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Artificial Intelligence Anxiety of Nurses and Related Factors

Hemşirelerin Yapay Zekâ Kaygısı ve İlişkili Faktörler

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ABSTRACT

The research was carried out to examine the artificial intelligence anxiety levels of nurses and their affecting factors. In this study, a descriptive and cross-sectional design was used. The sample of the study consisted of 120 nurses (n=120). The research data were collected between 10 July and 10 October 2021. Data were collected using a Nurse Information From (NIF) and Artificial Intelligence Anxiety Scale (AIAS). Mann- Whitney U and Kruskal-Wallis test were used in the analysis of research data. The average age of nursing was 31.05±7.40 and 82.2% were females. The AI levels of the nurses were found to be 43.36±11.13. It was determined that there was a difference between the educational status of the nurses, their knowledge of AI technologies, the effect of AI technologies in patient care and their AI anxiety levels ($p<0.05$). This study determined that AI anxiety was higher in nurses who had a lower education level, did not have knowledge about AI technologies, and thought that AI technologies would not have a positive effect on patient care.

Keywords: Artificial intelligence, Artificial intelligence anxiety, Nurse

ÖZ

Çalışma, hemşirelerin yapay zeka kaygı düzeylerini ve etkileyen faktörleri incelemek amacıyla yapılmıştır. Bu çalışmada tanımlayıcı ve kesitsel araştırma deseni kullanılmıştır. Araştırmanın örneklemini 120 hemşire oluşturmuştur (n=120). Araştırma verileri 10 Temmuz-10 Ekim 2021 tarihleri arasında toplanmıştır. Veriler "Hemşire Bilgi Formu (HBF)" ve "Yapay Zeka Kaygı Ölçeği (YZKÖ)" ile toplanmıştır. Verilerin analizinde Mann- Whitney U and Kruskal-Wallis testi kullanılmıştır. Hemşirelerin yaş ortalaması 31,05±7,40 olup %82,2'si kadındır. Hemşirelerin YZKÖ puan ortalaması 43,36±11,13 olarak bulundu. Hemşirelerin eğitim durumları, yapay zeka teknolojilerine ilişkin bilgileri, yapay zeka teknolojilerinin hasta bakımına etkisi ile yapay zeka kaygı düzeyleri arasında anlamlı bir fark olduğu belirlendi ($p<0,05$). Bu çalışmada, eğitim düzeyi düşük, yapay zeka teknolojileri hakkında bilgisi olmayan ve yapay zeka teknolojilerinin hasta bakımına olumlu bir etkisi olmayacağını düşünen hemşirelerin yapay zeka kaygısının daha yüksek olduğu belirlenmiştir.

Anahtar Kelimeler: Hemşire, Yapay zeka, Yapay zeka kaygısı

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INTRODUCTION

The term artificial intelligence (AI) was first defined by John McCarthy as "the science and engineering of making intelligent machines, especially intelligent computer programs.[1] Today, artificial intelligence is used in areas that require human intelligence such as visual perception, decision making, speech recognition, computer vision, machine learning, and language translation. [2] Since the introduction of artificial intelligence into the field of health in the 1970s, it has been used in important developments in early diagnosis and treatment, medical decision making, drug development, medical imaging, storage of medical records, and many other areas.

In the future, AI technologies will be frequently used in healthcare due to their features, such as achieving better patient outcomes at lower cost, processing large amounts of data, powerful computing capabilities, and personalized care.[2] Studies have reported that, with the use of AI in healthcare, care and treatment services will change and develop, it will be easier to integrate different types of data, and versatile care will be provided in a shorter time.[2,3] The benefits of new technologies and methods used in healthcare include improving treatment and care processes, communication with patients, processes related to the protection of health, and administrative processes of health institutions and organizations.[4] With the advancement of technology, the internet of things, AI, virtual reality, and robots provide benefits to people, but they also bring negative features such as uncontrollability and danger.[5] AI can create job change anxiety, privacy violation anxiety, security, regulation, and learning anxiety in humans.[6-8] It has also been argued that the introduction of AI technologies such as facial recognition and autonomous driving in the future will bring new concerns and security problems.[9,10] It is thought that the use of AI in health services may cause some concerns about ensuring patient and employee safety, ethical approach in maintaining uninterrupted and error-free medical processes of patients, and protecting patient rights. Besides, it is argued that making decisions through calculations and pros and cons analysis may also raise concerns about discrimination and prejudice.[11]

The use of AI technologies is of great importance for nurses who communicate closely with patients and perform care and treatment practices. It is evident that AI technologies will bring many changes and developments in both health services and the nursing profession.[2,3] Therefore, nurses need to know and understand how AI technology is used in patient care and treatment processes, its potential effects on patients, and fundamental issues related to AI concepts.[5] The continuous development of technology forces individuals to adopt and use new technologies in a very short time. This process of change triggers emotional and cognitive reactions in people, causing them to experience fear and anxiety. This feeling of fear and anxiety is defined as technophobia in the sense of phobia caused by technology. The use of new technologies puts a great deal of pressure on employees and may adversely affect their personal adaptation to technology by affecting their emotions. At the same time, this pressure can cause concern, anxiety, and poor job performance. Even if employees accept these changes in work processes, they may continue to experience anxiety and fear about the changes made by technology in their lives.[12] Although the general purpose of developing AI applications in healthcare is to benefit health professionals and patients, issues such as where and how AI will be used, what will be the changes and transformations for its use as well as the changes such as creating an additional workload on nurses, its effect on current nursing roles and differences in working methodology can create a state of concern or anxiety in nurses.[2,13] Choosing the technologies to be used, providing the necessary environment for the application of

the selected technologies, and adapting the prospective users to the technology are important steps in managing the state of anxiety and fear. While some studies on the subject have found that nurses' artificial intelligence anxiety levels are low,[14] some studies have found them to be at a medium level.[15,16] Nurses who can control their anxiety levels will adapt more easily to participatory and supportive roles. With the increasing use of AI technologies in health services, nurses' ability to use this technology will require them to develop skills, redefine and create work and clinical processes. The adoption of AI and other technologies is essential for employee adaptation to new technologies and the development and transformation of professional practice. Revealing the anxiety levels of nurses, who have important roles in health services, due to the use of AI technologies in healthcare and determining the factors associated with this anxiety will be an important step for the determination of future initiatives and the adaptation of employees.

Research Questions

1- What are nurses' artificial intelligence anxiety levels?

2- What are the factors affecting nurses' anxiety about artificial intelligence?

MATERIAL VE METHOD

In this study a descriptive and cross-sectional design was used. The sample of the study consisted of 120 nurses. Participation in this study was voluntary. The total response rate of the participants was 80%.

Instruments

Nurse Information Form (NIF): This form, which was developed by researchers in line with the literature on the subject, is a questionnaire consisting of a total of 14 questions about nurses' age, gender, daily internet use, computer usage information, technological devices used, knowledge of AI technologies in health services, and opinions of whether AI technologies will have a positive effect on the nursing profession.

Artificial Intelligence Anxiety Scale (AIAS): AIAS was developed by Wang and Wang (2019) to measure the AI level of individuals.[17] The Turkish validity and reliability study of the scale was performed by Akkaya, Özkan and Özkan in 2021[5]. The scale consists of 4 sub-dimensions that are learning, sociotechnical blindness, job replacement, and AI configuration, and 16 items. The highest score that can be obtained from the scale is 80, and the lowest score is 16. High scores indicate a high level of AI anxiety. The total internal consistency coefficient used to determine the reliability of the scale was α=0.937, and the coefficient for the learning dimension was α=0.948, the job replacement dimension was α=0.895, the sociotechnical blindness dimension was α=0.875, and the AI configuration dimension was α=0.950, and the scale had internal consistency. In this study, the scale's Cronbach's alpha coefficient was 0.92.

Procedure and Ethical Consideration

AIAS is used to measure perceived fear and discomfort about AI technologies and products and to predict human behavior.[5] After obtaining approval from the ethics committee and the institution (Date: 01.07.2021, No: 2021-5), an online questionnaire was created using "Google Forms" due to the COVID-19 pandemic and sent to the nurses' WhatsApp groups via text message, and they were asked to fill in the questionnaire. The research data were collected between 10 July and 10 October 2021. The data collection form, which includes the informed consent form stating the purpose of the study and that participation is voluntary and personal data will be kept confidential on the entry page followed by the questionnaire, was viewed by the researchers. NIF and AIAS were viewed by the nurses who approved the informed consent form. No identifying personal information was added to ensure the confidentiality of the information of the nurses participating in the study. After completing the research questionnaire, the

data were downloaded from the Google form to the researcher's password-protected computer and saved.

Data Analysis

SPSS 25.00 program was used to analyze the research data. The reliability of the scale was measured with the Cronbach's Alpha coefficient. Demographic data of nurses were analyzed as numbers, percentages, and mean values. A Kolmogorov-Smirnov test was used to determine whether the data showed a normal distribution. Since the nurses' mean AIAS scores did not show a normal distribution (p>0.05), Mann- Whitney U and Kruskal-Wallis tests were used to determine the factors affecting the nurses' artificial intelligence anxiety scale scores. According to the post hoc test, the effect size was calculated as 0.5 the alpha value was calculated as 0.05, and the power of the study was found to be a minimum of 0.84.

RESULTS AND DISCUSSION

The mean age of the nurses was 31.05±7.40 years, 89.2% of them were female, and 52.5% were married. It was determined that 64.2% of the nurses had a bachelor's degree, 90% had a nuclear family structure, 42.5% had a work experience of 1 - 4 years, and 41.7% were non-pandemic ward nurses. In terms of technology use, it was determined that 53.3% of the nurses used computers, tablets, and smartphones, 46.7% used the internet between 3-5 hours a day, 56.7% considered their computer use level to be sufficient, 63.3% did not have knowledge about AI technologies in health services, and 71.7% thought that the use of AI technologies would have positive effects in patient care and treatment (Table 1).

Table 1. Nurses' Descriptive Information and Views on Artificial Intelligence Technologies

Characteristics	Min-Mak.	X±SD
	N (Number)	% (Percentage)
Age	22- 49	31.05 ± 7.40
Gender		
Female	107	89.2
Male	13	10.8
Martial status		
Married	63	52.5
Single	57	47.5
Educational status		
Vocational school	11	9.2
Two-year college degree	17	14.2
Bachelor degree	77	64.2
Postgraduate degree	15	12.4
Family structure		
Nuclear	108	90
Extended	12	10
Working experience		
Less than a year	6	5
1- 4 years	51	42.5
5- 9 years	17	14.2
9 +years	46	38.3
Department		
Non-pandemic service	50	41.6
Pandemic service	17	14.2
Pandemic intensive care units	11	9.2
Non-Pandemic intensive care units	23	19.2
Emergency	12	10
Healthcare service directorate, education nurse, etc.	7	5.8

Table 1. (Devamı)

Used technological device		
Computer	14	11.7
Smart Phone	42	35.0
Computer, tablet, smartphone	64	53.3
Daily internet usage		
Less than 3 hours	36	30.0
3- 5 hours	56	46.7
5- 9 hours	22	18.3
9 + hours	6	5.0
Computer usage knowledge		
Never Enough	4	3.3
Less is enough	44	36.7
Enough	68	56.7
Very Enough	4	3.3
Do you know about artificial intelligence and technologies in nursing and health services?		
Yes	44	36.7
No	76	63.3
Will the use of artificial intelligence technologies in patient care and treatment have a positive effect on patient care?		
Yes	86	71.7
No	34	28.3
How will artificial intelligence technologies affect the profession in nursing practices and health services?		
Positive	68	56.7
Negative	52	43.3

This study examined the artificial intelligence anxiety levels of nurses working in the hospital and the affecting factors. The vast majority of nurses (63.3%) included in the study stated that they did not have knowledge about artificial intelligence technologies in nursing practices and health services. In a study conducted on nurse students, clinical nurses, and faculty members in the faculty of nursing, more than 70% of the nurses included in the study stated that they had heard of AI technologies in health services and nursing.[18] Menekli and Şentürk (2022) stated in their study that 58.5% of nurses did not know artificial intelligence technologies.[16] The low level of knowledge of nurses about this technology may be related to the fact that AI technologies are not used in the hospitals and clinics where the research was conducted and that the education curriculum of the nurses does not cover these technologies. In the study, it was determined that the level of artificial intelligence anxiety of nurses with a two-year college degree was higher than that of nurses with bachelor's and graduate degrees. No research results have been found to support this study finding or to present different results. This result shows that nurses who are better educated and knowledgeable about artificial intelligence have lower AIAS levels. It also shows that integrating subjects such as informatics, AI, and technology into the nursing education curriculum will have positive effects on the technology anxiety of nurses.

The mean score of the nurses' AI anxiety scale was 43.36±11.13, the score of the learning sub-dimension was 11.75 ± 3.73, the job replacement sub-dimension was 10.55±3.56, the socio-technical blindness sub-dimension was 12.60±3.40, the AI configuration sub-dimension was 8.04 ± 3.00 (Table 2).

Table 2. The Mean AIAS Score of The Nurses (n=120)

	X±SD	Median	Min-Max	Cronbach's alpha value
AIAS	43.36±11.13	43.00	16-69	0.92
Learning	11.75±3.73	11.00	15-23	0.89
Job Replacement	10.55±3.56	11.00	4-20	0.82
Sociotechnical Blindness	12.60±3.40	12.00	4-20	0.85
AI Configuration	8.04±3.00	8.00	3-15	0.94

There was no significant difference between the nurses' mean AIAS scores by gender, work experience, daily internet usage time, and the effect of AI technologies on the nursing profession (p>0.05). However, AIAS scores differed significantly by the nurses' education level, knowledge about AI technologies in health services and nursing, and opinions on the effect of AI applications in patient care (p <0.05). In the post-hoc test, it was determined that the anxiety levels of nurses with a two-year college degree were higher than nurses with bachelor's and graduate degrees (Table 3).

Table 3. Comparison of AIAS Scores According to Some Characteristics of Nurses (n=120)

Characteristics	X±SD	Statistical Analysis	p
Gender			
Female	2.75±0.64	z=-1.128	0.259
Male	2.38±0.97		
Educational status			
Vocational school	2.84±0.84	KW=12.517	0.006*
Two - year college degree	3.20±0.64		
Bachelor degree	2.65±0.63		
Postgraduate degree	2.32±0.66		
Working experience			
Less than a year	3.25±0.77	KW=5.959	0.114
1 - 4 years	2.80±0.70		
5 - 9 years	2.61±0.67		
9 + years	2.56±0.65		
Daily internet usage			
Less than 3 hours	2.60±0.78	KW=3.518	0318
3 - 5 hours	2.68±0.69		
5 - 9 hours	2.90 ±0.51		
9 + hours	2.85±0.68		
Do you know about artificial intelligence and technologies in nursing and health services?		z=-3.392	0.001*
Yes	2.45±0.61		
No	2.85±0.69		
Will the use of artificial intelligence technologies in patient care and treatment have a positive effect on patient care?		z=-3.666	0.000*
Yes	2.56±0.66		
No	3.06±0.64		
How will artificial intelligence technologies affect the profession in nursing practices and health services?			
Positive	2.71±0.64	z=-0.087	0.930
Negative	2.69±0.73		

*Post-hoc tests for pairwise comparison with Tamhane adjustment.

It was determined that the AIAS scores of the nurses who did not have knowledge about AI technologies, and who thought that these technologies would not have a positive effect on patient care and treatment were higher. Some studies on the subject support the findings of the research.[15,16] This result can be associated with uncertainty about the future, not knowing how AI technologies will be used in clinical functioning and nursing practices, and uncertainty about how these technologies will affect the profession and

professional practices. In the future, when AI technologies will be used more widely in clinical settings, nurses working in all fields will need to consider the impact of these technologies on the patient-nurse relationship, in the broader sense, in the nursing profession,[18] and use this development in a positive way, together with nursing ethics and professional nursing values. It is seen that AI technologies to be used in the future will lead to reconceptualization and reorganization of nursing practices, resulting in new nurse roles, new virtual care models, and new workflow processes.[19-22] Ensuring the participation of nurses in all stages of AI technologies such as design, implementation, and evaluation will facilitate the use of these technologies. Nurses, who will be at the center of digital transformation in the health system in the next 20 years, will play an important role in increasing the interaction and efficiency between the health system, patients, and health professionals.[23] In ensuring this transformation, giving importance to the education of nurses and continuing education services, development of workplace/management support, and digital skills will reduce the anxieties and concerns that may arise regarding development and change.

One of the important findings of the study is that the majority of nurses reported that they did not have knowledge about artificial intelligence technologies in health services, but they thought that the use of these technologies would have positive effects (56.7%) on patient care and treatment and the nursing profession. There are a limited number of research results on the subject. This result shows us that the nurses included in the study are open to innovations and have positive views on the use of AI technologies. Indeed, the low AIAS scores of nurses (43.36±11.13) may be related to this positive opinion. In a similar study, 40% of the participants thought that AI technologies would have positive effects on patient care and treatment practices, and 70% of them thought that they would revolutionize the profession by creating an individualized care plan, speeding up administrative tasks, and automating routine work.[18] As an inevitable part of technological development and progress, the use of artificial intelligence applications in health services will definitely change health practices and functioning to a great extent, and nurses who take part in this change will have a great deal of work. It can be said that redefining the nature and knowledge of nursing based on the developing technology and planning the nursing education curriculum accordingly will have positive effects so that it can exist and strengthen as a profession and practice discipline in this process of change.

In the present study, the artificial intelligence anxiety levels of the nurses were 43.36±11.13, and the highest sub-dimension was sociotechnical blindness. It is seen that the nurses' AIAS score is not high. It is known that individuals with high artificial intelligence anxiety are likely to have higher motivated learning behaviors.[17] In the process of technological development and change, anxiety and skepticism are two of the biggest obstacles to progress.[23] Information and education on this subject are of great importance to ensure sustainable and effective technological progress, and to increase the quality of clinical practice and care. Those with sociotechnical blindness cannot accept that AI is a system and only works with people or social institutions. A study examining the effects of technophobia in healthcare professionals found that there is a significant and positive relationship between technology use and trust in technology, that is, when technology use increases, trust in technology also increases.[24] With the increase in health technologies such as AI, we think that the creation of an effective learning culture that enables the reframing of information will reduce the level of anxiety towards these technologies.

In this study, despite the nurses' low level of knowledge about AI technologies, the rate of nurses who think that AI will positively affect patient care and treatment was quite high. Artificial intelligence anxiety was higher in nurses who had a lower education

level, did not have knowledge about AI technologies, and thought that artificial intelligence technologies would not have a positive effect on patient care.

The limitation of the study is the online collection of research data from nurses working in a single center due to the COVID-19 pandemic. This study cannot be generalized to all nurses in Turkey and is limited to nurses working in the hospital where the study was conducted and who agreed to participate in the study.

CONCLUSION

As a result of this study, it is seen that the most significant factors affecting the level of AI anxiety in nurses are the lack of education and knowledge about AI technologies. It is important for the future of the nursing profession to reframe the nursing education that combines technology and AI in the curriculum and to investigate the effects of technology in the nursing profession and the ways of adopting technology in nursing practice. The importance of using artificial intelligence for nurse managers and clinical nurses is as follows;

Nurse managers

-Nursing managers have an important role in the artificial intelligence-supported reconceptualization of nursing care services.

-It is the responsibility of manager nurses to determine and control the areas where artificial intelligence will be used.

-Artificial intelligence also effectively helps manager nurses in providing manpower resources, which directly affects cost and quality.

Clinical Nursing

- Developments in artificial intelligence and technology will strengthen nursing practices.

-Robots equipped with artificial intelligence software will help reduce the physical workload of nurses.

-Artificial intelligence will allow the nurse-patient relationship to improve with instant patient notifications.

-Nurses will focus more on care with the use of artificial intelligence technologies.

Recommendations for future research are to collect data face-to-face and from different sample groups, and conduct qualitative studies to better determine the problems and relationships.

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