	6.19±2.33	27.26±9.15
	Testing and significance			t=0.589[a], p=0.557	t=-0.595[a], p=0.553	t=0.352[a], p=0.725
Perceived income status	Income less than expenses[1]	124	68.9	21.13±6.53	5.91±2.10	27.04±7.60
	Income equals expenses[2]	46	25.5	20.63±5.31	6.28±1.88	26.91±5.92
	Income exceeds expenses[3]	10	5.6	28.50±6.59	7.30±2.50	35.80±8.32
	Testing and significance			F=6.922[b], **p=0.001**	F=2.366[b], p=0.097	F=6.948[b], **p=0.001**
	Multiple comparisons*			3>1, 2	-	3>1, 2
Seizure frequency	Once in 1-3 months	59	32.8	21.54±6.08	6.12±2.07	27.66±7.47
	Once in 1-3 months	34	18.9	22.71±6.21	5.91±1.66	28.62±6.76
	Once a year	87	48.3	20.82±6.77	6.13±2.26	26.94±7.80
	Testing and significance			F=1.068[b], p=0.346	F=0.141[b], p=0.869	F=0.631[b], p=0.534
	Multiple comparisons*			1>2, 4	-	-
Seizure type	Generalized tonic-clonic[1]	87	48.3	22.90±6.51	6.09±2.17	28.99±7.75
	Partial[2]	32	17.8	18.53±6.29	6.16±1.90	24.69±6.77
	Unidentified[3]	61	33.9	20.80±5.92	6.03±2.10	26.84±7.05
	Testing and significance			F=6.094[b], **p=0.003**	F=0.038[b], p=0.963	F=4.373[b], **p=0.014**
	Multiple comparisons*			1>2	-	1>2
Using medication	No[1]	11	6.1	15.64±7.20	5.45 ±0.93	21.09±6.41
	Monopharmacy[2]	61	33.9	21.98±6.23	6.07 ±2.15	28.05±7.61
	Polypharmacy[3]	108	60.0	21.68±6.27	6.16 ±2.14	27.83±7.28
	Testing and significance			F=4.947[b], **p=0.008**	F=0.567[b], p=0.568	F=4.465[b], **p=0.013**
	Multiple comparisons*			2, 3>1	-	2, 3>1
Getting vaccinated during the pandemic	Yes	152	84.4	20.73±5.50	5.86±2.10	26.59±6.38
	No	28	15.6	25.11±9.49	7.29±1.56	32.39±10.71
	Testing and significance			t=-2.368[a], **p=0.024**	t=-3.415[a], **p<0.001**	t=-2.778[a], **p=0.009**

Table 1. Continued

Demographic characteristics	n	%	Vaccine hesitancy scale in pandemics		
			Lack of confidence	Risk	Total
			$\bar{X}$ ± SD	$\bar{X}$ ± SD	$\bar{X}$ ± SD
			Min.	Max.	$\bar{X}$ ± SD
Age			18	82	41.57±13.84
Epilepsy duration			3	60	16.48±11.31

[a]: Independent groups t-test, [b]: One-way ANOVA test, *: Tukey test, SD: Standard deviation, Min.: Minimum, Max.: Maximum

Table 2. The comparison of the personal information of epilepsy patients based on city (n=180)

Personal information		Giresun (n=102)	Erzurum (n=78)	p*
Educational status*	Illiterate or literate	1 (1.0)	10 (12.8)	**<0.001**
	Primary education	27 (26.5)	25 (32.1)	
	Secondary education	59 (57.8)	27 (34.6)	
	Undergraduate and postgraduate	15 (14.7)	16 (20.5)	
Perceived income status*	Income less than expenses	76 (74.5)	48 (61.5)	**0.007**
	Income equals expenses	25 (24.5)	21 (26.9)	
	Income exceeds expenses	1 (1.0)	9 (11.5)	
Seizure type*	Generalized tonic-clonic	53 (52.0)	34 (43.6)	**0.006**
	Partial	10 (9.8)	22 (28.2)	
	Unidentified	39 (38.2)	22 (28.2)	
Age**	$\bar{X}$ ± SD	39.72±13.95	44.00±13.40	**0.039**
Epilepsy duration**	$\bar{X}$ ± SD	15.97±10.75	17.14±12.04	0.493

*: Pearson chi-square test, **: Independent groups t-test, SD: Standard deviation

Table 3. The distribution of the sub-dimensions and total scores of the vaccine hesitancy scale in pandemics (n=180)

Vaccine hesitancy scale in pandemics	Score obtainable from the scale			Scores received by epilepsy patients		
	Min.	Max.	Avg.	Min.	Max.	$\bar{X}$ ± SD
Lack of confidence	8	40	24	8	40	21.41±6.45
Risk	2	10	6	2	10	6.08±2.09
Total	10	50	30	14	46	27.49±7.49

Min.: Minimum, Max.: Maximum, SD: Standard deviation, Avg: Average

Table 4. Two-way ANOVA analysis (n=180)

	Lack of confidence		Risk		Sum	
	F	p	F	p	F	p
Education level*city of location	5.567	**0.001**	2.348	0.074	6.129	**<0.001**
Perceived income level*city of location	1.760	0.175	0.464	0.630	1.456	0.236
Seizure type*city of location	8.787	**<0.001**	1.104	0.334	7.458	**<0.001**

ANOVA: Analysis of variance

that in Erzurum among those with only primary school education. However, the situation reversed for those who were illiterate or who had secondary, undergraduate, or higher education, with the averages higher in Erzurum than in Giresun.

Examination of the mean scores on the "distrust" subscale of the "vaccine hesitancy scale in pandemics" by seizure type showed the average score among participants with partial seizures in Giresun was higher than that in Erzurum. However, the situation was reversed among those with generalized tonic-clonic seizures: the mean scores in Erzurum were higher than those in Giresun. When mean total scores on the vaccine hesitancy scale in pandemics were examined across groups, the mean in Giresun was higher than that in Erzurum among participants with partial seizures. However, the situation was reversed for those with generalized tonic-clonic seizures, and the averages in Erzurum were higher than those in Giresun.

Results for the relationships among age, duration of epilepsy, and scores on the vaccine hesitancy scale during pandemics are presented in Table 5.

There was a weak negative correlation between age and the lack of confidence sub-dimension scores ($r=-0.152$, $p<0.05$). A low-level, significant negative correlation was found between the duration of

epilepsy and the lack of confidence (r=-0.176, p<0.05) and risk (r=-0.176, p<0.05) sub-dimensions, and the total score (r=-0.179, p<0.05) (Table 5).

The results of the multiple linear regression analysis used to examine the effect of personal information on vaccine hesitancy scale scores are presented in Table 6.

Table 5. The correlation between vaccine hesitancy and age and epilepsy duration (n=180)

Vaccine hesitancy scale in pandemics	Age	Epilepsy duration
Lack of confidence	r=-0.152, **p=0.041**	r=-0.151, **p=0.043**
Risk	r=-0.009, p=0.900	r=-0.176, **p=0.018**
Total	r=-0.134, p=0.073	r=-0.179, **p=0.016**

Table 6. The multiple linear regression analysis results (n=180)

Model	β	95% CI	T	p	VIF	Tolerance
Constant	-	-	3.72	<0.001	-	
Gender (RC: Female)						
Male	-0.12	-0.46-0.21	-0.73	0.469	1.46	0.69
Marital status (RC: Married)						
Single	-0.37	-0.77-0.03	-1.83	0.069	1.64	0.61
Educational status (RC: Illiterate or literate)						
Primary education	-0.15	-0.74-0.44	-0.49	0.623		
Secondary education	-0.31	-0.89-0.27	-1.06	0.291	1.31	0.76
Undergraduate and postgraduate	-0.43	-1.08-0.23	-1.29	0.199		
Place of residence (RC: City center)						
Town	-0.02	-0.31-0.27	-0.11	0.910	1.18	0.85
Village	-0.20	-0.65-0.26	-0.86	0.394		
The city lived (RC: Giresun)						
Erzurum	0.09	-0.19-0.36	0.63	0.530	1.19	0.84
Perceived income status (Income less than expenses)						
Income equals expenses	0.24	-0.10-0.58	1.38	0.171	1.29	0.78
Income exceeds expenses	1.86	1.20-2.53	5.52	**<0.001**		
RC: Income equals expenses						
Income exceeds expenses	1.62	0.97-2.28	4.88	**<0.001**		
Seizure frequency (RC: Once a year)						
Once every 1-3 months	0.08	-0.23-0.39	0.50	0.615	1.15	0.87
Once every 3-6 months	0.02	-0.33-0.38	0.13	0.896		
Seizure type (RC: Generalized tonic-clonic)						
Partial	-0.48	-0.87-(-0.09)	-2.45	**0.015**	1.20	0.83
Unidentified	-0.30	-0.60-0.01	-1.93	0.056		
Understanding the seizure (RC: Yes)						
No	0.20	-0.12-0.53	1.23	0.222	1.27	0.79
Medication use (RC: None)						
Monopharmacy	1.88	1.20-2.55	5.50	**<0.001**	1.29	0.77
Polypharmacy	1.98	1.32-2.63	5.95	**<0.001**		
Getting vaccinated during the pandemic (RC: Yes)						
No	1.52	1.13-1.92	7.71	<0.001	1.24	0.81
Age	-0.08	-0.27-0.11	-0.83	0.407	1.63	0.61
Epilepsy duration	-0.02	-0.18-0.13	-0.30	0.763	1.35	0.74
RC; R=0.69, R^2=0.40, $F_{(25,154)}$=5.77, **p<0.001,** cook distance: $\bar{X}$ ± SD=0.01±0.02						
Min.=2.24x10^{-7}, Max.=0.16; Durbin-Watson=1.71						

Min.: Minimum, Max.: Maximum, SD: Standard deviation, RC: Reference category, VIF: Variance inflation factor, CI: Confidence interval

The variance inflation factor (<5) and tolerance (<1) values for the predictor variables are within the acceptable range, indicating no significant multicollinearity. The Durbin-Watson value is close to 2, indicating that there is generally no autocorrelation. The absence of observations with a Cook's distance >1 demonstrates the reliability of the model. The constructed multiple linear regression model was significant ($p<0.001$), with the predictor variables accounting for 40% of the variance in the dependent variable. Perceived income status, seizure type, medication use, and vaccination during the pandemic are significant predictors. Those whose income exceeds their expenses have higher mean scores than those whose income is less than or equal to their expenses. Those with generalized tonic-clonic seizures have higher mean scores than those with partial seizures. Those with monopharmacy or polypharmacy have higher mean scores than those who do not use medication. Those who were not vaccinated during the pandemic have a higher mean score than those who were vaccinated (Table 6).

DISCUSSION

The study data provide information on current perceptions and attitudes of individuals with epilepsy towards the COVID-19 vaccine. It has been reported that attitudes towards the vaccine, perceptions of trust, and vaccine hesitancy continue to have an impact over time, even after the acute phase of the COVID-19 pandemic has ended.[32,33] In particular, concerns about seizure control, vaccine safety, and potential interactions with primary care centers are specific factors that may influence vaccination decisions in this patient group. This study is important because it determines the attitudes and perceptions towards vaccines of individuals with epilepsy living in two different regions, shows the relationship between vaccine hesitancy and sociodemographic and disease-specific variables, and contributes to the development of targeted education and counseling strategies for health professionals. However, it must be considered that regional differences in sociodemographic characteristics and access to health services may affect the results, as participants were included from two different provinces. Even so, the results offer important insights into how policies aimed at improving vaccine safety in the community must be shaped for individuals with chronic diseases, such as epilepsy.

The results of the study suggest that individuals with epilepsy scored 21.41±6.45 on the lack of confidence sub-dimension, 6.08±2.09 on the risk sub-dimension, and 27.49±7.49 on the total scale of the vaccine hesitancy scale during pandemics. While the mean scores for the lack of confidence sub-dimension and the total score were below the average obtainable score, the mean score for the risk sub-dimension was at the average level. This indicates that the overall level of vaccine hesitancy and distrust among individuals with epilepsy is below the moderate level; however, these individuals still have concerns about possible side effects. A moderate level of perceived risk regarding vaccines may affect individuals' vaccination decisions. Although short-term vaccine safety is generally well reported in individuals with epilepsy, individuals' perceptions and fears affect their behavior.[34] This result highlights that increases in seizures thought to occur after vaccination are rare based on current evidence; however, it emphasizes the importance of providing information clarifying that precautions can be taken against triggering factors, such as fever.

A significant relationship was detected between marital status and the mean score of the risk sub-dimension of the vaccine hesitancy scale during pandemics in individuals with epilepsy; married individuals had higher mean scores than single individuals. This indicates that married individuals perceive greater potential risks of vaccination and have higher levels of risk anxiety, which might increase vaccine hesitancy. Married individuals with epilepsy expressed stronger concerns about the risks and side effects of vaccination and about the possibility that vaccination might trigger seizures than single individuals. They may experience anxiety not only about their own health but also about the health of their family members.[30] The results also imply that the concern that vaccine administration will worsen seizures in individuals with epilepsy is frequently reported in the literature.[35,36] Married individuals may be exposed to negative perceptions of the vaccine held by their spouse or family members and may be influenced by these relatives' concerns in their environment.[37]

A significant relationship was detected between the perceived income level, seizure frequency, seizure type, and medication use status and the mean scores on the vaccine hesitancy scale in pandemics, specifically the lack of confidence subdimension and the total score ($p<0.05$). In this context, individuals whose income exceeded their expenses were found to have higher average scores than others. This finding suggests that the perception of trust in vaccines among individuals with epilepsy may differ according to both sociodemographic and disease-specific clinical conditions. The literature shows that there are varying relationships between socioeconomic level and attitudes toward vaccination, and that access to information, health literacy, and risk assessment processes may play a role in these relationships.[38,39] However, the small number of participants in this study whose income exceeded their expenses may have reduced the stability of statistical estimates and increased the probability of type I error. In this context, our finding suggests that the relationship within this subgroup of participants should be confirmed in larger samples. Nevertheless, this study's finding demonstrates the clinical importance of individualized information, considering that individuals with high income levels may also experience anxiety and a lack of information about newly discovered vaccines, especially during pandemics.

The mean scores for those with generalized tonic-clonic seizure type were higher than for those with partial seizure type ($p<0.05$). Previous studies of vaccine hesitancy among individuals with epilepsy have reported that one of the most frequent reasons is the concern that it may worsen seizures.[27,28] This is considered related to individuals' clinical experiences with seizures or their assessments of the vaccine. A finding of this study indicates that vaccination programs during the pandemic should focus not only on the vaccination history but also on the clinical characteristics of the disease in individuals with epilepsy.

Those using monopharmacy or polypharmacy had higher mean scores on the confidence-deficiency subdimension and the total scale than those not using drugs ($p<0.05$). Antiepileptic drug use is common among individuals whose disease is actively monitored and whose goal is to achieve seizure control. This may raise concerns about both vaccine-drug interactions and the negative impact on seizure control resulting from altered drug effectiveness.[40] However, the limited sample size of the non-medication subgroup (n=11) may affect the stability of statistical estimates. The possibility of a type I error due to multiple subgroup comparisons should be considered. These data from the study suggest that this relationship needs to be validated in larger, more balanced samples. Nevertheless, addressing

concerns about vaccination with a brief assessment during routine outpatient practice would be an important step, especially for evaluating the presence of drug-vaccine interaction concerns in patients with polypharmacy.

The sub-dimensions and total mean scores of the vaccine hesitancy scale during pandemics differed significantly by vaccination status during the pandemic ($p<0.05$). The results suggest that the mean scores for the lack of confidence and risk sub-dimensions and the total mean score of the scale were higher in those who were not vaccinated than in those who were vaccinated. It is well established that confidence in and risk perception of vaccines are the main determinants of vaccine hesitancy during pandemics. Vaccine acceptance decreases with decreasing confidence and increasing risk perception.[41,42] Lack of confidence and risk-taking behavior in individuals with epilepsy have been reported among those who are hesitant about vaccination or have insufficient vaccine acceptance.[30,43] This shows the importance of presenting data on vaccine safety, possible side effects, and epilepsy clearly.

Study Limitations

This study, conducted during the pandemic, focused on vaccine hesitancy toward COVID-19 vaccines among individuals with epilepsy and on the factors influencing this hesitancy. However, the study was limited to individuals with epilepsy who presented to the neurology outpatient clinics of hospitals in the northern and eastern regions of Türkiye. The assessment of individuals' vaccine hesitancy through a questionnaire is an important factor that may affect the generalizability of the study findings. The limited sample size in some subgroup analyses might have reduced the stability of some estimates and affected the generalizability of the results. The study's inclusion of epilepsy groups from two different regions suggests the possibility of regional differences. It is recommended that future studies examine regional differences using larger sample sizes. Another limitation of the study is that factors such as health literacy, anxiety, exposure to misinformation, trust in health systems, and sources of vaccine-related information, which are important determinants of vaccine hesitancy, were not evaluated. Despite these limitations, the study is important because it is one of the few studies in both the Turkish and international literature that evaluate attitudes toward vaccines during the COVID-19 pandemic. Furthermore, the findings are expected to make important contributions to the planning and implementation of vaccination programs for individuals with chronic diseases during future pandemics.

CONCLUSION

The results of the present study indicate that individuals with epilepsy had low levels of general hesitancy and of lack of confidence regarding the COVID-19 vaccine, while their vaccine-related risk levels were moderate. Sociodemographic and epilepsy-specific characteristics affected their hesitancy. Further comprehensive studies in this field are recommended, using qualitative assessments with open-ended questions to allow individuals to express their perception of vaccine risk and to examine its interaction with medication use and seizure control status. It is also recommended that informative activities presenting evidence-based scientific results regarding the potential effects of the vaccine be communicated by reliable sources such as the International Epilepsy Association or Epilepsy Societies. Although general hesitancy is not high, perceived risk, particularly regarding seizure worsening and side effects, should be considered. For this reason, risk-focused and individualized counseling strategies should be prioritized in practice. Future studies could be designed to determine the sources of information that contribute to vaccine risk perceptions, to assess the extent to which these potential risks might affect the disease, and to conduct more in-depth assessments of individuals with epilepsy who have poorly controlled seizures.

Ethics

Ethics Committee Approval: Prior to conducting the study, approval was obtained from the Atatürk University Non-Interventional Clinical Research Ethics Committee (approval no: 18, date: 02.05.2025).

Informed Consent: Patients were informed, and their verbal and written consent was obtained before data collection.

Footnotes

Authorship Contributions

Surgical and Medical Practices: N.İ.A., D.A.C., N.B., Concept: N.İ.A., D.A.C., N.B., Design: N.İ.A., D.A.C., N.B., Data Collection or Processing: N.İ.A., D.A.C., N.B., Analysis or Interpretation: N.İ.A., D.A.C., N.B., Literature Search: N.İ.A., D.A.C., N.B., Writing: N.İ.A., D.A.C., N.B.

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REFERENCES

1. Elsas SM, Gregory WL, White G, Navarro G, Salinsky MC, Andrews DJ. Aura interruption: the Andrews/Reiter behavioral intervention may reduce seizures and improve quality of life - a pilot trial. *Epilepsy Behav*. 2011;22(4):765-772. **[Crossref]**
2. Karaca A, Durna Z. Psychosocial support in epilepsy patient. Gümüşhane *University J Health Sci.* 2018;7(1):218-225. **[Crossref]**
3. Artan T, Meydan S, Irmak HS. Turkish version of the fear of COVID-19 scale: validity and reliability study. *Arch Health Sci Res.* 2021;8(2):117-123. **[Crossref]**
4. World Health Organization. Novel coronavirus (2019-nCoV) situation report - 51 [Internet]. Geneva: World Health Organization; 2020. **[Crossref]**
5. Siahaan YMT, Ketaren RJ, Hartoyo V, Hariyanto TI. Epilepsy and the risk of severe coronavirus disease 2019 outcomes: a systematic review, meta-analysis, and meta-regression. *Epilepsy Behav.* 2021;125:108437. **[Crossref]**
6. Cabezudo-García P, Ciano-Petersen NL, Mena-Vázquez N, Pons-Pons G, Castro-Sánchez MV, Serrano-Castro PJ. Incidence and case fatality rate of COVID-19 in patients with active epilepsy. *Neurology.* 2020;95(10):e1417-e1425. **[Crossref]**
7. Wadman M, You J. The vaccine wars. *Science.* 2017;356(6336):364-365. **[Crossref]**
8. Lu L, Zhang Q, Xiao J, et al. COVID-19 vaccine take-up rate and safety in adults with epilepsy: data from a multicenter study in China. *Epilepsia.* 2022;63(1):244-251. **[Crossref]**
9. Lu Q, Wang YY, Wang QH, et al. Safety of inactivated COVID-19 vaccine in tuberous sclerosis complex patients with epilepsy treated with rapamycin. *Seizure.* 2022;99:71-74. **[Crossref]**

10. Massoud F, Ahmad SF, Hassan AM, Alexander KJ, Al-Hashel J, Arabi M. Safety and tolerability of the novel 2019 coronavirus disease (COVID-19) vaccines among people with epilepsy (PwE): a cross-sectional study. *Seizure.* 2021;92:2-9. **[Crossref]**
11. Larson HJ. Blocking information on COVID-19 can fuel the spread of misinformation. *Nature.* 2020;580(7803):306. **[Crossref]**
12. Kata A. A postmodern Pandora's box: anti-vaccination misinformation on the Internet. *Vaccine.* 2010;28(7):1709-1716. **[Crossref]**
13. Farhud DD. Impact of lifestyle on health. *Iran J Public Health.* 2015;44(11):1442-1444. **[Crossref]**
14. Amit Aharon A, Nehama H, Rishpon S, Baron-Epel O. A path analysis model suggesting the association between health locus of control and compliance with childhood vaccinations. *Hum Vaccin Immunother.* 2018;14(7):1618-1625. **[Crossref]**
15. Patty NJS, van Dijk HM, Wallenburg I, et al. To vaccinate or not to vaccinate? Perspectives on HPV vaccination among girls, boys, and parents in the Netherlands: a Q-methodological study. *BMC Public Health.* 2017;17(1):872. **[Crossref]**
16. Çapar H, Çınar F. Vaccine hesitancy scale in pandemics: Turkish validity and reliability study. *Gevher Nesibe Journal IESDR.* 2021;6(12):40-45. **[Crossref]**
17. Turkish Epilepsy Association. Epilepsy patients and COVID-19 [Internet]. [cited 2025 Oct 29]. **[Crossref]**
18. Gul ZB, Atakli HD. Effect of the COVID-19 pandemic on drug compliance and stigmatization in patients with epilepsy. *Epilepsy Behav.* 2021;114(Pt A):107610. **[Crossref]**
19. Kuroda N, Kubota T. Psychological impact of the COVID-19 pandemic for patients with epilepsy: a systematic review and meta-analysis. *Epilepsy Behav*. 2021;124:108340. **[Crossref]**
20. Van Hees S, Siewe Fodjo JN, Wijtvliet V, et al. Access to healthcare and prevalence of anxiety and depression in persons with epilepsy during the COVID-19 pandemic: a multicountry online survey. *Epilepsy Behav*. 2020;112:107350. **[Crossref]**
21. Baştuğ Gül Z, Gözübatık Çelik RG, Üzülmez Yıldız M, et al. The impact of the coronavirus disease 2019 outbreak on the quality of life of patients with epilepsy. *Arch Epilepsy.* 2021;27(2):78-84. **[Crossref]**
22. Eren F, Gul G. The impact of COVID-19 outbreak on quality of life, seizure frequency, depression, and anxiety in patients with epilepsy: a cross-sectional study during the early period. *Arch Epilepsy.* 2021;27(4):212-220. **[Crossref]**
23. Güçlü Altun İ, Koç G, Özen Barut B, Gökçil Z. Evaluation of the seizure frequency and severity in patients with epilepsy who had COVID-19. *Arch Epilepsy.* 2021;27(3):163-170. **[Crossref]**
24. Kuroda N, Shibata A, Kubota T. Impact of the coronavirus disease (COVID-19) crisis on women with epilepsy. *Epilep Seizure.* 2021;13(1):31-35. **[Crossref]**
25. Polat H, Bingol N, Ay E. Evaluation of COVID-19 fear and sleep quality in individuals with epilepsy: a cross-sectional study. *Front Neurol.* 2025;16:1576177. **[Crossref]**
26. Elmalı AD, Bebek N, Yıldırım İ, et al. COVID-19 and epilepsy: its effects on seizures, treatment and social life. *Epilepsi.* 2020;26(2):49-58. **[Crossref]**
27. Huang A, Lu Y, Ji J, et al. The effect of COVID-19 vaccination on epileptic seizures in patients with epilepsy: a clinical observation in China. Hum *Vaccin Immunother.* 2022;18(6):2141519. **[Crossref]**
28. Romozzi M, Rollo E, Quintieri P, et al. Impact of COVID-19 vaccine on epilepsy in adult subjects: an Italian multicentric experience. *Neurol Sci.* 2022;43(8):4627-4634. **[Crossref]**
29. Lou D, Song Y, Li D, Shi Y, Wang B, Yang L. COVID-19 vaccination uptake in children with epilepsy and vaccine hesitancy among their parents: a survey. *Eur J Pediatr.* 2024;183(6):2763-2768. **[Crossref]**
30. Wang S, Lv J, He C, et al. COVID-19 vaccination hesitancy and safety among adult people with epilepsy in eastern China. *Epilepsy Behav.* 2023;138:108984. **[Crossref]**
31. Cohen J. Statistical power analysis for the behavioral sciences. 2nd ed. Hillsdale (NJ): Lawrence Erlbaum Associates; 1988. **[Crossref]**
32. Temsah MH, Alhuzaimi AN, Aljamaan F, et al. Parental attitudes and hesitancy about COVID-19 vs. routine childhood vaccinations: a national survey. *Front Public Health.* 2021;9:752323. **[Crossref]**
33. Smith BA, Ricotta EE, Kwan JL, Evans NG. COVID-19 risk perception and vaccine acceptance in individuals with self-reported chronic respiratory or autoimmune conditions. *Allergy Asthma Clin Immunol.* 2023;19(1):37. **[Crossref]**
34. Leung WCY, Ho RW, Leung AK, et al. Risk of seizure aggravation after COVID-19 vaccinations in patients with epilepsy. *Vaccines (Basel).* 2024;12(6):593. **[Crossref]**
35. Elshebawy H, Kishk NA, Alaa N, Hussein M, Abdelghaffar M, Magdy R. Impact of COVID-19 vaccination in patients with epilepsy. *Egypt J Neurol Psychiatry Neurosurg.* 2024;60:146. **[Crossref]**
36. Shyamsundar MS, Nair PP, Aghoram R, Mohan SP, Sinha S, Wadwekar V. COVID-19 vaccination status among people with epilepsy attending a tertiary care epilepsy clinic: a cross-sectional study. *Int J Epilepsy*. 2023;9(1/2):7-12. **[Crossref]**
37. Deng JS, Ying CQ, Lin XQ, et al. Impact of household decision makers' hesitancy to vaccinate children against COVID-19 on other household members: a family-based study in Taizhou, China. *SSM Popul Health.* 2023;24:101517. **[Crossref]**
38. Lamot M, Kirbiš A. Understanding vaccine hesitancy: a comparison of sociodemographic and socioeconomic predictors with health literacy dimensions. *Vaccines (Basel).* 2024;12(10):1141. **[Crossref]**
39. Wang Q, Leung K, Jit M, Wu JT, Lin L. Global socioeconomic inequalities in vaccination coverage, supply, and confidence. *NPJ Vaccines.* 2025;10(1):91. **[Crossref]**
40. Öcek Ö, Ortan P. Effects of COVID-19 infection and vaccines on patients with epilepsy: real-life experiences. *Noro Psikiyatr Ars.* 2023;60(4):310-315. **[Crossref]**
41. World Health Organization. Summary WHO SAGE conclusions and recommendations on vaccine hesitancy [Internet]. Geneva: World Health Organization; 2015 [cited 30 Nov 2025]. **[Crossref]**
42. Pourrazavi S, Fathifar Z, Sharma M, Allahverdipour H. COVID-19 vaccine hesitancy: a systematic review of cognitive determinants. *Health Promot Perspect.* 2023;13(1):21-35. **[Crossref]**
43. Asadi-Pooya AA, Karimi A, Razavizadegan SMA, Ashjazadeh N, Nemati H. COVID-19 vaccine-related frequently asked questions (FAQs) by people with epilepsy and carers in Iran; educational video is included. *Epilepsy Behav.* 2022;133:108763. **[Crossref]**