Nurses' Opportunities and Challenges regarding Application of Artificial Intelligence in Intensive Care Units

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Abstract:

Background: The application of artificial intelligence (AI) in healthcare may help address some of the issues that global healthcare systems are now facing opportunities AI was a bridge between healthcare and technology in nursing today. **Aim of the study:** to determine nurses' opportunities and challenges regarding application of artificial intelligence in intensive care unit. **Research design**: A descriptive research design was used in this study. **Setting:** This study was conducted at intensive care units and medical emergency unit at Al-Eman general Hospital. **Sample:** Was included a convenience sampling of available critical care nurses work at the previous mention setting. **Tools**: Tool one: Nurses' opportunities regarding application of artificial intelligence questionnaire; tool two: Nurses challenges regarding application of artificial intelligence questionnaire. **Results:** about 58 % from nurses had good knowledge regarding AI with mean &SD had 35.24 ± 11.07 . Also, 69 % from nurses had satisfactory nurse's challenges regarding AI. The current study revealed relation between total score of nurse's challenges regarding AI and total score of nurse's knowledge regarding opportunities of AI. Additionally, nurses had satisfactory nurses' challenges regarding AI. **Recommendations:** Performing scientific research concentrated on AI at ICU at Egypt and preparing training program for nurses about opportunities and AI challenges facing them.

Keywords: Artificial Intelligence, Challenges, Intensive Care Unit & Nurses' opportunities

Introduction:

Some of the problems that healthcare systems around the world confront may be resolved with the use of artificial intelligence (AI). In general, artificial intelligence (AI) refers to a computerized system (hardware or software) that possesses the ability to carry out tasks or thinking processes that are typically associated with human intellect. Therefore, artificial intelligence (AI) is not a single technology but rather a variety of technologies with a wide range of applications. (Lena et al., 2024).

Nevertheless, while putting AI technology into practice, some issues and difficulties could call for method optimization along with the particular environment. The success of AI in a clinical healthcare setting is dependent on factors other than technical performance, therefore we may characterize it as complicated sociotechnical interventions. (Launa et al., 2024)

Prospects Artificial Intelligence in Nursing There has always been a connection between healthcare and technology. However, healthcare is changing as a result of AI's efficiency and growing sophistication. These eight nursing domains are currently covered by AI in healthcare: diagnosis, early detection, end-oflife care, healthy living, research, preparation, and treatment. (**Piette et al., 2022**). Challenges and limitations of the following are some of the barriers that prevent AI in healthcare safety from being successfully adopted and implemented smoothly: Due to the gathering and storing of data from several sources, AI and big data characteristics may pose a challenge to medical ethics, including an individual's right to privacy. Furthermore, hackers may abuse medicolegal algorithms to create autonomous procedures, endangering the security and safety of sensitive data. AI research should adhere to standards and ethics in order to avoid such problems. AI algorithms may be prone to mistakes, which could result in unjust and unfavorable outcomes depending on socioeconomic background and ethnicity. (**Dorr et al., 2023**)

Additionally, ambiguous ethical standards and contextual interpretation cause major problems for AI system coding. By implementing preventive and precautionary measures, the direct or indirect effects of AI on patients or doctors should be reduced. There are few evidence-based studies on the effectiveness and safety of AI in healthcare, and its implementation without adequate validation raises concerns about patient harm and clinicians' trust in technology. Clinicians, for example, frequently exhibit resistance and discomfort with the use of AI in healthcare. (Asan et al., 2020)

Significance of the study:

These days, artificial intelligence (AI) technology can monitor, detect, and quantify risks and benefits in the healthcare industry using massive data, machine learning algorithms, and robotics. Artificial intelligence lowering the cost of clinical trials in terms of lost human time during the development of new medications, artificial intelligence benefits the healthcare industry. Past the diagnostic, clinical, and therapeutic decisions made from a medical perspective. (Ali et al., 2023)

Critical heath care setting needs to adapt quickly to new developments in technology, legal requirements, and patient needs. AI in healthcare can help with proactive patient care, lower risks in the future. Cost, quality, and treatment outcomes drive the further growth of AI technology to new levels of use and value in healthcare. Researchers believe that no one has made an effort to investigate nurses' opportunities and challenges regarding application of artificial intelligence in intensive care unit. At Assiut university Hospital so, that the goal of this study was conducted.

Aim of the study:

The study aims to determine nurses' opportunities and challenges regarding application of artificial intelligence in intensive care unit.

Research questions:

- 1. What are the nurses' opportunities regard application of artificial intelligence?
- 2. What are the nurses' challenges regard application artificial intelligence

Subject and Methods

Design:

A descriptive exploratory research design was utilized to conduct this study which is defined as emphasizes on exploring and understanding the meaning which a person or group of people ascribe to a social or human problem (**Creswell**, **2014**).

Setting:

This study was conducted at intensive care units and medical emergency unit at Al-Eman general Hospital. Intensive care units at Al-Eman general Hospital include (general intensive care unit, medical intensive care unit, coronary care unit and neurosurgery intensive care unit).

Sampling:

The study subject included a convenience sampling of available critical care nurses about 100 nurses who work at the previous mention setting.

Tools of data collection:

Two tools were used by the researcher in this study after reviewing of the related literatures (Parthasarathy et al., 2018; He et al., 2019; Robert, 2019; Lee and Yoon, 2021; Petersson et al., 2022; Astuti and Opoku, 2023)

Tool (1): Nurses' opportunities regarding application of artificial intelligence questionnaire:

This tool developed by the researcher after reviewing of the related literatures (Lee and Yoon, 2021; Astuti & Opoku, 2023) to explore nurses' opportunities regarding application of artificial intelligence in intensive care unit. This tool comprises two main parts:

Part (I): Demographic data:

It included such as age, gender, social status, qualifications, experience years in critical care nursing, previous workshop on AI, previous training on AI applications, and work setting.

Part (II): Nurses' knowledge regarding application of AI questionnaire:

To assess nurses' knowledge regarding of application of AI as relieving workload, improved disease treatment, medical error reduction and service quality, increased productivity, improved operational efficiency, and reduction medical cost.

Scoring system:

Poor (Less than 60 %) (19-44)

Good (60 less than 75 %) (45-70)

Very good (More than 75 %) (71-95)

Questionnaire that consists of 19 multiple choose questions

Minimum score (19)

Maximum score (95)

Tool (2): Nurses challenges regarding application of artificial intelligence questionnaire:

This tool developed by the researcher after reviewing of the related literatures (**Parthasarathy et al., 2018**; **He et al., 2019**; **Robert, 2019**; **Petersson et al., 2022**) to explore nurses' challenges regarding application of artificial intelligence in intensive care unit. This questionnaire will include challenges face critical care nurses as the ethical implications of using AI in intensive care unit, potential misuse of critically ill patient data, elevated costs of the system, the need for continuous updates, replace human interaction and empathy in patient care.

Scoring system

Satisfactory (More than 75%)

Unsatisfactory (Less than 75 %)

Questionnaire that consists of 18 multiple choose questions

Minimum score (18)

Maximum score (90)

Methods

The study was conduct through the following phases: **Preparatory phase:**

- Official permission to carry out the study was taken from the responsible head of at Al-Eman general

Hospital in Assiut Governorate to conduct the study.

- The study tools were designed after extensive literature review.

Pilot study

A pilot study will be conducted (10%) of nurses worked in the selected setting to examine the applicability, feasibility, efficiency and clarity of the developed tools.

Content validity and Reliability:

Content validity of the study was done by jury of (5) experts who are specialists in the field of critical care nursing from Assiut University, and necessary modifications will be done.

Reliability of the study tool: The reliability of the test will be calculated by using correlation coefficient and it will be estimated by Alpha Cronbach's test for this study. Tool one =0.089, tool two =0.91.

Ethical and legal considerations:

- Research proposal was approved from Ethical committee in the Faculty of Nursing.
- There was no risk for study subject during application of the research.
- Informed consent was obtained from the nurses' participants that are willing to participate in the study. After explaining the nature and purpose of the study.
- Confidentiality and anonymity were assured.
- The participants had the right to refuse to participate and/or withdraw from the study without any rational at any time.
- The study followed common ethical principles in clinical research.
- Nurses were assured that the data of this research will be used only for the purpose of research.

Data collection procedure

The collection of data has been done under the complete supervision of the researcher and it is done in 2 phases:

Phase (1): Nurses questionnaire translated into Arabic language to be filled with the nurses, that contain questions related to the study aim, that was in form of Multiple-choice questions to facilitate nurse's responses.

Phase (2): Structured interviews with the nurses (4-6 nurses) within each meeting to clarify nurses' responses to the research study question and facilitate a better understanding of their choices.

-The researcher took notes during the interview to be included in the data analysis. An audio recording was used during the interview after taking approval from the nurses to help the researcher better investigation of collected data.

- The focus group interview (4-6 nurses) was conducted with nurses working in intensive care units.

- The interview was designed by the researcher based on the literature review to assess the nurse's knowledge of opportunities and challenges regarding application of artificial intelligence
- Nurses who met the study inclusion criteria and were interested to participate in this study were enrolled to participate.
- Instructions were provided on how to complete the questionnaires. Data was collected within six months.
- The researcher was assessed demographic data of nurses by using tool 1 (part I).
- Every nurse was interviewed to know their opportunities and challenges regarding the AI by using tool 1 (part II).
- Every nurse was interviewed to know their challenges regarding the AI by using tool 2.
- To avoid missing data, the researchers was instructed all participants to answer all questions

Statistical analysis:

The researcher used a personal computer to enter the data. The statistical packages for social sciences (SPSS) version 27.0 software were used to analyze all of the data. Each tool's content was examined, categorized, and then coded by the researcher. The mean and standard deviation (Mean, St. D) were used to characterize continuous variables, while the number and percentage were used to characterize categorical variables. When categorical variables were compared using the ci-square test, a P value of less than 0.05 was deemed statistically significant.

Results:

Variables	No	%
Academic qualification		
Nursing Diploma	4	4.0
Nursing Institute	41	41.0
Nursing Bachelor	53	53.0
Master	2	2.0
Attending training courses		
Yes	53	53.0
No	47	47.0
Site of work		
General ICU	33	33.0
Medical ICU	18	18.0
Coronary ICU	15	15.0
Neurosurgery ICU	15	15.0
Medical Emergency	19	19.0



Figure (1): Percentage distribution of nurse's gender



Figure (2): Percentage distribution of nurses age groups



Figure (3): Percentage distribution for nurses' years of experience

Table (2.a): Percentage distribution of nurses'	knowledge regarding	opportunities of application of
AI in intensive care unit (No=100)		

Steps		Strongly agree		Agree		Natural		Disagree		Strongly disagree	
		%	No	%	No	%	No	%	No	%	
Economic Opportunities and Efficiency											
Artificial Intelligence can provide new economic opportunities for my organization	46	46.0	29	29.0	23	23.0	2	2.0	0.0	0.0	
Artificial Intelligence helps to increase productivity	48	48.0	26	26.0	26	26.0	0.0	0.0	0.0	0.0	
Artificial Intelligence can improve operational efficiency	38	38.0	38	38.0	22	22.0	2	2.0	0.0	0.0	
Artificial Intelligence can reduce medical costs	43	43.0	26	26.0	29	29.0	2	2.0	0.0	0.0	
Enhancing Patient Care											
Artificial Intelligence can improve the practice of critical nursing care	46	46.0	31	31.0	19	19.0	4	4.0	0.0	0.0	
Artificial Intelligence can decrease the number of medical mistakes	42	42.0	36	36.0	22	22.0	0.0	0.0	0.0	0.0	
Artificial Intelligence can have positive impacts on critical care nurses' well-being	37	37.0	40	40.0	23	23.0	0.0	0.0	0.0	0.0	
Artificial Intelligence can give critical nurses more time with patients.	44	44.0	32	32.0	22	22.0	0.0	0.0	2	2.0	

Table (2.b): Percentage distribution of nurses'	knowledge regarding opportunities of application of
AI in intensive care unit (No=100)	

Steps		Strongly agree		Agree		Natural		Disagree		ongly gree
	No	%	No	%	No	%	No	%	No	%
Diagnostic Precision and Error Reduction										
Artificial Intelligence helps to reduce human diagnostic and therapeutic error	60	60.0	15	15.0	21	21.0	2	2.0	2	2.0
Artificial Intelligence improves disease treatment	38	38.0	33	33.0	29	29.0	0.0	0.0	0.0	0.0
Artificial Intelligence can deliver clinically relevant, vast amounts of high-quality data in real time	45	45.0	33	33.0	22	22.0	0.0	0.0	0.0	0.0
Artificial Intelligence improves the quality of health care, which in turn will increase patient safety and satisfaction	42	42.0	31	31.0	25	25.0	2	2.0	0.0	0.0
Workload Relief and Bias Reduction										
Artificial Intelligence can relieve workload	48	48.0	24	24.0	26	26.0	2	2.0	0.0	0.0
Artificial Intelligence helps to reduce unconscious bias	33	33.0	38	38.0	27	27.0	0.0	0.0	2	2.0
Job Automation and Replacement										
An artificially intelligent agent would be better than an employee in many routine jobs	40	40.0	31	31.0	25	25.0	4	4.0	0.0	0.0
Artificial intelligence can be used to replace some tasks normally carried out by health care	32	32.0	32	32.0	34	34.0	2	2.0	0.0	0.0

Table	(3.a):	Percentage	distribution	of	Nurses'	challenges	regarding	application	of	artificial
		intelligence	in intensive ca	are	unit que	stionnaire (N	10 = 100			

Steps		Strongly agree		Agree		Natural		Disagree		Strongly disagree	
-	No	%	No	%	No	%	No	%	No	%	
Errors, reliability and implementation Challenges I think artificial intelligence systems make many errors	34	34	26	26	33	33	6	6	1	1	
Computers can be hacked, which can lead to health care problems	47	47	22	22	28	28	2	2	1	1	
Artificial intelligence needs continuous updates.	56	56	25	25	17	17	1	1	1	1	
Applications of artificial intelligence cannot be used to provide opinions	45	45	33	33	20	20	1	1	1	1	
It is difficult to apply to all patients	32	32	37	37	26	26	4	4	1	1	
Data acquisition occurs at stages of artificial intelligence implementation	29	29	44	44	22	22	2	2	3	3	
Human-MachineInteractionandRelationshipsArtificial intelligencewill negatively affectthe health care providers-patient relationship	42	42	25	25	30	30	2	2	1	1	
It will be difficult to totally replace health care providers' consultation with digital tools	38	38	31	31	26	26	4	4	1	1	
Artificial intelligence reduces the trust and quality of the nursing care providers/patient	33	33	35	35	29	29	2	2	1	1	

Table	(3.b):	Percentage	distribution	of Nurse	s' challenges	regarding	application	of	artificial
		intelligence	in intensive ca	are unit qu	estionnaire (N	No = 100)			

Items		Strongly agree		Agree		Natural		Disagree		ongly agree
	No	%	No	%	No	%	No	%	No	%
Ethical and Social Concerns										
Organizations use artificial intelligence unethically	35	35	17	17	32	32	13	13	3	3
Artificial intelligence may lead to misuse of critically ill patient data	34	34	27	27	23	23	15	15	1	1
Using artificial intelligence led to elevated costs of the system	38	38	26	26	31	31	4	4	1	1
Cannot identify responsible for causing harm caused by artificial intelligence mistakes	42	42	30	30	23	23	4	4	1	1
Ethical and social issues occur at stages of artificial intelligence implementation	34	34	34	34	26	26	2	2	1	1
Job Replacement and Trust										
A longstanding concern regarding artificial intelligence in healthcare is the fear it will replace jobs	39	39	30	30	28	28	0.0	0.0	3	3



Figure (4): Percentage distribution and mean & standard deviation of total levels score of nurses knowledge regarding opportunities AI



Figure (5): Percentage distribution of total levels score of nurse's challenges regarding AI

Table (4): Relation between total score of nurses`	knowledge regarding AI	and sociodemographic
data of nurses $(No = 100)$		

	L						
Variables	Pe	oor	G	ood	Very	y good	p. value
	No	%	No	%	No	%	_
Gender							
Male	9	39.1	19	32.8	7	36.8	220
Female	14	60.9	39	67.2	12	63.2	.329
Age							
Less than 20 years	1	4.3	1	1.7	0	0	0.348
From 20 - < 30 years	19	82.6	46	79.3	17	89.5	
From 31- < 40 years	3	13.0	11	19.0	1	5.3	
From 41- < 50 years	0	0	0	0	1	5.3	
Academic qualification							
Nursing Diploma	0	0	3	5.2	1	5.3	0.047*
Nursing Institute	9	39.1	24	46.6	5	26.3	
Nursing Bachelor	13	56.5	24	46.6	13	68.4	
Master	1	4.3	1	1.7	0	0	
Years of experience							
Less than 5 years	16	69.6	47	81.0	14	73.7	0.029*
From 5 - < 10 years	6	26.1	8	13.8	3	15.8	
From 10- < 15 years	1	4.3	1	1.7	2	10.5	
More than 15 years	0	0	2	3.4	0	0	
Attending training courses							
Yes	23	100	58	100	19	100	0.328
No	0	0	0	0	0	0	
Site of work							
General ICU	6	26.1	19	32.8	8	42.1	5.152
Medical ICU	6	26.1	9	15.5	3	15.8	
Coronary ICU	4	17.4	7	12.1	4	21.1	
Neurosurgery ICU	4	17.4	10	17.2	1	5.3	
Medical Emergency	3	13.0	13	22.4	3	15.8	

Chi square test for qualitative data between the two groups or more *Significant level at P value < 0.05, **Significant level at P value < 0.01.

Variables	Satisf	actory	Unsatis	factory				
	No	%	No	%	p. value			
Gender								
Male	26	38.8%	9	27.3%	1.293			
Female	41	61.2%	24	72.7%				
Age								
Less than 20 years old	1	1.5%	1	3.0%				
From 20 - $<$ 30 years old	56	83.6%	26	78.8%	1 1/18			
From $31 - \langle 40 \rangle$ years old	9	13.4%	6	18.2%	1.148			
From $41 - < 50$ years old	1	1.5%	0	0%				
Academic qualification								
Nursing Diploma	3	4.5%	1	3.0%				
Nursing Institute	26	38.8%	15	45.5%	805			
Nursing Bachelor	37	55.2%	16	48.5%	.005			
Master	1	1.5%	1	3.0%				
Years of experience								
Less than 5 years	54	80.6%	23	69.7%				
From 5 - < 10 years	8	11.9%	9	27.3%	4 400			
From 10- < 15 years	3	4.5%	1	3.0%	4.477			
15 years or more	2	3.0%	0	0%				
Attending training courses								
Yes	67	100%	33	100%	0.543			
No	0	0%	0	0%	0.545			
Site of work								
General ICU	23	34.3%	10	30.3%				
Medical ICU	13	19.4%	5	15.2%				
Coronary ICU	9	13.4%	6	18.2%	.791			
Neurosurgery ICU	10	14.9%	5	15.2%				
Medical Emergency	12	17.9%	7	21.2%				

Table (5): Relation between total score of r	urses' challenges regarding AI an	d sociodemographic
data of nurses (No = 100)		

Chi square test for qualitative data between the two groups or more

*Significant level at P value < 0.05,

**Significant level at P value < 0.01.

Tables (6): Relation	between	total s	score	levels	of	nurses'	knowledge	and	total	score	of	nurse's	
	challen	ges regard	ling ar	rtificia	l intelli	ige	nce	-						

Delation	Satisfactory	7	Unsat	n voluo		
Kelation	No	%	No	%	p. value	
Good	34	50.70	24	72.70		
Poor	17	25.40	6	18.20	0.884	
Very good	16	23.90	3	9.10		

Chi square test for qualitative data between the two groups or more

*Significant level at P value < 0.05,

** \tilde{S} ignificant level at P value < 0.01.

Table (1): Illustrates the demographic data of the critical care nurses. As regard nurse qualifications, it was observed that the most of the nurse's qualifications were technical institute with percentage of 41% and 53 % were Bachelor degree nurses.

Concerning Site of work, it was found that 33 % from nurses from general ICU and 19% from medical emergency unite.

Figure (1): Illustrates the demographic data of the critical care nurses. Regarding gender, it was found that the majority of the nurses was female with the

percentage of (65%) while the male nurses were (35%).

Figure (2): Shows age groups, it was found that the majority of the nurses about 82 % from 25 - 30 years old

Figure (3): Demonstrates years of experience of nurses, it was revealed that 77% less than 5 years. Regarding training course, it was found that about 53% of nurses had training courses. Concerning types of ICU, it was observed that 33% from nurses from general ICU and 19% and 18% from medical and emergency medical respectively.

Table (2.a): Shows of nurse's knowledge regarding opportunities of application of AI in intensive care unit. Regarding economic opportunities and efficiency, it was found that about 44 % and 29 % from nurses had strongly agree and agree respectively told the artificial intelligence can provide new economic opportunities for my organization. About 48 % and 26 % from nurses had strongly agree and agree respectively report artificial intelligence helps to increase productivity. About 48 % from nurses reported that strongly agree artificial Intelligence can improve operational efficiency. About 43 % and 26 % from nurses had strongly agree and agree respectively report that Artificial Intelligence can reduce medical costs.

As regard AI Enhancing Patient Care, it was observed that 46% and 31% from nurses had strongly agree and agree respectively report that artificial intelligence can improve the practice of critical nursing care. Also 46 % and 31 % from nurses had strongly agree and agree that Artificial Intelligence can decrease the number of medical mistakes. About 34 % and 40 % from nurses had strongly agree and agree that artificial Intelligence can have positive impacts on critical care nurses' well-being. 44 % and 32 % from nurses had strongly agree and agree that Artificial Intelligence can give critical nurses more time with patients. Concerning Training and Skill Development, it was observed that 49 % and 29 % from nurses had strongly agree and agree that artificial Intelligence can use high-fidelity simulations and develop clinical scenarios to enhance critical care providers' training.

Table (2.b): Demonstrates nurse's knowledge regarding opportunities of application of AI in intensive care unit. Regarding diagnostic precision and error reduction It was found that 60 % and 21 from the nurses had strongly agree and agree that artificial intelligence helps to reduce human diagnostic and therapeutic error. Also 38 % and 33 % from the nurses had strongly agree and agree that consider artificial Intelligence improves disease treatment. About 45 % and 33 % from the nurses had strongly agree and agree that report artificial Intelligence can deliver clinically relevant, vast amounts of high-quality data in real time. Also 42 % and 31 % from the nurses had strongly agree and agree that report artificial Intelligence improves the quality of health care, which in turn will increase patient safety and satisfaction.

Regarding workload relief and bias reduction, it was observed that 48 % 24 % from the nurses had strongly agree and agree that report artificial Intelligence can relieve workload. About 33% and 38 % from the nurses had strongly agree and agree that report artificial Intelligence helps to reduce unconscious bias. As regard Job Automation and Replacement, it was found that 40 5 and 31 % from the nurses had strongly agree and agree that report An artificially intelligent agent would be better than an employee in many routine jobs. About 32% from the nurses had strongly agree and agree that told artificial intelligence can be used to replace some tasks normally carried out by healthcare professionals.

Table (3.a): Shows nurses' challenges regarding application of artificial intelligence in intensive care unit. Regarding Errors, reliability and implementation Challenges, it was found that 34 %, 26 % and 33 % from the nurses had strongly agree, agree and natural respectively told that I think artificial intelligence systems make many errors. Also 47 %, 22 % and 28 % from the nurses had strongly agree, agree and natural respectively told that Computers can be hacked, which can lead to health care problems

The most of nurses had about 56 %, 25 % with strongly agree and agree respectively told that Artificial intelligence needs continuous updates. Also 45 % and 33 % with strongly agree and agree respectively told that Applications of artificial intelligence cannot be used to provide opinions in unpredicted situations. About 32 % and 34 % with strongly agree and agree respectively told that It is difficult to apply to all patients.

Concerning Human-Machine Interaction and Relationships, it was found that 42 % and 25 % from the nurses had strongly agree, agree and natural respectively told that Artificial intelligence will negatively affect the health care providers-patient relationship.

Nearly 38 % and 31 % from the nurses had strongly agree, agree and natural respectively told that It will be difficult to totally replace health care providers' consultation with digital tools. About 33 % and 35 % from the nurses had strongly agree, agree and natural respectively told that Artificial intelligence reduces the trust and quality of the nursing care providers/patient.

About 55% and 29% from the nurses had strongly agree, agree and natural respectively told that artificial intelligence will decrease health care providers/patients' face-to-face contact 35% and 40 % from the nurses had strongly agree, agree and natural respectively told that critical nurses will become increasingly dependent on computer algorithms

Table (3.b): Illustrates nurses' challenges regarding application of artificial intelligence in intensive care unit. Concerning ethical and Social Concerns, it was found that 35% and 32% from the nurses had strongly agree and natural respectively told that organizations use artificial intelligence unethically. 34 % and 27% from the nurses had strongly agree and natural respectively told that artificial intelligence may lead

to misuse of critically ill patient data. About 38 % and 26 % from the nurses had strongly agree and agree respectively told that Using artificial intelligence led to elevated costs of the system.

Also about 42 % and 30 % from the nurses had strongly agree and agree respectively told that cannot identify responsible for causing harm caused by artificial intelligence mistakes. About 34 % and 26 % from the nurses had strongly agree, agree and natural respectively told that Ethical and social issues occur at stages of artificial intelligence implementation.

As regard Job Replacement and Trust, it was observed that 39 % and 30 % from the nurses had strongly agree and agree respectively told that a longstanding concern regarding artificial intelligence in healthcare is the fear it will re place jobs. Finally about 34 %, 30% and 35 % from the nurses had strongly agree, agree and natural respectively told that The degree of trust in technology and healthcare professionals may differ between individuals and generations.

Figure (4): Shows total levels score of nurses knowledge regarding AI, it was observed that 58 % from nurses had good knowledge regarding AI. While 23 % had poor knowledge regarding AI with mean & St. D had 35.24 ± 11.07

Figure (5): Shows total levels score of nurse's challenges regarding AI, it was observed that 69 % from nurses had satisfactory nurses challenges regarding AI. While 31 % had unsatisfactory nurses' challenges regarding AI.

Table (4): Shows relation between total score of nurses knowledge regarding AI and sociodemographic data of nurses. It was found that there are relation between total score of nurses knowledge regarding AI and sociodemographic data of nurses regarding nurses qualifications and years of experience with p. values = 0.047^* and 0.029^* respectively

Table (5): Demonstrates relation between total score of nurse's challenges regarding AI and sociodemographic data of nurses. It was found that there were no relation between total score of nurses challenges regarding AI and sociodemographic data of nurses.

Table (6): Illustrates relation between total score of nurse's challenges regarding AI and total score of nurse's knowledge regarding AI. There was no relation between the both total score levels.

Discussion:

Opportunities of AI at health care system: Three areas of inconsistency were identified: inclusive collaboration, ongoing safety assessment, and efficiency or environmental protection. These issues are of particular importance as they highlight the need for clear, intentional action between and among various stakeholders comprising the interstitial or connective tissue that unify a system in pursuit of a shared vision (**Piette et al., 2022**).

Finding of the current study revealed the demographic data of the critical care nurses. **Regarding gender**, it was found that the majority of the nurses was female in the study sample. This results agreement with **Abdullah et al., 2023** who indicates that all head nurses were female. This results disagreement with **Lena et al., 2022** who documented that the majority of the nurses was male. These results may be related to the majority of students admitted to study nursing were female in secondary school of nursing.

Concerning age, it was found that the majority of the nurses were from 25 - 30 years old. This results on the same line of **Hazarika**, **2020** who found that the most of study sample of nurse's age group from twenty to thirty years. These results may be attributed to work overloud choose young age from nurses to enable do hard work in ICU setting. However, **Abuzaid et al.**, **2022** who found that more than fifty percent from nurses were in the age range of 40 to less than 50 years old with mean and standard deviation 40.53 ± 4.918 years. This result may be attributed to different setting and sample

As regard nurse qualifications, it was observed that the more than fifty percent of the nurse's qualifications were bachelor degree nurses. This result disagreement with Ahlstedt et al., 2020 who observed that the majority from nurses were bachelor degree. This result may be attributed to increase number of graduated students from faculty of nursing. As regard years of experience of nurses, it was revealed that the majority from nurses less than 5 years' experience. However, this results in contrast with Azzi et al., 2020 who documented that the majority from nurses had ≥ 15 years of experience. Regarding training course, it was found that about more than fifty percent from nurses attended training courses. This results disagreement with Buchanan et al., 2021 who found that ten percent from the nurses had taken previous training in artificial intelligence. This result may be attributed to fund for training was different from setting to another.

Finding of the current study revealed the nurse's knowledge regarding opportunities of application of AI in intensive care unit. **Regarding economic opportunities and efficiency**, it was documented that about less than fifty percent from nurses told the artificial intelligence can provide new economic opportunities for my organization.

This results disagreement with **Chang et al., 2022** who reported that the majority of studied nurses indicated the potential economic opportunities and

efficiency of AI in health care setting and assist healthcare professionals in their duties. AI has proven beneficial in medical imaging, diagnosis and treatment, virtual health assistance, and drug development. This result may be attributed to fund for AI machine was different from setting to another.

As regard, artificial intelligence helps to increase productivity, it was documented that about fifty percent from nurses had report artificial intelligence helps to increase productivity. This results in contrast with **Matheny et al., 2020** who found that the majority of nurses told artificial intelligence helps to increase productivity through diagnosis and patient monitoring: AI is used for personalized medicine and predictive analytics to identify diseases early and monitor their progression, resulting in better patient outcomes and reduced healthcare costs. This result may be attributed to fund for AI machine was different from setting to another.

Concerning, artificial Intelligence can improve operational efficiency, about less than fifty percent from nurses reported that artificial Intelligence can improve operational efficiency. This results agreement with **Cyril et al., 2020** who reported that AI can aid in the development and improve the efficiency and effectiveness of patient care, with several specific opportunities for implementation.

Finding the current study revealed that a bout less than fifty percent from nurses had reported that artificial intelligence can reduce medical costs. This results on the same line with **Sit et al., 2020** who indicated that AI may be costly and time-consuming, the long-term benefits of utilizing medical AI reduce medical costs. AI has the potential to enhance patient outcomes and increase the efficacy of the healthcare, even though it presents some challenges in healthcare.

The current study demonstrated that about less than fifty percent from nurses agree that artificial Intelligence can have positive impacts on critical care nurses' well-being can give critical nurses more time with patients. This results agreement with Cyril et al., 2023 who found that AI has had a hugely positive impact on the nursing and healthcare industries by improving productivity, accelerating diagnosis, and assisting with ongoing patient condition monitoring. Nurse robots, bedside terminals, and predictive analytics are just a few of the AI technology options that are available to help nurses and other medical professionals perform their jobs. Certain human interactions and relationships between nurses and patients are among the things that AI cannot replace, even though it can make some of the tasks that nurses perform easier.

Concerning Training and Skill Development, it was observed that fifty percent from nurses had strongly agree that artificial Intelligence can use high-fidelity simulations and develop clinical scenarios to enhance critical care providers' training. This results contrast with **O'Connor et al., 2023** who reported that the majority from nurses reported that AI enhance and assess critical thinking skills training through use of these tools explore different perspectives and develop informed opinions. This results may be attributed to AI increase critical thinking skills training and help with language acquisition and communication skills, such as writing, support digital literacy skills

Regarding diagnostic precision and error reduction It was found that the most from the nurses had strongly agree that artificial intelligence helps to reduce human diagnostic and therapeutic error and improves disease treatment. This results on the same line with **Von et al., 2022 who** documented that Artificial intelligence (AI) has made significant contributions to the healthcare fields by improving diagnostic accuracy and relieving pressure on limited healthcare resources.

Finding of the current study revealed that about less than fifty percent from the nurses had strongly agree that report artificial Intelligence can deliver clinically relevant, vast amounts of high-quality data in real time and improves the quality of health care, which in turn will increase patient safety and satisfaction. This results agreement with **Emami et al., 2024** who observed that the most of nurses reported that AI enables critical care nurses to design personalized rehabilitation programs that cater to the particular requirements of every patient, increasing the likelihood of a full recovery.

This results may be due to AI-powered rehabilitation systems enhance the quality of care by giving critical care nurses real-time feedback and direction and technology used by AI systems to track patient movement and make sure exercises are done safely and correctly.

Additionally, **Al Kuwaiti et al., 2023** who documented that this instant feedback can be used by all nurses to address possible issues, modify the rehabilitation program as needed, and offer patients individualized support. In addition to improving the efficacy of the rehabilitation process, this real-time feedback encourages patient motivation and engagement, which improves patient outcomes while maintaining safety.

Regarding workload relief and bias reduction, it was observed that nearly fifty percent from the nurses had strongly agree that report artificial Intelligence can relieve workload and helps to reduce unconscious bias. This results contrast with **Apell & Eriksson**, **2023** whom reported that the most of nurses told that **AI** has is being used by the nurses so that proper information and data of the patients are available to them which is seen to help them get proper time to plan the process of care which will be make decision without bias. These results may be related to AI help in the patients getting proper care within proper time which is essential for the wellbeing of the patient.

Another research study documented by Asan & Choudhury, 2021 who found that that AI has often contributed challenges as there has been bias within the healthcare system which hinders proper care provided to the minorities. Research also states that AI does not always provide accurate data and this can lead to misinformation about the patients and access to data which is not accurate which can further have negative impacts on the care process

Findings of that current study demonstrated that challenges regarding application of artificial intelligence in intensive care unit. Regarding Errors, reliability and implementation challenges, it was found that nearly thirty percent from the nurses had strongly agree told that I think artificial intelligence systems make many errors and Computers can be hacked, which can lead to health care problems. This results on the same line with **Arora**, 2020 who found that AI usage creates risk for cybersecurity issues where confidential data can be hacked which can impact patient safety This inevitably leads to poor quality when it comes to patient's care.

The current study showed that human-machine interaction and relationships. it was found that less than fifty percent from the nurses told that Artificial intelligence will negatively affect the health care providers-patient relationship. This results agreement with Flavián et al., 2022 who found that Concerns about AI may have resulted in a loss of the "human touch" in nursing care and strained relationships between nurses and patients. Furthermore, the potential for AI to supplant human interaction and empathy in patient care is a challenge, according to Zhang et al. (2022). AI can create customized care plans, but it cannot take the place of the human element that is crucial nursing. to Concerning ethical and Social Concerns, it was found that nearly thirty percent from the nurses had strongly agree that organizations use artificial intelligence unethically and may lead to misuse of critically ill patient data. This results disagreement with Brian et al., 2020 who documented that making sure AI technologies are created and applied in a way that complies with ethical and legal requirements, such as patient data privacy and informed consent, is one of the challenges associated with using AI in nursing. This outcome could be explained by the fact that funding for AI machines varied depending on the environment.

About nearly forty percent from the nurses had strongly agree that Using artificial intelligence led to

elevated costs of the hospital. This results contrast with **Elsayed et al., 2021** who observed that AI may be costly and time-consuming; the long-term benefits of utilizing medical AI tools increase the costs. AI has the potential to enhance patient outcomes and increase the efficacy of the healthcare, even though it presents some challenges in healthcare.

As regard Job Replacement and Trust, it was observed that nearly forty percent from the nurses had strongly agree told that a longstanding concern regarding artificial intelligence in healthcare is the fear it will replace jobs. This results agreement with **Webb**, 2023 who documented that AI content being passed off as human work and excessive automation using AI tools leading to job losses and social unrest.

Finding of the current study demonstrated that total levels score of nurses knowledge regarding AI opportunities, it was observed that the most from nurses had good knowledge regarding AI with mean &standard deviation had 35.24 ± 11.07 . This results disagreement with **Abuzaid et al. 2022** who observed that low percent from nurses had good knowledge regarding AI with mean & standard deviation $34.61\pm.811$. These results may be related to different sample and setting. This result may be attributed to different sample size and setting.

The current study showed that relation between total score of nurse's knowledge regarding AI opportunities and sociodemographic data of nurses. It was found that there are relation between total score of nurses knowledge regarding AI and sociodemographic data of nurses regarding nurses qualifications and years of experience with p. values = 0.047^* and 0.029^* respectively. This results disagreement with Abdullah & Fakieh, 2020 who found that there was no statistical difference by gender, age, or educational attainment and total score of nurses knowledge regarding AI opportunities. This result may be attributed to fund for AI machine was different from health care setting to another.

Finding of the current study showed that relation between total score of nurses challenges regarding AI and sociodemographic data of nurses. It was found that there was no relation between total score of nurse's challenges regarding AI and sociodemographic data of nurses. This results agreement with **Ronquillo et al., 2021** who found that no relation between total score of nurse's challenges regarding AI and sociodemographic data of nurses. This result may be attributed to different sample size and setting.

Conclusion:

Considering the results of the study, it is possible to emphasize the following conclusions. In this study most of critical care nurses had good knowledge regarding AI. Additionally, the most nurses had satisfactory nurses' challenges regarding AI. Also, the current study revealed relation between total score of nurse's challenges regarding AI and total score of nurse's knowledge there were no relation between the both total score levels.

Recommendations:

- Conducting of Health policy must develop strategies that increase readiness of the institutions to apply AI, increase the abilities of nurses for appropriate use of AI through well trained.
- Preparing training programs for ICU nurses to inform them of the possible uses of AI challenges.
- Preparing and distributing a brochure about the opportunities and challenges including AI implementation in nursing.
- Reapply this research on a large sample size acquired from different geographical area in Egypt for generalization.

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