



Artificial Intelligence in Nursing Practice: Challenges and Barriers

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Abstract:

Background: AI has become increasingly popular in the healthcare industry, particularly in nursing. AI helps healthcare professionals streamline their workflows, reduce errors and provide better care to patients. **Aim:** To assess challenges and barriers of using artificial intelligence as perceived by nursing personnel. **Design:** A descriptive research design was utilized. **Setting:** At EL Fayoum University hospitals. **Subjects:** All nursing personnel (250) were included in the study. **Tools:** Two tools were used for collecting data: Nursing Personnel's Knowledge about Artificial Intelligence Questionnaire and Nursing Personnel's Perception about Challenges and Barriers of Using Artificial Intelligence in Nursing Practice. **Results:** (58%) of the studied nursing personnel had unsatisfactory level of knowledge about AI. While, (64.8%) of the studied nursing personnel had a positive perception about challenges and barriers of using AI in nursing practice. **Conclusion:** There was a highly significant positive correlation between total knowledge score and total perception score about challenges and barriers of using AI in nursing practice. **Recommendations:** Encourage nurses to increase their knowledge and perception toward AI through training programs and providing further education to enable them integrate AI into nursing practices. Introduce fundamentals of AI into nursing curricula. Further research should be carried out to assess the AI impact on the patient-nurse relationship.

Keywords: Artificial intelligence, Barriers, Challenges, Nursing practice

Introduction

Artificial intelligence is a fast-developing field of technical advancement that is attracting the interest of worldwide competitors, business executives, defense experts, and legislators alike. AI technologies are increasingly prevalent in different organizations and society sectors, one of these sectors is healthcare. Where, these technologies have the ability to make transformation on many aspects of patient care, in addition to administrative processes within provider, payer and pharmaceutical organizations. The complexity and rise of data in healthcare operations means that AI will increasingly be applied within this field. The main categories of applications include diagnosis and treatment (Khalaf et al., 2022; Hussein et al., 2023 & Romero et al., 2024).

Artificial intelligence refers to the simulation of human intelligence in machines like computers or robots that are programmed to mimic cognitive functions that humans associate with other human minds, such as learning, decision making, problem solving, reasoning and communicating and has three main types in healthcare: machine learning, deep learning, and natural language processing (Zheng, et al., 2022; Al-Sabawy, 2023).

Artificial intelligence-based technologies have the potential to transform healthcare by deriving new and important insights from the vast amount of data generated during the delivery of healthcare every day. High value applications include earlier disease detection, more accurate diagnosis, identification of new observations or patterns on human physiology, and development of personalized diagnostics and therapeutics (Gupta et al., 2023; Mahdi et al., 2023).

Artificial intelligence technologies have been used in nursing profession for long years, but not recognized as AI. AI is implemented in nursing, such as scientific decision support, mobile health, sensor-based technologies, voice helpers and robotics. However, the rising interest in AI in healthcare setting is associated with new discussions on the relationship between AI and nursing. Nurses must be involved in directing the growth and use of AI technologies in the healthcare settings. So, there is a necessity for the nursing profession to participate and well understand of AI (Sabra et al., 2023).



The results of increasing application of AI in nursing both positive and negative. AI can cause damage to patients, nurses, and the career overall. Also, there are great possible benefits for AI to the profession, serve as influential tool for nurses, advance quality of care, improve patient outcomes, increase efficiency, and reduce healthcare costs. AI can also help nurses make informed decisions by analyzing vast amounts of data and providing personalized care plans for patients. One of the primary benefits of AI in nursing is its ability to analyze patient data, identify potential health risks, alert nurses to potential problems before they become severe, reduce the potential for medical errors and malpractice (Ergin et al., 2023; Sabra et al., 2023 & Wilson et al., 2023).

Furthermore, AI has tremendous capabilities in assisting and amplifying nurses' tasks, nurses have emotional and interpersonal skills that are critical in providing good, holistic healthcare. The nurse is responsible for evaluating the patient's overall condition, determining appropriate courses of action, and assisting patients and their families in coping with health and emotional problems. In other words, AI can help nurses perform their tasks more efficiently and accurately. At the same time the role of nurses to provide excellent and humane healthcare services will be maintained vital (Adi et al., 2023; Romero et al., 2024).

The uses of AI-based technologies in nursing practice have elevated fears and public debate, with many fearing that this technology can substitute nurses. While, other major worries focused around the ethical use of these technologies, such as management data bias and the necessity to grow new perspectives on technology implementation and identifying barriers in technology approval between nurses is equally as important today. Some of these fears could be relieved by offering sufficient information about AI for users, comprehending the existing research on these technologies, and through providing information regarding the ethics of AI in nursing (Kanekar, 2023).

Nurses primarily agree that AI could support the health and well-being of their patients, but there are many issues resulted from the use of AI in healthcare settings, such as; problems with the use of health data, concerns about cyber security, the problem of responsibility, and the combination of AI tools into current practice, ethical considerations and the limited ability of nurses to fully comprehend how decisions made by AI systems are attained. However, the main challenges to overcome are privacy and data protection, as well as ensuring that AI is implemented in an ethical and non-discriminatory manner (Albert, 2022; Bavli et al., 2024 & Samad et al., 2024).

Significance of the study:

Egypt had become a safer place to live and do business and to achieve Egypt's Vision 2030, the country has begun to adopt AI and technology in various sectors. The government is becoming more intrusive in sparking the growth of AI through initiatives aimed at boost research and development within its borders. Regarding an Egyptian society powered by AI and robotics, the government has set a general target of 7.7% of Egypt's Gross Domestic Product to be derived from AI and robotics by 2030 (Egypt's Artificial Intelligence Future, 2020).

Artificial intelligence has the potential to revolutionize the nursing industry and have a significant impact on healthcare delivery. By leveraging AI technology, nursing professionals can improve patient care, optimize workflows, improve decision making, and transform the way healthcare is delivered (Gouripur, 2024). AI is expected to help provide proactive patient care and reduce future risks for patients, nurses and the entire profession. As a result, research into the use of AI technology in healthcare settings is increasing. Nurses have varying attitudes and feelings about adopting AI technology (Tursunbayeva & Renkema, 2023).

Aim of the study:

The aim of this study is to assess challenges and barriers of using artificial intelligence as perceived by nursing personnel through:

1. Assess level of knowledge of nursing personnel about artificial intelligence in selected hospitals.
2. Identify challenges and barriers of using artificial intelligence as perceived by nursing personnel.

Research questions

1. What is level of nursing personnel's knowledge about artificial intelligence?
2. What are challenges and barriers of using artificial intelligence as perceived by nursing personnel?

Subjects and Methods

Research design:

A descriptive research design was used in this study.

Setting:

The study was conducted at EL Fayoum university hospitals.

Subjects:

The study subjects included all nursing personnel at selected settings. Both genders were included with at least six months of experience at the current critical care area. The researcher excluded those who attended previous training about artificial intelligence and who had not basic computer skills. The total number of nursing personnel who met inclusion criteria and accepted to participate in this study was (N=250).

Tools for data collection:

Two tools were used for data collection.

First tool: Nursing Personnel's Knowledge about Artificial Intelligence Questionnaire: This tool was developed by the researcher after reviewing of relevant literature (Boillate et al., 2022; Morii et al., 2022).

It consisted of two parts:

Part I: Personal data of nursing personnel: It included age, gender, educational level in nursing, current job, experience in current critical care unit, ...etc.

Part II: Nursing Personnel's Knowledge about Artificial Intelligence Questionnaire: It was utilized to assess nursing personnel knowledge about artificial intelligence. It included (19) MCQs questions about AI in nursing practice as definition, benefits, uses, importance, advantages and disadvantages, ethical considerations, etc.

Scoring system:

The total score was (19 points). Nursing personnel's responses were measured on two points, correct= 1 and incorrect = 0. Nursing personnel's knowledge was considered satisfactory if the percent score was 65% or above and unsatisfactory if less than 65%.

- Satisfactory $\geq 65\%$ (≥ 12 points)
- Unsatisfactory $< 65\%$ (< 12 points)

Second tool: Nursing Personnel's Perception about Challenges and Barriers of Using Artificial Intelligence in Nursing Practice. It was developed by the researcher after reviewing of relevant literature (Taylor, 2021; Aggar et al., 2022 & Çınar Yücel et al., 2022).

It consisted of two parts:

Part I: Challenges of AI in Nursing Practice and included (25 items)

Part II: Barriers of AI in Nursing Practice and included (21 items)

Scoring system:

Nursing personnel's responses were measured on a 3-points Likert scale ranging from 0=disagree, 1= neutral, 2=agree, the total score was (92 points).

The score was perceived as:

- Positive $\geq 65\%$ (≥ 60 points)
- Negative $< 65\%$ (< 60 points)

Validity:

Face and content validity for the study tools were done. Tools were translated into Arabic and were tested by a jury group of three experts specialized in nursing administration through an opinionnaire sheet.

Reliability:

Tools were tested by Cronbach's alpha:

- **First tool:** Nursing personnel's knowledge questionnaire yield Cronbach's alpha showed (0.78) which indicated an acceptable reliability.



- **Second tool:** Nursing personnel's perception yield Cronbach's alpha showed (0.84) which indicated excellent internal consistency.

Ethical considerations :

Prior study conduction, the research approval was obtained from the Scientific Research Ethics Committee at the faculty of nursing Helwan University. In addition, an approval was obtained from the director of EL Fayoum university hospitals either medical or nursing before starting the study. The researcher was assured anonymity and confidentiality of nursing personnel's data and informed them about research purposes. Nursing personnel were informed about the study aim, process and they allowed to choose to Participate or not in the study and they have the right to withdraw from the study at any time. Ethics, values, culture and beliefs were respected.

Pilot study:

A pilot study was carried out after translation of the tools and before starting the actual data collection. The aim of the pilot study was to confirm clarity, applicability of the tools and to estimate the time required for fulfilling the questionnaires sheet. A pilot study was conducted on (10) % of the study subjects (25 nurses) from 10th of February 2023 to 15th of March 2023. Based on the pilot study, no modifications were done and the final version was prepared to be distributed to nursing personnel. So, the pilot study participants were included in the study sample.

Fieldwork:

The actual field work started at the beginning of April 2023 to the end of June 2023. The researcher met the managers of EL Fayoum university hospitals to explain the aim of the study to gain their approval and support for data collection in their facility. The researcher went to the selected hospitals (3 days / week) in both shifts (day and night shifts). The researcher met nursing personnel individually, and explained the aim of the study, and methods of data collection. The researcher was present all the time during fulfilling the study tools to answer any questions. The time needed to complete the both tools ranged between (15-25) minutes. The researcher checked the completeness of each filled sheet to ensure that no missed data.

III- Administrative Item

To carry out the study, an official letter was issued from Faculty of nursing, Helwan University explains the aim of the study for the director of EL Fayoum university hospitals either medical or nursing for obtaining the permission for data collection.

IV-Statistical Item

Upon completion of data collection, data was computed and analyzed using the Statistical Package of Social Science (SPSS) software version 22 in windows 7 (SPSS Inc., Chicago, IL, USA). Simple descriptive analysis in the form of numbers and percentages of qualitative data, and arithmetic means as central tendency measurement, standard deviations as a measure of dispersion of quantitative parametric data. For quantitative data, independent samples t test was used. For qualitative data, Chi square test was used, Bivariate Pearson correlation test to test the association between variables, Reliability test for questions included in questionnaire tested by Cronbach's alpha test of reliability. The P-value < 0.05 was considered statistically significant.

Results:

Table (1) illustrates that (50%) of the studied nursing personnel aged from 20 to less than 25 years old but only (2%) were older than or equal to 30 years old with the mean \pm SD (24.7 \pm 2.1). Regarding their gender (53.2%) of them were females and (46.8%) were males. (74%) of them were graduated from technical nursing institute; while only (0.8%) of them graduated from nursing technical secondary schools and had master degree. According to their current job, it was found that (92.4%) of the study subjects were staff nurses; while only (1.6 %) of them were nurse supervisor.

As regards their years of experience it was found that (43.2%) had from "1" to less "3" years of experience and (27.6%) had from "3" to less "5" years of experience with the mean \pm SD was (3.4 \pm 2.1) years. According to their computer skills, it was found that all of them had computer skills but none of them received training about artificial intelligence. While, (44.8%) of them used from two to four AI applications. Additionally, (17.2%) of them used one AI application. Finally, (59.2%) of them worked at ICU, while only (6.4%) worked at CCU and only (6%) of them worked in the dialysis unit.

Table (2) and figure (1) reveal that (42%) of the study subjects had satisfactory level of total knowledge about AI and (58%) had unsatisfactory level.

Table (3) shows that (37%) of the total knowledge items about AI was correct, while (63%) was incorrect with total mean \pm SD (0.38 \pm 0.46). Additionally, (50.4%) of the studied nursing personnel answered correctly about item (No.1) in the advantages of AI “Advantage of using AI in nursing practice”. While, (83.2%) answered incorrectly about item (No.1) in the importance of AI “AI plays important role in nursing practice”.

As regards to mean percentage, the highest was for section “Definitions of AI” (48), while the least was for section “Goal of AI” (21.5).

Table (4) and figure (2) illustrate that (64.8%) of the studied nursing personnel had a positive perception about total challenges and barriers of using AI in nursing practice and only (35.2%) perceived them negatively.

Table (5) and figure (3) reveal that there was a highly statistically significant association between nursing personnel’s knowledge level and their perception about challenges and barriers of using AI in nursing practice with p-value <0.001.

Table (6) and figure (4) indicate that there was a statistically significant positive correlation between knowledge and perception about challenges and barriers of AI with (P 0.01*and 0.02*), (R 0.153 and 0.151) respectively. Additionally, there was a highly significant positive correlation between total knowledge score and total perception score about AI with (p 0.009*) and (R 0.164).

Table (1): Personal data of studied nursing personnel (N=250)

Variables	Number (N=250)	
	No.	%
Age (years)		
20 <25 years	125	50%
25 <30 years	120	48%
\geq 30 years	5	2%
Mean \pm SD	24.7 \pm 2.1	
Gender	No.	%
Male	117	46.8
Female	133	53.2
Educational level in nursing	No.	%
Nursing technical secondary school	2	0.8
Technical nursing institute	182	74
Bachelor degree	53	21.2
Post graduate diploma degree	8	3.2
Master degree	2	0.8
Current job	No.	%
Staff nurse	231	92.4
Head nurse	15	6
Nurse Supervisor	4	1.6
Years of experience	No.	%
1<3 years	108	43.2%
3 <5 years	69	27.6%
\geq 5 years	73	29.2%
Mean \pm SD	3.4 \pm 2.1	
Have basic computer skills	No.	%
Yes	250	100
No	0	0
Number of AI applications used in work	No.	%
One app	43	17.2

2-4 apps	112	44.8
>4 apps	95	38
Working unit	No.	%
ICU	148	59.2
OR	35	14
Dialysis	15	6
ER	36	14.4
CCU	16	6.4

Table (2): Percentage distribution of nursing personnel’s total level of knowledge about AI in nursing practice (N=250)

Knowledge level (n=250)	Frequency	
	No.	%
Satisfactory	105	42
Unsatisfactory	145	58

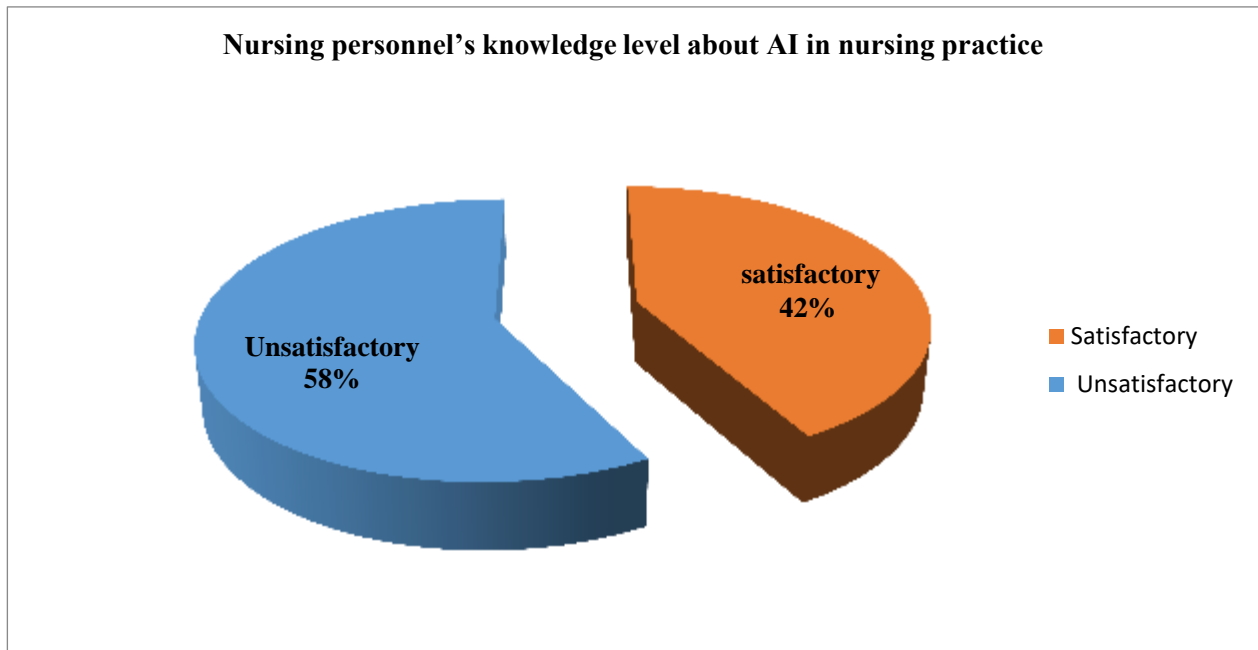


Figure (1): Distribution of the studied nursing personnel according to the percent score of knowledge level (N=250)

Table (3): The frequency distribution and percentage responses to items of knowledge assessment about artificial intelligence (N=250)

Knowledge items	Knowledge						
	Correct		Incorrect		Mean	SD	Mean %
	No.	%	No.	%			
Definitions of AI							
1. Definition of AI	119	47.6	131	52.4	0.48	0.50	48
2. Definition of AI in nursing practice	121	48.4	129	51.6	0.48	0.50	
Goal of AI							
1. The main goal of AI	47	18.8	203	81.2	0.18	0.38	21.5
2. Purpose of using AI in health care	64	25.6	186	74.4	0.25	0.43	
Benefits of AI							
1. AI can help nurses in work	124	49.6	126	50.4	0.50	0.50	45.3
2. Benefit of using AI in nursing	97	38.8	153	61.2	0.39	0.48	
3. AI is partnering with nurses to provide care	117	46.8	133	53.2	0.47	0.50	
Importance of AI							
1. AI plays important role in nursing practice	42	16.8	208	83.2	0.17	0.37	37
2. Nurses need AI in nursing practice	100	40	150	60	0.40	0.49	
Advantages of AI							
1. Advantage of using AI in nursing practice	126	50.4	124	49.6	0.50	0.50	44
2. AI imply an advantage in nursing practice	94	37.6	156	62.4	0.38	0.48	
Disadvantages of AI							
1. Disadvantage of using AI in nursing practice	107	42.8	143	57.2	0.43	0.49	33
2. AI can cause problems in nursing practice	59	23.6	191	76.4	0.23	0.42	

Table (3): The frequency distribution and percentage responses to items of knowledge assessment about artificial intelligence (N=250), cont

Knowledge items	Knowledge						
	Correct		Incorrect		Mean	SD	Mean %
	No.	%	No.	%			
Ethical and legal issues of AI							
1. Ethical issue of AI in nursing	122	48.8	128	51.2	0.49	0.50	43
2. Ethical issue involved in using AI in nursing practice	89	35.6	161	64.4	0.36	0.48	
3. Ethical consideration should follow when using AI	107	42.8	143	57.2	0.43	0.49	
4. legal issue for using AI in nursing	109	43.2	141	56.4	0.44	0.49	
Risks of AI							
1. The risk of using AI in nursing	89	35.6	161	64.4	0.36	0.48	28
2. Risk of using AI in nursing practice	50	20	200	80	0.20	0.40	
Total	99	37	151	63	0.38	0.46	38

Table (4): Frequency distribution of total nursing personnel' perception about challenges and barriers of using AI in nursing practice (N=250)

Perception level (n=250)	Perception level			
	Positive		Negative	
	No.	%	No.	%
Perception about challenges	147	58.8	103	41.2
Perception about barriers	170	68	80	32
Total perception level	162	64.8	88	35.2

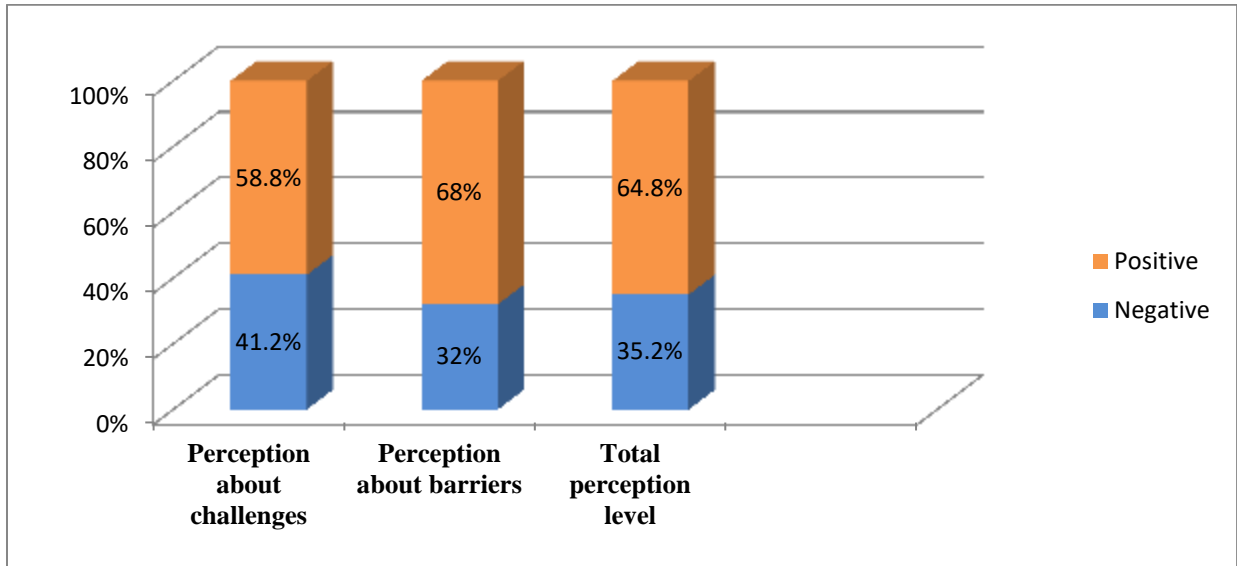


Figure (2): Frequency distribution of the studied nursing personnel according to their total perception about challenges and barriers of using AI in nursing practice (N=250)

Table (5): Correlation between nursing personnel’s knowledge level and their perception about challenges and barriers of using AI in nursing practice (N=250)

Perception levels	Knowledge level				X ²	P- value
	Satisfactory		Unsatisfactory			
	No	%	No	%		
Positive	79	48.8	26	29.5	8.6	<0.001*
Negative	83	51.2	62	70.5		

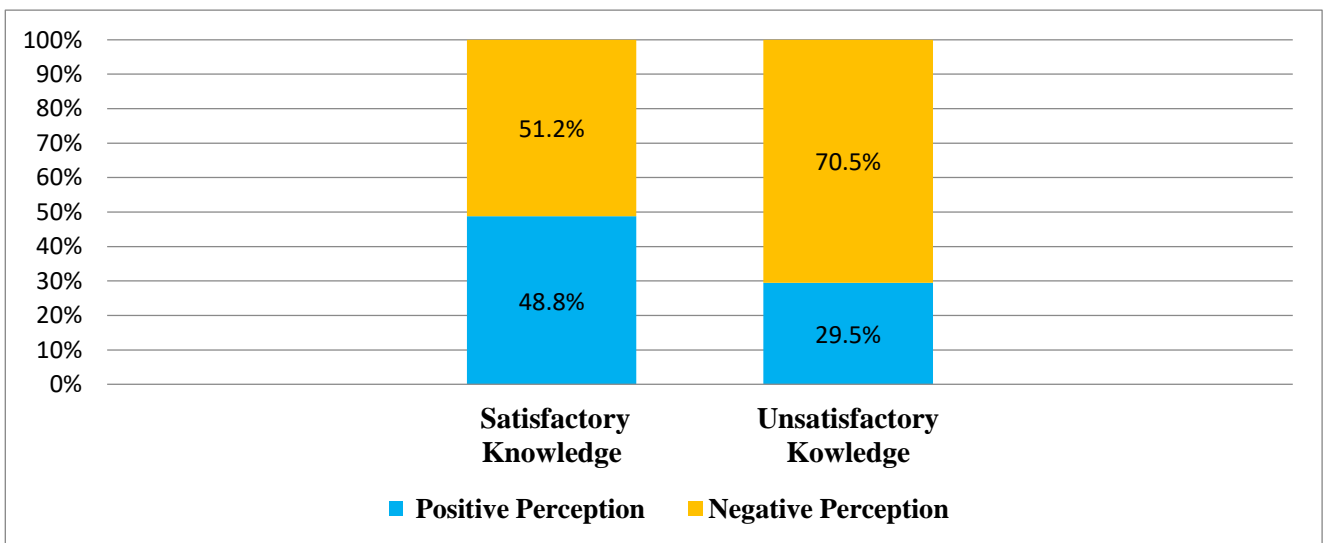


Figure (3): Percentage distribution of the studied nursing personnel’s knowledge level and their perception about challenges and barriers of using AI in nursing practice (N=250)

Table (6): Correlation coefficient between nursing personnel’s knowledge score and perception score about challenges and barriers of using AI in nursing practice (N=250)

Perception scores	Knowledge score		
	R	p-value	Sig.
Perception about challenges	0.153	0.01*	S
Perception about barriers	0.151	0.02*	S
Total perception level	0.164	0.009*	HS

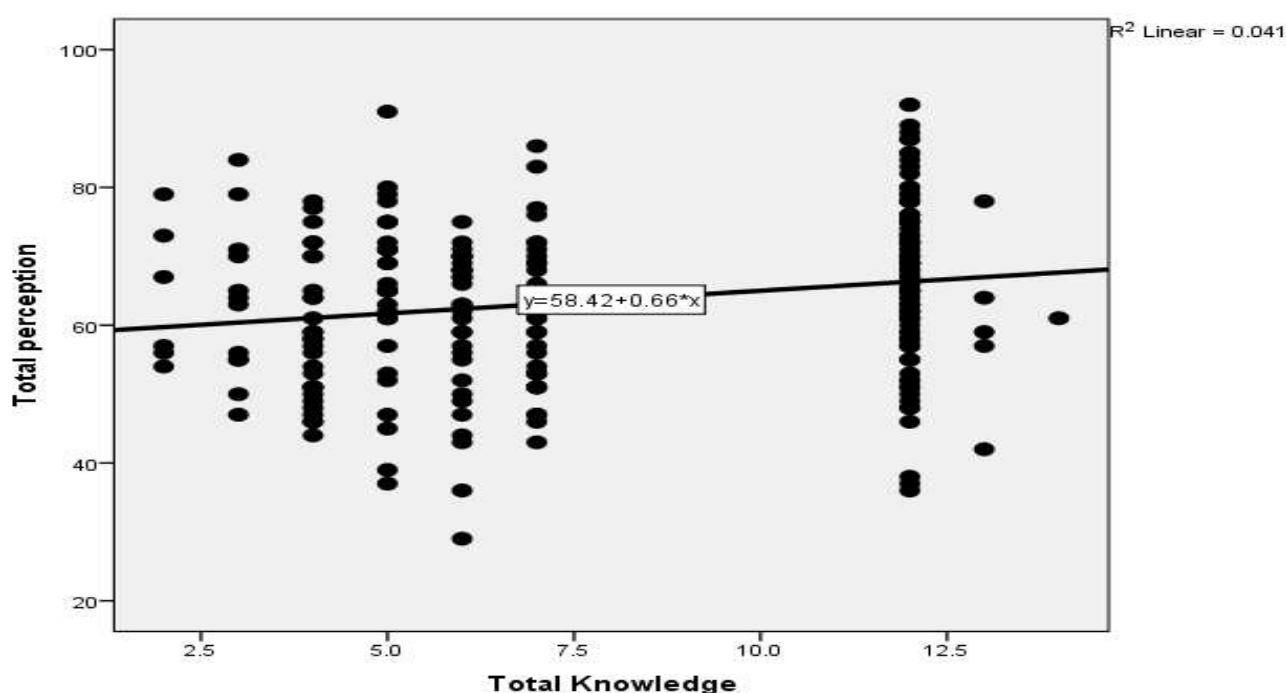


Figure (4): Correlation between nursing personnel’s knowledge score and perception score about challenges and barriers of using AI in nursing practice (N=250)

Discussion

The aim of the present study was to assess challenges and barriers of using artificial intelligence as perceived by nursing personnel through assess level of knowledge of nursing personnel about artificial intelligence in selected hospitals and identify challenges and barriers of using artificial intelligence as perceived by nursing personnel.

Knowledge assessment is an inseparable part of the integration of AI in nursing practice. So, they must be aware and knowledgeable about AI to enable a seamless and safe integration of AI into nursing practice (*Taryudi et al., 2022; Hussein et al., 2023*). As regards nursing personnel’s total level of knowledge about artificial intelligence, the present study revealed that more than half of the studied nursing personnel had unsatisfactory level of knowledge about AI. While more than two fifths of them had satisfactory level of knowledge about AI.

This result supported by **Mohamed et al., (2023)** who reported that only a tiny percentage of head nurses had adequate knowledge of artificial intelligence prior to program implementation. Also, **Taie, (2020)** who stated that all of the nurse managers had a lack of knowledge about AI. Additionally, **Mohamed et al., (2023)** who found that in the pre intervention



period the total level of knowledge about AI was satisfactory among less than one fifth of studied nurses but was unsatisfactory among the majority of them.

On the same line, these results were consistent with **Ahmed et al., (2022)** who reported that the majority of the study subjects had lack of detailed knowledge about AI and its applications in healthcare.

On the contrary, the results of this study were inconsistent with **Al-Sabawy, (2023)** who reported that nearly a quarter of the studied nurses reported having no knowledge about AI and the majority of them had adequate knowledge of AI. From the researcher's point of view, these results could be explained by that all nursing personnel who were included in this study did not attend any previous training about AI and most of them stated that nursing curricula did not include the fundamentals of AI.

AI has many applications in healthcare and nursing, including assisting in disease assessment, diagnosis, solving various clinical problems, reducing lost data, enhancing good nursing communication skills, improving inpatient care management, diminish nurse workload, and improving patient safety (**Zhou et al.,2022; Hussein et al., 2023**). So, the results of this study revealed that more than half of the study subjects answered correctly about item "Advantages of using AI in nursing practice".

These findings were supported by **Swan, (2021)** who reported that near to two thirds of the studied nurses reported agreement with AI advantages in diagnosis and physical examinations such as vital signs, palpation, and auscultation. Also, the majority of them reported that AI can be used in appropriate health assessments such as screening for depression and anxiety, healthy eating and physical activity, social support or social isolation, quality of life and ability to manage their own health.

On the same line with **Gabriel, (2023)** who reported that more than three quarters of the study subjects believed that AI can effectively analyze patient medical data. These findings disagree with the study held by **Carrol, (2019)** who mentioned that applications and advantages of artificial intelligence to nurses in care delivery environments are still vague. Likewise, **Mohamed et al., (2023)** who reported that less than one fifth of the studied nurses answered correctly about "Advantages of artificial intelligence".

In addition, **Abdullah, (2020)** who mentioned that most of the study subjects were unaware of the advantages of artificial intelligence applications in the health sector and problems concerning artificial intelligence application in healthcare gained a high score.

Meanwhile, the results of this study revealed that the majority of the studied nursing personnel answered incorrectly about item "AI plays an important role in nursing practice". These findings were supported by **Mohamed et al., (2023)** who reported that the majority of the studied nurses answered incorrectly about "Importance of artificial intelligence ". Also, **Ahmed et al., (2022)** who stated that more than three quarters of the study subjects were not aware of the importance of practical application of AI.

Conversely, these findings were inconsistent with **Gabriel, (2023)** who reported that healthcare workers recognized the importance of AI in healthcare and medicine, particularly in early disease diagnosis and found that more than two thirds of participants had correct knowledge regarding AI assists practitioners in early diagnosis and assessment of disease severity.

The present study revealed that near to two thirds of the studied nursing personnel had a positive perception about challenges and barriers of using AI in nursing practice and more than one third perceived them negatively. These results supported by **Sommer et al., (2024)** who reported that near to two thirds of the studied nurses had a positive perception about AI. Furthermore, a study conducted by **Sabra et al., (2023)** who reported that the majority of the studied nurses had moderate perception toward usage of AI in healthcare. Also, **Elsayed & Sleem, (2021)** who stated that the majority of the studied nurses had moderate perception towards using AI in nursing settings.

On the same line with **Taie, (2020)** who stated that the majority of the studied nurses and medical managers perceived the application of AI positively in nursing and medicine. Also, **Khalaf et al., (2022)** who found that the highest percentage of studied Physicians had a high level of perception about AI applications and the highest percentage of studied nurses had a moderate level of perception. Furthermore, **Al-Sabawy, (2023)** who stated that more than half of the

studied nurses had a moderate perception of AI utilization in nursing practice. In addition, **Syed et al., (2023)** who reported that the majority of the study subjects at a Saudi university in Riyadh appeared to have positive perceptions, awareness, and good opinions towards AI and its use in the healthcare sector

From the researcher's point of view, these results can be explained by that COVID-19, providing an opportunity for nurses to recognize the value of applying AI in nursing practice. Furthermore, AI has become of great importance nowadays due to the tendency of the health sector to use it in multiple areas of patient and community services and seek to provide the necessary information on how to apply it in line with Egypt's Vision 2030, which aims at the digitization of all society sectors.

As regards the relation between nursing personnel's knowledge level and their perception about challenges and barriers of using AI in nursing practice. the present study showed that there was a highly statistically significant association between nursing personnel's knowledge level and their perception about challenges and barriers of using AI in nursing practice. These findings were supported by **Labrague et al., (2023)** who reported that there was a highly statistically significant association between the study subjects' perception of AI and their knowledge of AI technologies.

Contradictory to present study results **Al-Medfaa et al., (2023)** who reported that there was no statistically significant association between the perception and the participants' knowledge about AI. Also, **Syed et al., (2023)** who reported that there was no statistically significant association between the perception of the study subjects about AI and their AI knowledge.

Regarding the correlation between the studied nursing personnel's knowledge about AI and their perception about challenges and barriers of using AI in nursing practice. The present study found that there was a highly significant positive correlation between total knowledge score about AI and total perception score about challenges and barriers of using AI in nursing practice among nursing personnel. These findings were supported by **Catalina et al., (2023)** who mentioned that there was a significant positive correlation between the study subjects' knowledge about AI and their perception about AI. From the researcher's point of view, this result may be related to the new trend of Egyptian hospitals for application of AI in various workplaces as response to Egypt's vision 2030.

Conclusion

In the light of the current study findings, it can be concluded that:

More than half of the studied nursing personnel had unsatisfactory level of knowledge about AI. While, near to two thirds of them had a positive perception about challenges and barriers of using AI in nursing practice. Additionally, there was a highly significant positive correlation between total knowledge score about AI and total perception score about challenges and barriers of using AI in nursing practice.

Recommendations

Based on the current study findings, the following recommendations were proposed:

1- Healthcare organizations:

- Encourage nurses to increase their knowledge and perception toward AI through training programs and providing further education to enable them integrate AI into nursing practices.
- Enhance the readiness of healthcare organizations for AI through good technological infrastructure and budget.

2- Nursing institutions:

- Introduce fundamentals of AI into nursing curricula.
- Ensure collaboration between nursing professionals, educators, and AI developers to integrate AI competencies into nursing curricula and professional development programs.

3- Further studies:

- Further research should be carried out to assess the AI impact on the patient-nurse relationship.
- Further study is needed to examine ethical and legal guidelines used by nurses for implementation of AI in nursing practice that affect patients care outcomes.

References

1. **Abdullah, R. (2020).** Healthcare Employees' Perceptions of the Use of Artificial Intelligence Applications: Survey Study, *Journal of medical internet research*, 22(5), e17620, doi:10.2196/17620 <https://www.jmir.org/2020/5/e17620/>
2. **Adi, P., Maulana, I., Lestari, D., Ariyanto, V., & Purnomo, A. (2023).** The Scientific Progress and Prospects of Artificial Intelligence for Cancer Detection: A Bibliometric Analysis. In 2023 International Seminar on Intelligent Technology and Its Applications (ISITIA) (pp. 638-642).
3. **Aggar, C., Grace, S., Shinnars, L., Smith, S., & Stephens, A. (2022).** Exploring healthcare professionals' perceptions of artificial intelligence: Piloting the Shinnars Artificial Intelligence Perception tool. *Digital Health* Volume 8: 1–8 DOI: 10.1177/20552076221078110 journals.sagepub.com/home/dhj.
4. **Ahmed, I., Jeon, G., & Piccialli, F. (2022).** From artificial intelligence to explainable artificial intelligence in industry 4.0: a survey on what, how, and where. *IEEE Transactions on Industrial Informatics*, 18(8), 5031-5042.
5. **Albert, D., BLEclercq, C., Witt, H., Hindricks, G., Katra, P., elliger, A., ... & Weidinger, F. (2022).** Wearables, telemedicine, and artificial intelligence in arrhythmias and heart failure: Proceedings of the European Society of Cardiology Cardiovascular Round Table. *Europace*, 24(9), 1372-1383
6. **Al-Medfa, K., Al-Ansari, M., Darwish, H., Qreebala, A., & Jahrami, H. (2023).** Physicians' attitudes and knowledge toward artificial intelligence in medicine: Benefits and drawbacks. *Heliyon*, 9(4).
7. **Al-Sabawy, R. (2023).** Artificial Intelligence in Nursing: A study on Nurses' Perceptions and Readiness. Master of Science in Community Health Nursing, Kirkuk Health Department, Iraqi Ministry of Health, Pp1-11.
8. **Bavli, I., Ho, A., Mahal, R., & McKeown, J. (2024).** Ethical concerns around privacy and data security in AI health monitoring for Parkinson's disease: insights from patients, family members, and healthcare professionals. *AI & SOCIETY*, 1-11.
9. **Boillat, T., Nawaz, F., & Rivas, H. (2022).** Readiness to Embrace Artificial Intelligence Among Medical Doctors and Students: Questionnaire-Based Study. *JMIR Medical Education*, 8(2), e34973. Doi: 10.2196/34973.
10. **Carroll, M. (2019).** Artificial intelligence, critical thinking and the nursing process. *On-Line Journal of Nursing Informatics*, 23(1).
11. **Catalina, M., Fuster-Casanovas, A., Vidal-Alaball, J., Escalé-Besa, A., Marin-Gomez, X., Femenia, J., & Solé-Casals, J. (2023).** Knowledge and perception of primary care healthcare professionals on the use of artificial intelligence as a healthcare tool. *Digital Health*, 9, 20552076231180511.
12. **Çınar Yücel, Ş., Ergin, E., Karaarslan, D., & Şahan, S. (2022).** Artificial Intelligence and Robot Nurses: From Nurse Managers' perspective: A Descriptive Cross-Sectional Study. *Journal of Nursing Management*, 30(8), 3853-3862.
13. **Egypt's Artificial Intelligence Future, (2020).** available at <https://www.rebellionresearch.com/blog/egypt-s-artificial-intelligence-future>
14. **Elsayed, W., & Sleem, W. (2021).** Nurse Managers' perception and Attitudes toward Using Artificial Intelligence Technology in Health Settings. *Assiut Scientific Nursing Journal*, 9(24.0), 182-192. <http://asnj.journals.ekb.eg> <http://www.arabimpactfactor.com>.
15. **Ergin, E., Karaarslan, D., Şahan, S., & Bingöl, Ü. (2023).** Can artificial intelligence and robotic nurses replace operating room nurses? The quasi-experimental research. *Journal of Robotic Surgery*, 17(4), 1847-1855.
16. **Gabriel, T. (2023).** Data Privacy and Ethical Issues in Collecting Health Care Data Using Artificial Intelligence Among Health Workers (Master's thesis, Center for Bioethics and Research ProQuest Dissertations & Theses), 2023. 30989995.
17. **Gouripur, K. (2024).** The Impact of Artificial Intelligence on Healthcare: A Revolution in Progress. *The North and West London Journal of General Practice*, 10(1).
18. **Gupta, B., Gaurav, A., Panigrahi, K., & Arya, V. (2023).** Analysis of artificial intelligence-based technologies and approaches on sustainable entrepreneurship. *Technological Forecasting and Social Change*, 186, 122152.
19. **Hussein, J., Khan, B., Fatima, H., Qureshi, A., Kumar, S., Hanan, A., & Abdullah, S. (2023).** Drawbacks of artificial intelligence and their potential solutions in the healthcare sector. *Biomedical Materials & Devices*, 1(2), 731-738.
20. **Kanekar, A. (2023).** Role of Open AI (Artificial Intelligence)–Innovations in Health Behavior Change Interventions. In *Healthcare* (Vol. 11, No. 20, p. 2710). MDPI.
21. **Khalaf, K., Ghallab, A., & Abdelhafez, H. (2022).** Health care providers' perception about artificial intelligence applications. *Assiut Scientific Nursing Journal*, 10(31), 204-215.
22. **Labrague, J., Aguilar-Rosales, R., Yboa, C., & Sabio, B. (2023).** Factors influencing student nurses' readiness to adopt artificial intelligence (AI) in their studies and their perceived barriers to accessing AI technology: A cross-sectional study. *Nurse Education Today*, 130, 105945.
23. **Mahdi, S., Battineni, G., Khawaja, M., Allana, R., Siddiqui, K., & Agha, D. (2023).** How does artificial intelligence impact digital healthcare initiatives? A review of AI applications in dental healthcare. *International Journal of Information Management Data Insights*, 3(1), 100144.
24. **Mohamed, A., Awad, G., Eldiasty, M., & ELsaid ELsabahy, H. (2023).** Effect of the Artificial Intelligence Enhancement Program on Head Nurses' Managerial Competencies and Flourishing at Work. *Egyptian Journal of Health Care*, 14(1), 624-645.
25. **Mohamed, H., Abed EL-Rahman, M., Mahmoud, F., & Heggy, Y. (2023).** The Effect of Educational Program on Nurses' Knowledge and Attitude Regarding Artificial Intelligence. *Egyptian Journal of Health Care*, 14(2), 1110-1128.
26. **Morii, Y., Mukai, M., Ogasawara, K., Suzuki, T., Tamori, H., & Yamashina, H. (2022).** Acceptance of the Use of Artificial Intelligence in Medicine Among Japan's Doctors and the Public: A Questionnaire Survey. *JMIR human factors*, 9(1), e24680. Published on 16.3.2022 in Vol 9, No 1 (2022): Jan-Mar available at <https://preprints.jmir.org/preprint/24680>
27. **Romero, M., Mosquera Orgueira, A., & Mejía Saldarriaga, M. (2024).** How artificial intelligence revolutionizes the world of multiple myeloma. *Frontiers in Hematology*, 3, 1331109.
28. **Sabra, E., Abd Elaal, K., Sobhy, M., & Bakr, M. (2023).** Utilization of artificial intelligence in health care: Nurses' perspectives and attitudes. *Menoufia Nursing Journal*, 8(1), 243-257.



29. **Samad, Z., Inam, M., Shiekh, S., Minhas, K., Vaughan, M., Krittanawong, C.,... & Virani, S. (2024).** A review of top cardiology and cardiovascular medicine journal guidelines regarding the use of generative artificial intelligence tools in scientific writing. *Current Problems in Cardiology*, 102387.
30. **Sommer, D., Schmidbauer, L., & Wahl, F. (2024).** Nurses' perceptions, experience and knowledge regarding artificial intelligence: results from a cross-sectional online survey in Germany. *BMC nursing*, 23(1), 205.
31. **Swan, A. (2021).** Assessing the Knowledge and Attitudes of Registered Nurses about Artificial Intelligence in Nursing and Health Care. *Nursing Economic\$,* 39(3).
32. **Syed, W., Basil A., Al-Rawi, M. (2023).** Assessment of awareness, perceptions, and opinions towards artificial intelligence among healthcare students in Riyadh, Saudi Arabia. *Medicina*, 59(5), 828.
33. **Taie, S. (2020).** Artificial intelligence as an innovative approach for investment in the future of healthcare in Egypt. *way*, 11, 12.
34. **Taryudi, T., Lindayani, L., Purnama, H., & Mutiar, A. (2022).** Nurses' View towards the Use of Robotic during Pandemic COVID-19 in Indonesia: A Qualitative Study. *Open Access Maced J Med Sci*. 2022 Jan 01; 10 (G): 14-18.
35. **Taylor, S. (2021).** The Relationship Between Nurse Wellbeing and Artificial Intelligence: A Quantitative Correlational Study (Doctoral dissertation, University of Phoenix). DocuSign Envelope ID: 4F2F4D29-103E-4954-94F4-F87F769308AF
36. **Tursunbayeva, A., & Renkema, M. (2023).** Artificial intelligence in health-care: implications for the job design of healthcare professionals. *Asia Pacific Journal of Human Resources*, 61(4), 845-887
37. **Wilson, L., Higgins, O., Atem, J., Donaldson, E., Gildberg, A., Hooper, M., ... & Welsh, B. (2023).** Artificial intelligence: An eye cast towards the mental health nursing horizon. *International Journal of Mental Health Nursing*, 32(3), 938-944.
38. **Zheng, Z., Ning, H., Shi, F., Farha, F., Xu, Y., Xu, J., ... & Choo, R. (2022).** Artificial intelligence in cyber security: research advances, challenges, and opportunities. *Artificial Intelligence Review*, 1-25.
39. **Zhou, J., Cao, W., Wang, L., Pan, Z., & Fu, Y. (2022).** Application of artificial intelligence in the diagnosis and prognostic prediction of ovarian cancer. *Computers in Biology and Medicine*, 146, 105608.