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# Psychometrics of the Attitude Scale towards the use of Artificial Intelligence Technologies in Nursing

Dilek Yılmaz<sup>1\*</sup>, Derya Uzelli<sup>2</sup> and Yurdanur Dikmen<sup>3</sup>

## Abstract

**Background** It is clear that nursing practice is directly affected by artificial intelligence (AI), and in this regard, a need is felt for more information on the knowledge and attitudes of nurses to the use of AI technology in nursing care practice. However, no inclusive measurement instrument tested for validity and reliability evaluating the attitudes of nurses to the use of AI technology was found. The aim of this research was to develop and test the validity of the Attitude Scale Towards the Use of Artificial Intelligence Technologies in Nursing (ASUAITIN) in the Turkish language.

**Methods** The research was a methodological and cross-sectional study, designed to develop and test the validity of the ASUAITIN. STROBE guidelines were followed in the study. In order to create the starting materials, the researchers made a scan of the literature. Two hundred nurses working in the internal medicine, surgical and intensive care departments of a university hospital in the Marmara Region of Turkey were included in the study. Items were assessed for content validity. ASUAITIN was tested for construct validity and internal consistency reliability.

**Results** ASUAITIN consists of 15 items. It has two dimensions, positive attitude, and negative attitude to AI technology in nursing practice, and practice and explains 67.762% of total variance. Item loads were between 0.529 and 0.866. Cronbach alpha values were calculated to be 0.910 for the total scale, 0.933 for Factor 1, and 0.917 for Factor 2.

**Conclusions** The results of this study show that the ASUAITIN scale are validated and reliable measurement tool. ASUAITIN can be used as an instrument to assess the attitudes to AI technology in practice among nurses working in the clinical field.

**Clinical trial number** Not applicable.

**Keywords** Artificial intelligence, Artificial intelligence technologies, Scale, Nursing

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## Background

Today, AI systems are developing rapidly, and new applications and uses in health services are rapidly increasing. The integration of AI into health services provides the potential for the improvement of patient care, an increase in the sensitivity of diagnosis, and the widening of access to health services [1, 2]. Also, it has been stated that AI technologies have many applications in health services, including assessing illness, helping to solve various clinical and diagnostic problems, reducing loss of data, improving the care management of hospitalized patients, reducing the work load of personnel, and increasing patient safety [2–4]. AI technologies in the health care environment enable a reduction in the cost of health services, an increase in the satisfaction and clinical safety of patients and their families and the productivity of these services, and the formation of an extremely valuable support system for the wellbeing of patients and the health sector in general [5–7].

With the appearance of AI, nursing practices have shown advances in the modern health environment, and this has brought with it many positive results [8–11]. By providing real-time decision-making help, AI has been reported to have the potential to help the practice of nursing by reducing the time spent on activities other than care [8, 12]. Empirical evidence has shown that AI technologies affect nursing procedures including current nursing roles, clinical care and nurse-patient relations [10, 13–16].

In nursing, AI technologies cover a wide area, for example in AI-supported clinical decision support systems. With these systems, patient data can be analyzed, evidence-based recommendations can be made as a result of this analysis, and nurses can carry out definite diagnosis and treatment plans [10, 11, 17, 18]. Also, AI technologies have a place in patient monitoring, with algorithms which continuously track vital signs and alert nurses to potential changes or deteriorations in patients [12, 16, 19]. Today, many AI technologies are actively used in nursing, such as in drug distribution [20], data mining, speech recognition [21] and in the estimation of physical disorder [22]. At the same time, it has been said that future applications of AI technology will to a great extent help nurses to provide individualized and evidence-based care [10, 13, 22].

It has been reported that, despite AI technologies having potential benefits in patient care, their implementation in nursing care has caused concerns and argument among nurses due to the fear that they may endanger the ethics of care and even replace nursing care [7, 10, 18, 23]. Including AI based technologies into the nursing discipline increases these concerns. Among the increasing discussion topics of recent years is that technology may replace human-to-human interaction, compromising

care ethics [7, 10, 18, 24] and that it may create uncertainty in the provision of transparent nursing care [18, 25, 26]. In a study by Abuzaid et al. 43% of nurses stated that AI technologies would threaten nursing practices, and 57% that it would put the nursing profession at risk [13]. In a study by Rony et al. conducted with nurses, it was reported that nurses accepted that AI technologies had the potential to improve patient outcomes and to optimize care procedures, but that they were worried about the preservation of the value of the nature and the essential human contact of nursing [9].

There are a number of studies in the literature which examine the levels of knowledge, the perceptions and the attitudes of nurses to AI technologies. In these studies, it is shown that education on AI given to nurses had a significant positive effect on their knowledge and attitudes regarding AI [3, 6]. In a study by Rony et al. examining the views of nurses on the role of AI in shaping the future of health services, the nurses included in the research stated that AI technologies could have potential benefits and risks [9]. Also, in a study by Abuzaid et al. conducted with nurses working in health institutions in the United Arab Emirates, the nurses said that AI technologies would take the place of many nursing procedures (88%), and while they would threaten nursing practices (43%) [13]. In a study by Elderiny et al., it was found that nurses' perceptions regarding AI technologies were at a medium level [2]. Apart from these, it has been reported in studies with nursing students have a positive attitude to AI technologies [14, 27, 28]. Nurses who are at the forefront of patient care play an important part in the use of AI technologies and in the future will be significantly affected by this technology [9, 10, 29]. As is seen, nurses, who play an important role in health services, are constantly being faced with new and more advanced technology and have to try to get used to these changes even before they have become totally accustomed to the old technology. It is very important to determine the attitude of nurses, who are the key health service providers in patient care, in order to include the use of AI technology in practices in the clinical field, and to prepare for the health environment of the future. It is clear that nursing practices will be directly affected by AI technologies in the future, and in this regard a need is felt for more information on the knowledge and attitudes of nurses to the use of AI technologies in care practices. However, most current studies focus on the development of AI applications, and compare interventions performed before and after the integration of AI, and very few studies were found which researched attitudes to the use of AI technologies in nursing practice [3, 9, 13]. Moreover, no comprehensive measurement tool within the scope of these studies was found that had a valid and reliable study evaluating nurses' attitudes to the use of AI technologies.

With this shortcoming in mind, the aim of this study was to develop the Attitude Scale towards the Use of Artificial Intelligence Technologies in Nursing (ASUAITIN), and to test it for validity and reliability in the Turkish language. In this way, using an objective measurement instrument to measure the views of nurses currently employed in patient care in the clinic of this technology may serve as a guide for institutional measures such as education needs analysis, in-service training and promotional work which will accustom them to this process. Also, nurses may have worries about the ethical and confidentiality problems which may arise with the use of AI technology. Determining their attitudes to this subject may help to develop suitable measures and policies on this by understanding their concerns. It is important to take into account the importance of the concerns of nurses regarding AI, particularly in measures and policies surrounding practices that use AI.

The aim of this research was to develop the Attitude Scale towards the Use of Artificial Intelligence Technologies in Nursing (ASUAITIN) in the Turkish language and to test its validity.

## Methods

### Study design

The study was a methodological and cross-sectional study designed to develop and test ASUAITIN. This study had a design of division into two main phases, consistent with scale design and development recommendations [30]. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines were followed.

### Setting

The study was conducted between March and June 2024 at a university hospital in the Marmara Region of Turkey.

### Development of ASUAITIN

#### Item generation

At this stage, the research team carried out a literature scan in the field relating to the use of AI technologies in nursing practices. The item pool of the scale was created by the researchers, benefitting from the literature on the use of AI technologies in nursing practice. Then, the main results were labelled, shared, compared, and discussed in a consensus meeting among the research team members to achieve their final agreement and to solve possible divergences in defining the main results. First, a pool of 20 items was created. Then, in meetings, the item pool was reduced because of the inclusion of repetitions. In a consensus meeting with the research group, the number of items was reduced to 15 in line with these results, and the first draft scale was created. On this draft scale, the first six items related to a negative attitude to

AI technologies in nursing practices, and the remaining nine related to a positive attitude to AI in nursing.

### Content validity

In order to examine content validity, the scale was subjected to a process of expert views. A total of 15 experts took part in this process. These were academic nurses and clinical nurses, most of whom had a master's degree or higher. One of the experts, who was an academic nurse, had many studies on AI, and there was a laboratory with healthcare AI products in the institution where this expert worked. In the determination of Content Validity Rates (CVR), first, the experts were asked to evaluate each item on the draft scale as "completely suitable", "suitable", "suitable but needs changes", or "not suitable" for each item on the draft scale form. Also, an opportunity was given for the experts to make recommendations on each item. After that, the importance of each item was assessed quantitatively from 1 to 4, representing of no importance, moderately important, important, and very important. Then, for each item, the number of experts giving a "suitable" view for that item was divided by half of the total number of experts expressing their views on the item [31]. CVR for each item was determined by subtracting 1 from this ratio for each item [32]. No item was assessed as unsuitable by all experts, and therefore no item was eliminated.

In the responses from the experts, five comments were obtained, and all of these were accepted following discussion within the research team. Items for which revision was recommended were revised. Some items were made more comprehensible without changing their meaning. The results showed that item rating was between 0.75 and 0.95, and the mean significance scores for each item were from 3.31 to 4.00. Acceptable content validity is defined as the average Scale-level Content Validity Index = 1 and Item-level Content Validity Index = 1.00 if the number of experts is five or less, and an Item-level Content Validity Index  $\geq 0.78$  and the average Scale-level Content Validity Index  $\geq 0.9$  if the number of experts is six or greater [33, 34].

### Participants

The population of the research consisted of the nurses working in the internal medicine, surgery and intensive care units of the hospital where the research was conducted ( $N=420$ ). As more AI technologies were used in existing nursing practices in the clinical field, it was decided to form the research population in this way. The inclusion criteria were as follows: (a) registered nurses with  $>1$  year of clinical experience and (b) voluntary participation in this study. The exclusion criteria were: (a) nurses working in nonclinical departments; and (b) nurses not working at the hospital during the

investigation period (those currently retired or on leave for sickness or personal reasons).

The data collection process started with a pilot application. In order to evaluate whether the ASUAITIN was a comprehensible and appropriate scale, the scale was first applied to 10 nursing. This group of nurses on whom the pilot application was conducted was not included in the analyses.

In the sample selection in the research, the convenience sampling method was used. Sample size was calculated based on ten participants for each item [35, 36], and therefore, 150 participants were sufficient. Considering the possibility of participants leaving the study halfway and of questionnaires being incompletely filled, a total of 210 nurses were invited to participate in the study. Finally, seven nurses withdrew during the research process and three were unable to complete the questionnaires, so that 200 nurses were included in the study analysis.

## Instruments

### *Demographic characteristics questionnaire*

This form was applied to obtain descriptive information on the nurses such as their age, education level, the unit where they worked, years of work in the profession, and weekly working hours.

### **Attitude scale towards the use of artificial intelligence technologies in nursing (ASUAITIN)**

The scale consists of 15 items, with two dimensions of a positive attitude by nurses to AI technologies in nursing practice and a negative attitude to AI technologies in nursing practice. For example, “I think that in the future when AI technologies are used more, the nursing profession will be damaged” is negative, and “There are many beneficial applications of AI technologies in nursing” is positive. Each item is assessed on a five-way Likert type scale of 1–5, with high scores indicating a positive attitude. The highest score obtainable on the scale is 75, and the lowest is 5 (Supplementary Material 1).

## Data collection

Research data was collected between March and June 2024 by face to face interview with the nurses. It was explained to the nurses that all the data would be used for scientific study and that their responses would in no way affect their professional lives. The nurses who agreed to participate were given information about the research, and the necessary legal approval was obtained. Later, a researcher went around all the clinics of the hospital and distributed the data collection forms to each of the participating nurses. The participants took approximately ten minutes to complete the questionnaire. After

completion, the forms were taken back, and included in the evaluation.

## Statistical analysis

Descriptive statistics of demographic variables were presented by frequency and percentage. Descriptive statistics of items were given as mean and standard deviation (SD).

An exploratory factor analysis (EFA) using a principal component analysis with Varimax rotation was performed to identify the construct validity of the ASUAITIN. Before examining with EFA analysis, Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measurement of sampling adequacy for factor analysis were applied. The criteria used in testing for the construct of items of ASUAITIN were as follows: (a) items with loading below 0.4, (b) items loaded on to more than one factor with similar loadings and (c) each common factor containing < 3 items [34]. In order to examine the reliability of the scale, internal consistency reliability was used, and this was calculated with the Cronbach alpha coefficient. Cronbach alpha coefficients of more than 0.70 were taken as acceptable [37].

EFA was performed with IBM SPSS ver.23.0 (IBM Corp. released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.) Statistical significance level was considered as  $p < 0.05$ .

## Ethical considerations

The necessary institutional permission was obtained from the hospital where the research was conducted. The research was approved on 28 February 2024 with decision number 2024-02 by Bursa Uludağ University Health Sciences Research and Publications Ethics Committee. The study was conducted in accordance with the Declaration of Helsinki, and informed consent was obtained from the nurses to ensure that they understood the purpose of the study, their right to participate or withdraw, and data confidentiality. Anonymity was assured and no force or pressure was applied. The data was used only for the purposes of research.

## Results

### **Demographic characteristics**

The characteristics of the participants are presented in Table 1. The mean age of the nurses participating in the research was 34.62 (SD = 5.31) years, 87% were female, and 67.5% were university graduates. They had 11.81 (SD = 8.97) years of experience in the nursing profession, 57% worked for more than 40 h a week, and 53% were working in the internal medicine units.

**Table 1** Participants' characteristics ( $n = 200$ )

	Mean (SD)	N (%)
Age: mean (SD) years	34.62 (5.31)	
Years in the profession	11.81 (8.97)	
Gender		
Female		174 (87.0)
Male		26 (13.0)
Educational level		
Ordinary degree		14 (7.0)
Bachelor's degree		135 (67.5)
Master's		39 (19.5)
Doctorate		12 (6.0)
Place of work		
Internal medicine		106 (53.0)
Surgery		44 (22.0)
Intensive care unit		50 (25.0)
Hours worked per week		
Less than 40 h		86 (43.0)
40 h or more		114 (57.0)

Abbreviation: SD, Standard deviation

**Construct validity****Exploratory factor analysis (EFA)**

In the EFA, a principal component analysis was performed to examine the initial structure of the ASUAITIN (Table 2). As there was no item below 0.40 in the item total correlation, no items were eliminated. In establishing sample adequacy, the result of the Bartlett test

was found to be  $\chi^2 = 2371.040$ ,  $df = 105$ ,  $p < 0.001$ , and a Kaiser-Mayer-Olkin (KMO) value of 0.936 was found (Table 2). Thus, it was established that the data was suitable for EFA and that the sample size of the scale was completely adequate [38, 39].

The scree graph showed that only two of the 15 components of the ASUAITIN had eigenvalues of less than 1 (Fig. 1). The ASUAITIN consisted of two factors, accounting for 67.762% of the total variance. The item loadings were 0.529–0.866. One of the factors was negative attitude to the use of AI in nursing practice (items 1, 2, 3, 4, 5 and 6), and the other was positive attitude to the use of AI in nursing practice (items 7, 8, 9, 10, 11, 12, 13, 14 and 15) (Table 2).

**Reliability**

In the study, internal consistency reliability was measured. Table 3 shows the Corrected Item-Total Correlation and Cronbach Alpha of Item Deleted statistics relating to internal consistency reliability and the items' mean and standard deviation values.

Table 4 shows the internal consistency results and descriptive statistics of ASUAITIN. As a result of analysis, it was found that the Cronbach alpha value of the

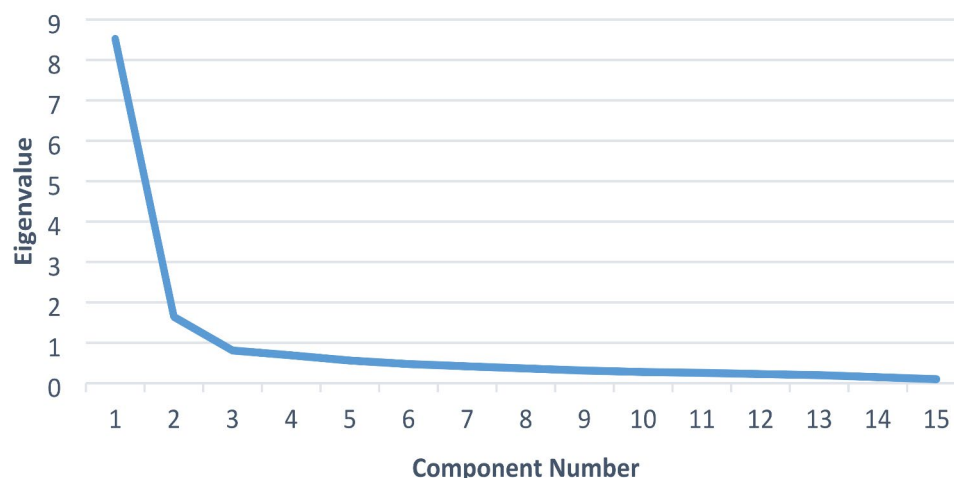
**Table 2** Rotated factor loadings for the 15 items of ASUAITIN

No	Items	Factor 1	Factor 2
1	I think artificial intelligence technologies will be a hindrance to the application of nursing care practices.	0.758	
2	I feel uncomfortable when I think how artificial intelligence technologies will be used in the future in nursing care.	0.784	
3	I think that the nursing profession will be harmed if artificial intelligence technologies are used more in the future.	0.819	
4	I think that the use of artificial intelligence technologies in nursing care will put patient safety at risk.	0.842	
5	I think it isn't right to use artificial intelligence technologies in nursing.	0.832	
6	I think that the use of artificial intelligence technologies in nursing practice can cause ethical problems.	0.801	
7	Artificial intelligence technologies can provide new opportunities for nurses.		0.640
8	The field of use of artificial intelligence technologies in nursing is wide.		0.739
9	There are many beneficial applications of artificial intelligence technologies in nursing.		0.689
10	I would prefer to use a system with artificial intelligence for some routine nursing procedures, like vital findings and pain assessment.		0.684
11	Predictions about the patient by artificial intelligence technologies (nursing diagnosis, care needs, etc.) can provide practical opportunities to make the profession easier.		0.686
12	I think that benefitting from artificial intelligence technologies in nursing is achievable.		0.529
13	I would like to have skills in learning and using artificial intelligence technologies in nursing.		0.828
14	I would like to have training on learning the use of artificial intelligence technologies in nursing.		0.866
15	I think it is necessary to include artificial intelligence technologies in the core curriculum of nursing education.		0.820
Variance (%)		56.812	10.950
Cumulative (%)		56.812	67.762
KMO		0.936	
Bartlett's test of sphericity		Approx. Chi-Square = 2371.040 $df = 105$ $p < 0.001$	

Abbreviation: ASUAITIN, Attitude Scale towards the Use of Artificial Intelligence Technologies in Nursing. Principal component analysis was used



## Scree Plot



**Fig. 1** The scree plot of ASUAITIN

**Table 3** Descriptive statistics of ASUAITIN items and reliability

	Mean	SD	Corrected item-total correlation	Cronbach's alpha if item deleted
Item 1	2.28	1.04	0.764	0.925
Item 2	2.46	1.10	0.826	0.917
Item 3	2.47	1.13	0.815	0.918
Item 4	2.67	1.07	0.839	0.915
Item 5	2.39	1.08	0.870	0.911
Item 6	3.08	1.15	0.702	0.933
Item 7	3.65	0.95	0.687	0.909
Item 8	3.59	0.93	0.766	0.904
Item 9	3.60	0.86	0.756	0.905
Item 10	3.72	0.95	0.592	0.916
Item 11	3.71	0.93	0.719	0.907
Item 12	3.18	1.00	0.504	0.923
Item 13	4.02	0.79	0.788	0.903
Item 14	3.98	0.83	0.818	0.901
Item 15	3.82	0.91	0.808	0.901

Abbreviation: SD, Standard deviation; ASUAITIN, Attitude Scale towards the Use of Artificial Intelligence Technologies in Nursing

**Table 4** Descriptive statistics and Cronbach's alpha values of two-factorial scale

Factors	Factor 1	Factor 2
Number of items	6	9
Cronbach's alpha	0.933	0.917
Mean	15.36	33.29
Standard deviation	5.71	6.37
Minimum-Maximum	6–30	9–45

Abbreviation: SD, Standard deviation

scale developed was 0.910. The Cronbach alpha value of Factor 1 was calculated to be 0.933, and that of Factor 2 to be 0.917 (Table 4).

## Discussion

This study was designed to develop ASUAITIN, to measure the attitudes of nurses to the use of AI technologies in nursing practices.

AI technologies have the potential to create a revolution in the provision of health services, to improve patient outcomes and to transform the role of nurses [1]. However, as well as the potential benefits of the use of AI technologies in nursing, concern has also been expressed that there may be risks, and that ethical problems may arise [7, 9, 18]. Few studies were seen in the literature setting out the perceptions and attitudes of nurses to AI technologies [3, 10, 13]. Furthermore, the literature revealed that no valid and accurate scale had been designed to assess nurses' attitudes on the employment of AI technology in the clinical setting. Thus, within the framework of studies in the literature, the ASUAITIN was developed with the idea that nurses working in the clinical field might have positive and negative attitudes to AI technologies. It was found as a result of the study that the ASUAITIN was a valid and reliable scale to measure the attitudes of nurses to the use of AI technologies in nursing practice.

First in the work to develop the scale, an examination was started of studies in the literature. In examining the content validity of the ASUAITIN, a method based on expert opinion was followed. Items for which revision was recommended were revised and made easier to understand, but the number of items was unchanged. It was found that the item rating of the 15-item draft scale

was between 0.75 and 0.95, and the significance score for each item was 3.31–4.00. This result was seen to provide a CVR for the ASUAITIN [33, 34]. In examining the construct validity of the ASUAITIN, EFA was applied. As no item was below 0.40 in item-total correlation, no items were eliminated. As a result of the analyses, it was found that the data was suitable for EFA, and that the sample size of the scale was completely adequate. It was seen that this result was in accordance with the literature [36, 38, 39]. As a result of the study, it was determined that the ASUAITIN consisted of two factors, and explained 67.762% of total variance. It was seen that item loads were between 0.529 and 0.866. Factor 1, consisting of the first six items, was a negative attitude to the use of AI technology in nursing and Factor 2, consisting of items 7–15, was a positive attitude to the use of AI technology in nursing, giving a two-factor structure. The validity of the ASUAITIN was found to be at a good level. As a result of the study, Cronbach alpha values according to the ASUAITIN internal consistency reliability results were 0.910 for the total scale, 0.933 for Factor 1, and 0.917 for Factor 2. It is seen from these results that the Cronbach alpha values of the sub-scales were above 0.917. Zhu et al. state that a Cronbach alpha value higher than 0.8 represents ideal consistency [34]. Therefore, these results show that the subscales of ASUAITIN have good consistency according to the standard classification recommendation [36, 40]. ASUAITIN is the first valid and reliable instrument to measure the attitudes of nurses to AI technologies used in care applications. ASUAITIN can help to measure attitudes to AI technologies, which have the potential to transform the role of nurses working in the clinical field, and can be used to determine the readiness of nurses in health institutions where AI technologies will be used. ASUAITIN is expected to be used in assessing the attitudes among nurses working in the clinical field to AI technologies.

## Strengths and limitations

### Strengths

A strong aspect of this study is that it presents a valid and reliable instrument developed to measure the attitudes of nurses working in the clinical field to the use of AI technologies. ASUAITIN may provide a contribution to determining the attitudes to AI technologies of nurses working in the clinical field.

### Limitations

The study has a few limitations. The research was conducted at a single hospital and convenience sampling methods were used, and this may affect the generalizability of the research. Only Turkish nurses were included in the study, and therefore cultural variables may have affected attitudes to the use of AI technology nursing

applications. Considering that nurses in different cultures may have different attitudes to AI technologies, it is recommended that this measurement instrument be adapted through language studies with nurses from different cultures. In this way, the scale can provide meaningful and effective results in every culture. Also, there may be some prejudices in some studies, and the fact that all of the questions depend on the statements of the nurses may affect the bias of the research. Nevertheless, to reduce bias, we took account of a 20% sample loss rate, and strictly checked the inclusion and exclusion criteria of the sample. In order to reduce data bias, participants were asked to fill in the questionnaires anonymously. Considering all these limitations, a need is felt for later studies with a larger sample and nurses from different cultures, and for scales to be developed in different languages.

## Conclusion

As far as is known, this study is the first to focus on the development and verification of a measurement instrument to assess the attitudes among nursing professionals to the use of AI technologies. This study shows that ASUAITIN is a valid and reliable scale for the assessment of attitudes towards AI technologies in practice among nurses working in the clinical field. This scale may help to determine the attitudes of nurses in health institutions where AI technologies are to be used.

### Abbreviations

AI	Artificial Intelligence
ASUAITIN	Attitude Scale Towards the Use of Artificial Intelligence Technologies in Nursing
CVR	Content Validity Rates
EFA	Exploratory Factor Analysis
KMO	Kaiser-Meyer-Olkin
SD	Standard Deviation

## Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12912-025-02732-7>.

Supplementary Material 1

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### Author contributions

D. Y. and D. U. Conceptualization, methodology, investigation, resources, data curation and writing - original draft. D. Y. and Y. D. Conceptualization, methodology, interpretation of data, writing - review & editing.

### Funding

This research received no external funding.

### Data availability

All data generated or analysed during this study are included in this published article and its supplementary appendix.

## Declarations

### Ethics approval and consent to participate

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki. All participants were informed of the voluntary nature of their participation and the commitment to confidentiality and anonymity. Signed informed consent was obtained from all participants prior to the start of data collection; they were informed of the purpose of the study, the nature of their participation and their right to withdraw at any time. Approval was obtained from the Bursa Uludağ University Health Sciences Research and Publications Ethics Committee, Approval no: (2024-02).

### Consent for publication

Not applicable.

### Informed consent

Written consent has been obtained from the participants.

### Competing interests

The authors declare no competing interests.

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## References

- Cary MP Jr, De Gagne JC, Kauschinger ED, Carter BM. Advancing health equity through artificial intelligence: an educational framework for preparing nurses in clinical practice and research. *Creative Nurs*. 2024;30:154–64.
- Elderiny SNM, Ahmed SAA, Elhoty MAE. Intensive care nurses' knowledge and perception regarding artificial intelligence applications. *Trends Nurs Health Care J*. 2024;8:195–220.
- Hussein Mohamed S, Abed El-Rahman Mohamed M, Farouk Mahmoud S, HessianYousef Heggy E. The effect of educational program on nurses' knowledge and attitude regarding artificial intelligence. *Egypt J Health Care*. 2023;14:1110–28.
- Zhou J, Zhang F, Wang H, Yin Y, Wang Q, Yang L, et al. Quality and efficiency of a standardized e-handover system for pediatric nursing: a prospective interventional study. *J Nurs Manag*. 2022;30:3714–25.
- Kulkarni S, Seneviratne N, Baig MS, Khan AH. Artificial intelligence in medicine: where are we now? *Acad Radiol*. 2020;27:62–70.
- Makhlouf E, Alenezi A, Shokr EA. Effectiveness of designing a knowledge-based artificial intelligence chatbot system into a nursing training program: a quasi-experimental design. *Nurse Educ Today*. 2024;137:106159.
- von Gerich H, Moen H, Block LJ, Chu CH, DeForest H, Hobensack M, et al. Artificial Intelligence-based technologies in nursing: a scoping literature review of the evidence. *Int J Nurs Stud*. 2022;127:104153.
- O'Connor S, Yan Y, Thilo FJ, Felzmann H, Dowding D, Lee JJ. Artificial intelligence in nursing and midwifery: a systematic review. *J Clin Nurs*. 2023;32:2951–68.
- Rony MK, Kayesh I, Bala SD, Akter F, Parvin MR. Artificial intelligence in future nursing care: exploring perspectives of nursing professionals-a descriptive qualitative study. *Heliyon*. 2024;10:e25718.
- Rony MK, Parvin MR, Ferdousi S. Advancing nursing practice with artificial intelligence: enhancing preparedness for the future. *Nurs Open*. 2024;11:e2070.
- Van Bulck L, Couturier R, Moons P. Applications of artificial intelligence for nursing: has a new era arrived? *Eur J Cardio Nurs*. 2023;122:e19–20.
- Alazzam MB, Tayyib N, Alshawwa SZ, Ahmed MK. Nursing care systematization with case-based reasoning and artificial intelligence. *J Healthc Eng*. 2022;1959371.
- Abuzaid MM, Elshami W, Fadden SM. Integration of artificial intelligence into nursing practice. *Health Techno*. 2022;12:1109–15.
- Labrague LJ, Aguilar-Rosales R, Yboa BC, Sabio JB, de Los Santos JA. Student nurses' attitudes, perceived utilization, and intention to adopt artificial intelligence (AI) technology in nursing practice: a cross-sectional study. *Nurse Educ Pract*. 2023;73:103815.
- Buchanan C, Howitt ML, Wilson R, Booth RG, Risling T, Bamford M. Predicted influences of artificial intelligence on nursing education: scoping review. *JMIR Nurs*. 2021;4:e23933.
- Ng ZQ, Ling LY, Chew HS, Lau Y. The role of artificial intelligence in enhancing clinical nursing care: a scoping review. *J Nurs Manag*. 2022;30:3654–74.
- Jain A, Way D, Gupta V, Gao Y, de Oliveira Marinho G, Hartford J, et al. Development and assessment of an artificial intelligence-based tool for skin condition diagnosis by primary care physicians and nurse practitioners in tele dermatology practices. *JAMA Netw Open*. 2021;4:e217249.
- Martinez-Ortigosa A, Martinez-Granados A, Gil-Hernández E, Rodriguez-Arrastia M, Ropero-Padilla C, Roman P. Applications of artificial intelligence in nursing care: a systematic review. *J Nurs Manag*. 2023;32:19127.
- Liu Q, Yang L, Peng Q. Artificial intelligence technology-based medical information processing and emergency first aid nursing management. *Comp Math Methods Med*. 2022;8677118.
- Booth RG, Strudwick G, McBride S, O'Connor S, López ALS. How the nursing profession should adapt for a digital future. *BMJ*. 2021;373:1–5.
- Topaz M, Murga L, Gaddis KM, McDonald MV, Bar-Bachar O, Goldberg Y, et al. Mining fall-related information in clinical notes: comparison of rule-based and novel word embedding-based machine learning approaches. *J Biomed Inf*. 2019;90:103103.
- Ronquillo CE, Peltonen LM, Pruinelli L, Chu CH, Bakken S, Beduschi A, et al. Artificial intelligence in nursing: priorities and opportunities from an international invitational think-tank of the nursing and artificial intelligence leadership collaborative. *J Adv Nurs*. 2021;77:3707–17.
- Robert N. How artificial intelligence is changing nursing. *Nurs Manag*. 2019;50:30–9.
- Stokes F, Palmer A. Artificial intelligence and robotics in nursing: ethics of caring as a guide to dividing tasks between AI and humans. *Nurs Philosop*. 2020;21:e12306.
- Peirce AG, Elie S, George A, Gold M, O'Hara K, Rose-Facey W. Knowledge development, technology and questions of nursing ethics. *Nurs Ethics*. 2020;27:77–87.
- Seibert K, Domhoff D, Bruch D, Schulte-Althoff M, Fürstenau D, Biessmann F, et al. Application scenarios for artificial intelligence in nursing care: rapid review. *J Med Internet Res*. 2021;23:e26522.
- Ruiz-Talavera D, De la Cruz-Aguero JE, García-Palomino N, Calderón-Espinoza R, Marín-Rodríguez WJ. Artificial intelligence and its impact on job opportunities among university students in North Lima, 2023. *EAI*. 2023;10:1–8.
- Cho KA, Seo YH. Dual mediating effects of anxiety to use and acceptance attitude of artificial intelligence technology on the relationship between nursing students' perception of and intention to use them: a descriptive study. *BMC Nurs*. 2024;23:212.
- Secinaro S, Calandra D, Secinaro A, Muthurangu V, Biancone P. The role of artificial intelligence in healthcare: a structured literature review. *BMC Med Infor Dec Mak*. 2021;21:1–23.
- Rattray J, Jones MC. Essential elements of questionnaire design and development. *J Clin Nurs*. 2007;16:234–43.
- Hu Q, Qin Z, Zhan M, Wu B, Chen Z, Xu T. Development of a trigger tool for the detection of adverse drug events in Chinese geriatric inpatients using the Delphi method. *Int J Clin Pharm*. 2019;41:1174–83.
- Hu J, Fallacaro MD, Jiang L, Wu J, Jiang H, Shi Z, Ruan H. IFNA approved Chinese anaesthesia nurse education program: a Delphi method. *Nurse Educ Today*. 2017;56:6–12.
- Polit DF, Beck CT. The content validity index: are you sure you know what's being reported? Critique and recommendations. *Res Nurs Health*. 2006;29(5):489–97.
- Zhu Y, Zhan YC, Zhu JM, Huang L, Zhang L, Zhang M, Li BK. The development and psychometric validation of a Chinese empathy motivation scale. *J Clin Nurs*. 2019;28:2599–612.
- Kline RB. Principles and practice of structural equation modeling (5th edition). New York: Guilford Press, 2023.
- Wang X, Qi W, Chan S, Shi Z. Development and psychometric evaluation of a Chinese version of auditory hallucination risk assessment scale in patients with a diagnosis of schizophrenia. *J Clin Nurs*. 2020;29:3414–24.
- Dos Santos FC, Riner ME, Henriques SH. Brazilian questionnaire of competencies of oncology nurses: construction and test of content validation. *Int J Nurs Sci*. 2019;6:288–93.
- Bartlett MS. A note on the multiplying factors for various  $\chi^2$  approximations. *J Royal Stat Soc Ser B (Meth)*. 1954;16:296–8.



39. Kaiser HF. An index of factorial simplicity. *Psychometrika*. 1974;39:31–6.
40. Streiner DL, Norman GR. *Health measurement scales: a practical guide to their development and use*. Oxford University Press; 2003.

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