Section: Community Medicine

Original Research Article

KNOWLEDGE AND ATTITUDE TOWARDS APPLICATION OF ARTIFICIAL INTELLIGENCE IN HEALTHCARE AMONG DOCTORS OF BAHRAICH, INDIA

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Abstract

Background: Artificial Intelligence (AI) is an umbrella term which is used to describe the multidisciplinary approach to use statistical, mathematical, and computer sciences to simulate intelligent behaviour. Artificial intelligence (AI) and related technologies are beginning to be applied to healthcare as well. The use of AI in the field of Radiology and Pathology is well known. These technologies also have the potential to transform many aspects of patient care. Although AI in healthcare is still at a rudimentary level, still much is to be done especially in low and middle income countries where there are no or minimal concrete plans to implement AI. **Materials and Methods:** It was a cross sectional study conducted among the doctors of Maharaja Suhel Dev State Medical College of Bahraich and the associated teaching hospital from 15th of November to 15th of December. Data was collected by a semi structured questionnaire prepared using Google forms. Participation in the study was completely voluntary and responses were kept anonymous to ensure confidentiality of the data. Data was analysed by using SPSS 26 software. **Result:** Half of the doctors declared their knowledge of artificial intelligence to be average (50%), for majority of the doctors the source of knowledge of artificial intelligence was internet (65.8%). More than half agreed that artificial intelligence is essential in healthcare. 87.2% of the doctors were interested in learning the application of artificial intelligence in healthcare and medical education. A total of 26 doctors had applied artificial intelligence in their practice. **Conclusion:** The present study concluded that the knowledge about artificial intelligence of majority of the doctors was average or above average. Majority of the doctors had positive attitude towards the application of AI in healthcare but they did not consider it to be a threat to their employment. AI is considered essential in healthcare by most of the study participants.

INTRODUCTION

Artificial intelligence (AI) in medicine refers to using computers and advanced technology, such as machine learning algorithms, to assemble and process data input from experts and analyze it, producing critical thinking comparable to that of a human being.[1] Another author defines Artificial Intelligence (AI) as an umbrella term which is used to describe the multidisciplinary approach to use statistical, mathematical, and computer sciences to simulate intelligent behavior.[2]

AI technology is widely used in many fields. Some of its applications are: advanced web search engines (e.g., Google Search), recommendation systems (YouTube, Amazon, and Netflix), understanding human speech (eg. Alexa), generative or creative tools (ChatGPT and AI art) etc.[1] The term Artificial intelligence was coined by John McCarthy who is also considered as the father of artificial intelligence. Artificial intelligence (AI) and related technologies are beginning to be applied to healthcare as well. AI has been primarily used for tasks which involved visual imagery, where it can analyze images and detect any abnormal phenotypic characteristics in

them.[3] There are two main branches through which application of AI in healthcare is anticipated- virtual, which involves mathematical algorithms improving learning; and second is physical, which involves the use of robots and medical devices.[4] There are already a number of research studies suggesting that AI can perform as well as or better than humans at key healthcare tasks, such as diagnosing disease.[5] The use of AI in the field of Radiology and Pathology is well known. Another area where AI is extremely helpful is in the counselling psychology sector of health. Depression is generally seen as a stigma by Indian society. Hence, AI helps providing chatbots (e.g. Wysa) which assure empathetic support and suggest when to consult human practitioners. Anonymity is a vital factor in this case which helps the patients sharing their feelings without being concerned of being judged or categorized (Rodriguez R, Sinha S, Tripathi S. Impact of Artificial Intelligence on the health protection scheme in India. Public Administration and Policy, 2020; 23(3):273-281). These technologies also have the potential to transform many aspects of patient care. AI will also help to lessen some of the drawbacks of traditional methods of diagnosis and treatment, including the risk of errors because of burnout in the medical field and other psychological impacts, the need to examine many patients quickly, the occasional inaccuracy of the diagnosis, and patients' anxiety when confronted by a doctor.[6] According to WHO, by 2035, there will be a shortage of nearly 12.9 million health care workers worldwide (WHO, 2017)

Some studies suggest that the factors which influence patient engagement and adherence are increasingly being addressed by big data and AI. This problem has long been seen as the 'last mile' problem of healthcare. The more patients proactively participate in their own well-being and care, the better the outcomes – utilization, financial outcomes and member experience.[7]

However, like with other innovative technologies, there are various challenges and limitations of AI as well that always need to be considered. Some of the problems are like protection of patient's privacy, ethical concerns, reliability of input data.[8]

Another imminent challenge of the widespread use of advanced technologies is that AI could pose a threat to physicians' jobs.[9] There has been much hue and cry about the fact that AI will lead to automation of jobs and substantial displacement of the workforce. A Deloitte collaboration with the Oxford Martin Institute suggested that 35% of UK jobs could be automated out of existence by AI over the next 10 to 20 years.[10] As afar as our knowledge is considered while some automation of jobs is possible, but there are other factors as well that would limit job loss. The reality is that machines can never completely replace humans.

Although AI in healthcare is still at a rudimentary level, still much is to be done especially in low and middle income countries where there are no or minimal concrete plans to implement AI. The fact that AI has come to stay can't be neglected and its future in healthcare seems bright, hopeful and promising. Given the influence of AI and machine learning in our society today, and the requirement of sound knowledge of programming for effective application of AI in healthcare, it is important that AI be taught to specialists especially in the medical field where making wrong choices have grave consequences.[11]

Accordingly, our study is aimed at assessing the knowledge and attitude of doctors towards the application of artificial intelligence in healthcare.

MATERIALS AND METHODS

Study Design: Cross sectional study conducted by distributing questionnaires online which was prepared with the help of google forms.

Study Settings: The study was conducted in the Maharaja Suhel Dev State Medical College of Bahraich and the associated teaching hospital. It is a tertiary care health centre.

Study Population: All the registered doctors who have at least completed their graduation (MBBS) and practising or undergoing training for speciality in the medical college and associated teaching hospital.

Study Duration: study was conducted from 15th of November to 15th of December.

Eligibility Criteria

Inclusion criteria:

Those who have at least completed their MBBS.

Those who gave consent to participate in the study.

Exclusion criteria:

Those who did not gave consent to participate in the study.

Sample Size: The questionnaire was sent to a total of 140 doctors working in the medical college and associated teaching hospital. 23 doctors did not respond therefore the total sample size came out to be 117.

Methodology

Data Collection Tool: pre tested semi-structured questionnaire made using google forms

Method Of Data Collection: A validated semi structured self-administered questionnaire was prepared using google forms which was distributed online to all the study participants. Study participants were detailed about the nature and purpose of the study. Participation in the study was completely voluntary. Pilot study was done in a small group before being disseminated to all the study participants, to look for any loopholes in the questionnaire and to ensure the clarity, understanding and interpretation of the questionnaire. These study subjects were not included in the final study. As the questionnaires were anonymous, it was not possible to detect and exclude duplicates, but it is highly unlikely that respondents will fill and submit the form multiple times.

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Junior doctors: All those doctors who were graduates (completed their MBBS) and working in the medical college and associated teaching hospital.
Senior doctors: All those doctors who were post graduates (completed their MBBS and MD/ MS) and working in the medical college and associated teaching hospital.
Details of questionnaire: The questionnaire begins with few lines informing the study participants about the objectives and purpose of the study. Then consent was taken by asking the study participants to check the box of whether they agree or disagree to participate in the study.
The questionnaire was divided into three parts. The first section collected information on demographic details and background of the study participants like age, gender, qualification (whether graduate or postgraduate) department in which they are working, designation, years of experience etc. Second section dealt with the questions regarding the knowledge of doctors about AI. The knowledge of AI was not assessed by the authors but was self-declared and rated by the doctors. The third section contained items to know their attitude towards role of AI in healthcare. The questions which were answered using the Likert scale had options ranging from 1, "strongly disagree," to 5, "strongly agree," with 3 being "neutral". Only completed questionnaires were included in the analysis. The participants had the right to anytime withdraw from the study.
Ethical Clearance: The study ensured that the privacy of each participant was adequately protected. The responses were anonymous. Only after they gave consent to participate in the study, were they asked to fill and submit the form. The form was sent to a total of 140 doctors out of which 23 did not respond. Ethical clearance was obtained from the institute's ethical committee.
Statistical Analysis: Data was analyzed by using SPSS 26 software. Chi square test was used to compare categorical data. The continuous variables were presented as mean and standard deviation. p value less than 0.05 was considered as statistically significant.

RESULTS

The results of our study showed that the majority of the doctors (83.7%) were in the age group of 21-40 years. The study participants were predominantly male (78.6%). According to the qualification 55.5% of the doctors were graduate and rest 44.4% were post graduates. [Table 1] describes these baseline characteristics of the study participants.

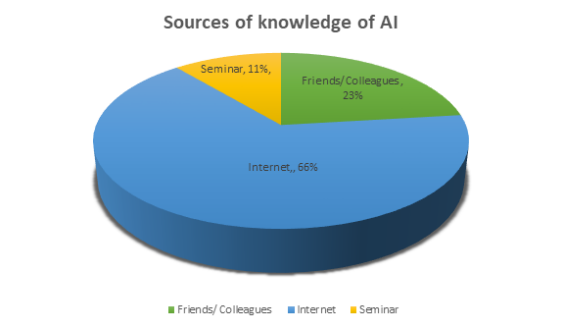

Figure 1: Sources of knowledge of AI

[Table 2] (a) shows the knowledge of doctors regarding the application of Artificial intelligence in healthcare. The mean of knowledge was found to be 3.14 ± 0.77. Half of the doctors declared their knowledge to be average (50%) and almost 30% said that they had above average knowledge about AI. 1.8% each of the study participants said that they had poor and excellent knowledge of AI.
[Table 2] (b) shows that majority of the doctors (70.9%) know about the application of AI in healthcare but only 36.8% of the study participants know about machine learning and deep learning.
[Figure 1] shows that for majority of the study participants, the source of knowledge of artificial intelligence was internet (65.8%), 23.1% and 10% had knowledge from friends/colleagues and seminars respectively.

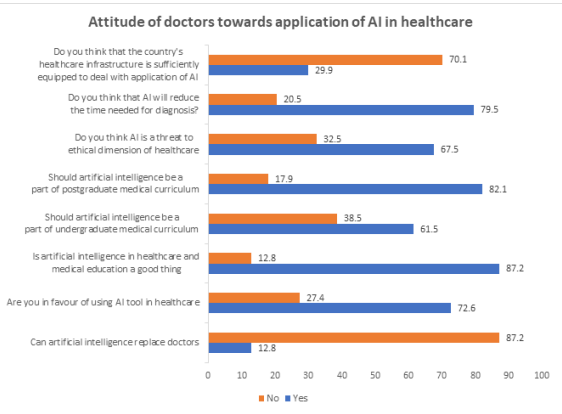

Figure 2: Attitude of doctors towards application of AI in healthcare

[Figure 2] shows the responses of doctors' attitude towards application of AI in healthcare. Although majority of the doctors were in favour of using AI in healthcare (72.6%), agreed that it will reduce the time needed to make a diagnosis (79.5%) but most of them also believed that artificial intelligence cannot replace doctors (87.2%). Most of the study participants said that AI in medical education is a good thing (87.2%) and should be included in postgraduate medical curriculum (82.1%), but comparatively a smaller percentage (61.5%) agreed that it should be included in undergraduate medical curriculum. 67.5% of the study participants considered artificial intelligence to be a threat to

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ethical dimension of healthcare. Majority of the doctors believed that currently the country's health infrastructure is not sufficiently equipped to deal with the application of artificial intelligence.

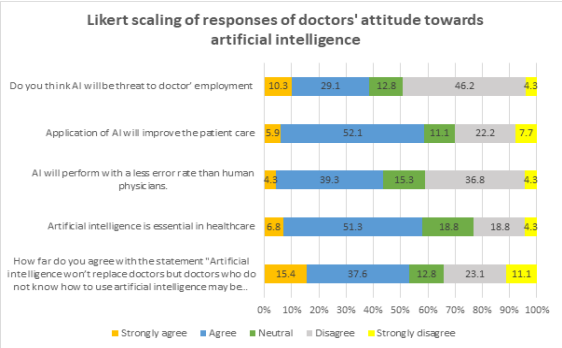

Figure 3: Likert scaling of responses of doctors' attitude towards artificial intelligence

[Figure 3] shows the responses of doctors' attitude towards the application of AI on likert scale. Majority of the doctors disagreed that AI will be a threat to doctors' employment (46.2%). More than half (58%) of the study participants were in favour that AI application will improve the patient care. The agreement (43.6%) and disagreement (41.1%) was almost equal when asked whether AI will perform with less error rate than humans. More than half agreed that artificial intelligence is essential in healthcare.

[Table 3] shows the results of practice of artificial intelligence among doctors. Out of the total 117 study participants, 87.2% were interested in learning the application of artificial intelligence in healthcare and medical education. A total of 26 doctors had applied artificial intelligence in their practice and out of these 96.25 believed that its application was easy for them and their task was also made easy.

[Table 4] shows the mean and standard deviation of knowledge of artificial intelligence among the doctors. The difference in knowledge level was found to be significant between the male (3.07 ± 0.768) and female doctors (3.40 ± 0.707) but no such difference was found when the knowledge was compared between the senior (3.50 ± 0.707) and junior (3.00 ± 0.882) doctors. The mean of knowledge was more in younger age group (3.10 ± 0.746) as compared to those in the group between 41-60 years (2.95 ± 0.848). However the difference in knowledge across various age groups was also not statistically significant (p 0.289).

The effect of gender and post on the attitude of doctors towards the application of artificial intelligence is shown in [Table 5]. The effect of post on the attitude of doctors towards the application of AI was found to be significant, the mean of all the junior doctors' responses was more (3.49 ± 1.19) than the seniors when asked "AI won't replace doctors but doctors who don't know how to use AI will be replaced". The mean of responses to the question whether AI is essential in healthcare is more than 3 in all the cases meaning thereby that most of the doctors considered that AI is essential in healthcare. However the difference in the opinion across various groups was not statistically significant. The difference in the responses of senior and junior doctors in response to whether they consider AI to be a threat to employment or not was found to be statistically significant (p value 0.039) with junior doctors agreeing (mean 3.17) that AI may be a threat to employment of doctors in the future. The difference in responses to other two questions, "Do you think AI perform with less error rate" and "Application of AI will improve patient care" was also not found to be statistically significant.

Table 1: Baseline characteristics of the study population

Variables	N=117	%
Age		
21-30	50	42.7
31-40	48	41
41-50	16	13.6
51-60	3	2.5
Gender		
Males	92	78.6
Females	25	21.3
Qualification		
MBBS	64	54.7
MD/MS	53	45.3
Post		
Junior doctors	64	54.7
Senior doctors	53	45.3

Table 2: a&b Knowledge of artificial intelligence.

How is your knowledge about AI	N (%)	Mean ± SD
Poor	2 (1.8%)	3.14 ± 0.77
Below average	19 (16.2%)	
Average	59 (50.4%)	
Above average	35 (29.9%)	
Excellent	2 (1.8%)	
Table 2(b)		

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Do you know about any application of AI in medical field	N	%
Yes	83	70.94017
No	34	29.05983
Do you know about machine learning and deep learning		
Yes	43	36.75214
No	73	62.39316

Table 3: Descriptive statistics for practice of artificial intelligence

Variable	Yes N (%)	No N (%)
Are u interested in learning the application of artificial intelligence in healthcare and medical education?	102 (87.2%)	15 (12.8%)
Have you ever applied artificial intelligence technology in medical field	26 (22.2%)	91 (77.8%)
Was it's application easy for you?	25 (96.2%)	1 (3.8%)
Was your task made easy?	25 (96.2%)	1 (3.8%)

Table 4: Effect of gender and post on the Knowledge about AI

Variables		Mean	Std. Deviation	Std. Error Mean	p-value
Gender	Male	3.07	0.768	0.080	0.046
	Female	3.40	0.707	0.141	
Post	Junior	3.16	1.194	0.150	0.287
	Senior	3.35	1.049	0.143	
Age	21-40	3.10	0.746	0.075	0.289
	41-60	2.95	0.848	0.195	

P<0.05 is significant

Table 5: Effect of gender and post on the Attitude of doctors towards AI

		Mean	Std. Deviation	Std. Error Mean	p-value
AI won't replace doctors but doctors who don't know how to use AI will be replaced					
Gender	male	3.20	1.225	0.128	0.611
	female	3.36	1.469	0.294	
Post	Junior	3.49	1.190	0.150	0.017
	Senior	2.93	1.315	0.179	
AI is essential in healthcare					
Gender	male	3.22	1.060	0.110	0.240
	female	3.48	0.960	0.190	
Post	Junior	2.16	0.677	0.085	0.182
	Senior	2.35	0.850	0.116	
AI will be a threat to employment					
Gender	male	3.02	1.148	0.12	0.399
	female	2.80	1.155	0.231	
Post	Junior	3.17	1.199	0.151	0.039
	Senior	2.74	1.049	0.143	
AI will perform with a less error rate					
Gender	male	3.07	1.097	0.114	0.383
	female	2.88	0.881	0.176	
Post	Junior	3.10	1.118	0.141	0.438
	Senior	2.94	0.979	0.133	
AI will Improve patient care					
Gender	male	3.23	1.14	0.119	0.717
	female	3.32	1.108	0.222	
Post	Junior	3.16	1.194	0.150	0.354
	Senior	3.35	1.049	0.143	

DISCUSSION

AI is a game-changer, and the healthcare sector will be able to avail several opportunities from this technological development.[12] The major focus is on providing services to those areas where the infrastructure is not yet available or primary healthcare quality is questionable. However, a full-fledged replacement of physicians and doctors by automation is still a debatable topic which will be socially addressed in the future.[13] The application of AI in health sector very much depends upon the knowledge and attitude of doctors towards AI. The present study showed generally positive attitude of doctors towards the application of AI in health sector.

In our study the mean score of knowledge about artificial intelligence among doctors was found to be 3.14. Contrary to our study findings, a study from Syria6 showed the mean score of Knowledge of AI among the study participants to be 1.82 ± 1.83. Such low levels may be explained by the inclusion of medical students as well along with the doctors as study participants. The difference in knowledge level was found to be significant between the male and female doctors Almost similar result was shown by a study where the knowledge score on the Likert scale (1 = strongly disagree to 5 = strongly agree) was found to be 3.25 (1.00-5.00), and the knowledge score compared by gender was statistically significant (p=0.002).3 In the present study more than

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half of the doctors did not consider AI to be a threat to employment, which is consistent with findings from other studies.[14-16] but not consistent with a recent study from Saudi Arabia in which the item "AI could replace me in my job" ranked first with a mean of 3.11 (SD 1.17).[17] Some participants, in which the majority were the younger ones, did report a fear that AI may be a threat to their employment. With regard to the question "will AI improve the patient care", the responses of participants in the present study concurred with other studies.[18,19] Our study showed that 87.2% of the study participants were interested in learning the application of artificial intelligence in healthcare. Contrary to the findings of our study, a study from Oman conducted on physicians and medical students showed that only 23.55% participants had interest to learn more about AI if dedicated courses and training are offered.[16]

Despite all of these reported barriers, physicians who participated in this study showed an overall willingness to learn about AI applications. Our study showed some difference in the attitude of senior and junior doctors towards AI for eg. in response to the question "AI won't replace doctors but doctors who don't know how to use AI will be replaced" and "AI will perform with a less error rate", the senior doctors mainly disagreed while the junior doctors agreed to these statements showing that seniors are somewhat less motivated towards AI. This reported resistance among senior doctors may be due to lack of awareness and competencies. In a systematic review to study the major barriers to successful digital health applications in developing countries in general and Arab countries specifically, a lack of technical competencies and knowledge among healthcare workers was reported as one of the main barriers.[20]

CONCLUSION

The present study concluded that the knowledge about artificial intelligence of majority of the doctors was average or above average. Although majority had a positive attitude towards AI in context of its ability to improve patient care, its necessity in healthcare but the participants remained apprehensive of its ability to replace physicians as majority of the doctors did not agree that AI can replace doctors. They did not consider AI to be a threat to their employment but majority believed that doctors who do not learn AI can soon be replaced. The responding participants were also in favour of including AI in medical curriculum especially at postgraduate level. Formal training courses to teach about AI should be focused on to facilitate coherent and scientifically supported dissemination of knowledge in medical schools and hospitals. Further large-scale studies are needed to have deep understanding about the perception and attitude of doctors regarding AI which will further assist in developing policies for changes in medical curriculum and training of future doctors.

Ethical consideration: The study was approved by the Institute's Ethical committee.

Author contributions - Each author contributed significantly to the work that was published, whether it was through ideation, study design, execution, data acquisition, analysis, and interpretation, or in all of these areas. They also participated in the article's drafting, revision, or critical review process, approved the final version that was published, chose the journal to which the article was submitted, and agreed to take responsibility for all aspects of the work that went into it.

Conflict of interest -The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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