Intensive Care Nurses' Knowledge and Perception Regarding Artificial Intelligence Applications

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Abstract

Background: Artificial intelligence has the potential to revolutionize healthcare by enhancing patient care and driving a new era in the field. **Aim:** The present research aimed to identify the intensive care nurses' knowledge and perception regarding artificial intelligence applications. **Research design:** This research used a descriptive design. **Setting:** Intensive Care Unit at Suez-Canal and Ain Shams University Hospitals. **Subject:** Convenient sample composed of all nurses working in Intensive Care Unit with total number of (160) who are working at time of data collection in the previous listed study settings. **Tools:** The study utilized two data collection tools**: Tool (I):** Self-administered artificial intelligence knowledge questionnaire, and **Tool (II):** Nurses' Perception regarding artificial intelligence applications. **Results:** There were statistical significance differences between the Intensive Care Unit nurses' perception level regarding applications of artificial intelligence in health care setting with age, educational qualifications, and years of experience in Intensive Care Unit. Also, there was a highly statistically positive correlation between total knowledge and perception among the intensive care nurses. **Conclusion:** Around two-thirds of studied nurses had unsatisfactory level of knowledge, as well, the majority of the nurses had moderate perception level regarding artificial intelligence applications in Intensive Care Unit. **Recommendations:** Provide appropriate information about the benefits, challenges, and issues surrounding the implementation of artificial intelligence in nursing settings and the potentials of these technologies to improve health care processes and efficiencies.

***Key words*:** Artificial Intelligence, Intensive care Nurses, Knowledge, Perception.

1. Introduction

Artificial intelligence (AI) technologies offer practical advantages in various fields, including healthcare systems. The reproduction of human cognitive capabilities, paving the way for a paradigm shift in healthcare due to increased data availability and rapid advancements in

analytics techniques **(Jiang et al., 2017)**.

Currently, artificial intelligence enhances health proximity and precision by combining machine learning and deep learning mechanisms, resulting in better matching **(Hernon et al., 2023)**. In healthcare setting, artificial intelligence has numerous applications in disease assessment, diagnosis, clinical problem solving, data reduction, nursing communication, inpatient care management, nurse workload reduction, patient safety improvement, and electronic handover systems **(Seibert et al., 2021; Zhou et al., 2022)**. According to **Tang et al. (2021)**, AI may be enhanced education for analysis, prediction, guiding, evaluation, and adaptive learning. Furthermore, **Liu et al. (2022)** revealed that AI-based medical information processing may improve nursing care management.

Artificial intelligence is being used in nursing information systems to monitor client data, maintain patient data, manage quality, enhance care efficacy, and document patient information. However, challenges include technological limitations, increased system costs, and ongoing upgrades. These obstacles hinder the effective implementation of AI-based decision support systems in nursing, requiring ongoing improvements and cost-effectiveness **(Mehdipour, 2019)**.

Perception is the conscious recognition and interpretation of sensory stimuli, which serve as a basis for understanding, learning, and motivation. It is also known as awareness or comprehension of something easily understood **(Adel et al., 2018)**.Researchers have studied the perception of AI in healthcare professionals, finding that they generally have a positive attitude towards AI and anticipate it to benefit their daily tasks; although they are aware of the issues it raises **(Maassen et al., 2021)**.

Intensive Care Units (ICUs) are vital services providing multidisciplinary care to critical patients. Nurses need comprehensive training to provide quality care and safety. Health organizations should encourage appropriate training and develop competencies to ensure teamwork. Technology plays a vital role in ICUs, and it is important to assess nurses' perceptions of its effect on critical care units. This helps them enforce positive effects and reduce negative effects, ensuring optimal patient health status **(Almarhabi et al., 2021)**.

Applications of artificial intelligence

help with proactive patient care, future risk reduction, and improved operations. This technology aids in clinical decision-making, enabling nurses to create personalized care plans, reduce documentation time, and improve accuracy and completeness in nursing care **(Joseph et al., 2020)**.

The use of artificial intelligence in healthcare is regarded as a priority in national health policies to address challenges such as pandemics, rising healthcare costs, staff shortages, burnout, and an increasingly elderly population with more complex health needs **(Peek & Sujan 2020 ; Joshi & Morley, 2019)**.

Over 200 medical devices utilizing machine learning which is a type of AI got regulatory clearance in Europe and the United States between 2015 and 2020 **(Muehlematter et al., 2021)**. AI technologies are anticipated to be included in all sectors of healthcare, such as ambulance services triage **(Blomberg et al., 2019)**, sepsis management **(Komorowski et al., 2018)**, palliative care **(Avati et al., 2018)** and mental health **(Fitzpatrick et al., 2017),** and for diagnostic purposes as cancer screening **(McKinney et al., 2020)**.

The impact of AI in healthcare is unclear due to its limited use, weak evidence base, and potential bias in retrospective studies **(Nagendran et al., 2020 &Wu et al., 2021)**.

Nowadays, AI is significantly impacting nursing practice through the use of robots in drug dispensing, bots for special needs, and decision-making systems for nursing diagnosis, planning, and intervention. **(Booth et al., 2021)**. Intensive Care nurses are crucial in nursing care delivery, but current research mainly focuses on AI applications and their integration, without examining the understanding and readiness of practitioners to incorporate AI into their daily practices. Few studies have explored this topic **(Maskara et al., 2017)**.So; the researchers are interested to study intensive care nurses' perception regarding artificial intelligence applications.

Significance of the study:

Artificial intelligence technologies, particularly in healthcare, are increasingly being utilized in various organizations and social sectors, potentially altering patient care and administrative procedures. Due to the increasing complexity and variety of data in healthcare operations, artificial intelligence will be increasingly used in

diagnosis and treatment **(Davenport & Kalakota, 2019)**.

The advancement of artificial intelligence technology in healthcare has significantly improved cost, quality, and care outcomes, while also facilitating efficient data analysis, but few studies have explored employees' perceptions of these technologies **(Shaik, 2020)**.

Egypt is embracing artificial intelligence and technology in various sectors, including healthcare, to achieve Vision 2030. The government is actively supporting AI growth through research and development, with a public objective of 7.7% of Egyptian Gross Domestic Product being generated from AI and robots by 2030. This move aims to create a society driven by AI and robotics **(Egypt's Artificial Intelligence Future, 2020)**.So that, the importance of the present study is to enhance intensive care nurses' perception regarding artificial intelligence applications through help nurses to enforce on negative aspects effects in order to ensure optimal patients' health status.

The aim of the study:

The present research aimed to identify the intensive care nurses' knowledge and perception regarding artificial intelligence applications.

Research questions:

In order to achieve the current study's aim, the following research questions were developed:

1. What are the intensive care nurses' levels of knowledge regarding artificial intelligence applications?
2. What are the intensive care nurses' levels of perception regarding artificial intelligence applications?

3. Subject and Methods:

Research Design:

To achieve the aim of the current study, a descriptive design was used. Descriptive research is a type of designs in which the research explores, and explains an individual, group, or a situation **(Hunter, 2019)**.

Research Setting:

The current study was conducted at Intensive Care Unit at Suez-Canal and Ain Shams University Hospitals.

The major Intensive Care Unit at Suez-Canal University Hospitals, Ismailia governorate, contains sixteen beds; Neuro-Critical Care Unit contains two beds, and the

Cardiac Care Units (CCU) consisted of 18 beds.

Ain Shams University Hospitals contain; Major Intensive Care Unit (A&B) which contains 32 beds with 16 for each one; Neuro-Stroke Critical Care Unit contains 12 beds, and Cardiac Care Units (CCU) contains 19 beds, and the Cardiac Care Unit (CCU) of the Cardiothoracic Academy affiliated to Ain Shams University Hospitals that contains 20 beds.

The researchers chose only these ICUs with exclusion of respiratory ICU and Surgical ICU at Al-Demerdash University Hospitals, as they are similar to those of Ismailia University Hospitals and avoid difference in artificial intelligence applications in these settings that may negatively affect the study results.

Subjects:

Convenient sample made up of all nurses employed by Suez-Canal and Ain Shams University Hospitals in intensive care units at the time of data collection, with a total of 160 nurses volunteering to take part in the research.

Sample size:

$$n = \frac{N \times p\,(1-p)}{[(N-1) \times (d^2 \div Z^2) + (p\,(1-p))]}$$

n=Sample size= 159.9 ~ 160

N= Total society size = 255

D= Error percentage= (0.05)

P= Percentage of availability of the character and objectivity (Probability) = (50%)

Z= The corresponding standard class of significance

(Confidence level) 95%= (1.96) **(Thompson, 2012)**.

Tools of data collection:

The following two tools were used to gather data required for the study:

Tool (I): Self-administered artificial intelligence knowledge questionnaire:

This questionnaire was used to assess intensive care nurses' knowledge of artificial intelligence. It was composed of two parts as follows:

The first part: Personal data: it included seven items as follow; age, gender, educational qualifications, work place, years of experience and hospital setting.

The second part: Intensive care nurses' knowledge regarding artificial intelligence applications: it was developed by the researchers after reviewing recent relevant literature **(Lennartz et al., 2021; Shinners et al., 2021; & Shimon et al., 2021)** to assess the artificial intelligence knowledge levels of

nurses in Intensive Care Unit.

The tool contained 35 items of three different types: true and false (15 items), multiple-choice (10 items), and match (10 items). All items were divided into seven categories: 1) definition, 2) importance and benefits, 3) core components and characteristics, 4) barriers, 5) role and strategies, 6) principles, and 7) applications.

Scoring system:

Each true or false, multiple-choice, and match items received a "one" if it was correct and a "zero" if it was incorrect. The Intensive Care Unit nursing staff was considered to have satisfactory artificial intelligence knowledge if the percent score was 80% or higher and unsatisfactory artificial intelligence knowledge if the percent score was less than 80% (**Jiang et al., 2017**).

Tool (II): Nurses' Perception regarding artificial intelligence applications:

It was developed by **Abdullah & Fakieh, (2020)** to identify intensive care nurses' perception levels regarding artificial intelligence applications. This scale includes 14 items classified under three subscales; Subscale one: knowledge of nurses about AI. It contains 4 items. Subscale two: Advantages of using AI. It contains 5 items. Subscale three: Problems of application of AI in health care. It includes 5 items.

Scoring system:

Scoring of perception of AI scale was as follows through five point Likert scale; (1) for strongly disagree, (2) for Agree, (3) for Neutral, (4) for Agree and (5) for strongly agree". The sums of the scores according to the three subscale; were as follows 0 - ≤ 40 was considered as low perception, a score of 41 - ≤ 80 was considered as moderate perception level and a score of ≥ 81 was considered as high perception **(Elsayed & Sleem, 2021)**.

Tools validity:

All of the research tools were translated into Arabic and retranslated into English by the researchers and a language expert before being presented to a bilingual group of five experts in medical surgical and critical care nursing department (2 professors and 3 assistant professors) at the Faculty of Nursing in Suez-Canal and Helwan University for face and content validation. Minor adjustments were made, and the tools

were deemed valid from their perspective.

Tools reliability:

The Cronbach's alpha coefficient reliability test showed good internal consistency of the tool, with self-administered AI knowledge questionnaire scoring 0.79 and perception about AI applications questionnaire scoring 0.85.

Pilot study:

A pilot study was conducted on 16 nurses in the Intensive Care Unit, representing 10% of the total study sample, to assess the tools' clarity, feasibility, applicability, and time required. The study included the pilot nurses and the questionnaire remained unchanged due to positive feedback, taking place in April 2023.

Ethical considerations:

The Faculty of Nursing at Helwan University granted ethical approval for a study with code no (33) with date 29/3/2023. Official approvals from hospital authorities were obtained. Informed consent was obtained from participating nurses in the Intensive Care Unit, ensuring understanding of the study's purpose, rights to participate or withdraw, and data confidentiality. Anonymity was maintained, and no coercion or pressure was applied. Data was declared confidential and used only for research purposes.

Field work:

An approval was obtained from a scientific ethical committee of the faculty of nursing at Helwan University. Testing the validity of the proposed tools using content and face validity added for testing the reliability. The directors of chosen settings received a letter outlining the goals and procedures for data collection from the dean of the nursing faculty at Suez-Canal and Ain Shams University Hospitals. The researchers introduced themselves to the study sample, explained the aim of the study, and how to fill-in the study tools. Written consent was obtained from volunteered participated ICU nurses to complete the study. The researchers met the nurses in Intensive Care Unit either individually or in groups throughout different shifts to distribute the questionnaires during meetings. The nurses in ICU filled-in the tools individually at once and some of them read the questionnaires and fixed another time to fill them. Filling the questionnaire

required from 10-15 minutes. The researchers were available during data collection to explain any interpretation from the study sample. The data collection process started from the May 2023 to the middle of July, 2023. The researchers visited the selected settings two days per week for each hospital during the morning and afternoon shifts. The average number of nurses who answered the questionnaire was ranged from three to five nurses per day.

Statistical analysis:

The study utilized SPSS ver. 32 for data entry and statistical analysis, presenting data in descriptive forms like frequencies, percentages, and chi-square. Spearman correlation analysis Co-efficient was used to assess relationships among quantitative variables, with statistical significance at a P-value of ≤ 0.05.

4. Results:

Table (1): Shows that the nurses' personal data in the Intensive Care Unit. It illustrates that 41.25 % of the nurses in the studied sample were at age group 20: < 25 years old. Also, 51.3% & 57.5% of the studied nurses were female and had technical institute of nursing respectively. Additionally, 90% of intensive care nurses working in main ICU. Considering years of experience in ICU, 46.3% of intensive care nurses have experience <3 years. Moreover, equal percentage (50%) of the nurses in the Intensive Care Unit from Suez-Canal and Ain Shams University Hospitals.

Figure (1): Clarifies that the more than 66.2% of nurses had unsatisfactory level of knowledge about artificial intelligence applications in ICU, and 33. 8 % of them had satisfactory level knowledge about artificial intelligence applications in ICU.

Table (2): Illustrates that the intensive care nurses' perceptions regarding applications of artificial intelligence; there is nearly one-third of nurses in the Intensive Care Unit disagreed toward artificial intelligence in relation to knowledge, advantages and problems of AI applications in health care setting with percentage (38.75%, 42.5% & 31.25%) respectively.

Figure (2): Shows that 82.75% of the studied nurses had moderate perception level about artificial intelligence applications in ICU; and only 5.0 % had low perception level about artificial intelligence applications in

ICU.

Table (3): Demonstrate that there are a statistical significance differences between the intensive care nurses' perception level regarding artificial intelligence applications in health care setting with age, educational qualifications, and years of experience in ICU with P value =0.048*, 0.000* & 0.005* respectively. As well, there are no statistical significance differences between the ICU nurses' perception level toward applications of artificial intelligence in health care with gender and hospitals setting (0.067 & 0.883) respectively.

Table (4): Illustrates that the correlational between the total knowledge and perception among the intensive care nurses. It clarifies that there is a highly statistically positive correlation between total knowledge and perception among the intensive care nurses (at p= 0.000**).

4. Discussion:

Artificial intelligence is revolutionizing healthcare by enhancing nurses' roles and patient care. It aids in information synthesis, task completion, clinical problem-solving, decision-making, and patient outcomes. These technologies have the potential to advance healthcare independently. Educating nurses on how to use technology will impact their professional identities and create opportunities for future improvements in productivity, capacity, quality, and healthcare **(Ronquillo, 2021)**. Technology perceptions can hinder implementation success, but studies on measurable differences in attitudes and perceptions among healthcare staff are lacking, highlighting the importance of understanding these factors. So the present study aimed to identify the intensive care nurses' perception regarding artificial intelligence applications.

Regarding personal data of the intensive care nurses, the results of the present study showed that more than half of the intensive care nurses were females, aged between 20: < 25 years old, had technical institute of nursing, the majority of nurses working at main ICU and nearly half of them had years of experience <3 yrs.

This result is in disagreement with the study by **Abd El-Monem et al.,(2023),** which examine " The Relationship Between Artificial Intelligence Technology and Staff Nurses' Professional Identity and Problem-

Solving Skills " indicated that more than two-fifths of staff nurses ranged in age between 25 to less than 30 years old. As well as their years of experience slightly less than two fifth of staff nurses had 5 to less than 10 years of experience.

These results contradicted with a study analysis "Effect of Artificial Intelligence Enhancement Programme on Managerial Competencies and Workplace Flourishing for Head Nurses" done by **Mohamed et al. (2023)**, who found that all nurses their age range from 40 to less than 50 years with a mean of 40.53±4.918 years. Most of nurses had a bachelor's degree in nursing, with 15 years of experience.

Concerning intensive care nurses' knowledge level about artificial intelligence applications; the current research reported that majority of nurses had unsatisfactory level of knowledge. This finding could be explained by the fact that the majority of nurses in the intensive care unit had not previously attended any artificial intelligence training courses and stated that the nursing curriculum did not include the fundamentals of AI. Because only a small percentage of the studied nurses claimed to have learned AI through postgraduate courses, they had no prior knowledge of artificial intelligence. Furthermore, the absence of such a training session is due to a lack of concern on the part of responsible hospital authorities.

This result was corresponding with finding of **Mohamed et al. (2023)**, who revealed that only a tiny percentage of head nurses had adequate knowledge of artificial intelligence prior to program implementation in their study. Also, in accordance with these results, **Lai, et al. (2020)**, confirmed a general deficiency of knowledge in the participants of AI in a study entitled "A Qualitative Survey Study of French Actors' Perceptions of AI in Healthcare".

Result of this study also corroborated with the findings of **Abuzaid et al. (2022)**,in a study titled "Artificial Intelligence Integration in Nursing Practice" who explored an inadequate understanding and knowledge of AI principles and technical potential in the nursing profession and concluded that higher education institutions and healthcare organizations must design and implement appropriate AI educational and training programs for nursing staff to improve their competency in promoting the safe integration and application of AI into nursing practice. Likewise; the majority of nursing staff

confirmed that basic AI knowledge should be addressed in nursing education and training courses.

Furthermore, **Zhang et al. (2022),** in the study " A sociotechnical Viewpoint on the Development and Application of Smart Glasses Technology for Emergency Medical Care", that investigated the use of artificial intelligence in clinical nursing among Chinese nursing staff and concludes that the study yielded excellent results and contributed to the use of artificial intelligence technology in clinical nursing, as well as recommending the development of effective application measures in tandem with the actual work content.

In addition, **Swan, (2021)**, who study "Registered Nurses' Knowledge and Perceptions of Artificial Intelligence in Nursing and Healthcare", in the United States and discovered that the majority of nurses were unaware of or did not understand AI applications in clinical practice.

On the other hand; this finding was contradicted with **Sabra et al. (2023)**, in their study titled "Artificial Intelligence Application in Healthcare: Nurses' Views and Attitudes", revealed that the participants had good knowledge about AI. This may reveal a positive support to change that is relatively typical in healthcare settings. As well, these findings contradict those of **Sheela, (2022)**, who found that, more than half of participants had prior knowledge of AI in his study" Nursing students' perspectives on artificial intelligence". This result answers the first question asking about the intensive care nurses' levels of knowledge regarding artificial intelligence applications.

In the contexts of intensive care nurses' levels of perception regarding artificial intelligence applications in relation to knowledge about AI. The present study findings indicated that one-third of nurses disagreed that AI applications could substitute them in their duty, while one-quarter of nurses agreed that they had high hopes about AI applications in the health care settings, and they had adequate knowledge about AI. From the researchers' point of view there was a positive support to change that is relatively typical in healthcare settings. Also, this may be due to the staff nurses use artificial intelligent technology in their daily life in the

form of smart phones and other devices and they became aware of the concept and importance of using AI in nursing settings, especially at the present time, after the existence of pandemics.

This result goes in line with **Sabra et al. (2023)**, who reported the similar findings. However, **Castagno & Khalifa, (2020)**, found that, more than two-thirds of subjects without any fear reported AI will substitute them at their work. Also, **Frey & Osborne, (2017)**, reported that slightly less than half of professions will be substituted by AI over some number of years, Also, **Smith & Anderson, (2017)**, demonstrated that two-thirds of Americans anticipate that within 50 years robots and processers will do much of the skills that done by persons now. Also, **Lai et al. (2020)** confirmed a general deficiency of knowledge on the participants of AI.

In relation to intensive care nurses' levels of perception regarding artificial intelligence applications in relation to advantages of using AI; the findings indicated that, two-thirds of nurses agreed that uses of AI can improve their practice in health care setting, help to decrease the number of medical mistakes, and offer clinically relevant, high-quality data. From the researchers' point of view, nurses consider AI technology is flexible enough to be used to every patient regardless the technology was created by experts with practical expertise in nursing.

Furthermore; this finding was supported by those of **Kwak et al. (2022)**, in his study which examines "The impact of self-efficacy, anxiety, attitude, and understanding of AI ethics on the behavioral intentions of nursing students ", who reported that positive attitudes towards AI initially expected its usage and application. As well, in a study identify "Attitudes of Nursing Managers Towards Making Nursing Decisions Using Artificial Intelligence" was done by **Mehdipour (2019)**, highlighted that nursing that use AI effectively, will be able to provide better, faster, and safer services.

These findings were congruent with **Shameer et al. (2018)** who found that AI can develop a huge amount of data in a correct, quick, and effective technique by using multifaceted statistical and computing algorithms. As well as, **Trivedi et al. (2018)** asserted that, AI can help in establishing of precise diagnoses and suitable treatment plans and offers assistance on the best treatments

for cancer and conducts genome analyses. In addition, **Vaananen et al. (2021)** reported that the use of AI may prevent medication errors such as drug overdoses.

The study finding was supported by **Gherheș, (2018)**, who conducted a study entitled "Perception, Expectations, Hopes, and Advantages of Artificial Intelligence" as reported that positive perceptions about the emergence and development of artificial intelligence entities/devices, the advantages it could bring in the future by creating advanced robots, surpassing human intelligence, allowing humans to control intelligent weapons, the emergence of new trades, the improvement of healthcare and human health, and the optimization of material resources.

In the same line, **Kumari & Hemalatha, (2021)** held a study about " Human Resources Management Practices' Perception of Artificial Intelligence: With Particular Reference to Chennai IT Companies" and demonstrated that employees don't view AI systems as a threat for them, and they have a very good image of the technology.

In the regard of intensive care nurses' levels of perception regarding artificial intelligence applications in relation to problems of applications in health care setting. The result showed that one-third of nurses agreed that AI is not flexible to be useful for every patient and difficult to apply to arguable issues. This result supported by **Oh et al. (2019)**, who reported that, nurses perceived that AI cannot implement to debatable subjects and that it would not be applied to each patient. Moreover; **Sabra et al. (2023)** revealed that, less than half of nurses, agreed that AI is inflexible and difficult to apply due to contentious problems. This result was agree with **Elsayed & Sleem, (2021)**, who found that perception of advantages toward using artificial intelligence achieved the highest mean score followed by the problems concerning artificial intelligence application in healthcare among nurse managers. Otherwise, **Abdullah & Fakieh, (2020)**, reported that the highest score was regarding problems concerning artificial intelligence application in healthcare followed by advantage toward using artificial intelligence among health care employees.

The advancement of artificial intelligence technology to additional adoption and value across healthcare is perpetuated by cost, quality, care outcomes, and helps to

analyze large amounts of data efficiently. However, few studies have investigated employee perceptions of artificial intelligence technology **(Shaik, 2020)**.

In terms of intensive care nurses' levels of perception regarding artificial intelligence applications, the current study findings indicated that more than two-thirds of nurses had moderate perception level about artificial intelligence applications in ICU, while, slightly one-fifth of nurses had low level of perception. From the researchers' opinion; this may be due to the widespread of artificial intelligence technology applications into every aspect of society in response to Egypt's Vision 2030 which focus on using artificial intelligence in a variety of working settings including health care sector.

The present study results supported by **Elsayed & Sleem, (2021)**, in a study entitled "Attitudes and Perceptions of Nurse Managers about The Use of AI in Healthcare Settings ", and reported that more than three-quarters of studied sample had moderate perception towards using AI in nursing setting. While the minority of nurses had high perception. Also, **Abdullah & Fakieh, (2020)**, conducted a study entitled " Perceptions of Artificial Intelligence Applications by Healthcare Workers: A Survey Study", demonstrated that the overall perception of health care employees toward AI was moderate. From the researchers' point of view; this may explained by the fact that Covid 19 providing opportunity for nurses to recognize the benefit of applying AI in nursing settings.

In the context of intensive care nurses' levels of perception regarding AI applications in relation to their personal data. There were statistically significant differences between intensive care nurses' levels of perception toward applications of artificial intelligence in health care setting and age, educational qualifications, in addition to years of experience in ICU. As well, there are no statistical significance differences between the intensive care nurses' perception level toward applications of artificial intelligence in health care with gender and hospitals setting.

According to correlation between intensive care nurses' total knowledge and perception regarding applications of artificial intelligence in health care; there was a highly statistically positive correlation between total knowledge and perception among the intensive care nurses. These findings were in congruent with **Elsayed and Sleem, (2021)**, who asserted that there is a significant

positive relation between education of nurse managers' demographic characteristics and their perception toward using AI. Moreover, in contrary, with **Sabra et al. (2023)**, who demonstrate that no significant difference found between nurses' perception toward AI and their qualifications, as well experiences. From the researchers' point of view; this result may due to that senior and junior nurses exposed to the same information and environmental incentives that influence way they think and their impression about AI. This result answers the second question asking about the intensive care nurses' levels of perception regarding artificial intelligence applications.

5. Conclusion:

Based on the study results, it was concluded that more than two-thirds of the intensive care nurses had unsatisfactory level of knowledge regarding artificial intelligence applications. Also, the majority of nurses had moderate perception level regarding artificial intelligence applications. Inaddition there were a statistical significance differences between the intensive care nurses' perception level toward applications of artificial intelligence in health care setting with age, educational qualifications, and years of experience in ICU. Moreover, there is highly statistically positive correlation between total knowledge and perception among the intensive care studied nurses.

6. Recommendations:

Based on the findings of the current study, the researchers suggested the following recommendations**:**

- Preparing and distributing a manual about artificial intelligence applications among health care providers, to raise their awareness about AI applications in health care settings.
- Provide appropriate information about the benefits, challenges, and issues surrounding the implementation of artificial intelligence in nursing settings and the potentials of these technologies to improve health care services and efficiencies.
- Conduct a scientific study focusing on AI in healthcare at Egypt in different settings and to provide more representative results.
- In-service training programs should be organized to foster problem solving skills of nurses regarding artificial

intelligence applications in the clinical environment.

- Further study is recommended to identify barriers affecting utilization of artificial intelligence in health care settings.

Table (1): Personal data of the intensive care nurses percentage distribution (N= 160)

Personal data	N	%
Age (Years):		
20: < 25	66	41.25
25: < 30	62	38.75
30: < 35	24	15
≥35	8	5
Gender:		
Male	78	48.5
Female	82	51.3
Educational qualifications:		
Nursing school	18	11.25
Technical institute of nursing	92	57.5
Bachelor degree of nursing	32	20
Postgraduate studies in nursing	18	11.25
Work place:		
Main ICU	144	90
Neurologic ICU	8	5
CCU	8	5
Years of experience in ICU:		
<3 yrs.	74	46.3
3<6 yrs.	46	28.8
6<9 yrs.	30	18.8
9 yrs.>	10	6.3
Hospitals setting:		
Suez-Canal University Hospital	80	50
Ain shams University Hospital	80	50

Figure (1): Total intensive care nurses' knowledge level regarding artificial intelligence applications (N= 160)

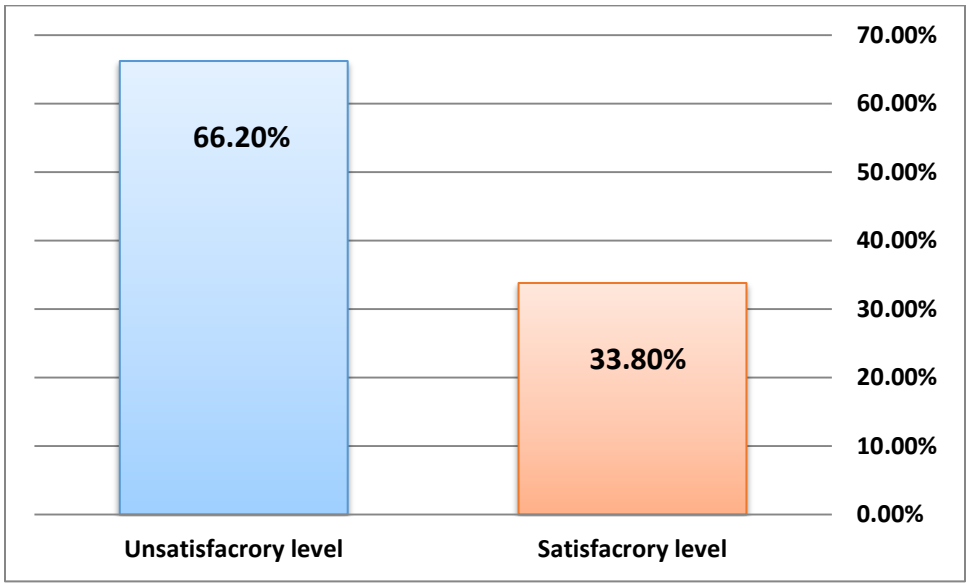

Table (2): Intensive care nurses' perception regarding applications of artificial intelligence (N= 160)

ICU nurses' perception about AI	Strongly agree		Agree		Neutral		Disagree		Strongly disagree	
	N	%	N	%	N	%	N	%	N	%
Knowledge about AI	8	5	14	8.75	25	15.63	62	**38.75**	51	31.88
Advantages of using AI	20	12.25	18	11.25	24	15	68	**42.5**	30	18.75
Problems of AI applications in health care	30	18.75	35	21.88	37	23.13	50	**31.25**	8	5
Total	19	11.88	22	13.75	29	18.13	60	**37.5**	30	18.75

Figure (2): Total intensive care nurses' perception levels regarding artificial intelligence applications in ICU (N= 160)

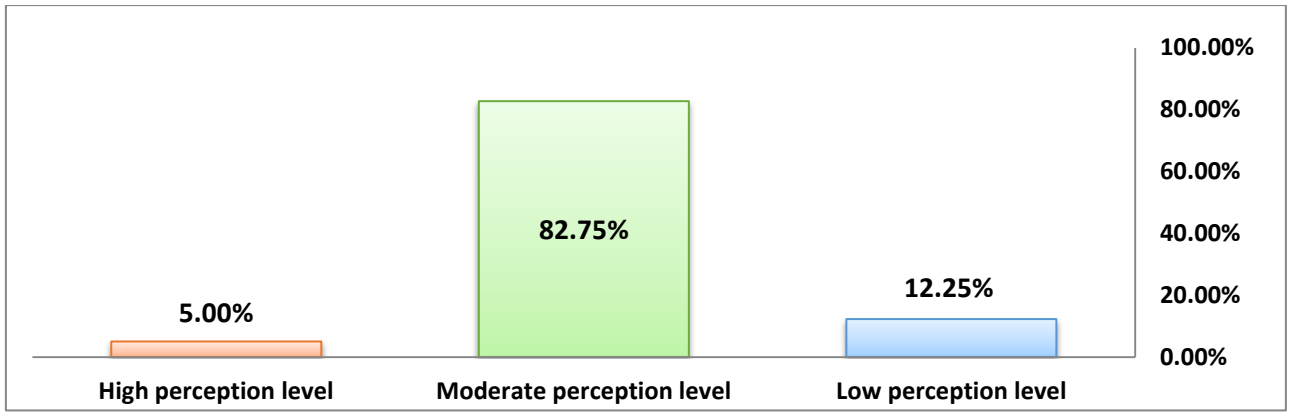

Table (3): Relation between intensive care nurses' perception regarding applications of artificial intelligence in health care and personal data (N= 160)

Personal data	Intensive care nurses' perception regarding AI applications						χ2 (mc)	P-value
	Low		Moderate		High			
	N	%	N	%	N	%		
Age (Years):								
20: < 25	3	15.0	32	44.44	4	50.0	0.852	0.048*
25: < 30	5	25.0	20	27.77	3	37.5		
30: < 35	5	25.0	6	8.33	1	12.5		
≥35	7	35.0	4	5.55	0	0		
Gender:								
Male	9	45.0	32	44.44	6	75.0	0.527	0.067
Female	11	55.0	40	55.56	2	25.0		
Educational qualifications:								
Nursing school	8	40.0	9	12.5	0	0	0.611	0.000*
Technical institute of nursing	7	35.0	11	15.75	0	0		
Bachelor degree of nursing	5	25.0	13	18.06	2	25.0		
Postgraduate studies in nursing	0	0	39	54.17	6	75.0		
Years of experience in ICU:								
<3 yrs	2	10.0	20	27.77	6	75.0	0.375	0.005*
3<6 yrs	4	20.0	24	33.33	2	25.0		
6<9 yrs	6	30.0	16	22.22	0	0		
> 9 yrs	8	40.0	12	16.67	0	0		
Hospitals setting:								
Suez-Canal University Hospital	9	45	35	48.61	4	50	0.292	0.883
Ain shams University Hospital	11	55	37	51.38	4	50		

Table (4): Correlation between intensive care nurses' total knowledge and perception regarding applications of artificial intelligence in health care (N= 160)

Items		Total knowledge	Total perception
Total knowledge	**R**	**-**	**0.926**
	P-value	**-**	**0.000****
Total perception	**R**	**0.918**	**-**
	P-value	**0.000****	**-**

**Highly significant p ≤ 0.01 r- Pearson correlation coefficient

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