

Experiences and Perceptions of Medical and Dental Practitioners of Bhopal City about Artificial Intelligence and Robotics in Medical Sciences and their Source of Information

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Abstract

Background: The use of artificial intelligence (AI) in the medical field is increasing and is expected to shape future clinical practice and job security. Thus, the purpose of this study is to determine the perception and experience regarding AI and robotics (R) and its implication in health care among healthcare professionals practicing in Bhopal city of Madhya Pradesh, India. **Materials and Methods:** The study was conducted using an online survey questionnaire to collect data on demographics of healthcare professionals, their experiences and perceptions toward the use of AI in their daily clinical practice and about the sources of information of AI. **Results:** A total of 90 professionals participated in the survey. Among them, 63.3% were registered dental specialists and 36.7% were medical specialists. The participants' attitudes were overall positive toward AI. Maximum healthcare professionals, i.e., 92.2% were heard about AI and R in health care and 63.3% were know the difference between AI and R. Most participants agreed that AI would reduce the time needed to establish a diagnosis and negatively affect employment rates. **Conclusion:** This study demonstrates that the attitudes toward the use of AI in medicine among practicing physicians in Bhopal are similar to those of physicians in developed countries in that they are positive and welcoming of AI implementation in practice. However, the potential effects of AI on job security are a major concern.

Keywords: Artificial intelligence, Experience, Healthcare professionals, Perceptions, Robotics, Sources.

INTRODUCTION

Robotics (R) is associated with the linkage between perception and action, and artificial intelligence (AI) plays a major role in facilitating this intelligent relationship. AI is “the automation of processes related to intellect, such as learning, decision-making, and problem-solving.” according to Richard Bellman's 1978 definition.^[1]

AI is a novel part in the field of science and technology. Since AI is rapidly becoming a essential tool in the dentistry and medical discipline, it is also referred to as the “Stethoscope of the 21st century.”^[2]

The term “AI” is frequently associated with R, pertaining to the use of technology to produce software or machines that can mimic mortal intelligence and perform specific tasks.^[3]

As an illustration, AI is used for building opinions in medical specialties that involve huge amounts of data, such as pathology and radiography. Robotic technology lessen risks while enabling healthcare professionals to work with better precision and lower stress.^[4]

The revolutionary means by which AI can transfigure data into outcomes that could ameliorate quality of care and clinical practices of our health professionals is instigative.^[5]

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There is plenty of discussion about how AI will impact healthcare jobs due to automation, but few wealthy nations have begun implementing AI in health care. Even medical communities around the world are ready to get training in the basic concepts of AI, which will enhance patient care and perceptions for the future. Global medical professionals expressed enthusiasm about the inclusion of fundamental AI principles in medical curricula and recognized the worth of the growing significance of AI in health care.^[6] There is an increasing conformity that medical education should be influential in imparting fundamental knowledge regarding AI and its significance in the healthcare sector.

The Indian government has acknowledged the significance of AI in the healthcare sector and has initiated measures to encourage its implementation. In 2018, the government introduced the National Health Stack, a digital framework designed to establish a standardized and interoperable system for healthcare delivery across the nation. In addition, the National Digital Health Mission was established to develop a comprehensive digital health ecosystem that facilitates the provision of healthcare services. However, the integration of AI in India's healthcare system encounters numerous obstacles, including a lack of standardization in healthcare data, insufficient infrastructure and funding, and a deficit of skilled professionals. It is expected that AI will play a vital and imminent role in various sectors, particularly in health care.^[7]

Medical practitioners must enhance their knowledge and stay abreast of technological advancements. Consequently, healthcare professionals should be prepared to adopt this technology, which is poised to enhance patient care and create new job opportunities. To cultivate a sustainable healthcare workforce capable of adapting to the swiftly evolving digital healthcare landscape, it is essential to comprehend clinicians' experiences and perceptions of AI in healthcare delivery. The relationship between technology and clinicians warrants further investigation. While numerous studies have examined the awareness of AI among healthcare professionals in various countries, there is a notable scarcity of research from developing nations like India, highlighting an urgent need to raise awareness of AI in health care within the medical community. Furthermore, it is crucial to collect data that accurately represents the Indian context; thus, our study was designed to assess healthcare professionals' experiences and perceptions regarding AI and its implications for health care.

MATERIALS AND METHODS

Study design and participants

A descriptive cross-sectional survey was conducted from August to September 2023 to assess the perception and experience regarding AI and R and its implication in health care among healthcare professionals practicing in Bhopal city of Madhya Pradesh, India. The study was conducted using an online survey questionnaire and all the medical and dental doctors of Bhopal city were considered.

Sampling technique

Both convenience sampling (researchers themselves contacted doctors to participate in the study) and snowball sampling (the participating doctors were asked to forward the questionnaire to their colleagues) were used so that maximal participation could be ensured.

Eligibility criteria

Inclusion criteria

Only medical and dental doctors who have completed their degree and practicing in Bhopal city of Madhya Pradesh were included in the study.

Age group

There is no strict age limits.

Exclusion criteria

Doctors who are not practicing in Bhopal city of MP or the doctors not yet completed their degree were excluded from the study.

Study instrument/questionnaire

The questionnaire consisted of two parts: Demographic details of medical and dental professionals and their perception and experience toward AI and R in health care. The online questionnaire contained a total of 19 questions to assess the experience and perception toward AI and R.

Informed consent

Informed consent forms were attached with each questionnaire for the participants to read and sign if they were willing to participate in the study. The information obtained from the study was treated with confidentiality and used for study purpose only.

Data collection procedure

At the beginning of the questionnaire, the participants were briefly informed about the objective of the study and the different sections of the questionnaire. A well designed pretested and a pre-validated questionnaire was designed on Google Forms and link generated was shared through social media and an e-mail to the working doctors and received all responses through an online survey submission.

Statistical analysis

Data cleaning and analysis were performed using the Statistical Package for the Social Sciences v. 25.0 (IBM Corporation, Armonk, New York, USA). Descriptive statistical analysis was performed using frequencies' percentages. The level of significance was set at $P \leq 0.05$.

RESULTS

Total 90 doctors were recruited in the study as shown in figure 1. On analyzing the study data, 22 participants were found to be male subjects, whereas 68 were female medical professionals. The maximum age range (66 %) of participating professional was found to be ranging between 25 and 39 years. Most of the medical professionals were dental specialist (63.3%) followed

by medical specialist (36.7%). Among the participants, most of the professionals were MDS (42.2%) followed by MD/MS (34.4%) while maximum professionals (41.1%) having more than 10 years of experience (Table 1).

Maximum healthcare professionals, i.e., 92.2% were heard about AI and R in health care and 63.3% were know the difference between AI and R. Utmost participants (72.2%) were consider that AI and R will help budding doctors in diagnosis and decision-making and 84.4% were believe that the AI can be used for screening the patients, whereas 88.9% and 77.8% know that the R can be used in surgeries and in the enhancement of clinical practices, respectively. The participants appeared to think that AI could lead to major advances in dentistry and medicine (81.1%), open up better job opportunities for medical professionals (65.6%), and it should be part of undergraduates or postgraduate training (77.8%). More than half of the participant (65.6%) believes that AI can be used as a quality control tool to assess the success of treatments, whereas 93.3% and 84.4% consider that it can be used in forensic science and a treatment planning tool in medicine, respectively. The vast majority of participants (73.3%) consider that AI can be used to predict the course of a disease and determine chance of recovery and 65.6% consider it as a definitive diagnostic tool in the diagnosis of diseases. Regarding their clinical practice, only 16.7% offered specific training in AI or R though 27.8% and 25.6% encountered AI tools in their theoretical training and clinical practice, respectively. Greater part of respondents (90%) thinks that they should receive specific training on the use of AI tools in health care (Table 2).

Participants reported different sources of information about AI and R; most participants (41%) get the information from social media followed by lectures (37%), newspaper (8%), and TV (2%) (Graph 1).

DISCUSSION

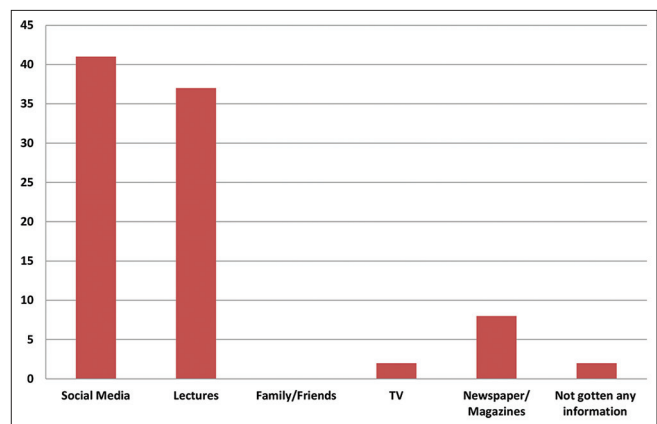
It is a well-known fact that the medical world is highly influenced by R/AI. The expansion, as well as the applicability of AI, presently exhibits involvement in the medical and dental fields.^[8] AI may be used for supporting medical and dental diagnosis and has demonstrated continued expansion since the previous decade.^[9]

R is a next generational based technology that has created novel pathways in different areas of medicine.^[10] Robotic surgery is a useful technique for performing medical surgeries, which results in less blood loss and shorter hospitalization than traditional scalpel surgery. Thus, the use of R can result in the improvement of medical procedures associated with clinical practices.

The applications that are based upon the use of AI may help in restructuring patient-based care, reducing treatment procedural period, improvements in health care at reduced cost factor covering a wide population, and finally assisting prognosis, acting as a protective barrier in case of infectious diseases such as COVID-19.^[11]

Table 1: Demographic characteristics of participants

S. No.	Variables	Categories	Frequency	Percentage	Mean	SD
1.	Gender	Male	22	24.4	1.76	0.432
		Female	68	75.6		
2.	Age	25–39 years	66	73.3	1.39	0.698
		40–49 years	13	14.4		
		50–59 years	11	12.2		
3.	Job title	Dental specialist	57	63.3	1.37	0.485
		Medical specialist	33	36.7		
4.	Qualification	BDS	19	21.1	2.50	1.173
		MDS	38	42.2		
		MBBS	2	2.2		
		MD/MS	31	34.4		
5.	Job experience	<5 years	28	31.1	2.10	0.849
		5–10 years	25	27.8		
		More than 10 years	37	41.1		



Graph 1: Sources of information about artificial intelligence and robotics

Pretested Questionnaire was designed on Google forms and shared through social media and emails

↓
Total 94 working doctors was responded

↓
4 unfilled or partially forms were received

↓
Due to this, 4 participants were excluded from the study

↓
Based on completely filled forms received during the study period

↓
90 final Participants were included in the study

Figure 1: Flow chart of participants recruitment procedure

Yu and Kohane in 2006 included the then “proposed system of Artificial Nerve Organs Network” that can detect the wearing

Table 2: Experiences and perception regarding AI and R among healthcare professionals

S. No.	Statements	Yes	No	Maybe	P-value
1.	Have you heard about AI and R in Health care?	83 (92.2)	2 (5.6)	5 (2.2)	0.105
2.	Do you know the difference between AI and R?	57 (63.3)	27 (30)	6 (6.7)	0.369
3.	Do you think AI and R will help budding doctors in diagnosis and decision making?	65 (72.2)	3 (3.3)	22 (24.4)	0.183
4.	Do you know that the AI can be used for screening the patients?	76 (84.4)	9 (10)	5 (5.6)	0.025
5.	Do you know that the robotics can be used in surgeries?	80 (88.9)	7 (7.8)	3 (3.3)	0.030
6.	AI has uses in the enhancement of clinical practices?	70 (77.8)	2 (2.2)	18 (20)	0.263
7.	Do you think AI will lead to major advances in dentistry and medicine?	73 (81.1)	00	17 (18.9)	0.856
8.	Learning AI will open up better job opportunities for medical Professionals	59 (65.6)	7 (7.8)	24 (26.7)	0.449
9.	AI applications should be part of Undergraduates or postgraduate dental training	70 (77.8)	00	20 (22.2)	0.008
10.	AI can be used as a quality control tool to assess the success of treatments.	59 (65.6)	11 (12.2)	20 (22.2)	0.007
11.	AI can be used in forensic dentistry	84 (93.3)	00	6 (6.7)	0.195
12.	AI can be used as a treatment planning tool in dentistry	76 (84.4)	5 (5.6)	9 (10)	0.004
13.	AI can be used as a prognostic tool to predict the course of a disease and determine whether there is a chance of recovery?	66 (73.3)	3 (3.3)	21 (23.3)	0.311
14.	AI can be used as a definitive diagnostic tool in the diagnosis of diseases	59 (65.6)	6 (6.7)	25 (27.8)	0.337
15.	Were you ever offered specific training in AI or robotics?	15 (16.7)	72 (80)	3 (3.3)	0.023
16.	Have you ever encountered AI tools in your theoretical training?	25 (27.8)	62 (68.9)	3 (3.3)	0.013
17.	Have you ever encountered AI tools in your clinical practice?	23 (25.6)	65 (72.2)	2 (2.2)	0.017
18.	Do you think that doctors should receive specific training on the use of AI tools in healthcare?	81 (90)	4 (4.4)	5 (5.6)	0.014

AI: Artificial intelligence, R: Robotics

loss of teeth. By making use of backward propagation of neuralbased networks, most specifically, X-ray radiographic images of teeth can be analyzed and thus, the resultant networking system may prove to be more accurate for the detection of dental caries.^[12]

The present study showed that 92.2% doctors heard about AI and R in health care. The majority of dentists was aware of R and AI and recognized its importance within the health care profession. However, only half of the respondents understood the distinction between R and AI. Our results were higher than the previous study conducted in central India (68%) and North India (55.8–77.4%).^[13,14] Nevertheless, our result is to some extent similar to a study done by Krishnaprakash *et al.* stated that 82.6% had previously heard about AI and R.^[15] Interestingly, a prior study conducted in Saudi Arabia revealed that 90.7% of participants were familiar with R and AI in health care; however, only 7% were able to distinguish between the two concepts.^[16] We contend that the reported level of awareness in that study was likely exaggerated due to its methodology, which conflated AI and R.^[16] Furthermore, the study's participant pool included individuals from various nationalities, as they were recruited at an international conference. Consequently, we affirm that our findings provide a more accurate representation of awareness regarding AI in Saudi Arabia. One possible explanation for the higher levels of knowledge and awareness of AI in health care observed in Indian studies could be attributed to the country's significant advancements and services in information technology. Nevertheless, the prevalence of AI in health care is increasing, and the discrepancies in knowledge and awareness rates may stem from variations in educational curricula across different countries and institutions.

Present study revealed that 72.2% and 84.4% respondents think that AI and R will help doctors in diagnosis and decision-making and can be used for screening of patients, respectively. Similar study has done by Alzahrani in Saudi Arabia shows less percentage (32%), whereas other research revealed a slightly higher percentage toward accuracy of RD and AI in diagnosing diseases (53.4% and 60.6%, respectively) as compare to present research.^[17] This variation may be due to the difference in educational curricula across countries and institutes.

Maximum participants (88.9%) in present study also think that it can be used in surgeries and 77.8% believed that AI and R enhances clinical practices, whereas according to Abouzeid *et al.* over 60% of participants agreed that the application of R and AI improve clinical practices.^[16] Present research shows maximum percentage toward the use AI and R in surgeries and clinical practice since with time the practitioners realize that it offers high-quality work in less chair time and increases precision, and decision-making, although also improving patient outcomes and reorganizing healthcare delivery.

Majority of participants (81.1%) thought that AI will lead to major advances in dentistry and medicine and more than half (65%) considered that it will open up better job opportunities for medical Professionals. This aligns with a study conducted by Aboalshamat in Saudi Arabia, where 76% of participants think that AI will lead to major advances in dentistry and medicine and 75% consider it as better job opportunity for medical professionals in future, similar to our results.^[18]

While in the present study, 78% of the participants also suggests that AI application should be part of undergraduates or postgraduate dental training like other research, whereas 74.60% and 79.80% of dental students agreed that topics about

AI should be included in undergraduate and postgraduate dental education, respectively. A further study reported that a 72.2% of medical and dental students agreed that AI and RD should be part of medical/dental training.^[19] Medical and dental practitioners were found to possess greater adaptability along with a higher positive attitude toward enhancing their knowledge regarding the usage of this modern technology in various fields of medicine including academics. Healthcare professionals are motivated to learn AI and its uses.

In the present study, 65%, 85% and 74% of participants believe that it can be used as a quality control tool to assess the success of treatments, treatment planning tool and prognostic tool in the treatment of disease, respectively, similar to the previous research done in by Aboalshamat in Saudi.^[18] Whereas only 17% participants in our research said they had received specific training in AI or R while only 28% and 26% encountered AI tool in their theoretical and clinical training, respectively, thus about 90% doctors feel that they should receive specific training on the use of AI tools in healthcare which is similar to the France research done by Perrier *et al.* in 2022.^[20] It appears that specific training on AI in medical studies is currently lacking. Hence, doctors may confront AI tools directly in their clinical practice without prior instruction about the concepts behind algorithms, how AI solutions are developed and evaluated, and their limitations and potential biases.

Although employing AI has numerous challenges, as it cannot be incorporated into high-level discussions with different individuals for attaining their trust and assurance regarding procedures.^[14] Even today for attaining a thorough diagnosis in clinical situations, medical professionals are required for assessing tricky medical conditions which may include healthrelated background, conducting physical systemic examinations, and encouragement of discussions on interesting cases.^[15,16] Hence, considering the future influence of artificial technology on the healthcare system and associated industry, this topic must be necessarily included in the existing curriculum.

CONCLUSION

Although AI offers many assurances in health care, it raises technical, professional, and ethical queries. The greater part of participants who responded to this survey had positive attitudes toward AI and highlights the need to set up specific training programs in AI and the significance of ethical and societal issues linked with the accomplishment of AI in healthcare.

Upcoming research directions may include the following areas: first, exploratory qualitative methods such as ethnographic or grounded theory to discover deep thoughts and perceptions of healthcare professionals toward RD and AI might be suggested. Second, development of dental or medical education curricula concerning RD and AI may also be advocated. Finally, potential collaborations among institutes and stakeholders regarding RD and AI industry to thoroughly investigate these

technologies and demonstrate the impacts of RD and AI models in clinical practice might also be emphasized.

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