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The effect of artificial intelligence anxiety on job performance of surgical nurses

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Abstract

Background: Technology is changing very quickly. The study aim is to examine the effect of artificial intelligence anxiety of surgical nurses on their work performance.

Research design: Cross-sectional and descriptive.

Sample: 140 nurses who agreed to participate were included.

Three tools were employed for collection data; Tool (one): Personal Information Form: Surgical nurses' knowledge about socio demographic questionnaire.

Tool (two): Artificial Intelligence Anxiety Scale.

Tool (three): Job Performance Scale for Nurses.

Results: A significant difference was found between the mean of artificial intelligence anxiety of surgical nurses and socio-demographic and work variables ($p<0.05$). Surgical nurses' work performance decreased as artificial intelligence anxiety increased ($p<0.001$).

Conclusion: Surgical nurses exhibited a level of artificial intelligence anxiety that exceeded the moderate threshold. Artificial intelligence anxiety moderately affected nurses' work performance.

Recommendations: It is essential for surgical nurses to be supported in their integration of artificial intelligence into their professional practice.

Keywords: Surgical nursing, artificial intelligence, anxiety, job performance

Introduction

Considering the advances in artificial intelligence (AI), there is a rapid evolution and transformation in technology today. All organisations need to be prepared for and adapt to these changes in order to survive [1, 2]. In order for healthcare professionals who focus on human life to be competent, knowledgeable and better equipped, the education they receive will need to be restructured in accordance with the current conditions [3]. Considering the advances in the field of artificial intelligence, it is inevitable that healthcare professionals will encounter new technologies and applications in the clinical systems they use in the future. Therefore, health educators and managers should approach the issue of artificial intelligence meticulously. Many health sciences institutions abroad emphasize that artificial intelligence should be included in health education [4].

For nurses, research on artificial intelligence technologies and concern about artificial intelligence is a highly innovative topic. Increasing research in this field will make valuable contributions to the literature. Artificial intelligence is expected to transform all areas such as management, clinical service, education, policy and research in nursing [5]. It will be possible for nurses providing care to surgical patients to integrate artificial intelligence technology into their practices in the near future, depending on the economic situation of the countries. Artificial intelligence will function as an important tool to support the professional development of nurses and to achieve further goals such as improving population and global health [6]. However, the lack of cultural and ethical values in nursing services provided through robots integrated with artificial intelligence may negatively affect important outcomes such as quality of care and patient satisfaction. This situation may cause ethical and moral issues to be raised. For example, in addition to protecting the health status of patients, nurses' ethical difficulties in prioritising when intervening simultaneously with two patients in emergency situations may create an ethical paradox in terms of artificial intelligence [7]. Another ethical problem is who will be responsible for malpractice cases that may be caused by ethical and moral norms that are missing in the software or hardware of robots produced with artificial intelligence in the provision of nursing services. Uncertainty about how these ethical issues will be resolved constitutes an important problem. Since robot nurses are not yet sufficiently developed, the role of nurses in processes such as taking initiative and critical thinking will become even more critical [8]. In addition, with the start of the use of robot nurses called care robots, ethical problems regarding the protection of patient privacy may arise. Therefore, it will also be necessary to make legal regulations to ensure the confidentiality of patient information in the information

systems of all robots [9]. Access to the data owned by care robots by people who do not have access permission may violate the confidentiality of personal data [10]. It is very important for nurses to observe the patient frequently in order to predict the problems that may occur in the postoperative process and take precautions. When robots developed with artificial intelligence are given patient visit and observation tasks, the frequency of nurses visiting the patient may decrease, which may cause patients to feel lonely. Patients may think that what the machines say is more important than what they say. This situation may have negative psychological consequences for patients [10, 11]. Since the individual to whom the nurse provides care is a complex being, it may be difficult for these robots to comprehensively evaluate all these aspects with limited software programmes [12]. In order to address these concerns, research is ongoing to integrate human characteristics such as common sense and intuition into artificial intelligence. However, while some researchers think positively about this issue, others think that this will not be possible [13].

According to a study, healthcare professionals have moderate concerns about the use of artificial intelligence in the healthcare sector. This may be due to the fact that they do not have enough ideas about artificial intelligence and have not yet used any artificial intelligence applications. Although it is generally thought that artificial intelligence will be beneficial in the field of health, there is concern about the possible consequences of its widespread use in clinical practice. These concerns include privacy issues, the belief that it may be more dangerous than nuclear weapons, and fear of unemployment [14].

As a result, nurses will face ethical dilemmas and it is predicted that this situation will negatively affect their job performance. In the literature, it is seen that the number of studies on the concerns of surgical nurses about artificial intelligence is insufficient. The aim of this study is to examine the effect of artificial intelligence anxiety of surgical nurses on their job performance.

Materials and Methods

Research design

The study was cross-sectional and descriptive.

Subjects and Setting

In this study, 8 nurses in the ear, nose and throat service (24 beds), 34 nurses in the general surgery service (52 beds), 36 nurses in the operating theatre (number of tables 12), 12 nurses in the neurosurgery service (26 beds), heart surgery service (12 beds), cardiac surgery service (12 beds), cardiothoracic surgery service (12 beds), cardiothoracic surgery service (12 beds), and cardiac surgery service (12 beds) in Zonguldak Atatürk State Hospital, The study was planned to be conducted with a total of 146 nurses including 11 nurses in vascular and thoracic surgery service (24 beds), 12 nurses in orthopedics service (24 beds), 12 nurses in urology service (26 beds), 6 nurses in burn unit (10 beds), 15 nurses in angio unit (4 beds). However, 6 nurses refused to participate in the study. A total of 140 nurses were included in the study population.

Tools of Data collection

Tool (I): Personal Information Form

It is a 13-item form including the nurse's age, gender, marital and educational status, professional and operating theatre working experience, working style, average weekly working time, income status, status of using artificial intelligence applications, status of using artificial intelligence in the institution, status of receiving training on artificial intelligence, status of artificial intelligence applications that may cause ethical violations.

Tool (II): Artificial Intelligence Anxiety Scale (AIAS)

It is a 21-item scale created by Wang & Wang [15] and whose validity and reliability was confirmed by Terzi [16]

This scale includes questions to assess nurses' concerns about artificial intelligence. Each item is scored between 1 and 7 and is graded from "1=Never agree" to "7=Totally agree". The minimum score is 21 and the maximum score is 147. The scale has four different dimensions: learning, job change, sociotechnical blindness and artificial intelligence configuration [17].

Tool (III): Job Performance Scale for Nurses

It was created by Greenslade and Jimmieson [18] and adapted into Turkish by Harmancı Seren *et al.* It is a 31-item Likert-type scale. It is graded as "(1) Strongly disagree", "(2) Disagree", "(3) Neither agree nor disagree", "(4) Agree", "(5) Strongly agree". This scale was developed to evaluate the performance of nurses in daily working processes [18, 19].

Ethical Consideration

Before the research, ethics committee permission was obtained from Bartın University Social and Human Sciences Ethics Committee on 11/6/2024 with Protocol No. 2024-SBB- 0887. Zonguldak Provincial Health Directorate gave institutional approval (Issue No: E-30707382-799-260622954). After the necessary permissions were obtained, the purpose and scope of the study were explained to the nurses and they were invited to participate in the study and their written consent was obtained. The data of the study were collected and recorded by the researcher using the questionnaire technique.

Data statistical analysis

IBM SPSS Statistics version 25 (IBM Inc., Armonk, NY, USA) programme was used to analyse the findings. Confidence interval was 95% and significance level was accepted as $p<0.05$. Mean, standard deviation, minimum and maximum for quantitative findings and frequency and percentage calculation methods were used for categorical findings. The use of parametric tests was necessitated by the observation of a normal distribution in the data. The Student's t-test was used to compare quantitative data. In scenarios with more than two groups, one-way analysis of variance (ANOVA) was used. Pearson's correlation analysis was used to assess the relationship between surgical nurses' AI concerns and their job performance.

Results

The mean age of the surgical nurses participating in the study was 28.18±6.425 and the average working year in the surgical clinic was 5.504±3.049. The majority of nurses (n= 91) held a bachelor's degree (65%). A statistically significant difference was identified in the mean scores on the Artificial Intelligence Anxiety Scale of male and female nurses (p=0.038). The mean score on the Artificial Intelligence Anxiety Scale was higher for women than for men (43.24±5.42, 39.30±6.08; t=2.324, p=0.038). There was no statistical difference in the average scores on the artificial intelligence anxiety scale according to graduation levels (p=0.851) (Table 1).

Table 1: Differences in the mean scores of the nurses from the Artificial Intelligence Anxiety Scale according to their characteristics (n=140)

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Variable	Mean ±SD (Range)	Relevance	Statistical Test	p-value
Age	28.18±6.45 (18-53)	83.42±6.14		p = 0.012
- 18-29	24.25±7.87 (18-29)	73.62±6.02		
- 30-40	35.28±7.21 (30-40)	79.54±7.58	F = 3.125	p = 0.035
- 41-53	43.02±7.15 (41-53)	81.83±7.86		
Work Experience (Years)	12.65±2.121 (1-22)	75.73±5.06		p = 0.026
Clinic Experience (Years)	5.504±3.049 (1-14)	73.62±6.02		p = 0.025
Gender				
- Female	101 (72.1%)	43.24±5.42	t = 2.324	p = 0.038
- Male	39 (27.9%)	39.30±6.08		
Educational Status				
- Secondary Education/High School	41 (29.3%)	30.65±5.41	F = 0.065	p = 0.851
- Undergraduate	91 (65%)	22.12±5.41		
- Graduate	8 (5.7%)	28.77±6.85		

x̄: Mean, **SD:** Standard Deviation.

The study found that nurses working night shifts (79.77±5.35; t=0.214, p=0.024) reported the highest levels of artificial intelligence anxiety. A significant relationship was identified between the average weekly working hours of nurses and the average score on the artificial intelligence anxiety scale, with a positive correlation being found (83.42±6.14; r=0.52, p=0.012). In the present study, the proportion of participants who use artificial intelligence applications outside of the hospital was found to be 22.9%, while 8.6% use them in the clinic. Furthermore, 62.1% of participants expressed concerns that artificial intelligence applications may lead to ethical violations. It is also noteworthy that no participants had received training in artificial intelligence (Table 2).

Table 2: Differences in the mean scores of the nurses from the Artificial Intelligence Anxiety Scale according to their working characteristics (n=140)

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Variable	n	%	x̄± SD (Min-max)	Relevance
Your average weekly working time (hours)			52.17±8.58 (40-96)	r = 0.52, p = 0.012
Way of working				
Continuous Day Shift Procedure	32	22.9	54.87±6.59 (32-87)	75.46±7.55 (42-117), t = 0.214, p = 0.024
Continuous Night	19	13.5	79.77±5.35 (36-132)	
Income status				
Income Less Than Expenses	62	44.3	62.41±6.34 (32-96)	p = 0.132
Income Equals Expenditure	58	41.4	59.18±5.23 (24-87)	F = 1.124
Income More Than Expenditure	20	14.3	58.83±6.21 (27-93)	
Do you use artificial intelligence applications?				
Yes	32	22.9	38.16±4.25 (24-58)	t = 3.310, p = 0.036
No	108	77.1	89.24±6.51 (62-121)	
Do you use artificial intelligence in your organisation?				
Yes	12	8.6	41.57±4.08 (32-61)	t = 2.310, p = 0.021
No	128	91.4	92.08±6.97 (71-132)	
Have you received training on artificial intelligence?				
Yes	0	0	0	t = 2.667, p = 0.012
No	140	100	83.42±6.14	
Can artificial intelligence applications cause ethical violations?				
Yes	87	62.1	42.24±5.24 (32-56)	t = 2.415, p = 0.032
No	53	37.9	93.47±5.45 (68-105)	

x̄: Mean, SD: Standard Deviation

The mean total score of the "Artificial Intelligence Anxiety Scale" for the nurses was 83.42±6.14. The highest mean score was 35.28±5.07 for the "Learning" sub-dimension, and the lowest mean score was 17.08±4.89 for the "AI Configuration" sub-dimension. The mean total score of the "Job Performance Scale for Nurses" for the nurses was 73.11±5.62 (Table 3).

Table 3: Total score averages of the nurses "Artificial intelligence anxiety scale", and "Job performance scale for nurses" (n=140)

Scales	Items	x̄±SD	Min-Max
Artificial Intelligence Anxiety Scale Dimensions			
Learning (8 items)	1-8	83.42±6.14	24-147
Job Replacement (6 items)	9-14	35.28±5.07	8-56
Sociotechnical Blindness (4 items)	15-18	27.96±5.48	6-42
AI Configuration (3 items)	19-21	19.54±4.11	4-28
		17.08±4.89	3-21
Job Performance Scale for Nurses	1-31	73.11±5.62	5-155

x̄: Mean, SD: Standard Deviation.

There were significant negative correlations between nurses' Job Performance Scale for Nurses and the Artificial Intelligence Anxiety Scale sub-dimensions of learning (r=-0.768, $p<0.001$), job substitution (r=-0.483, $p<0.001$), socio-technical blindness (r=-0.680, $p<0.001$) and AI configuration (r=-0.850, $p<0.001$) (Table 4). This suggests that as surgical nurses' anxiety about artificial intelligence rises, their performance in the workplace declines.

Table 4: The relationship between nurses' scores on the "Artificial Intelligence Anxiety Scale", and "Job Performance Scale for Nurses" (n=140)

	Artificial Intelligence Anxiety Scale			
Job Performance Scale for Nurses	**Learning**	**Job Replacement**	**Sociotechnical Blindness**	**AI Configuration**
r	-0.768**	-0.483**	-0.680**	-0.850**
p	<0.001	<0.001	<0.001	<0.001

Discussion

In a study examining the anxiety levels of health professionals about artificial intelligence, it was concluded that the anxiety levels of health professionals were at a moderate level. In this study in which nurses, physicians and technicians/technicians participated, it was found that nurses' artificial intelligence anxiety was higher than physicians [20]. In the study of Maraş and colleagues, nurses and nurse candidates stated that they were neither very anxious nor fully prepared for the rise of artificial intelligence [21]. In our study, it was determined that nurses experienced more than moderate level of artificial intelligence anxiety. Although artificial intelligence has the potential to lead to radical changes in healthcare services, it also brings some risks and quality assurance problems. Despite this, it is emphasised that it should be seen as a tool that facilitates the work of employees and makes them more efficient [22].

In the study of Maraş *et al.* a statistically significant relationship was found between Artificial Intelligence Anxiety Scale scores and the age of nurses ($p<0.05$) [21]. In our study, a significant difference was found between age and Artificial Intelligence Anxiety Scale scores ($p<0.05$). However, the literature review revealed that healthcare professionals' perception of artificial intelligence is independent of demographic variables such as age, gender and working time [20, 23]. In addition, Filiz *et al.* concluded that artificial intelligence anxiety is not affected by situations such as whether the person is married or not, how long he/she has been working at work, or whether artificial intelligence is used at work.

In Filiz *et al.*'s study, a significant difference was found between educational level and artificial intelligence anxiety average ($p<0.05$), and it was determined that high school graduates had more artificial intelligence anxiety than postgraduate graduates. However, in our study, no significant difference was found between educational status and more artificial intelligence anxiety. It is seen that the participants gave the highest score (x̄=4.03) to the question "I am afraid that an artificial intelligence technique/product may be used for malicious purposes.". The second highest score was given to the question "I am afraid that the widespread use of humanoid robots will take away people's jobs." (x̄ =3.91), and the third highest score was given to the question "I am afraid that an artificial intelligence technique/product may make us lazier." (x̄ =3.82) [20]. However, the main purpose of artificial intelligence is to make people's lives easier by improving health services [24]. It is seen that the success of digital technologies in nursing depends on the characteristics and preferences of nurses, and factors such as gender, age, and willingness to use technology affect nurses' adoption of digital tools [25]. As a result of these, in our study, it is seen that as the artificial intelligence concerns of surgical nurses increase, their performance in their workplaces decreases. There is a high correlation between the Job Performance Scale for Nurses and 'AI Configuration', which is one of the sub-dimensions of the Artificial Intelligence Anxiety Scale. Technological changes can negatively affect job performance by causing anxiety and anxiety in employees. Even if employees accept the changes in business processes, they may continue to worry about the uncertainty created by technology in their lives [26].

Conclusion

It was found that the mean of artificial intelligence anxiety of surgical nurses was more than medium level, and the socio-demographic and work variables such as age, gender,

professional and working years in the institution, average weekly working hours, shift type and the use of artificial intelligence in the institution were effective, but the educational status did not affect artificial intelligence anxiety. As a result of these, it was observed that as artificial intelligence anxiety increased, nurses' work performance decreased, and artificial intelligence anxiety moderately affected nurses' work performance.

Recommendations

In light of the findings of this study, the following recommendations are proposed:

- The provision of psychological support to mitigate nurses' apprehensions regarding artificial intelligence.
- The augmentation of nurse training in the domain of artificial intelligence.
- The allocation of greater emphasis to nurses' concerns in studies examining the implications of artificial intelligence on the nursing profession.

Conflict of Interest

Not available

Financial Support

Not available

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