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Validity And Reliability Study of General Attitude Towards Artificial Intelligence Scale in Healthcare

Sağlık Hizmetlerinde Yapay Zekaya Yönelik Genel Tutum Ölçeği Geçerlik Ve Güvenirlik Çalışması

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Abstract

In order for artificial intelligence based systems to be completely functional and successful, users' attitudes and perceptions about artificial intelligence need to be carefully examined. It was aimed at adapting the general attitude scale regarding artificial intelligence into Turkish and determining its validity and reliability with the data collected from patients. The "General Attitude Towards Artificial Intelligence Scale," which consists of 20 items, was used to evaluate the general attitude toward artificial intelligence. 329 participants in total, ranging in age from 18 to 65, took part in the research. Of the participants, 111 (34%) were men and 218 (66%) were women. Cronbach Alpha values for positive, negative, and general attitudes are 0.917, 0.827, and 0.871, respectively. The mean score for positive attitudes is 3.40, 2.99 for negative attitudes and 3.19 for the overall mean. The results of the study demonstrate that the Turkish version of the "General Attitude Towards Artificial Intelligence Scale" can be considered a reliable and valid measurement tool that is appropriate for usage in our country. The scale might be considered a crucial instrument for distinguishing attitudes toward the positive and negative aspects of artificial intelligence. It is believed to be beneficial to the studies to be conducted in health services and with patients.

Keywords: Reliability and validity, healthcare, artificial intelligence.

Özet

Yapay zeka tabanlı sistemlerin tamamen başarılı şekilde ve amaca uygun olarak kullanılabilmesi için kullanıcıların yapay zeka hakkındaki tutumlarının ve algılarının dikkatli bir şekilde incelenmesi gerekmektedir. Yapay zekaya yönelik genel tutum ölçeğinin Türkçeye uyarlanarak, hastalardan toplanan verilerle geçerlik ve güvenirliğinin belirlenmesi amaçlanmıştır. Yapay zekaya yönelik genel tutumu ölçmek amacıyla 20 ifadeden oluşan “Yapay Zekaya Yönelik Genel Tutum Ölçeği” kullanılmıştır. Çalışmaya yaşları 18- 65 arasında değişen 329 kişi katılmıştır. Katılımcıların 218’i (%66) kadın, 111’i (% 34) ise erkektir. Pozitif, negatif ve genel tutumlar için Cronbach Alpha değerleri sırasıyla 0.917, 0.827 ve 0.871'dir. Pozitif tutumlar için ortalama puan 3.40, negatif tutumlar için 2.99 ve genel ortalama için 3.19'dur. Yapılan araştırma sonucunda “Yapay Zekaya Yönelik Genel Tutum Ölçeği” Türkçe formunun ülkemizde kullanılabilecek güvenilir ve geçerli bir ölçüm aracı olarak değerlendirilebileceğini göstermektedir. Yapay zekanın olumlu yönleri ve olumsuz yönlerine yönelik tutumları ayırmak için ölçek önemli bir ölçüm aracı olarak değerlendirilebilir. Sağlık hizmetleri içerisinde ve hastalarla yapılacak çalışmalarda katkı sağlayacağı düşünülmektedir.

Anahtar Kelimeler: Güvenilirlilik ve geçerlilik, sağlık hizmetleri, yapay zeka.

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1. Introduction

Artificial intelligence (AI) is a term that encompasses computer technologies that can mimic the function and performance of human intelligence. These technologies typically operate in areas such as reasoning, learning, adaptation, recall, evaluation, sensory understanding and interaction (AI, 2018; Russell & Norvig, 2010). Artificial intelligence, often referred to as augmented intelligence or augmented human intelligence, is revolutionizing a number of fields, including healthcare (Jiang et al., 2017; Worthington & Whittaker, 2006).

The use of artificial intelligence is growing rapidly and permeates many aspects of people's daily lives in both personal and professional contexts (Makridakis, 1995; Olhede & Wolfe, 2018). AI currently has the potential to improve human health, safety and productivity. Therefore widely utilized in various fields, especially in transportation, industry, service robots, entertainment, education, public safety and healthcare (Dignum, 2018).

Artificial intelligence and robotics are rapidly making their way into thehealthcare, playing a key role in certain medical functions, including diagnosis and clinical treatments (Gümüş, Kızılkaya, Orhan, & Maltaş, 2022). Artificial intelligence applications cover areas such as machine learning, predictive analytics, natural language processing and robotics. These applications offer solutions that can be used in a variety of medical domains. It is anticipated to have potential benefits to biomedical research, medical education and healthcare delivery. The findings of large-scale AI-processed clinical datasets are expected to play an important role in personalized medicine, clinical decision-making, and diagnosis (Rigby, 2019).

AI has been used in both patient-specific diagnostic and treatment decisions and has been used to address problems ranging from population-based risk prediction analysis (Jiang et al., 2017). As the use of AI develops, healthcare providers are investing in mobile health devices and the development of AI technologies in healthcare applications to increase patient safety, improve clinical quality and reduce costs. However, there are studies showing that not everyone is willing to use AI devices or systems in healthcare (Laï, Brian, & Mamzer, 2020). For the effective implementation of AI-based systems, users' attitudes and perceptions about AI need to be carefully examined (Romero-Brufau et al., 2020). It is necessary to understand the decision factors and barriers that lead to the acceptance or rejection of the use of AI-based devices in healthcare delivery. This is because it is seen as the most important consideration for healthcare providers and hospitals planning to introduce or increase the use of AI devices during healthcare delivery (Esmaeilzadeh, 2020).

It is stated that AI, which has the potential to increase efficiency in healthcare delivery and quality in patient care, carries significant risks in terms of privacy, security of patient data, protection of patient autonomy, and informed consent (Rigby, 2019). If individuals do not find interaction with an AI device useful, they may request interaction with doctors, and as a result, AI-based devices may not be used

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(Esmaeilzadeh, 2020). This is considered an important factor, especially for the healthcare sector, where patient participation is considered one of the most critical determinants of service quality. The development of AI tools in healthcare will only be satisfactory for everyone if a collaborative process is initiated among all participants. Therefore, the views of patients need to be taken into account, and some of the problems linked to patients need to be evaluated together (Laï et al., 2020). The rational use of AI in healthcare requires the acceptance of patients and their families. This is because modern healthcare aims at the participation and cooperation of patients, often described by the term 'patient empowerment'. Insufficient acceptance of therapeutic measures disrupts patient compliance and worsens otherwise possible successful outcomes (Kleinsinger, 2003), so concerns about AI may undermine the appropriate dissemination and use of these tools (Fritsch et al., 2022). Therefore, investing in AI technology without considering the beliefs of potential users and their willingness to accept AI devices can lead to wasted resources and/or the loss of customers (Esmaeilzadeh, 2020). Given the rapid development of technologies and their profound impact on society, research has indicated that attitudes towards AI should be measured on a regular basis. Data on public acceptance of AI informs legislators and organizations developing AI applications on how these applications should be managed for acceptance by end users (Schepman & Rodway, 2020).

2. Method

2.1. Aim of Study

While AI is gaining increasing importance in many areas of healthcare, there is little data on patients' views on the use of AI in medicine (Lennartz et al., 2021). In order for AI-based systems to be fully successful and fit for purpose, users' attitudes and perceptions about AI need to be carefully examined (Schepman & Rodway, 2020). From this point of view, the intended study aimed to determine the validity and reliability of the scale evaluating the general attitude towards AI, which is used in a variety of industry and cultures in different countries, in health services.

2.2. Population and Sample of the Research

The population of the study consisted of literate people over the age of 18 who had received any health service in the last year in Istanbul and who agreed to participate in the study. Participants were included in the study by a simple random sampling method.

2.3. Data Collection and Measurements

In order to measure the general attitude towards artificial intelligence, the “General Attitude Towards Artificial Intelligence Scale” developed by Schepman and Rodway (2020) and consisting of 20 statements was used. The scale includes two sub-dimensions related to positive and negative attitudes: The former refers to opportunities, benefits and positive feelings towards AI, while the latter refers to concerns and negative feelings towards AI.

The sample size was calculated, by taking into account the literature information, reaching ten times more people than the number of items on the scale (Büyüköztürk, Akgün, Kahveci, & Demirel, 2004).

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Using this technique, the sample size for the scale consisting of 20 items was determined to be 200, and 329 participants aged between 18 and 65 took part in the research. While 218 (66%) of the participants were female and 111 (34%) were male. The language validity of the General Attitude Towards Artificial Intelligence Scale (GAAIS) was conducted using the translation and back translation approaches. In this context, the scale was first translated from English to Turkish by two different English language experts who were unfamiliar with the scale and who were fluent in both Turkish and English. After comparing the translations, the appropriate arrangements were made. Two more academicians who are bilingual (English-Turkish) then translated the questionnaire from Turkish to English. The original questionnaire was compared with the translation, and any discrepancies were further discussed with experts before the questionnaire was finished. The study's data were gathered from April to September of 2023.

2.4. Ethical Considerations

By corresponding with "Astrid Schepman," the scale's creator, the required authorization was acquired. In addition, ethics committee permission was obtained from "Marmara University Health Sciences Institute Ethics Committee" on 20.06.2022-73. The study was performed according to the Declaration of Helsinki principles.

2.5. Limitations of the Research

The study has some limitations. The research covers patients living in Istanbul who received health services in the one-year period before the date of the research. Patients who resided in Istanbul and received medical care within a year prior to the research date are included in the study. These individuals served as the sample for the research. Locational effects and cultural differences may have contributed to the research. Therefore, generalizations cannot be made for other regions of Türkiye. There was no assessment based on a disease.

2.6. Data Analysis and Evaluation

The data were statistically analyzed using the SPSS (Statistical Package for the Social Sciences) 20.0 package program and AMOS package programs. Initially, the validity and reliability examination of the scale was conducted using the Cronbach Alpha coefficient value as well as exploratory and confirmatory factor analyses. The same sample was assessed for both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) since the sample number reached 329 patients. Koyuncu & Kılıç (2019) declare that two analyses can be carried out using the same participant data when a large sample size cannot be achieved. According to Worthington and Whittaker (2006), the structure of the data will be empirically exposed when EFA and CFA are conducted on the same sample.

3. Results

The sociodemographic details of the study participants are displayed in Table 1. The percentage of female participants is 66.3%, while the percentage of male participants is 33.7%. The majority of participants were married (57.8%) and almost half of the participants were 40 years of age or younger

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(72%). More than half of the participants have high school education or higher (58.9%). The largest occupational group of the participants was employed in the private sector (28.6%). The majority of the participants have an income of 15.000 Turkish Lira (TL) or less (54.4%). When it comes to medical care, the majority of participants (71.1%) prefer public hospitals.

Table 1. Socio-demographic Information Related to General Attitude Towards Artificial Intelligence Scale

Socio-demographic Information		N	%
Gender	Female	218	66.3
	Male	111	33.7
Marital Status	Single	139	42.2
	Married	190	57.8
Age (year)	18-30 years old	153	46.5
	31-40 years old	84	25.5
	41-50 years old	70	21.3
	≥ 51 years	22	6.7
Education	Primary and secondary	57	17.3
	High School	78	23.7
	Associate's Degree	88	26.7
	Undergraduate	81	24.6
	Post Graduate	25	7.6
Occupation	Health Technician	47	14.3
	Housewife	52	15.8
	Civil Servant	62	18.8
	Private Sector	94	28.6
	Other	74	22.5
Income	None	42	12.8
	< 8500 TL	30	9.1
	8500 TL-15000 TL	149	45.3
	15001 TL-20000 TL	67	20.4
	20001 TL-25000 TL	16	4.9
	≥ 25001 TL	25	7.6
Which health institution do you usually receive service?	State Hospital	234	71.1
	University Hospital	11	3.3
	Private Hospital	65	19.8
	Family Health Centre	19	5.8

As a result of the analyses, Cronbach Alpha coefficient and other descriptive statistics are presented in Table 2. Cronbach Alpha values for positive, negative and general attitudes are 0.917, 0.827 and 0.871, respectively. These findings indicate that the scale has a high internal consistency. The overall mean score is 3.19, the mean score for negative attitudes is 2.99, and the mean score for positive attitudes is 3.40. Findings show that the participants have a positive attitude towards AI in general.

Table 2. Mean Scores of General Attitude Towards Artificial Intelligence Scale and Its Subscales

Variables	Min-Max	$\bar{x}$±*sd*	Skewness	Kurtosis	Cronbach
Positive	0-6	3.40±1.35	-0.107	-0.608	0.917
Negative	0-6	2.99±1.35	0.112	-0.285	0.827
Overall average	0-6	3.19±1.01	-0.342	1.037	0.871

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X= Mean, SD= Standard Deviation

Explanatory factor analysis (EFA) is the first step in scale development investigations, and confirmatory factor analysis (CFA) is followed depending on how well it fits the content of the research (Doğan, Soysal, & Karaman, 2017). For EFA, firstly, the reliability of the scale was tested and item-total correlation values and Cronbach Alpha values were examined when the item was removed. Once the inter-item correlation and reliability were confirmed, EFA was started and Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) test was first applied in EFA.

Table 3. KMO and Bartlett's Test Values

Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy		.904
Bartlett's Test of Sphericity	**Approx. Chi-Square**	2791.753
	Df	171
	Sig.	.000

When Table 3 is analysed, the KMO test and Bartlett's test of sphericity were performed and KMO value was found as .904 and sphericity test result Approx Chi-Square= 2791.753 (df = 171, p < .001). After the KMO analysis, another step in the EFA of the scale was passed to factor dimensioning. In order to ascertain how many dimensions the scale was under, Table 4 was analyzed, and the eigenvalue was taken into account. In the analysis performed to determine the factor structure of the scale, a different structure emerged from the original scale. The 20th item on the scale was eliminated and the analysis proceeded with the remaining 19 items since it was discovered that the factor loading was less than 0.30.

Tablo 4. Total Variance Explained

Factor	**Initial Eigenvalues**		
	Total	**% of Variance**	**Cumulative %**
1	6.433	33.860	33.860
2	3.423	18.015	51.875

Table 4 displays the scale's classification under two dimensions with eigenvalues greater 1 and explaining 51.875% of the total variance. Furthermore, an analysis of the Scree Plot graph reveals that the scale is divided into two dimensions (Figure 1).

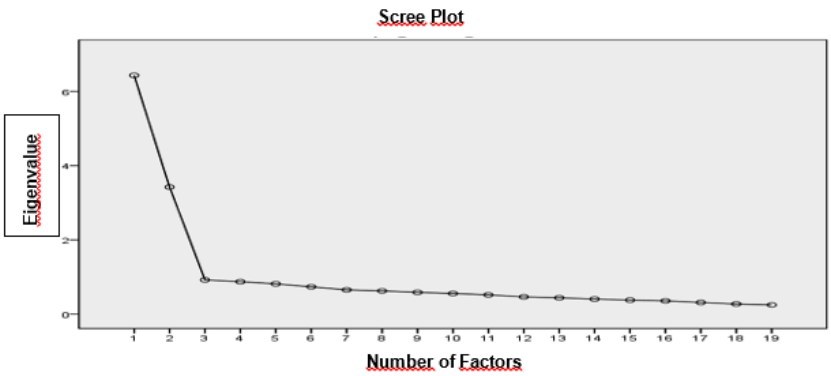

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Figure 1. Scree Plot of the Number of Factors of the General Attitude Towards Artificial Intelligence Scale

The rotated construction matrix produced by the varimax approach shows that the positive and negative items on the scale are grouped in two dimensions independently, as shown in Table 5.

Table 5. Rotated Constructs Matrix of the General Attitude Towards Artificial Intelligence Scale

Scale Items	$\bar{x}\pm sd$	Corrected Item-	Cronbach's	Positive	Negative
Positive_14	3.72±1.96	.650	.858	.771	
Positive_17	3.45±1.84	.627	.859	.745	
Positive_18	3.22±1.90	.590	.860	.730	
Positive_13	3.30±1.78	.589	.861	.714	
Positive_16	3.28±1.83	.608	.860	.705	
Positive_12	3.65±1.85	.575	.861	.702	
Positive_5	3.77±1.85	.593	.860	.695	
Positive_11	3.42±1.84	.595	.860	.683	
Positive_2	3.75±1.98	.566	.861	.676	
Positive_7	3.15±1.73	.558	.862	.667	
Positive_4	2.93±1.86	.496	.864	.601	
Positive_1	3.11±2.06	.469	.865	.580	
Negative_10	3.08±1.92	.346	.870		.794
Negative_9	3.26±1.98	.382	.868		.672
Negative_15	3.07±1.92	.368	.869		.659
Negative_8	2.39±1.70	.317	.871		.657
Negative_19	3.07±1.99	.337	.873		.571
Negative_6	2.65±1.72	.329	.873		.509
Negative_3	3.39±2.16	.319	.871		.483

X= Mean, SD=Standard Deviation

The CFA, an additional phase in scale development studies, was initiated as a result of the EFA. Figure 2 displays the scale model created in CFA, which is the final step in determining the scale's validity under two dimensions in EFA. Table 5 displays the model fit values for the model constructed in Figure 1.

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Figure 2. Confirmatory factor analysis path diagram of the scale

In Figure 2, error covariance was created between e2 and e5; e5 and e4 for positive attitude; and between e15 and e19; and e18 and e16 for negative attitude. The standardized item factor loadings ranged between 0.59 and 0.77 for positive attitude and between 0.47 and 0.83 for negative attitude.

It is evident from examining the fit indices in Table 6 of the overall attitude toward artificial intelligence that the values range from good fit to acceptable fit. According to Marcoulides and Schumacker (2001), χ^2/sd less than 3 indicates a good fit. Upon examining the obtained values, χ 2 /sd = 2.56. Based on the collected results, χ^2 /sd; IFI; TLI; CFI; and RMSEA are at a good fit level, while RMR; GFI; AGFI; and NFI values are at an acceptable fit level.

Table 6. General Attitude Towards Artificial Intelligence Scale Model Fit Values

Criteria	χ^2/SD	RMR	GFI	AGFI	NFI	IFI	TLI	CFI	RMSEA
Good Fit	≤3	≤0.05	≥0.95	≥0.95	≥0.95	≥0.95	≥0.95	≥0.9	≤0.05
Acceptab	≤5	≤0.08	≥0.90	≥0.90	≥0.90	≥0.90	≥0.90	≥0.9	≤0.08
Model fit	1.786	0.058	0.926	0.904	0.908	0.957	0.950	0.95	0.049

χ2/sd=Chi-squared/Degree of freedom, RMR (Root Mean Square Residual), GFI (Goodness Fit Index), AGFI (Adjusted Goodness of Fit Index), NFI (Normed Fit Index), IFI ((Incremental Fit Index), TLI (Tucker-Lewis Index), CFI (Comparative Fit Index) and RMSEA (Root Mean Square Error of Approximation).

4. Discussion

Our research on the general attitude towards artificial intelligence was conducted with 329 patients in Istanbul. The general attitude scale towards artificial intelligence was developed by Schepman and Rodway (Schepman & Rodway, 2020). The scale is a two-factor scale specifically used to determine people's attitudes towards artificial intelligence. The scale includes two sub-dimensions related to positive and negative attitudes: the former refers to opportunities, benefits, and positive feelings towards AI, while the latter refers to concerns and negative feelings.

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When the educational level of the patients who participated in the study was analyzed, it was observed that 75% had high school or higher education. This may play an important role in understanding health information and access to health services. Considering the income distribution of the participants, it was determined that the majority (54.4%) were in the income bracket of 15.000 TL and below. Regarding health service preferences, it was observed that the majority of the participants (71.1%) preferred public hospitals. Further analysis of this high incidence can be done with respect to the impact of education level and economic factors. However, access to and affordability of health services are affected by many factors. Education and income level are only two of these factors.

Cronbach Alpha values for positive, negative and general attitudes are 0.917, 0.827 and 0.871, respectively. The study conducted by Rodway and Schepman (2023) revealed positive attitude values of 0.88 and negative attitude values of 0.82. These findings indicate that the scale has a high internal consistency. According to the original scale article (Schepman & Rodway, 2020), the mean score for positive attitudes was 3.60, while the mean score for negative attitudes was 2.93 (Schepman & Rodway, 2020). The average score in our research is 3.19 for the overall average, 2.99 for negative attitudes, and 3.40 for positive attitudes. The findings of the research show that the participants generally have a positive attitude towards artificial intelligence. This result implies that the perception of artificial intelligence is developing in Türkiye and that it is accepted in health services.

In the confirmatory factor analysis, the loading value and error values of each item to the subscale were found to be below 0.90. These correlations can be considered to measure distinct dimensions because they are less than 0.95 (Kline, 2023). However, as a result of CFA, the factor loadings of all items show significance within the factor to which they are connected ($p < 0.001$). It is evident that the standardized values and the measurement tool have an appropriate structure in terms of items and sub-dimensions. The research's conclusion was that the RMSEA was 0.049. According to the RMSEA value, a good fit is defined as being equal to or less than 0.05, an acceptable fit as being between 0.08 and 0.10, and a bad fit as being larger than 0.10 (Hayduk, 1987). The findings obtained within the scope of the research indicate a good fit in terms of items and sub-dimensions. It may be concluded that the model successfully explains the research data in this case.

The total correlation coefficients obtained from the reliability analysis ranged from a low of 0.48 (Item 3) to a high of 0.79 (Item 10). Items that have item-total correlations of 0.40 or higher are considered to be very good discriminators; those that have correlations between 0.30 and 0.40 are good discriminators; between 0.20 and 0.30 should be corrected, and items with values lower than 0.20 should be excluded in the scale even if they are significant (Erkuş, 2003). One may conclude that artificial intelligence generally has a high degree of reliability based on the results of the general attitude towards artificial intelligence scale.

In descriptive analyses of a joint study conducted in several countries, the country with the highest level of GAAIS positivity was Finland (M = 4.80, SD = 1.24), followed by Poland (M = 4.54, SD = 1.32), Italy (M = 4.52, SD = 1.39), Germany (M = 4.48, SD = 1.37), Ireland (M = 4.35, SD = 1.32), and France (M =

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4.26, SD = 1.27). France (M = 4.44, SD = 1.43) had the highest level of negativity in the GAAIS, followed by Germany (M = 4.14, SD = 1.58), Ireland (M = 4.08, SD = 1.48), and Italy (M = 4.04, SD = 1.48). Poland (M = 3.94, SD = 1.52) and Finland (M = 3.51, SD = 1.43) ranked the lowest (Bergdahl et al., 2023). The results of a study conducted in the United Kingdom on the scale showed M = 3.60, SD = 0.60 for the positive dimension, M = 2.93, SD = 0.70 for the negative dimension, and 3.11 for the overall mean (Rodway & Schepman, 2023). M = 3.60, SD = 0.67 for positive attitudes, and M = 2.93, SD = 0.75 for negative attitudes were reported in the original scale article (Schepman & Rodway, 2020). Our study, conducted with patients in Türkiye, revealed that, M = 3.40, SD = 1.35 for positive attitudes, M = 2.99, SD = 1.35 for negative attitudes, and M = 3.19, SD = 1.01 for the general mean. The study's findings indicate that the findings of the GAAIS in Türkiye and the United Kingdom are comparable. In Türkiye and among the nations studied by Bergdahl et al. (2023), the average scores vary in certain areas. Socio-cultural and political conditions in different countries may affect attitudes towards the GAAIS. Demographic characteristics of the participants, such as education level, age, and gender, may also affect the results.

The study has some limitations. The research covers patients living in Istanbul who received health services in the one-year period before the date of the research. Patients who resided in Istanbul and received medical care within a year prior to the research date are included in the study. These individuals served as the sample for the research. Locational effects and cultural differences may have contributed to the research. Therefore, generalizations cannot be made for other regions of Türkiye. There was no assessment based on a disease. Expanding the scope of the research can be achieved by performing the research with various sample groups. The data in the table is current as of the date of the research. This information may change over time.

5. Conclusion

For successful and fit-for-purpose deployment of AI-based systems, a careful examination of users' attitudes and perceptions about AI is required. Therefore, investing in AI technology without recognizing the beliefs of potential users and their willingness to accept AI devices can lead to a waste of resources. The results of the research show that the Turkish form of the "General Attitude Towards Artificial Intelligence Scale" can be considered as a reliable and valid measurement tool that can be used in our country. Since it did not follow the 2-factor structure, the 20th statement on the original scale, "Artificial intelligence is used to spy on people," was excluded from the adaption study carried out in our nation. The scale might be considered as an important measurement tool to distinguish attitudes towards the positive aspects and negative aspects of artificial intelligence. It is believed to be beneficial to the research that will be done with patients and in health services. In addition, it is important to remember that the role of artificial intelligence will increase in the future development of health services, and the perspectives of both providers and users on AI will determine the place and importance of AI in health services. The findings of the study provide important information for artificial intelligence research and applications in the field of healthcare in Türkiye. With all these aspects, it is thought that the research will be beneficial.

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Conflict of Interest

There is no conflict of interest to declare by the author.

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