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Exploring Physicians' Perception of Artificial Intelligence Applications at National Liver Institute Hospital, Egypt: A Cross-Sectional Study

Marwa Ali Tahoon[1], Inas Maged Moaz[1]

[1]Department of Epidemiology and Preventive Medicine, National Liver Institute, Menoufia, Egypt

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ABSTRACT

Background: Artificial Intelligence (AI) is rapidly reshaping healthcare industry by utilizing advanced algorithms & computational models to enhance clinical practices, patient outcomes and healthcare systems. Objective: To assess the perception of physicians regarding utilization of artificial intelligence applications. Methods: A cross-sectional study was conducted. The study targeted physicians working at the National Liver Institute Hospital, Menoufia University, Egypt. Data were gathered using an online self-administered questionnaire. Results: A total of 250 physicians were included. The mean age was 35.5±6.5 years and 56% of physicians were females. Physicians' perception regarding AI applications varied, with the majority (52%) had moderate perception, 26% having a low perception, and 22% showing a high perception. Approximately 131 (38%) physicians had good knowledge about AI. Statistically significant differences were found between AI perception levels and Socio-demographic data including age, job title, and years of experience. Younger physicians (mean age 29.2±6.1 years) were more likely to have a high perception of AI than while older physicians (mean age 40.7±6.9 years). Resident physicians (43.6%) and assistant lecturers (32.7%) were more likely to have a high perception of AI, whereas professors (1.2%) had a lower perception. Physicians with less than 10 years of experience (81.8%) generally had a higher perception of AI compared to those over 10 years of experience (92.3%) who showed a lower perception. Conclusions: Although the findings suggest a generally positive attitude towards AI among physicians, there is still a need for education and discussion about its role and how to improve its utilization.

INTRODUCTION

Artificial intelligence (AI) is a comprehensive term that illustrates computer software utilizing intricate mathematical algorithms to interpret data and develop pre-defined outputs, yielding significant outcomes. AI uses algorithms and machine learning to evaluate and analyze data, deliver personalized experiences, and digitize repetitive and costly healthcare procedures.[1]

AI technologies are nowadays intensifying being used across several organizations and societal fields, including the healthcare sector.[2] AI technologies have been constructed to provide concrete profits in different sectors, involving applications in healthcare sector.[3-4] One common characteristic of AI is the replication of human intellectual functions. AI reshapes healthcare industry by initiating a significant change in the way healthcare is addressed. This has been supported by the rising accessibility of healthcare data and the rapid advancement in analytics techniques.[5]

Nowadays, healthcare systems in multiple areas have begun to depend on the storage of case data to deliver the highest standard of healthcare. Health care information technology systems can secure huge amounts of case information, because of the fast technological advancements. Nevertheless, to

Corresponding Author: Marwa Ali tahoon, Department of Epidemiology and Preventive Medicine, National Liver Institute, Menoufia, Egypt. Email: marwa.123ali&yahoo.com

upgrade health care quality, increase decision making, and decrease costs, it is considered necessary to use this data effectively.[6-7] Throughout the last decade, AI had resulted in a considerable advancement in healthcare sector.[8] AI has been implemented in healthcare discipline, such as genetic diagnosis, diagnostic imaging, clinical laboratory testing, screening, and health communications. These systems help healthcare professionals by providing relevant medical information to prevent faults in diagnosis and therapy, along with announcement of any health outcomes that pose a significant risk.[5]

Health system practitioners hold diverse insights and feelings towards the introduction of AI, despite its promising advantage.[9-10] Therefore; this study aimed to assess the perception of physicians at the National Liver Institute (NLI) hospital regarding the utilization of artificial intelligence applications.

METHODS

This study was conducted using a cross-sectional design. This study had been carried out at the NLI Hospital, Menoufia University, Egypt.

A total 600 physicians were currently working at NLI Hospital. Based on a previous study carried out on health care workers at Main Assiut University Hospital, [11] an estimated awareness level of 41% was assumed with 5% margin of error. The calculated sample size was approximately 73 physicians. However, the study ultimately covered 250 physicians to encompass a broader participant base. The sample size was determined using the EpiInfo program.

The study population included 250 physicians randomly selected from the total number of physicians (number = 600) working at National Liver Institute Hospital.

Data collection tool: The information required for this study was gathered using an online self-administered questionnaire. The questionnaire has been adapted from Oh et al,[10] with revisions that involve changing the questions from multiple-choice format to a Likert scale. The finalized questionnaire included two primary sections. The first section consisted of a set of Socio-demographic questions intended for gathering information on age, gender, job, and professional experience. The second section of the questionnaire about AI perception (included 14 questions) divided into three components; the perceptions of AI consist of 4 questions (Q1-Q4), then the advantages of utilizing AI included 5 questions (Q5-Q9) and the third component which focused on difficulties of using AI in healthcare, included 5 questions (Q10 – Q14).

We conducted a survey among physicians at NLI Hospital using Google Forms. The survey has been conducted online via a mobile phone invitation. Every participant received a unique link to access the online survey, which has been sent out through a department-specific group. The preface of the questionnaire provided participants with information regarding the survey's objective. The responses were completely anonymous. Responses were only recorded if the participant pushed the "submit" button at the end of the questionnaire, and each participant was permitted to make one submission.

Scoring: The scoring system for the response has been assessed using a 5-point ordinal Likert scale, with 1 representing "strongly disagree" and 5 representing "strongly agree". The scores of the items have been summed-up and subsequently transformed into a percentage score. A score ≤40% is categorized as low perception, a score from 41% to 80% is considered as moderate perception, and a score ≥81% is considered as high perception. [12]

Pilot study: Before initiating the actual collection of information, we have been conducted to verify the clearness, accessibility, and understanding of the study questionnaire, also to determine the time needed for the actual data collection. Moreover, to assess any potential challenges that may occur across the process of gathering information. It has been administered to 35 physicians, who accounted for 14% of the overall sample of participants in the study. The information gathered from the pilot study was examined and no modifications were applied to the study questionnaire.

The study tool was tested for its reliability by using Cronbach's Alpha Coefficient test, it was (α= 0.926). Thus indicates a high degree of reliability for the study tools.

Statistical analysis: The responses gathered from the study questionnaire were encoded and analyzed using the Statistical Package for Social Sciences (SPSS), version 22.0, developed by IBM Corp. in Armonk, NY. For each question, we calculated the mean, standard deviation for continuous data and frequencies, percentages for categorical data. To study the relationship between levels of AI perception and socio-demographic factors, we conducted chi-square and analysis of variance (ANOVA) tests. The level of significance for all tests has been set at P ≤.0.05.

RESULTS

Our study enrolled 250 physicians working at NLI Hospital, with mean age of 35.5±6.5 years, ranging from 24 to 56 years. The gender distribution was slightly skewed towards females (56% compared to 44%). Half of the participants held the position of Lecturer (49.2%). Assistant Lecturers constituted 15.6%. Assistant Professors, Resident Physicians and Professors constituted 14.4%, 12.8% and8.0% respectively. Additionally, a significant portion of the participants had over 10 years of experience (70%) (Table 1).

Regarding the overall perception of AI applications as illustrated by Figure 1 shows that the overall perception of AI applications among the physicians varied, with 52% of them had a moderate level of perception being the most common, 26% of them had a low perception of AI, and 22% exhibited a high perception of AI.

As regards perception of physicians about AI, about 38% of physicians declared that they had a good knowledge of AI (Q1). However, perceptions about AI superiority over human expertise (Q2) and concerns about AI replacing their jobs (Q3) were less prevalent (30% & 14% of them agree respectively). Approximately half of them (48%) are optimistic about the potential of AI in healthcare (Q4). (Figure 2)

Relating to advantages of AI, as shown in Figure 3, about 44% of physicians acknowledged that AI could speed up healthcare processes (Q5), 40% of them agreed with AI can reduce medical errors (Q6), 38% & 36% of the studied physicians agreed with that AI provide high-quality data in real-time (Q7) and overcome space-time constraints (Q8) respectively. Approximately half of them (48%) of them agreed that AI could avoid emotional exhaustion or physical limitations (Q9).

Regarding difficulties of using AI applications in health care, Figure 4 illustrates that many physicians (38%, 40%, 40% and 38%) believed that AI could not provide opinions in unexpected situations (Q10), lacked flexibility (Q11), faced difficulties in controversial subjects (Q12) and the low ability to sympathize with and consider the emotional well-being of the case (Q13). However, only 28% of them agreed that AI had been developed by a specialist with little expertise in medical practice (Q14)

For concerning the relationship between socio-demographic data and AI perception; Table 2 illustrates that younger physicians (mean age 29.2±6.1 years) were more likely to have a high perception of AI, while older physicians (mean age 40.7±6.9 years) tended to have a lower perception with statistically significant difference (P = 0.001). The perception of AI did not significantly differ among male and female (P = 0.46). Regarding their job title, resident physicians (43.6%) and assistant lecturers (32.7%) had a high perception of AI, whereas Professors (1.2%) showed a lower perception (p = 0.001). As regard their years of experience, physicians with < 10 years of experience (81.8%) were more likely to have a high perception of AI, while those with ≥ years of experience (92.3%) exhibited a lower perception (p = 0.001).

Table 1: Distribution of demographic and professional characteristics of the studied physicians working at National Liver Institute Hospital (N= 250)

	N (%)
Age/ years (*mean*± SD)	35.5±6.5 (24 - 56)
Gender	
Males	110 (44.0)
Females	140 (56.0)
Job title	
Resident Physician	32 (12.8)
Assistant Lecturer	39 (15.6)
Lecturer	123 (49.2)
Assistant professor	36 (14.4)
Professor	20 (8.0)
Years of experience (n, %)	
<10 years	75 (30.0)
≥ 10 years	175 (70.0)

SD: standard deviation

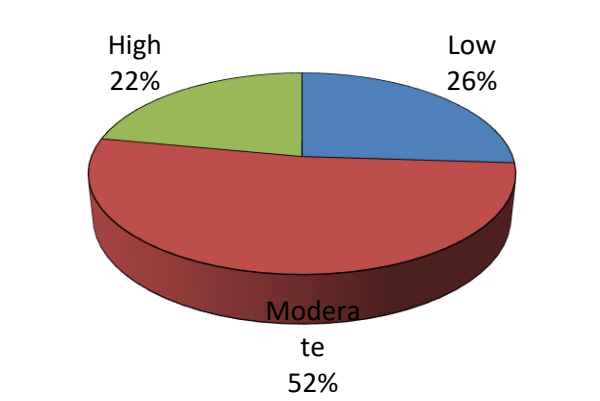

Figure 1: Levels of physician's perception at NLI about AI applications (N =250).

DISCUSSION

The healthcare industry has seen substantial increase in the application of AI over the last decade. AI has been implemented to gather clinical information and help healthcare practitioners in various clinical tasks, including identifying illnesses,

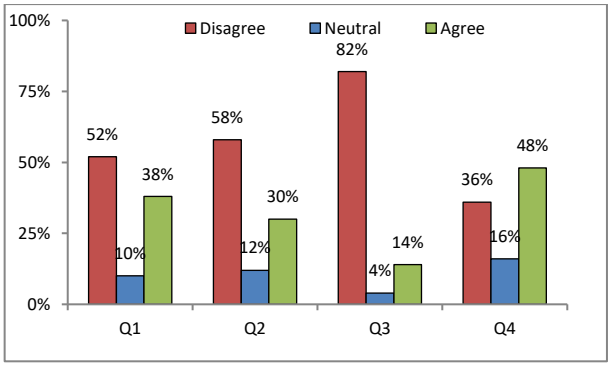

Figure 2: Distribution of overall perception of physicians about AI applications (N=250)

Note: Q1: I have good knowledge about artificial intelligence. Q2: Artificial intelligence abilities are superior to human experience. Q3: Artificial intelligence could replace me in my job. Q4: I have high hopes about artificial intelligence applications in the healthcare sector.

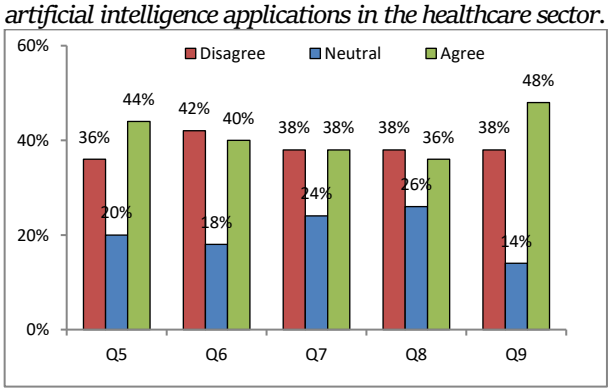

Figure 3: Distribution of physicians by their perception about the advantage of using AI (N=250)

Note: Q5: Artificial intelligence can speed up the process in health care. Q6: Artificial intelligence can help reduce the number of medical errors. Q7: Artificial intelligence can deliver clinically relevant, vast amounts of high-quality data in real time. Q8: Artificial intelligence has no space-time constraint. Q9: Artificial intelligence has no physical limitation or emotional exhaustion.

prioritizing or screening, risk assessments, and surgical procedures.[12] The insight of healthcare practitioners plays a critical role in deciding the effective implementation of AI in healthcare and will have an impact on future social uses of this technology.[13]

The results of our study provide precious insights about the perceptions of AI applications among physicians at the NLI Hospital. Our study, which involved a diverse group of 250 physicians, highlights several key themes about their perception regarding AI application in healthcare. Notably, their overall moderate perception indicates a cautious optimism about its potential. Whereas 52% of participants exhibited a moderate perception, the

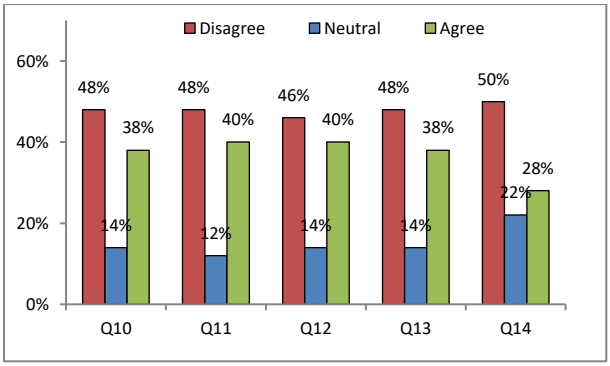

Figure 4: Distribution of physicians by their perception about difficulties of using AI in health care (N=250)

Note: Q10: Artificial intelligence cannot be used to provide opinions in unexpected situations. Q11: Artificial intelligence is not flexible enough to be applied to every patient. Q12: Artificial intelligence is difficult to apply to controversial subjects. Q13: Artificial intelligence has low ability to sympathize & consider the emotional well-being of the patient. Q14: Artificial intelligence has been developed by a specialist with little clinical experience in medical practice.

significant portion (22%) with a high perception suggests that there is a growing acceptance of AI potential benefits. This comes in line with the increasing integration of AI technologies in clinical practice, where physicians recognize the efficiency and accuracy that AI can bring to healthcare processes. This finding was consistent with the findings of a previous investigation carried out on Egyptian health care workers at Main Assiut University Hospital, which indicated that the overall perception of the health care providers in investigation regarding AI applications was moderate (41%). [11] Additionally, a study by Abdullah and Fakieh (2020) documented that healthcare providers in Saudi Arabia held a moderate perception regarding the use of AI applications..[14]

Only 30% agreed that AI abilities are superior to human experience, and concerns about job displacement were even less prevalent, with only 14% expressing fear of being replaced. This suggests that physicians have a profound understanding of AI, viewing it as a tool to assist their expertise rather than replace them. This finding aligns with the study by Castagno S and Khalifa M in 2020, which showed that only 28% of participants were worried that AI will replace them at their job.[15] Nevertheless, this contradicts the findings of prior research on AI indicating that 47% of jobs in the United States are at risk of "computerization" in the coming decades.[16] Additionally, our findings are in contrast to previous

Table 2: The relationship between physicians' perceptions of artificial intelligence applications at NLI Hospital and their demographic and professional information

Personal data	Perception about AI applications			P value
	Low (n = 65)	Moderate (n = 130)	High (n = 55)	
Age/ years (*mean*± SD)	40.7±6.9	35.5±3.4	29.2±6.1	0.001[a]
Gender				
Male	35 (53.8%)	60 (46.2%)	35 (63.6%)	0.460[b]
Female	30 (46.2%)	70 (53.8%)	20 (36.4%)	
Job title (n, %)				
Resident Physician	2 (3.1%)	6 (4.6%)	24 (43.6%)	
Assistant Lecturer	4 (6.2%)	17 (13.0%)	18 (32.7%)	
Lecturer	27 (41.5%)	88 (67.8%)	8 (14.5%)	0.001[c]
Assistant professor	21 (32.3%)	11 (8.4%)	4 (7.2%)	
Professor	11 (16.9%)	8 (6.2%)	1 (1.2%)	
Years of experience (n, %)				
<10 years	5 (7.7%)	25 (19.2%)	45 (81.8%)	0.001[b]
≥ 10 years	60 (92.3%)	105 (80.8%)	10 (18.2%)	

SD, Standard deviation; a, ANNOVA test; b, Chi-square test; c, corrected chi-square test; P value considered significant < 0.05;*

studies conducted by the Pew Research Center in 2016 [17] and in 2017 [18] revealed that 2/3 of Americans expect that robots and computers will execute a significant portion of the work currently performed by humans within the next 50 years and that 71% are worried about this in the future. This variation may be owing to the fact that AI cannot replicate human emotions or show empathy, which prevents it from engaging in the complex interactions needed to reassure patients and build their trust.[19]

According to the survey, most participants assume that AI is beneficial in the medical field. Specifically, 44% of physicians noticed that AI has the potential to enhance healthcare operations, while 40% agreed that AI may decrease medical errors. Our findings are in accordance with previous studies.[11,20,21] Furthermore, another study showed that among the 1,183 people who participated, about 50% of them recognized the significance of AI development in healthcare sector as prominent chance. Furthermore, only 11% of them recognized it as a significant threat to their treatment and privacy. [22]

The relationship between socio-demographic data and AI perception reveals major patterns. Younger physicians had a higher perception of AI, which may be assigned to their familiarity with technology and its applications in their training. Conversely, older physicians possibly having more familiarity with traditional practices showed a lower perception. This generational gap suggests that educational initiatives should target older practitioners aspiring to enhance their acceptance of AI technologies. This finding aligns with the research conducted by Elias, et al., 2012, suggesting that age plays a key role in addressing workplace technology.[23]

Job title and years of experience also played a fundamental role in shaping perceptions. Resident physicians and assistant lecturers displayed a positive perspective of AI likely due to their recent exposure to innovative technologies in their training. Alternatively, professors, who may have established methodologies and practices, demonstrated lower perceptions. This highlights that more experienced professionals may resist change which could be managed through targeted education and engagement strategies that revealed the benefits of AI in the healthcare industry.

In conclusion, whereas physicians generally have a positive insight into AI continued education and discussion about its role in healthcare are fundamental. It is important to deal with concerns about limitations of AI and its potential effects on the physician-patient relationship to ensure a comprehensive understanding of how AI can improve rather than undermine the quality of care. Future research should focus on how educational interventions affect knowledge and attitude of AI, as well as the practical effects of integrating AI technologies into routine clinical practice.

Ethical Considerations

All participants had to sign an online informed consent form. All of them were informed of the study objectives. We informed them that we considered their answers and data confidential; Participants were under no pressure to continue participating in the study. The protocol was approved under IRB number 00625/2024, the NLI Ethics Committee authorized this study (NLI IRB 00014014).

Competing interests: The authors declared that they have competing interests.

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Availability of data & materials: Any interested person may have access to the datasets utilized in this study by reaching out to the corresponding author.

Authors' contributions: M.A.T. & E.M.M. contributed to the conception & planning of the research. The research & administration have been conducted by M.A.T. & E.M.M. The statistical data analysis has been conducted by M.A.T., whereas the data interpretation was a collaborative endeavor involving M.A.T. & E.M.M. The initial draft was authored by M.A.T., with the subsequent review & editing conducted by M.A.T. & E.M.M. All authors conducted a critical review of the work before submission M.A.T. supervised the editing & preparation of the final text for publication. All authors have reviewed and approved the published version of the text.

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