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Attention: Artificial Intelligence is Coming! What Do Healthcare Professionals Say About This in Türkiye?

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Abstract

Artificial intelligence (AI) technology has been in growing use in healthcare to promote health via identification, prevention and treatment of diseases. The current study determined the perceptions and opinions of healthcare professionals (HPs) concerning the use and the pros and cons of AI. The study's quantitative arm included 233 HPs who completed the AI Pros and Cons Scale in İstanbul, Türkiye. The qualitative arm of the study included 11 physicians whose opinions were asked with interviews. In the quantitative arm, perception scores of HPs were high about pros and cons of AI, with higher scores favouring pros. In the qualitative arm, the majority of the physicians considered AI an indispensable assistant in their clinical practice, making clinical decisions faster, reducing workload and time consumption, and providing an early and accurate diagnosis. AI was not considered to fully replace the profession of HPs and final decisions would always be in the hands of physicians. There were also considerable concerns about overdiagnosis, insensitivity to emotional factors, and medical errors that might result from an insufficient amount of data. Currently, AI has already taken a long way in undertaking numerous tasks that once were only performed by HPs. This is particularly valuable for HPs to enhance their knowledge and capabilities.

Keywords: *Artificial intelligence, health, healthcare professional, artificial intelligence pros and cons scale*

Öz

Sağlık hizmetlerinde yapay zeka teknolojisi, hastalıkların tanımlanması, önlenmesi ve tedaviyle sağlığın geliştirilmesinde giderek daha fazla kullanılmaktadır. Bu çalışma, sağlık profesyonellerinin yapay zekanın sağlıkta kullanımı, artıları ve eksileri hakkındaki algılarını ve görüşlerini belirlemeyi amaçlamaktadır. Araştırmanın nicel bölümü, Yapay Zeka Artıları ve Eksileri Ölçeği'ni tamamlayan İstanbul'da görev yapan 233 sağlık profesyonelini kapsamaktadır. Araştırmanın nitel bölümünde ise 11 hekim ile görüşmeler gerçekleştirilmiştir. Katılımcıların, nicel yöntemde yapay zekanın artıları ve eksilerine yönelik algı puanlarının yüksek olduğu görülmektedir. Nitel sonuçlara göre hekimlerin çoğunluğu yapay zekayı klinik uygulamalarında daha hızlı klinik kararlar veren, iş yükünü ve zaman tüketimini azaltan, erken ve doğru tanı sağlayan vazgeçilmez bir yardımcı olarak görmektedir. Yapay zekanın sağlık profesyonellerinin işini elinden alacağı düşünülmemekle birlikte nihai kararın her zaman hekim tarafından verileceği ifade edilmiştir. Hekimlerin, aşırı tanı, duygusal faktörlere duyarsızlık ve yetersiz veri miktarından kaynaklanabilecek tıbbi hatalar konusunda da önemli endişeleri bulunmaktadır. Şu anda yapay zeka, bir zamanlar yalnızca sağlık profesyonelleri tarafından gerçekleştirilen çok sayıda görevi üstlenme konusunda şimdiden uzun bir yol kat etti. Bu, sağlık profesyonellerinin bilgi ve yeteneklerini geliştirmeleri açısından özellikle değerlidir.

Anahtar Kelimeler: *Yapay zeka, sağlık, sağlık çalışanları, yapay zekanın artıları ve eksileri ölçeği*

Introduction

The use of artificial intelligence (AI) has been growing constantly in the healthcare sector, with an extensive debate in the literature about its pros and cons1. In the 1940s, AI emerged from the question, "Could machines think?" (Jiang et al., 2017; Sucu, 2019; Pirim, 2006; Filiz et al., 2022), which entered the literature in 1956. AI is defined as a "computer and computer software that can think, analyze and learn like humans" (McCarthy, 2022; Gupta, 2017; Büyükgöze & Dereli, 2019)

Artificial intelligence technology has been in growing use in diagnostic imaging, genetic diagnosis, laboratory procedures, screening for early detection, and health communication (Nadarzynski et al., 2019) for many purposes to promote health, identify and prevent diseases, and treat illnesses (Jiang et al., 2017; Aladağ, 2021; Davenport & Kalakota, 2019). It is also time and effort-saving for healthcare professionals in long processes such as evaluating patients' radiology images and reports (Akalın & Veranyurt, 2021).

Among its applications in healthcare is the *Watson for Health* algorithm used in difficult-diagnose diseases and decision-making (Büyükgöze & Dereli, 2019; IBM, 2019), the *Veebot* used to facilitate drawing blood (Jeelani et al., 2015), the *"Robot Era"* to help elderly people with daily work (Di Nuovo et al., 2015; Karagöz, 2018).

There have been increasing reports in the literature on the use of and attitudes of healthcare professionals (HPs) to AI. A study from Saudi Arabia found that three out of four HPs had insufficient knowledge about AI and its advantages. In another study, a substantial proportion of HPs (78%) expressed their concerns that AI might replace HPs (Abdullah & Fakieh, 2020). Conversely, South Korean doctors and medical students displayed favorable attitudes toward AI, opposing to the opinion that AI would replace their roles in the future (Oh et al., 2019).

The current study aimed to determine the perceptions and opinions of HPs concerning the use of, and the pros and cons of, AI and its impact on the patient and the future of AI.

Methodology

Research Design

This quantitative and qualitative study was conducted on a cross-sectional design and a case-based design, respectively to determine perceptions of HPs on AI.

Recruitment

For the quantitative arm of the study, snowball sampling method was used for recruitment from state and private hospitals in the Anatolian Region of İstanbul, Türkiye. The minimum sample size was estimated by using a confidence interval formula with the following specification: a margin of error 5%, confidence level 95%, and response distribution 72%. A 21-item questionnaire was administered to 233 HPs (physicians, nurses and technicians). The questionnaire was developed using a Google survey template with the addition of seven socio-demographic items (gender, occupation, age, education status, work duration, department, and hospital) and 14 items adapted from the literature (Abdullah & Fakieh, 2020; Oh et al., 2019) concerning AI-related HPs' perceptions (4 items), advantages (5 items) and problems (5 items) as measured on a 5-point Likert scale (1=strongly disagree to 5=strongly agree). Each participant gave informed consent before starting the questionnaire.

For the qualitative arm of the study, convenience sampling was used, for which 15 physicians were selected from different disciplines in eight state and three private hospitals in the Anatolian Region of İstanbul, Türkiye between 19 and 30 April, 2022. Eleven of these physicians agreed to participate and were available for online or face-to-face interviews. The questions of this questionnaire, which includes eight open-ended questions, were prepared by the researchers in the light of the literature (Özlü et al., 2021). For testing and verification, a pilot study with two physicians was conducted under the guidance of two investigators. Initially, verbal consent from all participants was obtained either by the Zoom program or in person. The second author of this paper conducted each interview for approximately

30 - 45 minutes. All interviews were recorded after the verbal consent of the participants, were transcribed by the researchers and eventually a content analysis was carried out on 13.181 words.

Ethics Approval

The study was approved by the Hamidiye non-Interventional Research Ethics Committee of the University of Health Sciences Türkiye (April 8, 2022, and no:22/225) and conformed to the principles of the Helsinki Declaration.

Data Analysis

Quantitative data were processed using SPSS for Windows 22.00 software and AMOS software. After the domains of the scale were determined, confirmatory factor analysis was applied to verify the factor structure of variables. Descriptive statistics were expressed in frequency tables. The independent two-sample T-test was used for comparison between two groups and the one-way ANOVA analysis for three or more groups and, in case of insufficient sample size, the non-parametric Kruskal-Wallis H-test. Relationships between the variables were sought using the Pearson correlation coefficient. The significance level was set at $p<0.05$. Qualitative data from the open-ended interview form were converted into text in the Word program, and content analysis was made using the Maxquda 12 program, which creates a code list and places list items into specific categories to be turned into themes, which were separately checked by two investigators.

Validity and Reliability of Qualitative Data

The researchers paid particular attention not to interrupt the participants' responses during the interview. Conducting some interviews via Zoom program allowed participants to respond in a comfortable environment from their homes. The recordings were transcribed word by word by two investigators.

All procedures including design, data collection and analyses, and the results were presented to three academics with expertise in qualitative research for review and received approval thereof.

Validity and Reliability of the AI Pros and Cons Scale in Healthcare (AIPC Scale)

The AI Pros and Cons Scale (AIPC Scale) was verified using an exploratory factor analysis, which yielded a probability value of $p<0.000$ and a Kaiser-Meyer-Olkin (KMO) value of 0.774 on Bartlet's test with the excellent fitting-in factor analysis (Karagöz, 2019). Moreover, the overall concept exploratory was found as 49.26%, indicating a sufficient level of representation.

Explanatory and confirmatory factor analyses of the AIPC Scale are shown as supplementary materials. After excluding four items (items 2, 3, 10, 14) with factor loading values of <0.32, the reliability of the scale was found to be high, with a Cronbach's alpha coefficient of >0.60.

The confirmatory factor analysis was performed using AMOS version 22.0 (Meydan & Sesen, 2011), with all sub-dimensions included in the exploratory factor analysis preserved. Factor loadings of all items ranged from 0.57 to 0.96, showing the acceptability of the quantification model.

The confirmatory factor analysis was considered significant since the model fitting values x2 and x2/df were found as 68.757 and 32 ($p<0.000$). Since the fitting indexes of the model [GFI (0.947), CFI (0.959), SRMR (0.063), RMSEA (0.070)] were within the acceptable range, the confirmatory factor analysis was considered valid for the AIPC scale (Meydan & Sesen, 2011).

Results and Discussion

Sample Characteristics

The demographic characteristics of the 233 participants are summarized in Table 1. The mean age of the participants was 33.2±11.0 years. Females accounted for 70%, and nurses and physicians 60.3%. Most of the participants (60%) had a university degree, and 55.8% were working in outpatient and inpatient clinics.

Table 1. *Demographic characteristics of the participants (n=233)*

Variables	Groups	n	%
Gender	Female	163	%70.0
	Male	70	%30.0
	Nurse/midway	110	%47.4
Occupation	Physicians	30	%12.9
	Technicians	92	%39.7
	High school graduate	27	%11.6
Education status	University graduate	140	%60.3
	Master/Ph.D. graduate	65	%28.0
	Inpatient clinics	67	%28.8
Department	Outpatient clinics	63	%27.0
	Other	103	%44.2
Hospital	Public hospital	77	%33.0
	Training and research hospital	76	%32.6
	Private hospital	34	%14.6
	Other	46	%19.7
Work duration	0-10	137	%58.8
	≥11	96	%41.2
Age	33,20 ± 11 year	Min=19	Max=65

All participants responded to all items of the AIPC scale. According to descriptive statistics, kurtosis and skewness values were between -2 and +2, validating the use of parametric tests (George & Mallery, 2010). The reliability thresholds of all scales were sufficient (Cronbach's alpha coefficient between .710-.829) (Kalaycı, 2010). The distribution of AIPC scores according to variables is

Table 2. *The distribution of AIPC scores according to variables*

Variables	Pros of using AI in healthcare				Cons of using AI in healthcare				Total			
	$\bar{X}$	SS	Test	p	$\bar{X}$	SS	Test	p	$\bar{X}$	SS	Test	p
Gender												
Female	27.45	4.33	t= -2.027	.044*	11.71	2.21	t= 2.555	011*	33.73	4.31	t= -3.132	.002*
Male	28.73	4.61			10.90	2.25			35.82	5.42		
Work duration												
0-10 year	28.07	4.35	t= .955	.341	11.64	2.24	t= 1.418	.158	34.42	4.49	t= .224	.823
>11 years	27.50	4.58			11.22	2.23			34.28	5.14		
Occupation												
Nurse/midway	27.56	4.16	F= 1.341	.264	11.57	2.04	F= .302	.740	33.99	4.07	F= 1.728	.180
Physicians	27.07	5.37			11.50	2.62			33.56	6.60		
Technicians	28.39	4.46			11.33	2.38			35.05	4.80		
Education												
High school	27.96	4.32	H= .195	.907	10.89	2.29	H= 1.431	.489	35.07	4.65	H= .280	.870
University	27.92	4.56			11.54	2.29			34.37	4.73		
Master/Ph.D.	27.55	4.32			11.54	2.14			34.01	4.94		
Department												
Inpatient clinic	27.12	4.91	F= 1.211	.300	11.70	2.08	F= .611	.544	33.41	4.99	F= 1.887	.154
Outpatient clinic	28.14	4.58			11.48	2.29			34.66	5.04		
Other	28.11	4.01			11.31	2.33			34.79	4.37		
Hospital												
Public hospital	27.66	5.03	F= .730	.535	11.42	2.10	F= 1.177	.319	34.24	5.61	F= 1.425	.236
Training hospital	27.92	3.63			11.74	2.00			34.18	3.85		
Private hospital	27.09	4.8			11.65	2.77			33.44	4.52		
Other	28.52	4.33			10.98	2.41			35.54	4.67		

summarized in Table 3. Male participants had higher scores (28.7±4.6) on the pros of AI as well as a higher total score, whereas females had higher scores (11.7±2.2) on the cons (p=.011). Comparisons of other categories yielded similar results (Table 2).

Perceived degrees of pros and cons of AI are shown in Table 3. "AI can speed up the processes in health care" and "it is free from burn-out or physical limitations inherent to humans", and these two items have the highest mean scores among perceived degrees of pros of AI. The lowest-ranked item was the response to, "I have high prospects about AI applications in the health care sector" with a mean of 3.69.

The response, "AI has low ability to sympathize and consider the emotional well-being of the patient" ranked first with a high mean of 4.14 in the perceived degree of cons, a moderate level on the range of scores.

Table 3. *Perceived Degrees of Pros and Cons of AI (n=233)*

Perceived Degrees of Pros of AI				
Items		**Mean (Sd)**	**Rate (%)**	**Level***
1.	I have good knowledge about AI.	3.88 (.94)	72.00	High
4.	I have high prospects about AI applications in the healthcare sector.	3.69 (.97)	67.25	High
5.	AI can speed up the processes in health care.	4.21 (.74)	80.25	High
6.	Utilization of AI can reduce medical flaws.	3.82 (1.01)	70.50	High
7.	AI can provide real time high-quality clinically relevant data.	3.98 (.86)	74.50	High
8.	AI has no space and time constraints.	4.10 (.88)	77.50	High
9.	AI is free from burn-out or physical limitations inherent to humans.	4.15 (.92)	78.75	High
	Total	3.98 (.64)	74.50	High
Perceived Degrees of Cons of AI				
11.	AI is not flexible enough to be applied to every patient.	3.61 (.90)	65.25	High
12.	AI cannot be used to provide opinions in unexpected situations.	3.73 (.92)	68.25	High
13.	AI has low ability to sympathize and consider the emotional well-being of the patient.	4.14 (.87)	78.50	High
	Total	3.82 (.75)	70.50	High

*Range of scores 1-2.6, 2.6-3.4 and 3.4-5, indicate low, moderate, and high, respectively, perceived degrees of pros of AI.

Qualitative Results

Based on the responses provided by the participants to the questions, 44 codes were created under five themes. The themes, code list of the generated codes and selected responses of qualitative research are shown in Table 4.

All participants (n=11) stated that they knew about AI, only 27% of them had partial knowledge. In a response to the question, "Will AI replace your job?", participants said that although the use of AI is inevitable, it cannot replace HPs, because the final decision would always be made by physicians (n=10).

The response of the participants (n=11) to the question, "Does AI make your job easier or harder?" was that AI made their job easier and things much faster. One participant (P10) briefly described "It makes our job easier. It warns us, especially in cases that escape our notice. It speeds up our task, makes the diagnosis easier, and time is efficiently used."

Another item on the questionnaire was "What are the positive effects of AI in the diagnosis process?". The respondents stated that AI could see things that escape the human eye (n=4) and provided superior results, particularly in radiologic imaging (n=3). The answers given by two participants to the above question were as follows: P.1: "AI enables us to reach more precise decisions and results, as it can perform very complex analyses free from human emotions." P.8: "A treatment plan that can take hours for a physician to construct can be provided by AI in only one minute, even less".

The negative effects of AI on the diagnosis process were also interrogated (Item 6). The majority of the participants stated that AI ignored patients' emotional states. P.1: "AI lacks emotional aspects; instead, it uses a mathematical approach, bypassing human dimensions without flexibility".

The physicians were also asked what patients thought about AI (Item 7). Many physicians stated that patients' attitudes towards AI largely depended on their socio-demographic characteristics. Conservative patients may not easily adopt innovations such as AI.

Table 4. *Themes, codes and selected responses of qualitative research*

Themes	Codes	Selected Responses
Will AI replace your job?	Technology utilization Inevitability Productivity Critical helper Guidance/assistance May replace physicians to some extent Physicians make final decisions Fewer errors than humans' More utilization in internal medicine More background in surgical branches Jobs are easier	P2: "It will replace human tasks to some extent, but the control will be in the hands of the physician..." P7: "AI will be the greatest helper/excellent assistant in our jobs rather than replacing us". P10: "I don't think it will fully replace our jobs, but it will be one of our greatest supporters, especially in diagnostics..." P11: "Robots or AI will never replace surgeons. It will make things easier, but humans will still be involved."
Does AI make your job easier/more difficult?	Less workload Both pros and cons Time-saving Errors are less likely Facilitates our jobs Stronger memory Much faster Superior	P1: "It facilitates our tasks." P3: "Our jobs have become much easier" P7"...Of course, there are disadvantages as well as advantages. Especially in the case of complications, the human factor will come into play." P8: "It makes it easier for us to undertake part of the service we have to provide."
Positive Effects on the Diagnostic Process	More precise Superior results in radiologic imaging Time-saving Contributes to human experience Rapid and accurate diagnosis Early detection More reliable More objective	P2: "... Reduces malpractice. Increased quality..." P4: "I can evaluate diverse conditions simultaneously and use time efficiently..." P6: "AI may notice things that you may miss or cannot think of." P11:"...AI evaluates better than normal people in many areas of health..."
Negative Effects on the Diagnostic Process	Overdiagnosis Diagnosis should not be left entirely to AI May be misleading May lead to unnecessary analysis, examination, imaging Emotional factors are ignored	P1: "AI lacks emotional aspects; instead, it uses a mathematical approach, bypassing human dimensions without flexibility." P7: "The more advanced technology is, the more prudent we should be..." P9: "Risk of overdiagnosis. This can also be costly. "
Patient attitudes to AI	Patients will support AI. Interpersonal approach will differ. Conservative patients will be more cautious. They may have concerns about AI. There may have a negative attitude. Patient attitudes may differ according to services provided by AI. Attitudes may vary based on the socio-demographic characteristics of the patient. It's hard to predict. Patients will approach positively	"P5: "Patients who prefer traditional treatment methods may approach AI more reactively compared with patients who prefer modern treatment methods. P7: The health outlook of each society is different. Turkish society is open to the use of technology in health. P10: "The patient should be correctly informed, so that they can look positively at AI.
Additional opinions		P1: "AI cannot replace the doctor-patient relationship." P:7 "AI is a very important tool. It has the power to transform health. In the future, the provision of healthcare is unlikely without digital health technologies. P8 "I am hopeful for the future. P9: "Its spread will be faster in internal medicine, but slower in surgical branches.

Discussion

The current study showed high levels of knowledge and awareness about AI among HPs, which is nearly a common finding of other studies conducted among HPs and health sciences students (Filiz et al., 2022; Yılmaz et al., 2021).

In the quantitative arm, high perception scores of HPs about pros and cons of AI, with higher scores favouring pros. The situation can be elucidated by healthcare practitioners'

considerable degree of technical preparedness. The significance of "technology readiness" in influencing the acceptability of technological innovation within the realm of healthcare is widely acknowledged (Shaikh et al., 2021).

In the qualitative arm, only physicians were selected for their opinions about the applications of AI in the field of health. The majority of the physicians considered AI an indispensable assistant in their clinical practice, making clinical decisions faster, reducing workload and time consumption, and providing an early and accurate diagnosis. AI also has a limitless memory capacity and may detect abnormalities that are not discernable to the human eye. Moreover, AI has the advantage of being free from burn-out or physical limitations inherent to humans. On the other hand, AI was not considered to fully replace the professional of HPs and final decisions would always be in the hands of physicians. More specifically, AI provides a good opportunity for physicians to better prepare themselves for tasks that are special to human beings and skills that require empathy, persuasion, and big-picture integration, all of which are purely human attributes. This was also verified by the highest mean score obtained in response to the item: "AI has low ability to sympathize and consider the emotional well-being of the patient". There were also considerable concerns about overdiagnosis, insensitivity to emotional factors, and medical errors caused by insufficient amount of data. Our results are parallel with those reported by other studies (Jing et al., 2017; Davenport & Kalakota, 2019; Özlü et al., 2021). The consideration of artificial intelligence as a potential threat necessitates the inclusion of ethical dimensions in discussions surrounding the occurrence of erroneous medical practices (medical malpractice) that may arise from implementing artificial intelligence applications. An essential concern in this context is determining responsibility for the resulting repercussions. Additional subjects that were addressed encompass the deficiency of artificial intelligence in terms of its capacity for "natural" communication and empathy and its tendency to overlook multidimensional circumstances pertinent to real-world scenarios within the context of medical decision-making (Çalışkan et al., 2021).

It may be true that AI may bring about some job losses by reducing the amount of work in a particular subject, but it would generate new job opportunities, even novel jobs when AI applications become widespread. It is speculated that, among HPs, those who would most likely lose their jobs would be those who refuse to work in cooperation with AI (Davenport & Kalakota, 2019). Furthermore, it is vital to acknowledge that the integration of artificial intelligence in the realm of healthcare has the potential to give rise to novel sectors of commerce, consequently generating fresh prospects for employment.

Interestingly, we noted a gender difference in approaching to the pros and cons of AI, with significantly higher scores in favor of pros among male participants and significantly higher scores in favor of cons among female participants. This is in contrast with the finding of Abdullah and Fakieh (2020), who found no gender difference state about pros and cons of AI.

Conclusion

Currently, AI has already taken a long way in undertaking numerous tasks that once were only performed by humans. This is particularly valuable for HPs in healthcare to enhance human knowledge and capabilities. AI will also contribute our efforts to enhance connected care and holistic approaches, from which both patients and healthcare providers would benefit most.

Limitations and Strengths

The present study has some limitations. First, the participants were enrolled from centers located in only the Anatolian Region of İstanbul, limiting generalization of our results for the whole HPs population of Türkiye. Second, the quantitative data of the study were obtained by self-reported responses through an online survey, an approach that is inferior to one using face-to-face inquiries. On the other hand, utilization of both quantitative and qualitative methods enhances the strength of the study about HP perceptions concerning the pros and cons of AI.

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