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Determination of Artificial Intelligence Anxiety Status of Nursing Students: Cross-Sectional-Descriptive Study

Hemşirelik Öğrencilerinin Yapay Zekâ Kaygı Durumlarının Belirlenmesi: Kesitsel-Tanımlayıcı Çalışma

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* The study was presented as an oral presentation at the 1st International 21st National Nursing Students Congress, 11 May 2023

ABSTRACT

Aim: *The study aimed to determine the anxiety of nursing students about the emergence and use of artificial intelligence products.*

Materials and Method: *The data of this descriptive and cross-sectional study were collected between 02.01.2023 and 15.04.2023. The sample of the research consisted of 243 students. The data collection tool included an introductory information form and the Artificial Intelligence Anxiety Scale. T-test, and one-way ANOVA test were used to analyze the data.*

Results: *64.6% of the students had heard of artificial intelligence-supported devices used in healthcare, 54.7% thought that artificial intelligence applications were useful in ensuring patient safety, and 54.7% thought that the system would reduce the risk of making medical errors. The mean total score of the scale was 46.25 ± 9.66. There was a statistically significant relationship between thinking that artificial intelligence should be a course in education and thinking that artificial intelligence would be indispensable in surgical applications and the artificial intelligence anxiety scale ($p<0.05$).*

Conclusion: *Students' anxiety about artificial intelligence is at a moderate level. It was found that most students thought they should have courses on artificial intelligence applications and that artificial intelligence was useful in ensuring patient safety.*

Keywords: *Artificial Intelligence, Anxiety, Nursing Student, Health Care*

ÖZET

Amaç: *Araştırmada hemşirelik öğrencilerinin yapay zekâ ürünlerinin ortaya çıkması ve kullanıma sunulması ile ilgili kaygı durumlarını belirlemek amaçlandı.*

Gereç ve Yöntem: *Bu tanımlayıcı ve kesitsel araştırmanın verileri 02.01.2023-15.04.2023 tarihleri arasında elde edildi. Araştırmanın örneklemini 243 öğrenci oluşturdu. Veri toplama araçları arasında tanıtıcı bilgi formu ve Yapay Zekâ Kaygı Ölçeği yer aldı. Verilerin analizinde sayı yüzde, t-testi, Tek yönlü (Oneway) Anova testi kullanıldı.*

Bulgular: *Öğrencilerin %64.6'sı sağlık alanında kullanılan yapay zeka destekli cihazları duymuş olup %54.7'si yapay zeka uygulamalarının hasta güvenliğini sağlamada yararlı olduğunu ve %54.7'si sistemin tıbbi hata yapma riskini azaltacağını düşünmektedir. Çalışmada Yapay Zekâ Kaygı ölçeğinin toplam puan ortalamasının 46.25 ± 9.66 olduğu bulundu. Eğitimde yapay zekanın ders olması gerektiğini düşünme ve yapay zekanın cerrahi uygulamalarda vazgeçilmez olacağını düşünme ile yapay zekâ kaygı ölçeği arasında istatistiksel olarak anlamlı ilişki saptandı ($p<0.05$).*

Sonuç: *Öğrencilerin yapay zekâ kaygıları orta seviyededir. Öğrencilerin çoğunluğunun, yapay zeka uygulamaları ile ilgili derslerin olması gerektiğini ve yapay zekanın hasta güvenliğini sağlamada yararlı olduğunu düşündüğü sonucu bulundu.*

Anahtar Kelimeler*: Yapay Zeka, Anksiyete, Hemşirelik öğrencileri, Sağlık Bakımı*

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INTRODUCTION

The world population is increasing day by day, and the elderly population is growing in parallel. Between 2015 and 2050, the proportion of the world population aged 60+ is projected to almost double, from 12% to 22% (WHO, 2022a). In rapidly aging societies, machines, artificial intelligence (AI), and robots are expected to make people's lives easier and ensure them maintain their health properly. AI technologies are making a difference in many areas of public health and older people, where they can help predict health risks and events, support personalization of care management, and much more (WHO, 2022a, 2022b). In its report, the World Health Organization draws attention to the importance of ethical AI use (WHO, 2021). Human-robot interaction is about people, and robotics in care aims to support and help the nursing staff, not replace them. When the studies are examined, nurses think that robots will not replace nurses, will reduce their workload, and that using robots will benefit them (Ergin, Karaarslan, Şahan, & Çınar Yücel, 2022; Ergin, Karaarslan, Şahan, & Bingöl, 2023; Ohneberg et al., 2023). The technological devices to be developed are planned to reduce nurses' workload and support the increasing labor demand.

Artificial intelligence technologies are being developed, tested, evaluated, and applied to health services in many countries with limited participation of nurses in environments and specialties worldwide (Ng, Ling, Chew, & Lau, 2022; O'Connor et al., 2023). In studies conducted in nursing, it is recommended that the nurses should take part in groups that provide technological developments. The systematic review conducted by O'Connor et al. (2022) stated that curricula should be developed to train students in AI to lead and participate in these developments in health services (O'Connor et al., 2023). Having AI-content courses in the education curriculum of nursing students will make it easier for them to adopt AI-supported technologies after graduation (Labrague, Aguilar-Rosales, Yboa, Sabio, & de los Santos, 2023). It is important for them to step into the profession by embracing these technologies so that they can lead and participate in these digital initiatives in healthcare (O'Connor et al., 2023).

Studies investigating the knowledge, opinions, and concerns of students who constitute the future of the nursing profession about AI remain limited (Labrague et al., 2023; Lukić et al., 2023). In a study conducted with students studying at the faculty of health sciences, students' views on the use of AI were examined, and it was found that they had concerns and lack of knowledge about the use of AI (Yılmaz, Uzelli Yılmaz, Yıldırım, Akın Korhan, & Özer Kaya, 2021). In a different study, 2167 healthcare students from 18 universities were included, and their perspectives on AI were evaluated. The study has found that nursing students were optimistic about AI (Teng et al., 2022). When the studies conducted with medical students are examined, some of them have knowledge deficiencies and concerns about AI (Abid et al., 2019), while others state that it will not replace humans and that they currently have information about its usage areas (Öcal et al., 2020; Pinto dos Santos et al., 2019). This study aimed to investigate the anxiety of nursing students, future healthcare professionals at the forefront of patient care, about the emergence and use of different AI products with rapidly developing and changing technology.

Research Questions

The research sought answers to the following questions:

1. What are the anxiety levels of nursing students about the emergence and use of artificial intelligence products?
2. What are nursing students' perceptions of artificial intelligence applications in ensuring patient safety and reducing the risk of medical errors?
3. How do demographic factors (age, gender, education level) affect nursing students' anxiety levels about artificial intelligence?

MATERIAL AND METHOD

Research Type

The study was planned as a descriptive and cross-sectional study.

Study Population and Sample

The study was conducted in the Faculty of Health Sciences of a University between 02.01.2023 and 15.04.2023. Using the non-probability sampling method, students who accepted to participate in the study and who were studying in the nursing department were included (n:243).

The study population consisted of all students in the Nursing Department of the Faculty of Health

Sciences of the University (N: 526). Power analysis was performed to determine the sample size of the study. While calculating the power analysis, a 90% power ratio, 95% confidence limit, and 0.2 effect size were used (Cohen, 1992). As a result of the calculation, the number of samples was found to be 216. Considering that the questionnaires could be filled out incompletely or incorrectly, 243 students were included in the sample.

The inclusion criteria of the students are as follows: Individuals who are 18 years of age and over, who volunteer to participate in the study, who do not have a diagnosis of psychiatric illness, and who are students of the Nursing Department of the Faculty of Health Sciences of a University will be included.

Data Collection Tools

Data Collection Form: The form developed by the researchers in line with the literature includes 14 questions (age, gender, marital status, grade, questions about AI) (Akkaya et al., 2021; Başer et al., 2021; Çoban et al., 2022; Ölçer & Yılmaz, 2021; Yılmaz et al., 2021).

Artificial Intelligence Anxiety Scale (AIAS): The scale was developed by Wang & Wang (2019) (Wang & Wang, 2022). The AIAS is an assessment tool that asks each participant to reflect on their current experience. It is a 5-point Likert-type scale ranging from "not at all" 1 point to "completely" 5 points. The scale has 16 questions and four sub-dimensions: learning, job change, socio-technical blindness, and AI configuration. The score range that can be obtained from the scale is 16-80. An increase in the score obtained from the scale indicates that anxiety increases. The Turkish validity and reliability of the scale were conducted by Akkaya (2021). Cronbach alpha score of the scale is 0.937.

The researchers collected the data by creating face-to-face and online forms. Written and verbal permission was obtained from the students to apply the data collection form face-to-face. The link address was shared with the students via message in the online form. The first page of the online data collection form included the explanations in the informed consent form. Those who wanted to participate in the study participated by clicking the continue button at the bottom of the form.

Ethical Consideration

Ethics committee permission (Date: 06.12.2022, and Approvel Number: 2022/111) was obtained from the non-interventional ethics committee of a university, and permission was obtained from the Dean's Office of the Faculty of Health Sciences to include nursing students in the study. For the scale used in the study, permission was obtained from the authors who performed the validity and reliability of the scale. The principles of the Declaration of Helsinki were used to conduct the research.

Data Analysis

The data obtained from the study were analyzed using the IBM SPSS Statistics 25 program (IBM SPSS- Statistical Package for the Social Sciences For Windows). The results were evaluated at a 95% confidence interval and significance level of $p<0.05$. Among the descriptive statistical analysis methods, number and percentage, t-test, and one-way ANOVA test were used to analyze the data.

RESULTS

In the study, the average age of the students was 20.35 ± 1.37 years. 76.1% of the students were female, 32.9% were in the 3rd grade, and 64.6% had heard of artificial intelligence-supported devices used in the health field. 79.4% of the students think that there should be a course on AI applications in education, 54.7% believe that AI applications are useful in ensuring patient safety, and 54.7% believe that the system will reduce the risk of making medical errors. It was also found that 43.2% of the students did not think the increased use of AI would harm the profession, and 61.7% thought using AI in surgical applications was indispensable (Table 1).

Table 2 shows the mean values of the analyzed scale. When the mean scores of the sub-dimension of the AIAS were examined, learning was 10.58 ± 3.38, job change was 12.85 ± 3.78, sociotechnical blindness was 14.10 ± 3.23, AI configuration was 8.71 ± 2.99, and the total mean score of the scale was 46.25 ± 9.66.

Table 1. Sociodemographic Characteristics of Students (n = 243)

Characteristics	Mean±SD	
Age	20.35 ± 1.37	
	n	**%**
Gender		
Female	185	76.1
Male	58	23.9
Grade		
1st grade	77	31.7
2nd grade	60	24.7
3rd grade	80	32.9
4th grade	26	10.7
Hearing about artificial intelligence-supported devices used in the field of health		
Yes	157	64.6
No	86	35.4
Thinking that there should be a course on artificial intelligence applications in education		
Yes	193	79.4
No	17	7.0
Undecided	33	13.6
Thinking that artificial intelligence applications are useful in ensuring patient safety		
Yes	133	54.7
No	14	5.8
Undecided	96	39.5
The state of mind of an AI system to reduce the risk of making medical errors.		
Yes	133	54.7
No	17	7.0
Undecided	93	38.3
Thinking that the increase in the use of artificial intelligence will give harm the profession		
Yes	62	25.5
No	105	43.2
Undecided	76	31.3
Thinking that the use of artificial intelligence in surgical interventions is indispensable		
Yes	150	61.7
No	30	12.3
Undecided	63	25.9

Abbreviations: SD= standard deviation

Table 2. Distribution of Total Score and Sub-Dimension Averages of the Artificial Intelligence Anxiety Scale

Artificial intelligence anxiety scale	Mean ± SD	Min–Max	Items	Skewness	Kurtosis
Learning	10.58 ± 3.38	5-23	1-5	0.651	1.267
Changing jobs	12.85 ± 3.78	4-20	6-9	-0.063	-0.342
Sociotechnical blindness	14.10 ± 3.23	5-20	10-13	-0.375	-0.063
Artificial intelligence configuration	8.71 ± 2.99	3-15	14-16	0.102	-0.490
Scale total score	46.25 ± 9.66	22-78	1-16	-0.060	0.191

Abbreviations: SD= standard deviation

As seen in Table 3, there is a comparison of the mean total and subscale dimension scores of the AIAS with the sociodemographic variables of the students. In the research group, female students had higher mean scores in all sub-dimensions of the AIAS compared to males, and a statistically significant difference was found with the AI configuration sub-dimension (p=0.019). In the study, the mean scores of the AI configuration sub-dimension of the third-grade students were significantly higher than the first-, second-, and fourth-grade students (p=0.046). The learning sub-dimension and scale total mean scores of the students who thought there should be a course on AI applications in education were significantly higher than the other students (p=0.000; p=0.024). The learning and AI configuration sub-dimension and scale total mean scores of the students who were undecided about the indispensability of using AI in surgical applications were significantly higher than the other students (p =0.004; p =0.019; p =0.028). The mean scores of the students who thought that the increased use of AI would harm the profession were significantly higher than the other students (p<0.05).

Table 3. Comparison of Students' Sociodemographic Characteristics and Anxiety Scale Total Score and Subscale Averages

Characteristics	Learning Mean ± SD	Changing jobs Mean ± SD	Sociotechnical blindness Mean ± SD	Artificial intelligence configuration Mean ± SD	Scale total score
Gender					
Female	10.59 ± 2.93	12.98 ± 3.71	14.15 ± 3.19	8.96 ± 2.84	46.70 ± 9.01
Male	10.53 ± 4.58	12.43 ± 3.99	13.93 ± 3.36	7.91 ± 3.32	44.81 ± 11.46
	t=0118	t = 0.981	t= 0.463	t = 2.363	t = 1.307
	p =.906	p = .328	p = .644	p = .019*	p = .193
Grade					
1st grade[a]	9.90 ± 3.27	12.79 ± 4.07	14.51 ± 3.28	8.38 ± 3.31	45.61 ± 10.43
2nd grade[b]	11.11 ± 3.13	12.31 ± 3.18	14.01 ± 2.65	8.83 ± 2.47	46.28 ± 7.92
3rd grade[c]	10.81 ± 3.61	13.28 ± 3.86	13.77 ± 3.53	9.31 ± 3.12	47.18 ± 10.38
4th grade[d]	10.61 ± 3.44	12.96 ± 3.92	14.07 ± 3.36	7.57 ± 2.23	45.25 ± 8.88
	F =1.647	F = 0.766	F = 0.713	F = 2.710	F = 0.457
	p= .179	p = .514	p = .545	p = .046* a,b,d<c	p = .713
Thinking that there should be a course on artificial intelligence applications in education					
Yes[a]	10.05 ± 3.16	12.65 ± 3.87	14.16 ± 3.15	8.52 ± 3.01	45.40 ± 9.55
No[b]	14.00 ± 4.22	14.35 ± 2.76	13.05 ± 3.39	8.94 ± 2.46	50.35 ± 10.23
Undecided[c]	11.87 ± 2.88	13.24 ± 3.55	14.27 ± 3.58	9.69 ± 2.96	49.09 ± 9.23
	F=14.918	F=1.782	F=0.969	F=2.224	F=3.771
	p =.000** a,c<b	p =.171	p =.381	p =.110	p =.024* a,c<b
Thinking that the use of artificial intelligence in surgical interventions is indispensable					
Yes[a]	10.01 ± 3.31	12.55 ± 4.03	14.06 ± 3.20	8.33 ± 2.99	44.96 ± 10.03
No[b]	11.30 ± 3.61	14.26 ± 3.12	13.40 ± 3.24	8.80 ± 2.60	47.76 ± 8.72
Undecided[c]	11.58 ± 3.20	12.90 ± 3.30	14.52 ± 3.28	9.58 ± 3.01	48.60 ± 8.72
	F=5.777	F=2.609	F=1.256	F=4.009	F=3.636
	p =.004* a,b<c	p =.076	p =.287	p =.019* a,b<c	p =.028* a,b<c
Thinking that the profession will be given harm with the increase in the use of artificial intelligence					
Yes[a]	11.30 ± 4.13	14.95 ± 3.26	14.77 ± 3.34	9.62 ± 3.14	50.66 ± 9.83
No[b]	9.50 ± 2.83	11.28 ± 3.91	13.49 ± 3.23	8.04 ± 3.02	42.33 ± 9.46
Undecided[c]	11.27 ± 3.03	13.31 ± 2.97	14.39 ± 3.02	8.89 ± 2.60	48.07 ± 7.59
	t=10.052	t=22.5627	t=3.577	t=5.872	t=18.864
	p =.000** b,c<a	p =.000** b,c<a	p =.029* b,c<a	p =.003* b,c<a	p =.000** b,c<a

Abbreviations: p=level of statistical significance., F= ANOVA, t = Student's t test, *p < .05., **p < .00

DISCUSSION

Technology, which has become an integral part of our daily lives, emerges as a dynamic element that can improve the quality of life of individuals in all areas. Rapidly developing technology also enables the advancement of robot and AI technologies in health (Jiang, Jiang, Zhi, Dong, Li, Ma, Wang, Dong, Shen, & Wang, 2017; O'Connor et al, 2023; Pepito & Locsin, 2019). This development affects nursing practices. AI is used in many areas to reduce the workload in the nursing profession (Özdemir & Bilgin, 2021; Pepito et al., 2019; Vasquez et al., 2023). In the field of nursing, AI and robotics are used in the areas of patient positioning, deep learning approach, patient fall risk monitoring, education, and health protection and maintenance (Hee Lee & Yoon, 2021; Helaly, Badawy, & Haikal, 2023; Loftus et al., 2020; Pepito & Locsin, 2019; Wagner et al., 2023). In order to participate and lead in the rapid change of technology, the subject of AI must be included in the education curriculum of students (Labrague et al., 2023; O'Connor et al., 2023). In this study, the anxiety and thoughts of nursing students, who are the nurses of the future, about AI were examined. It was found that the students' anxiety about AI was moderate, and they thought that using AI in health would positively affect patient safety.

Within digital technology, the use of AI-supported devices in health is prevalent (Pepito & Locsin, 2019; WHO, 2021). In a study conducted among health sciences faculty students, 34.8% stated that they know that AI-supported devices are used in health (Yılmaz et al., 2021). In a study conducted among medical school students, students were asked, "Do you have information about AI applications used in medicine?" and 40.8% answered yes (Öcal et al., 2020). Another study found that first-year nursing students were aware of the possible benefits of AI applications in health and nursing (Lukić et al., 2023). In this study, 64.6% of the students had heard of AI-supported devices used in healthcare. More than half of the students stated that using AI in surgical applications is indispensable and that there should be a course on AI applications in education. These data suggest that most students are excited about the development of AI in the health field and are aware of this development.

The most important factor in ensuring patient safety is to reduce human errors, and there are AI technologies developed to support this situation (Arda, Guirnaldo, Permites, & Salaan, 2021; Epstein, 2021; Lei, 2022; Peng, Ang, Zhou, & Nair, 2023; Sirihorachai, Saylor, & Manojlovich, 2022; Soumpasis, Nashef, Dunning, Moran, & Slack, 2023). In the guidelines published to increase patient safety in the operating room, it is recommended to utilize computer-aided software and technological devices, especially in the prevention of foreign object forgetting and wrong-side surgery (Cochran, 2022; Speth, 2023; Weprin et al., 2021). Nursing students in the study think that using AI technology in their professional practices will reduce the risk of making medical errors in hospitals and be useful in ensuring patient safety. Similarly, health sciences students stated that AI would effectively reduce medical errors (Yılmaz et al., 2021). According to the results found in the study, it can be said that students will be willing to use AI-supported technologies to ensure patient safety when they start their profession and will approach the change positively. In order to ensure the development of this situation, it may be recommended to support students with training and course content on improving patient care outcomes using AI.

In a study conducted by Abid et al. (2019) with medical faculty students, the majority of students have stated that AI would take over clinical control in the future (57.5%), while some have remained undecided (23.4%) (Abid et al., 2019). It was determined that 43.2% of the students participating in the study did not think their profession would be harmed by the increasing use of AI in the health field, and 31.3% were undecided. On the other hand, their concerns about AI were moderate. Based on this result, it was found that using AI in the health field caused professional anxiety in some students. Students' anxiety about artificial intelligence stems from the need to adapt to uncertainties and innovations regarding the increasing use of artificial intelligence-supported devices and applications in the healthcare sector.

Limitation

The limitation of the study is that the research was conducted in a single center and not all classes had similar sample numbers.

CONCLUSION

It is predicted that AI technology will significantly impact the field of health in the future. In the study, students' anxiety levels about AI were

found to be moderate. However, students believe that this subject should be included in the course curriculum and think that using AI in surgical applications is indispensable. The most important factor that will contribute to the development of the profession with the use of technologies and bring care to the best points is the thoughts and opinions of students who are the profession's future. Therefore, educators should evaluate students' potential and encourage them to contribute to implementing AI-oriented health studies. However, educators should also have the necessary knowledge, skills, and equipment to understand and use AI technologies. Therefore, educators must conduct studies to gain awareness of AI and health issues. In addition, it should be ensured that students graduate well-equipped by developing artificial intelligence-oriented course content for educators on these subjects. It is thought that organizing activities for students, such as training seminars on health, including AI and professional adaptation, would be useful to eliminate AI anxiety.

Ethics Committe Approval

Ethics committee approval was received for this study from the Balikesir University Health Sciences Non-İnterventional Research Ethics Committee (Date: 16.12.2022, and Aproval Number: 2022/111).

Author Contributions

Idea/Concept: P.O., B.G., İ.E.M., M.M.M.; Design: P.O., S.E.; Supervision/Consulting: P.O., B.G., İ.E.M., M.M.M., S.E.; Analysis and/or Interpretation: P.O., S.E.; Literature Search: P.O., B.G., İ.E.M., M.M.M., S.E.; Writing the Article: P.O., B.G., İ.E.M., M.M.M., S.E.; Critical Review: P.O., S. E.

Peer-review

Externally peer-reviewed

Conflict of Interest

The authors have no conflict of interest to declare.

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REFERENCES

Abid, A., Awan, B., Ismail, T., Sarwar, N., Sarwar, G., Tariq, M. (2019). Artificial Intelligence: Medical students attitude ın district peshawar Pakistan. *Pak J Public Health*, *9*(1), 19–21. doi: 10.1186/s41747-018-0061-6

Akkaya, B., Özkan, A., Ozkan, H. (2021). Yapay Zeka Kaygı (YZK) Ölçeği: Türkçeye Uyarlama, Geçerlik ve Güvenirlik Çalışması. *Alanya Akademik Bakış*, *5*(2), 1125-1146. doi:10.29023/alanyaakademik.833668

Arda, M. S., Guirnaldo, S. A., Permites, I. D., Salaan, C. J. O. (2021). Object detection as a technological adjunct to the manual counting protocol during surgery. *2021 IEEE 13th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment, and Management, HNICEM 2021*. doi: 10.1109/HNICEM54116.2021.9731895

Cochran, K. (2022). Guidelines in practice: prevention of unintentionally retained surgical ıtems. *AORN Journal*, *116*(5), 427–440. doi:10.1002/aorn.13804

Cohen, J. (1992). Statistical power analysis. *Current Directions in Psychological Science*, *1*(3), 98–101. doi: 10.1111/1467-8721.ep10768783

Epstein, N. (2021). A perspective on wrong level, wrong side, and wrong site spine surgery. *Surgical Neurology International*, *12*(286). doi: 10.25259/SNI_402_2021

Ergin, E., Karaarslan, D., Şahan, S., Bingöl, Ü. (2023). Can artificial intelligence and robotic nurses replace operating room nurses? The quasi-experimental research. In *Journal of Robotic Surgery*, *17*(4), 1847–1855. doi: 10.1007/s11701-023-01592-0

Ergin, E., Karaarslan, D., Şahan, S., Çınar Yücel, Ş. (2022). Artificial intelligence and robot nurses: From nurse managers' perspective: A descriptive cross-sectional study. *Journal of Nursing Management*, *30*(8), 3853–3862. doi: 10.1111/jonm.13646

Hee Lee, D., Yoon, S. N. (2021). Application of artificial intelligence-based technologies in the healthcare industry: Opportunities and challenges. *International Journal of Environmental Research and Public Health*, *18*(1), 1–18. doi: 10.3390/ijerph18010271

Helaly, H. A., Badawy, M., Haikal, A. Y. (2023). A review of deep learning approaches in clinical and healthcare systems based on medical image analysis. *Multimedia Tools and Applications*. doi: 10.1007/s11042-023-16605-1

Jiang, F., Jiang, Y., Zhi, H., Dong, Y., Li, H., Ma, S., …Wang, Y. (2017). Artificial intelligence in healthcare: Past, present and future. In *Stroke and Vascular Neurology*, *2*(4), 230–243. BMJ Publishing Group. doi:10.1136/svn-2017-000101

Labrague, L. J., Aguilar-Rosales, R., Yboa, B. C., Sabio, J. B., de los Santos, J. A. (2023). Student nurses' attitudes, perceived utilization, and intention to adopt artificial intelligence (AI) technology in nursing practice: A cross-sectional study. *Nurse Education in Practice*, *73*. doi:

10.1016/j.nepr.2023.103815

Lei, L. (2022). Observation on the effect of ıntelligent machine-assisted surgery and perioperative nursing. In *Journal of Healthcare Engineering*, *2022*. doi:10.1155/2022/6264441

Loftus, T. J., Tighe, P. J., Filiberto, A. C., Efron, P. A., Brakenridge, S. C., Mohr, A. M., ... Bihorac, A. (2020). Artificial ıntelligence and surgical decision-making. In *JAMA surgery*, *155*(2), 148–158. NLM (Medline). doi: 10.1001/jamasurg.2019.4917

Lukić, A., Kudelić, N., Antičević, V., Lazić-Mosler, E., Glunčić, V., Hren, D., Lukić, I. K. (2023). First-year nursing students' attitudes towards artificial intelligence: Cross-sectional multi-center study. *Nurse Education in Practice*, *71*. doi: 10.1016/j.nepr.2023.103735

Ng, Z. Q. P., Ling, L. Y. J., Chew, H. S. J., Lau, Y. (2022). The role of artificial intelligence in enhancing clinical nursing care: A scoping review. *Journal of Nursing Management*, *30*(8), 3654–3674. doi:10.1111/jonm.13425

O'Connor, S., Yan, Y., Thilo, F. J. S., Felzmann, H., Dowding, D., Lee, J. J. (2023). Artificial intelligence in nursing and midwifery: A systematic review. In *Journal of Clinical Nursing*, *32*(13–14), 2951–2968. doi: 10.1111/jocn.16478

Ohneberg, C., Stöbich, N., Warmbein, A., Rathgeber, I., Mehler-Klamt, A. C., Fischer, U., Eberl, I. (2023). Assistive robotic systems in nursing care: a scoping review. *BMC Nursing*, *22*(1). doi: 10.1186/s12912-023-01230-y

Öcal, E. E., Atay, E., Önsüz, M. F., Altın, F., Çokyiğit, F. K., Kılınç, S., ... Yiğit, F. N. (2020). Medical faculty students' thoughts on artificial ıntelligence in medicine. TÖAD, 2(1), 9-16.

Özdemir, L., Bilgin, A. (2021). The use of artificial ıntelligence in health and ethical problems. *Sağlık ve Hemşirelik Yönetimi Dergisi*, *8*(3), 439–445. doi:10.54304/shyd.2021.63325

Peng, J., Ang, S. Y., Zhou, H., Nair, A. (2023). The effectiveness of radiofrequency scanning technology in preventing retained surgical items: An integrative review. In *Journal of Clinical Nursing*, 32(13–14), 3315–3327. doi:10.1111/jocn.16447

Pepito, J. A., Locsin, R. (2019). Can nurses remain relevant in a technologically advanced future? In *International Journal of Nursing Sciences*, *6*(1), 106–110. Chinese Nursing Association. doi:10.1016/j.ijnss.2018.09.013

Pinto dos Santos, D., Giese, D., Brodehl, S., Chon, S. H., Staab, W., Kleinert, R., … Baeßler, B. (2019). Medical students' attitude towards artificial intelligence: a multicentre survey. *European Radiology*, *29*(4), 1640–1646. doi:10.1007/s00330-018-5601-1

Sirihorachai, R., Saylor, K. M., Manojlovich, M. (2022). Interventions for the Prevention of Retained Surgical Items: A Systematic Review. In *World Journal of Surgery*, 46(2), 370–381. doi:10.1007/s00268-021-06370-3

Soumpasis, I., Nashef, S., Dunning, J., Moran, P., Slack, M. (2023). Safe implementation of surgical innovation: a prospective registry of the Versius Robotic Surgical System. *BMJ Surgery, Interventions, and Health Technologies*, *5*(1). doi:10.1136/bmjsit-2022-000144

Speth, J. (2023). Guidelines in Practice: Minimally Invasive Surgery. *AORN Journal*, *118*(4), 250–257. doi:10.1002/aorn.14001

Teng, M., Singla, R., Yau, O., Lamoureux, D., Gupta, A., Hu, Z., Hu, R., …. Field, T. S. (2022). Health care students' perspectives on artificial ıntelligence: countrywide survey in Canada. *JMIR Medical Education*, *8*(1). doi: 10.2196/33390

Vasquez, B. A., Moreno-Lacalle, R., Soriano, G. P., Juntasoopeepun, P., Locsin, R. C., Evangelista, L. S. (2023). Technological machines and artificial intelligence in nursing practice. *Nursing and Health Sciences*, *25*(3), 474–481. doi: 10.1111/nhs.13029

Yılmaz, Y., Uzelli Yılmaz, D., Yıldırım, D., Akın Korhan, E., Özer Kaya, D. (2021). Artificial ıntelligence and the opinions of the faculty of health sciences students on the use of artificial ıntelligence in health. *SDÜ Health Sciences Journal*, 12(3), 297-308. doi:10.22312/sdusbed.950372

Wagner, L., Kolb, S., Leuchtenberger, P., Bernhard, L., Jell, A., Wilhelm, D. (2023). Deep learning assisted intraoperative instrument cleaning station for robotic scrub nurse systems. *At-Automatisierungstechnik*, *71*(7), 572–579. doi: 10.1515/auto-2023-0062

Weprin, S., Crocerossa, F., Meyer, D., Maddra, K., Valancy, D., Osardu, R., … Autorino, R. (2021). Risk factors and preventive strategies for unintentionally retained surgical sharps: a systematic review. *Patient Safety in Surgery*, *15*(1), 1–10. doi:10.1186/s13037-021-00297-3

WHO. (2021). Ethics and Governance of Artificial Intelligence for Health: WHO guidance. In *World Health Organization*. Retrieved 01.12.2023, from http://apps.who.int/bookorders.

WHO. (2022a). *Ageing and Health*. World Health Organization. Retrieved 01.12.2023, from https://www.who.int/news-room/fact-sheets/detail/ageing-and-health

WHO. (2022b). *Ensuring artificial intelligence (AI)*

technologies for health benefit older people. World Health Organization. Retrieved 01.12.2023, from https://www.who.int/news/item/09-02-2022-ensuring-artificial-intelligence-(ai)-technologies-for-health-benefit-older-people