

Health care providers' perception about artificial intelligence applications

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Abstract

Background: The development of health care information technology and the emergence of artificial intelligence have yielded tools to improve the quality of several health care processes. **Aim:** to assess the health care providers' perception about artificial intelligence applications at Main Assiut University Hospital. **Study design:** A descriptive survey design was used. **Setting:** This study was conducted at Main Assiut University Hospital. **Subjects:** the study subjects included three types of health care providers (no=763): physicians (no=202), nurses (no=535), and technicians (no=26). **Data collection tool:** The study data collected through self – administered questionnaire which consists of personal characteristics data and perception about artificial intelligence questionnaire. **Results:** The overall perception of studied healthcare providers about artificial intelligence applications was moderate. The highest percentage of studied Physicians had a high level of perception about artificial intelligence applications. The highest percentage of studied Nurses had a moderate level of perception. The highest percentage of studied Technicians had an equal percent of both high and moderate level of perception. **Conclusions:** There were highly statistical significant differences between the perception levels about artificial intelligence applications with job type and educational qualification. There were no statistical significant differences between the perception levels about artificial intelligence applications with age, gender, and years of experience. **Recommendations:** Convey workshops and training programs for health care providers to educate them about artificial intelligence potential applications and synergies & preparing and distributing a manual about artificial intelligence among health care providers.

Keywords: *Artificial intelligence, Healthcare providers & Perception.*

Introduction:

Artificial intelligence (AI) is a broad terminology that refers to computer software that uses a complex mathematical algorithm to process data and produce pre-defined outputs that lead to relevant outcomes. Algorithms and machine learning are used by AI to evaluate and interpret data, provide personalized experience and automate repetitive and expensive health care operations (Lee & Yoon, 2021).

AI technologies are becoming more widely used in a variety of organizations and social sectors, including healthcare. Where, these technologies have the ability to make transformation on many aspects of patient care, as well as administrative processes among providers, payers, and pharmaceutical organizations. Because of the complexity and rise of data in healthcare operations, artificial intelligence will be used more frequently within this field mainly in diagnosis and treatment (Davenport & Kalakota, 2019).

Monitoring and assisting in documenting patient data, reporting forms, managing quality and minimizing hospitalization time, enhancing care efficacy and performing interventions at the appropriate time, cost effective and time saving, and assisting in the

documentation of patient information are some of the applications of artificial intelligence that could be used in nursing information systems. As with any technology, successful AI-based decision support systems for nursing face numerous barriers. These barriers and challenges include technological constraints, the system's elevated costs, and the continuous updates (Mehdipour, 2019).

AI has been used in medicine and a variety of healthcare services, including diagnostic imaging, genetic diagnosis, clinical laboratory, screening, and health communications. These systems assist physicians by delivering relevant medical information to prevent diagnostic and treatment errors, as well as alerts about any high-risk health outcomes (Jiang et al., 2017).

During the current COVID-19 (Coronavirus) pandemic, medical organizations are looking for new technologies to control and monitor the spread of the virus. Artificial intelligence is one of the technologies that can easily manage coronavirus spread by detecting high-risk patients. It can also be used to control the spread of the infection in real-time.

By correctly assessing a patient's medical history, AI can also predict the probability of mortality. It is also

critical in the fight against the virus, as it involves population screening, notification, medical assistance, and infection control recommendations (Haleem, et al., (2020), Bai, et al., (2020) & Hu, et al., (2020).

Artificial intelligence technologies were developed to provide practical benefits in a variety of fields, including health care. The replication of human intellectual functions is a typical aspect of AI. From the health care perspective, AI brings a "paradigm change to health care, powered by increasing availability of health care data and rapid progress of analytics techniques" (Wu et al., 2019).

In order to deliver the best quality of health care, health care systems in several nations have recently begun to rely on the storage of patient data. Health care information technology systems, as a result of rapid technological advancements, now have the capacity to hold massive amounts of patient data; however, proper use of this data is required to improve health care quality, improve decision-making, and lower costs. During the last decade, artificial intelligence (AI) has provided significant advancements in this area (Lovis, 2019).

Significance of the study

In a time of rapid healthcare transition, health organizations must respond rapidly to evolving technologies, regulations, and customer demand. Artificial intelligence helps in proactive patient care, decreased future risk, and updated work processes. The development of artificial intelligence technology to additional adoption and value across healthcare is maintained by cost, quality, and care outcomes (Commins, 2019).

While reviewing the literatures, the researcher found that there were four international studies published in professional articles and journals in the field of healthcare, the first one titled as " A study on the perception of medical professionals toward artificial intelligence " done by Maskara et al., (2017), the second one titled as " Physician Confidence in Artificial Intelligence: An Online Mobile Survey " done by Oh et al., (2019), the third one titled as " Physician perspectives on integration of artificial intelligence into diagnostic pathology " done by Sarwar et al., (2019), and lastly the fourth one in Saudi Arabia was performed by Abdullah & Fakhieh, (2020) titled as " Health Care Employees' Perceptions of the Use of Artificial Intelligence Applications: Survey Study ".

While there were only two national studies, the first one titled as " Artificial intelligence as an innovative approach for investment in the future of healthcare in Egypt " was done by Taie, (2020) and the second one titled as "Nurse Managers' perception and Attitudes Toward Using Artificial Intelligence

Technology in Health Settings " was done by Elsayed & Sleem, (2021).

Although these studies concentrated on the employee perceptions of AI implementation in their fields, the influence of different job types was not considered in Egypt. Although AI application (Health Information System) on small episode was recently started at Assiut University Hospital (EL-Rajhy Hospital and Heart Hospital), there is no studies conducted to study healthcare providers' perception about artificial intelligence applications so; the researcher decided to assess health care providers' perception about artificial intelligence applications at Main Assiut University Hospital.

Aims of the study

The present study was conducted at Main Assiut University Hospital to fulfill the following objectives:

1. Assess healthcare providers' perception about artificial intelligence applications.
2. Identify the difference among healthcare providers' perception levels about artificial intelligence applications.

Research questions

To fulfill the aims of the present study, the following research questions were formulated:

- Q1. What is the level of healthcare providers' perception about artificial intelligence applications at Main Assiut University Hospital?
- Q2. Is there a significance difference among healthcare providers' perception about artificial intelligence applications?
- Q3. Does job type influence perception of AI applications in the workplace?

Subjects and Methods

Technical design

This design was involved the research design, setting, subjects, and data collection tool.

Study design

A descriptive survey design was used to carry out the present study.

Study setting

The study was conducted at Main Assiut University Hospital including all departments of the hospital and special units with total beds number (1516) which classified as follow: medical units (140) beds, surgical unit (255) beds, intensive care units (173) beds and other units (special treatment units, postoperative care units, emergency care units, operation room, trauma units) (948) beds.

Subjects:

The study subjects consisted of (763) randomly selected from the total number of health care providers (no= 2239) working at Main Assiut University Hospital. The sample included three types of health care providers: physicians (no=202), nurses (no=535),

and technicians (no=26). Adequate sample size was selected by using **Thompson equation (2006)**.

$$p(D_0 = d_0) = \prod_{k=1}^K \left(\frac{1}{\binom{N}{n_{0k}}} \prod_{t=0}^{n_k - n_{0k}} q_{k,t,i} \right)$$

The study subjects and sample were selected by using electronic calculator as follows:

Health care providers	Total	Sample selected
Physicians:		
Resident physicians	408	139
Assistant lecturers	185	63
Nurses:		
Nurse managers	147	50
Staff nurses	1427	485
Technicians:		
Lab technicians	36	13
Radiology technicians	36	13
Total	2239	763

Data collection tool

The data needed for the study was collected using self-administered questionnaires, it comprised of two parts:

1st part: Personal characteristics data sheet which included data about; age, gender, educational qualification, current job title and years of experience.

2nd part: Perception about artificial intelligence questionnaire:

The questionnaire was adapted from **Oh et al, 2019** and modified by researcher including changing the questions from multiple choice to a Likert scale and omitting questions related to pure medicine, to become suitable to carry out the present study as the original questionnaire targeted doctors. It consisted of 42 items to assess health care providers' perception about artificial intelligence applications.

Scoring system:

The responding scoring system was measured on 3-point Likert scale. Ranging from; **(0)** for disagree, **(1)** for neutral, and **(2)** for agree. The scores of the items were summed-up and then converted into a percent score. A score less than or equal **40 %** considered as low perception, a score from **41% to 80%** considered as moderate perception, and a score equal or more than **81%** considered as high perception.

Administrative design:

An official approval to carry out this study was obtained from the Dean of Faculty of Nursing, Director of Main Assuit University Hospital, Nursing Director, participated health care providers of each department at Main Assuit University Hospital to be able to collect the necessary data for the present study.

Ethical Consideration:

Research proposal was approved by Ethical Committee at Faculty of Nursing, Assiut University, there is no risk for study participants during application of the research, oral agreement was taken from the participants in the study, Study participants have the right to refuse or to participate and/or withdraw from the study without any rational at any time, confidentiality and anonymity of obtained data were assured, the study was followed common ethical principles in clinical research and study participants' privacy was considered during collection of data.

Operational design:

The study was conducted throughout three main phases: 1st preparatory, 2nd pilot study, and 3rd data collection described as:

Preparatory phase

- This phase took about four months from May 2021 to August 2021 to end the proposal of the study.
- After reviewing the available literatures concerning the topic of the study, an Arabic translation of the study tool was done.
- The face validity (Jury) of the study tool was reviewed by the five experts (three Professors, one Assistant Professor and one lecturer) of the Nursing Administration Department, Faculty of Nursing, Assiut University.

Pilot study:

A pilot study was carried out before starting actual data collection to ensure the clarity, accessibility, understandability of the study tools and for time estimation before actual data collection. Moreover, to identify problems that may be encountered during the actual data collection. It was applied on seventy-seven healthcare providers which represent (10%) from total sample of studied participants. The data obtained from the pilot study was analyzed and no changes were done for the study tool, so healthcare providers included in the pilot study were included in the total studied healthcare providers.

The study tool was tested for its reliability by using Cronbach's Alpha Co-efficient test, it was ($\alpha=0.979$). Thus indicates a high degree of reliability for the study tools.

Data collection:

The researcher met with healthcare providers included in the study according to their schedules (morning, evening and night shift) to explain the purpose of the study ask them for participation. After obtaining oral agreement, the study tool was handled to the participated healthcare providers to be filled. Each participant took about fifteen minutes to fulfill the questionnaire. The whole duration for data collection took about four months from September 2021 to December 2021.

Statistical design:

Data entry and statistical analysis were done using the SPSS ver. 25 program Statistical Soft Ware Package for Social Science. Data was presented using descriptive statistics in the form of frequencies, percentages, mean, chi- square and standard deviation. Spearman correlation analysis Co-efficient was used for the assessment of the inter- relations among quantitative variables. Statistical significance was considered at P- value ≤ 0.05 .

Results:

Table (1): Distribution of personal characteristics of the studied healthcare providers working at Main Assiut University Hospital (n=763).

Personal data	Occupation							
	Physicians (n=202)		Nurses (n=535)		Technicians (n=26)		Total	
	No	%	No	%	No	%	No	%
Age: (years)								
< 30	140	69.3	364	68	16	61.5	520	68.1%
30 - < 40	54	26.7	119	22.2	7	27	180	23.6%
≥ 40	8	4	52	9.8	3	11.5	63	8.3%
Mean \pm SD (Range)	28.81 \pm 7.73 (20.0-60.0)							
Gender:								
Male	80	39.6	136	25.4	7	27	223	29.2%
Female	122	60.4	399	74.6	19	73	540	70.8%
Job type:								
Resident Physician	139	68.8	0.0	0.0	0.0	0.0	139	18.2%
Assistant Lecturer	63	31.2	0.0	0.0	0.0	0.0	63	8.3%
Nurse Manager	0.0	0.0	50	9.3	0.0	0.0	50	6.5%
Staff Nurse	0.0	0.0	485	90.7	0.0	0.0	485	63.6%
Lab Technician	0.0	0.0	0.0	0.0	13	50	13	1.7%
Radiology Technician	0.0	0.0	0.0	0.0	13	50	13	1.7%
Educational qualification:								
Diploma degree	0.0	0.0	485	90.6	26	100	511	67%
Bachelor degree	120	59.4	40	7.5	0.0	0.0	160	21%
Post-graduates	82	40.6	10	1.9	0.0	0.0	92	12%
Years of experience:								
< 10	194	96	364	68	16	61.5	574	75%
10 - < 20	8	4	116	21.7	7	27	131	17%
≥ 20	0.0	0.0	55	10.3	3	11.5	58	8%
Mean \pm SD (Range)	10.05 \pm 7.68 (2.0-40.0)							

Table (2): Percentage distribution of healthcare providers' perception about artificial intelligence applications (n=763).

	Disagree		Neutral		Agree		Mean \pm SD
	No.	%	No.	%	No.	%	
1. AI will not replace health care providers; but it will be used in work.	102	13.3	112	14.7	549	72.0	1.59 \pm 0.72
2. AI can give health care providers more time with patients.	102	13.3	112	14.7	549	72.0	1.60 \pm 0.72
3. AI helps health care providers to increase efficiency and make more precise decisions for their patients.	73	9.6	100	13.1	590	77.3	1.68 \pm 0.64
4. AI helps health care providers in making their daily to-do lists, also continuously assess the quality of health care and redirect them accordingly.	65	8.5	186	24.4	512	67.1	1.59 \pm 0.64
5. AI improves the quality of health care, which in turn will increase patient safety and satisfaction.	88	11.5	86	11.3	589	77.2	1.66 \pm 0.68
6. Health care provider will eventually become higher-level delegator.	417	54.6	131	17.2	215	28.2	0.74 \pm 0.87
7. AI will introduce a new role in health care, which is to ensure the patient's quality of care through collaboration with healthcare workers using updated technologies.	96	12.6	58	7.6	609	79.8	1.67 \pm 0.69
8. AI will help the health care providers to improve work and patient relationships.	443	58.1	113	14.8	207	27.1	0.69 \pm 0.87
9. A future of electronic health and hospital systems will mean health care providers can obtain feedback from patients and can offer them needed advice.	60	7.8	263	34.5	440	57.7	1.50 \pm 0.64
10. AI will negatively affect the health care providers - patient relationship.	277	36.3	248	32.5	238	31.2	0.95 \pm 0.82
11. The new generation of health care providers highly uses technology in their life, so they will be motivated to work within a technology-enabled environment.	58	7.6	122	16.0	583	76.4	1.69 \pm 0.61
12. Medication management, disinfection, carrying medical devices, lifting bedridden patients, navigating, and greeting patients and relatives in the hospital are all tasks that robots could support.	161	21.1	304	39.8	298	39.1	1.18 \pm 0.76
13. There are amazing innovations as a 3D print in healthcare can improve health care providers' jobs.	562	73.7	101	13.2	100	13.1	0.39 \pm 0.71
14. Virtual simulations could support the training phase of health care providers, preparing them for emergencies such as a cardiac arrest.	549	72.0	122	16.0	92	12	0.40 \pm 0.69
15. Virtual reality could become an excellent tool for health care providers to alleviate chronic pain for patients.	259	34	232	30.4	272	35.6	1.02 \pm 0.84
16. As health care requires refined social skills, a high level of empathy and emotional intelligence, robots, or smart algorithms aren't likely to fill up the field any time soon.	382	50.1	116	15.2	265	34.7	0.85 \pm 0.91
17. It will be difficult to totally replace health care providers' consultation with digital tools because digitals cannot imitate health care providers' nonverbal communication.	125	16.4	282	36.9	356	46.7	1.30 \pm 0.73
18. Health care provider's judgment is a vital part of clinical activity and the essence of being a health care provider.	121	15.9	179	23.5	463	60.6	1.45 \pm 0.75
19. AI reduces the trust and quality of the health care providers/ patients relationship.	124	16.3	282	37.0	357	46.7	1.31 \pm 0.73

	Disagree		Neutral		Agree		Mean \pm SD
	No.	%	No.	%	No.	%	
20.If there is a contrast between health care providers and AI opinion, the opinion of health care providers will be considered as 'right'.	50	6.5	57	7.5	656	86.0	1.79 \pm 0.54
21.Cannot definitely identify responsible for causing harm caused by AI mistakes may include the computer programmer or the clinician and others.	179	23.5	207	27.1	377	49.4	1.26 \pm 0.81
22.AI will decrease health care providers/ patients face-to-face contact, which will reduce health promotion interventions.	82	10.7	80	10.5	601	78.8	1.68 \pm 0.66
23.AI can use high-fidelity simulations and developing clinical scenarios to enhance health care providers ' training.	136	17.8	174	22.8	453	59.4	1.42 \pm 0.78
24.Health care providers and patients should be engaged together in the treatment decisions and journey.	75	9.8	199	26.1	489	64.1	1.54 \pm 0.67
25.AI helps to reduce human diagnostic and therapeutic errors.	72	9.4	97	12.7	594	77.9	1.68 \pm 0.64
26.AI helps health care providers in all medical and nursing fields.	191	25.0	222	29.1	350	45.9	1.21 \pm 0.82
27.AI has low ability to sympathize and consider the emotional well-being of the patient.	150	19.7	146	19.1	467	61.2	1.42 \pm 0.80
28.AI helps in offering unified patient care.	124	16.3	282	36.9	357	46.8	1.31 \pm 0.73
29.AI, as telemedicine provides patients' consultations all over the day and anywhere.	124	16.3	203	26.6	436	57.1	1.41 \pm 0.75
30.Unsafe AI could harm patients in the healthcare system by using misleading algorithms.	97	12.7	211	27.7	455	59.6	1.47 \pm 0.71
31.It is difficult to compromise between medical advice and the patient's wishes.	142	18.6	289	37.9	332	43.5	1.25 \pm 0.75
32.Healthcare professionals will become increasingly dependent on computer a algorithm, which in turn decreases their clinical practice.	50	6.5	57	7.5	656	86.0	1.79 \pm 0.54
33.The degree of trust in technology and healthcare professionals may differ between individuals and generations.	57	7.5	193	25.3	513	67.2	1.60 \pm 0.63
34.Using AI as in telehealth may promote patients' health and supported self-care.	83	10.9	238	31.2	442	57.9	1.47 \pm 0.68
35.AI has no space-time constraint.	142	18.6	289	37.9	332	43.5	1.25 \pm 0.75
36.Applications of AI cannot be used to provide opinions in unpredicted situations.	93	12.2	198	25.9	472	61.9	1.50 \pm 0.70
37.It is difficult to apply to all patients.	42	5.5	194	25.4	527	69.1	1.64 \pm 0.59
38.It is difficult to apply AI to controversial subjects.	47	6.2	252	33.0	464	60.8	1.55 \pm 0.61
39.If there is a contrast between health care providers and AI opinion, the AI opinion will be considered as right.	466	61.1	207	27.1	90	11.8	0.51 \pm 0.70
40.Computers can be hacked, which can lead to health care problems.	50	6.5	57	7.5	656	86.0	1.79 \pm 0.54
41.AI can deliver clinically relevant, vast amounts of high – quality data in real time.	142	18.6	289	37.9	332	43.5	1.25 \pm 0.75
42.AI was developed by a specialist with little clinical experience in medical and nursing practice.	76	10.0	100	13.1	587	76.9	1.67 \pm 0.65
Total	56.66 \pm 9.05 (15.0-75.0)						

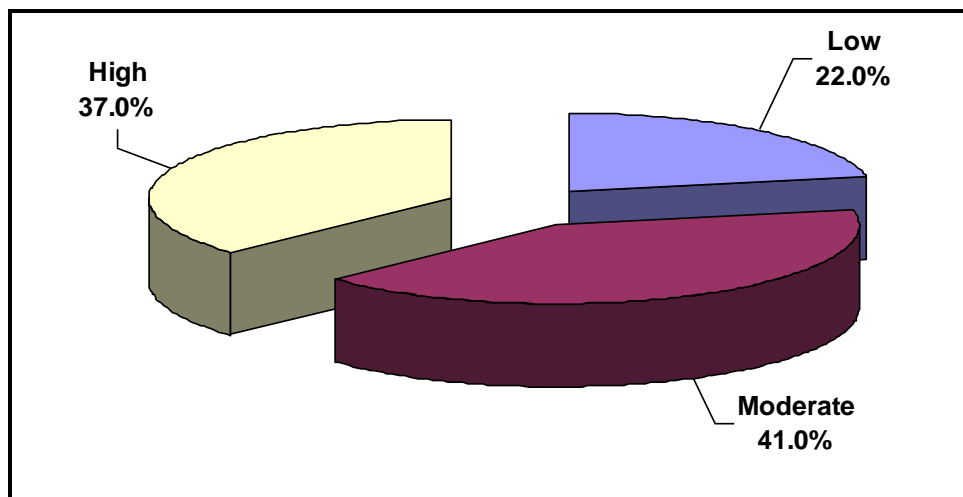


Figure (1): Levels of healthcare providers' perception about AI applications(n=763).

Table (3): Distribution of healthcare providers' perception about AI applications according to their occupation.

Perception levels about AI	Physicians (no=202)		Nurses (no=535)		Technicians (no=26)	
	No.	%	No.	%	No.	%
Low	55	27.2	105	19.6	8	30.8
Moderate	67	33.2	237	44.3	9	34.6
High	80	39.6	193	36.1	9	34.6
P-value	0.000*					

Table (4): Relationship between level of healthcare providers' perception about AI applications and their personal data.

Personal data	Levels of AI perception						P-value
	Low		Moderate		High		
	No.	%	No.	%	No.	%	
Age: (years)							0.242
< 30	109	21.0	223	42.9	188	36.1	
30 - < 40	45	25.0	71	39.4	64	35.6	
≥ 40	14	22.2	19	30.2	30	47.6	
Gender:							0.121
Male	52	23.3	79	35.4	92	41.3	
Female	116	21.5	234	43.3	190	35.2	
Job type:							0.000*
Resident Physician	51	36.7	47	33.8	41	29.5	
Assistant Lecturer	4	6.3	20	31.7	39	62	
Nurse manager	8	16.0	26	52.0	16	20.0	
Staff nurse	97	20.0	211	43.5	177	36.5	
Lab technician	3	23	4	30.8	6	46.2	
Radiology technician	5	38.5	5	38.5	3	23	
Educational qualification:							0.000*
Diploma degree	105	20.5	220	43.0	186	36.5	
Bachelor degree	39	24.4	64	30.0	57	35.6	
Post-graduates	24	26.1	29	31.5	39	42.4	
Years of experience:							0.131
< 10	102	20.4	218	43.7	179	35.9	
10 - < 20	43	23.8	71	39.2	67	37.0	
≥ 20	23	27.7	24	28.9	36	43.4	

*Statistically significant differences

Chi square test was used

Table (5): Correlation between score of AI perception with age and years of experience

	Score of AI perception	
	r-value	P-value
Age (years)	0.154	0.001*
Years of experience	0.104	0.004*

Table (6): Relationship between Mean score of healthcare providers' perception about AI applications and their personal data.

Personal data	Mean score of artificial intelligence perception			
	Physicians	Nurses	Technicians	Total
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Age: (years)				
< 30	55.63 ± 10.20	56.81 ± 8.39	52.59 ± 10.82	56.34 ± 9.04
30 - < 40	55.37 ± 7.83	57.04 ± 8.01	50.20 ± 8.53	56.37 ± 8.03
≥ 40	71.33 ± 1.15	58.91 ± 10.91	69.50 ± 6.40	60.17 ± 10.98
P-value	0.020*	0.237	0.013*	0.006*
Gender:				
Male	55.89 ± 10.75	57.03 ± 9.89	55.33 ± 12.65	57.26 ± 9.61
Female	55.75 ± 9.19	57.10 ± 8.12	54.21 ± 11.00	56.41 ± 8.80
P-value	0.923	0.929	0.811	0.238
Educational qualification:				
Diploma degree	--	57.20 ± 8.65	54.73 ± 11.56	57.03 ± 8.74
Bachelor degree	53.44 ± 10.03	55.98 ± 8.18	--	54.48 ± 9.64
Post-graduates	61.00 ± 6.59	55.96 ± 7.52	--	60.32 ± 8.08
P-value	0.000*	0.336	--	0.000*
Years of experience:				
< 10	55.44 ± 10.22	56.96 ± 8.46	52.59 ± 10.82	56.35 ± 9.14
10 - < 20	71.33 ± 1.15	57.21 ± 7.65	50.20 ± 8.53	56.69 ± 7.69
≥ 20	--	57.42 ± 10.66	69.50 ± 6.40	58.51 ± 10.89
P-value	0.019*	0.898	0.013*	0.132

Table (1): Illustrates that about two thirds of the studied health care providers were females (**70.8 %**), staff nurses (**63.6%**), had a diploma degree (**67%**), aged less than 30 years old (**68.1%**) approximately, and three quarters of them had years of experience less than 10 years (**75%**).

Table (2): Illustrates that the majority of the studied health care providers (**86%**) with highest mean score (**1.79 ± 0.54**) agreed that (If there is a contrast between health care providers and AI opinion, the opinion of health care providers will be considered as right), (healthcare professionals will become increasingly dependent on computer an algorithm, which in turn decreases their clinical practice), and (computers can be hacked, which can lead to health care problems).

Also more than three quarters of the studied health care providers (**77.3%, 77.2%, 79.8%, 76.4%, 78.8%, 77.9%, 76.9%**) approximately agreed that (AI helps health care providers to increase efficiency and make more precise decisions for their patients), (AI improves the quality of health care, which in turn will increase patient safety and satisfaction), (AI will

introduce a new role in health care, which is to ensure the patient's quality of care through collaboration with healthcare workers using updated technologies), (The new generation of health care providers highly uses technology in their life, so they will be motivated to work within a technology-enabled environment), (AI will decrease health care providers/ patients face-to-face contact, which will reduce health promotion interventions), and (AI helps to reduce human diagnostic and therapeutic errors).

On the other hand, the highest percent of the studied health care providers (**73.7%, 72%, 61.1%**) disagreed that (there are amazing innovations as a 3D print in healthcare can improve health care providers' jobs), (virtual simulations could support the training phase of health care providers, preparing them for emergencies such as a cardiac arrest), and (If there is a contrast between health care providers and AI opinion, the AI opinion will be considered as right).

Figure (1): Reveals that (**22.0%**) of studied health care providers had a low level of perception about AI

applications, (41.0%) had a moderate level and (37.0%) had a high level.

Table (3): Reveals that (27.2%) of studied physicians have a low level of perception about AI applications, (33.2%) have a moderate level and (39.6%) have high level. Also reveals that (19.6%) of studied nurses have a low level of perception about AI applications, (44.3%) have a moderate level and (36.1%) have a high level. while (30.8%) of studied technicians have a low level of perception about AI applications, and an equal percent (34.6%) have a moderate and high level.

Table (4): Illustrates that there are a highly statistical significance differences between the level of perception about AI applications with educational qualification and job type ($P=0.000^*$). There are no statistical significance differences between the level of perception about AI applications with age, gender and years of experience (0.242, 0.121 & 0.131) respectively.

Table (5): Shows that there is a significance positive correlation between score of perception about AI applications with age, and years of experience.

Table (6): Shows that the highest mean score of studied healthcare providers' perception about AI applications was related to participants who aged ≥ 40 (60.17 ± 10.98), males (57.26 ± 9.61), have Post-graduates qualification (60.32 ± 8.08) and have ≥ 20 years of experience (58.51 ± 10.89).

Discussion

Artificial intelligence (AI) has greatly expanded in health care in the past decade. In particular, AI applications have been applied to uncover information from clinical data and assist health care providers in a wide range of clinical tasks, such as disease diagnosis, triage or screening, risk analysis, and surgical operations (He et al., 2019).

Healthcare providers' perception is a key factor in determining successful implementation and will impact future societal applications of AI in healthcare (Vinueza et al., 2020). The present study conducted at Main Assiut University Hospital with the aims to assess healthcare providers' perception about artificial intelligence applications and to identify the difference among healthcare providers' perception about artificial intelligence applications.

The results of the present study showed that more than two thirds of studied healthcare providers were females, were staff nurses, aged less than 30 years old, had a diploma degree, and three quarters of them had years of experience less than 10 years (Table 1). This may be attributed to that the majority of sample were staff nurses.

These results were consistent with the study by Abdullah & Fakieh (2020), who indicated that most

of the healthcare employees were females, the majority of the sample were nurses and between 20 and 40 years old. Moreover, nearly half of the respondents had a bachelor's degree.

On the same line these findings agreed with study held by Elsayed & Sleem (2021), who showed that most of the studied nurse managers were females, more than half of them were supervisors, more than one third of them aged from 26-30 years old, had 5-10 years of experience, and the majority of sample had bachelor's degree of nursing education.

The results of the present study showed that, more than one third of studied healthcare providers agreed that, AI can deliver clinically relevant, vast amounts of high quality data in real time (Table 2). These results consistent with studies by Alsharqi et al (2018) & Shameer et al (2018), who indicated that AI can process a vast amount of data in an accurate, rapid, and efficient way by using complex statistical and computing algorithms.

The results of the present study showed that, about half of studied health care providers agreed that they cannot definitely identify who is responsible for causing harm caused by AI mistakes include the computer programmer or the clinician and others. This result was consistent with Kingston (2016) who stated that, even within current medical regulation, lines of responsibilities are not always clear when medical errors occur, and it is even less clear where responsibilities should lie when AI agents' increasingly support or even autonomously deliver healthcare services.

More than three quarters of studied health care providers agreed that AI helps to reduce human diagnostic and therapeutic errors. This result of the present study was consistent with Dilsizian & Siegel (2014) who stated that, an AI system can help to reduce diagnostic and therapeutic errors that are inevitable in the human clinical practice.

The results of the present study showed that the overall perception of studied health care providers about AI applications was moderate (Figure 1). This result went in the same line with Abdullah & Fakieh (2020), who mentioned in their study that employees in the Saudi health care sector have a moderate level of perception about AI applications.

Regarding the levels of healthcare providers' perception about artificial intelligence applications, the present study revealed that more than one third of studied physicians had a high level of perception about AI applications, about half of studied nurses had a moderate level of perception about AI applications, and about one third of studied technicians had an equal percentage of a moderate and a high level of perception about AI applications (Table 3). This result may be due to that artificial

intelligence has become of great importance nowadays due to the tendency of the health sector to use it in its various fields and seeks to provide the necessary information on how to apply it.

This result was consistent with **Elsayed & Sleem (2021)** who mentioned in their study that more than three-quarters of nurse managers had a moderate level of perception toward using AI. On the other hand, this result disagreed with **Mehdipour, (2019)**, who mentioned that the majority of nurse managers had a high level of awareness about applications of artificial intelligence in nursing.

The findings of the present study revealed that there were a highly significance differences between job type and educational qualification of studied healthcare providers and their perception about artificial intelligence applications (**Table 4**). This result may be related to that job type and educational qualification are the most important environmental stimuli that affect the way the healthcare providers think and their impression about anything, which in turns affect the providers' perception.

These results were in line with **Cherry, (2020)** who mentioned that perception was considered the sensory experience of the world. Perception includes both recognizing environmental stimuli and actions as a result of these stimuli. The whole things in the environment that has the possibility to be perceived is called environmental stimulus.

These findings were consistent with **Elsayed & Sleem (2021)** who mentioned in their study that there was a significant difference between job type, education and workplace of nurse managers and their perception about artificial intelligence applications.

Moreover, these results were supported by the study of **Abdullah & Fakieh (2020)**, who stated that there were significant differences between employees' perception about using AI applications and job type.

The findings of the present study revealed that there were no significance differences between age, gender and years of experience of healthcare providers and their perception about artificial intelligence applications. From the researcher point of view, this result due variation of participants in the study sample.

In the same line this result was supported by the survey study of **Abdullah & Fakieh (2020)**, who mentioned that there were no significant differences between employees' perception about using AI applications with age and gender.

Also, these findings were consistent with the study by **IJsebaert, (2019)** entitled attitudes towards robots and Artificial Intelligence at work in 22 European countries and revealed that age is a weak factor to make variation in robots and AI attitudes at work.

There was a positive correlation between healthcare providers' perception score about artificial intelligence applications with their age and years of experience as revealed in (**Table 5**). This result may be attributed to that when the providers become older, this leads to increase in the experience and awareness of them about the importance of using AI applications in healthcare settings to improve the quality of healthcare.

These findings were inconsistent with **Elsayed & Sleem (2021)** who mentioned in their study that there was not a significant positive relationship between age and years of experience of nurse managers with their perception toward using artificial intelligence.

The findings of the present study showed that the highest mean score of educational qualification regarding to perception about AI applications was related to healthcare providers who have postgraduate qualification with a highly significance differences between educational qualification of studied healthcare providers and their perception about artificial intelligence applications (**Table 6**). This result may due to the awareness of healthcare providers with high level of education of the need for AI and technology in health settings.

These findings were consistent with the study by **IJsebaert, (2019)** who declared that education has a significant positive effect on robots and AI attitudes at work.

As demonstrated in the same table, the highest mean score of years of experience regarding to the perception about AI applications was related to healthcare providers who have years of experience twenty years and more with no statistical significance differences between years of experience of studied healthcare providers and their perception about artificial intelligence applications. This result may be due to, with more years of experience, providers become more knowledgeable and aware about the need for AI and technology in healthcare setting which in turn will increase patient safety and satisfaction.

These findings were inconsistent with **Elsayed & Sleem (2021)** who mentioned in their study that there was no significant positive relationship between years of experience of nurse managers and their perception toward using artificial intelligence.

Also, the present study findings confirmed that the highest mean score of age regarding to the perception about artificial intelligence applications was related to healthcare providers who aged about fourty years old. This is due to that when healthcare providers become older in age, they become more informed, aware and contemporary with technological progress and its developments, and they are aware of the importance of artificial intelligence applications

Elias, et al .,(2012) mentioned that age is seen as a significant element to consider when addressing workplace technology and older workers are less eager to adapt, less able to training and less able to understand new concepts that have a negative effect on managers and employees ' behavior.

These findings of the study by IJsebaert, (2019), stated that, age is a weak factor to make variation in robots and AI attitudes at work. Older adults make new strategies to avoid using of technologies and robots and consequently are less likely to be positive towards them.

Conclusions

In the light of the study results, the following conclusions can be drawn:

- The highest percentage of healthcare providers in this study had moderate level of perception about artificial intelligence applications.
- There were a highly statistical significant differences between levels of AI perception with job type and educational qualification.
- There were no statistical significant differences between levels of AI perception with age, gender, and years of experience.

Recommendations

In the light of the results of this study the following recommendations will be suggested:

1. Convey workshops and training programs for health care providers to educate them about AI potential applications and synergies.
2. Preparing and distributing a manual about artificial intelligence among health care providers, to raise their awareness about AI applications in health care settings.
3. Redesigning nursing and medical instructional modules to present the concept of AI in healthcare.
4. Conduct a scientific studies focusing on AI in healthcare at Egypt in different settings and to provide more severe results.
5. Enhance the organizations preparedness for applying artificial intelligence through best infrastructure and finance.

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