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Does Artificial Intelligence influence medicine students in favoring Radiology as a future specialty -A survey in North India

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A B S T R A C T

Purpose: Numerous student surveys carried out worldwide has shown significant dilemmas, confusion about choosing Radiology as a future specialty due to emergence of artificial intelligence(AI). To know the influence of AI on medicine students choice in favoring Radiology as a future specialty, in this part of India, the survey was taken. International student surveys have shown considerable anxiety about pursuing radiology as a career due to artificial intelligence (AI). For a counterpart study in the US, we examined the impact of AI on US medical students' choice of radiology as a career, and how such impact is influenced by student's opinions on exposures to AI and radiology.

Methods: This study was conducted in North India across two universities. About ten medical schools participated in this anonymous online survey. Medical students pursuing their fourth and fifth year medicine course were included in study. Respondents ranking of radiology with AI and without AI were compared. Subjective opinions of medical students on radiology and AI, who put radiology on top three choices were compared to others. Students who consider Radiology in their first top three choices but changes their preference due to AI was statistically studied.

Results: 41.2% of participants ranked radiology specialty as their first choice. 24.5% of participants will not consider radiology specialty as their preference if AI did not exist.35% of medical students will have radiology as their first choice if AI did not exist. 44.1% are concerned about considering radiology as a specialty due to AI. 51.8% agree that there will be reduced job opportunities for radiologists due to replacement by AI in their lifetime. 62.3% agree that AI will enhance the efficiency of practicing radiology specialists.39% of participants who chose radiology as their preferred first choice believe that pre clinical lectures will be the most favorable way to acquire knowledge about AI in radiology,

Conclusion: AI has a negative impact to some extent on Indian medical students from north India as a future specialty. Also there is prevailing confusion and dilemma regarding AI. Few of the students were also curious about AI.

Keywords: Artificial intelligence; future specialty; Career choice; Medical education; Radiology.

INTRODUCTION

Artificial intelligence (AI) especially deep learning has drawn favorable attention and has gained plenty of interest in the field of radiology. This has been possible since the past decade.There has been advancements and improvement since the past few years.(1)

Choosing future specialty is an important question faced by medical students, after completion of their graduation. Several factors influence the decision of choosing a medical speciality. These domains may include prestige and professional success, personal preference, family and group influence, educational system, and global trend. (2).Also there has been a hype that radiology and pathology sector would be affected most by AI.(3)

In this study we are trying to disclose the reasons which will influence the students choice of selecting Radiology as a future speciality in view of AI. Also what measures need to be taken to resolve their confusion and increase their understanding regarding AI. What should medical students do to prepare themselves for AI.

MATERIALS AND METHODS

Study design, context, population: This is an observational cross sectional study conducted using online questionnaire Google form. The purpose of this survey was to assess the effect of artificial intelligence on medicine students in choosing Radiology as a specialty. This study was conducted in north India at Sharda university and Delhi university.

Inclusion and exclusion criteria:

Medical students pursuing their fourth and fifth year MBBS course in Sharda university and Delhi university were included in study. Medicine students who are freshers , in the first, second and third year and those who declined to participate in the study were excluded from the study.

Sample size and techniques:

Study instrument and data collection:

An electronic survey in English language received from a previously published study. Link of the questionnaire was shared with fourth and fifth year medicine students, via Google forms. The survey took about three to five minutes to be filled out. This survey was shared by the study's authors and data collectors from fourth and fifth year in the college. Different social media platforms like WhatsApp, Telegram were utilized to share the questionnaire with students.

The questionnaire was divided into three subdivisions. The first subdivision constituted consent ,demographic details, year in medical school, radiology ranking as compared to other specialties, ranking radiology if Artificial Intelligence did not exist and their interest in diagnostic or interventional radiology. The second subdivision looked for medical students level of perception of AI and its effect on their specialty choices, their exposure to radiology in the form of pre clinical lectures elective rotation etc and where did they hear about various applications of AI in radiology.

The third subdivision of the questionnaire evaluated the most beneficial way for medical students to learn about applications of AI in radiology.

Ethical considerations:

The ethical committee of Sharda university gave their approval. The survey was done with complete privacy, safety and confidentiality. Participants consent was obtained in the beginning before the start of the questionnaire. Participants were free to declare their non participation at any point of time during the survey. Refusal to participate involved no penalty or loss of benefits.

Pilot study: Validity and accuracy of the questionnaire was tested by pilot study with 10 % of the sample size. It was carried out after approval from ethical committee. Few questions were rearranged as per the pilot study results.

The final data analysis did not include Pilot study findings.

Statistical Analysis:

This online data was analyzed using SPSS(SPSS Inc-USA) version.

P value of less than 0.05 was regarded statistically significant.

RESULTS

The online questionnaire was responded by 571 medical students. Out of 571 respondents, males were 294 (51.5%) and females were 277 (48.5%). Bulk of the respondents i.e. 337 (59%) were from fifth year of medical school followed by fourth year medical students 234 (41.0%). Majority of participants i.e. 244(42.7%) were of age 23 years followed by age of 24 years 241(%42.2%).

		All Participant	%	Radiology top 3 Choice	%	P-value
Gender	Male	294	51.50%	216	73.50%	0.01
	Female	277	48.50%	228	82.30%	
Age Category	22	86	15.10%	65	14.60%	
	23	244	42.70%	192	43.20%	0.83
	24	241	42.20%	187	42.10%	
Academic Year	4	234	41%	178	40.10%	0.41
	5	337	59%	266	59.90%	
Radiology as a preferred specialty	Diagnostic	279	48.90%	214	76.70%	
	Interventional	143	25%	109	76.22%	
	Unsure	114	19.96	89	78.07%	0.99
	Not considering radiology	74	12.96	60	81.08%	

Table 1: Demographic characteristics and radiology as career speciality among the top three choices of medical students participants study survey. (n=571).

86 (15.1%) students of 22 years participated in this online survey.
444 students ranked radiology as one of their top three specialty preferences .

41.2% of participants ranked radiology specialty as their first choice. 24.5% of participants will not consider radiology specialty as their preference if AI did not exist.

35% of medical students will have radiology as their first choice if AI did not exist.

42.6% medical students are interested in diagnostic radiology. Medical students who agreed that they have a good understanding of field of radiology were 28.2%. 35.6% agree that they have a good understanding of how AI will be used in Radiology. 44.1% are concerned about considering radiology as a specialty due to AI. 51.8% agree that there will be reduced job opportunities for radiologists due to replacement by AI in their lifetime. 62.3% agree that AI will enhance the efficiency of practicing radiology specialists.

About 289(50.6%) medical students were exposed to radiology through pre clinical lectures, 156 (27.3%) through radiology attending residents (p<0.05), 226 (39.6%) through other medicine colleagues/students,218 (38.0%) students were exposed to radiology through media/internet.

Students who selected radiology as first three choices had an exposure to radiology through pre clinical lectures, elective rotation, medical school interest group, radiology attending residents, medical students,media/internet, research, academic journals, family, research experience .

Factors	Radiology top 3 choice	Not prefer Radiology	Total	P value
Exposure to Radiology				
Pre clinical lectures	211 (73%)	78 (27%)	289	0.006
Required clerkship rotation	33 (70.2%)	14 (29.8%)	47	0.194
Elective rotation	78 (75.7%)	25 (24.3%)	103	0.584
Medical school interest group	93 (78.8%)	25 (21.2%)	118	0.757
Shadowing				
Research	29 (85.3%)	5 (14.7%)	34	0.276
Conferences	24 (70.6%)	10 (29.4%)	34	0.3
None	112 (86.8%)	17 (12.2%)	129	0.005
Exposure to Artificial Intelligence				
Radiology attending residents	109 (699%)	47 (30.1%)	156	0.005
Non radiology attending residents	38 (65.5%)	20 (34.5%)	58	0.018
Academic journals	72 (68.6%)	33 (31.4%)	105	0.012
Medical students	173 (76.5%)	53 (23.5%)	226	0.574
Family	65 (86.7%)	10 (13.3%)	75	0.047
Media/internet	168 (77.1%)	50 (22.9%)	218	0.754
Research experience	28 (87.5%)	4 (12.5%)	32	0.173
I have not heard of use of AI in radiology	69 (87.3%)	10 (12.7%)	79	0.027

Table 2: Student Participants' exposure to radiology and artificial intelligence (n=571).

The students who did not prefer radiology also had exposure to radiology but to a lesser extent. Statistically significant difference (p<0.05) was found between the two groups i.e. in exposure to pre clinical lectures and radiology attending residents.

According to table 3, 44 (9.9%)students who chose radiology specialty as one of top three choices strongly agree that they have a good understanding of field of radiology, as compared to 18(14.2%) students who has not regarded radiology in their top three choices. However the difference was not found to be statistically significant.

49(11%) of students who has radiology specialty in their preferred three choices strongly agree that they have a good understanding of how AI will be used in radiology. While 17 (13.4%) students who has not chosen radiology in their preferred three choices strongly agree that. But this difference is not statistically significant. (p> 0.149)

67(15.1%)students who has chosen radiology in top three choices strongly agree they are concerned about considering radiology as a specialty due to AI compared to 21 (16.5%) of the general students.

| Statement		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	P value
I have a good understanding of the field of radiology.	Radiology top 3 choice	44 (9.9%)	79 (21.2%)	188 (42.3%)	94 (21.2%)	39(8.8%)	0.082
	Not considering radiology	18 (14.2%)	20 (15.7%)	61 (48%)	25 (19.7%)	3 (2.4%)	
I have a good understanding of how artificial intelligence will be used in radiology.	Radiology top 3 choice	49 (11%)	100 (22.5%)	179 (40.3%)	76 (17.1%)	40 (9%)	0.149
	Not considering radiology	17 (13.4%)	37 (29.1%)	52 (40.9%)	16 (12.6%)	5 (3.9%)	
I am concerned about considering radiology as a specialty due to artificial intelligence.	Radiology top 3 choice	67 (15.1%)	121 (27.3%)	157 (35.4%)	67 (15.1%)	32 (7.2%)	0.229
	Not considering radiology	21 (16.5%)	43 (33.9%)	35 (27.6%)	23 (18.1%)	5 (3.9%)	
There will be a decrease in job opportunities for radiologists due to replacement by artificial intelligence in my lifetime.	Radiology top 3 choice	76 (17.1%)	146 (32.9%)	129 (29.1%)	69 (15.5%)	24 (5.4%)	0.263
	Not considering radiology	20 (15.7%)	55 (43.3%)	31 (24.4%)	17 (13.4%)	4 (3.1%)	
Artificial intelligence will increase the efficiency of practicing radiologists.	Radiology top 3 choice	86 (19.4%)	181 (40.8%)	125 (28.2%)	34 (7.7%)	18 (4.1%)	0.295
	Not considering radiology	29 (22.8%)	60 (47.2%)	28 (22%)	8 (6.3%)	2 (1.6%)	

Table 3: Subjective opinions of medical students on radiology and AI, who put radiology on top three choices compared to others, based on a 5-point Likert scale.

76(17.1%) of students who has chosen radiology specialty as one of their preferred three choices strongly agree that there will be reduced job opportunities for radiologists due to replacement by AI in their lifetime compared to 20(15.7%) of general students.

86(19.4%) students with radiology in their first three preferred choices strongly agree that AI will enhance the overall output of practicing radiologists as compared to 29(22.8%) of students who were not considering radiology.

In all these results, p value was not found to be significant.

Fig 1 shows radiology ranking with AI and without AI, as wished by medical pupils.
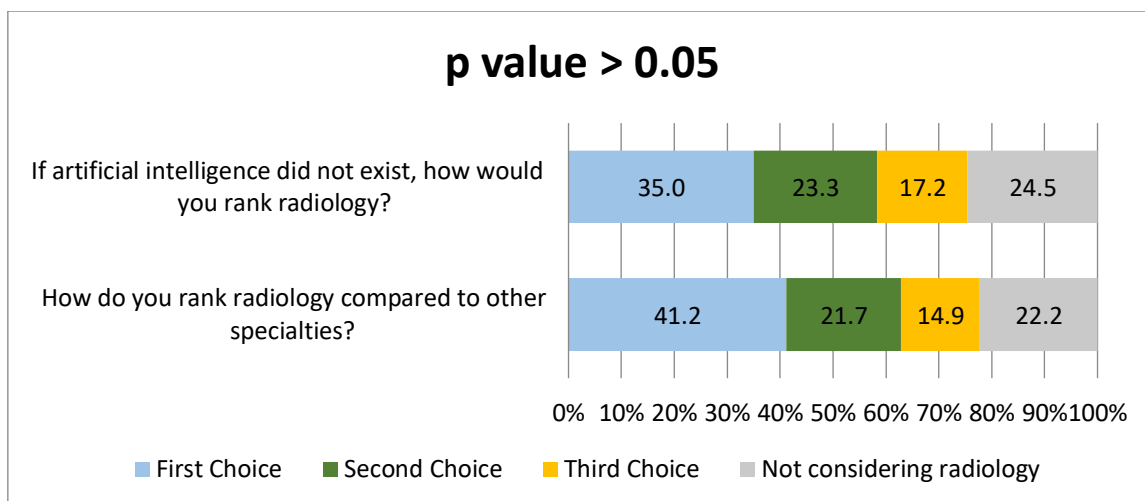
Figure 1: Radiology ranking by participants with AI and without AI.

35.026%students ranked radiology without AI as their first choice and 41.156% students ranked radiology with AI as their first choice.

23.3% students ranked radiology without AI as their second choice and 21.716% students ranked radiology with AI as their second choice.

The difference in ranking radiology with and without AI was statistically not significant.

Figure 2 shows that 39% of participants who chose radiology as their preferred first choice believe that pre clinical lectures will be the most favorable way to acquire knowledge about AI in radiology, while 11% participants for whom radiology was not the preferred choice agreed to this.

18% of participants who chose radiology as their preferred first choice consider that medical school interest groups will be helpful to impart knowledge about AI in radiology.

15% of students who chose radiology as preferred first choice believe that elective rotation will be helpful to impart knowledge about AI in radiology.5% each of participants who chose radiology as their first choice believe that conferences and research will be beneficial way for medical students to acquire knowledge about AI in radiology.
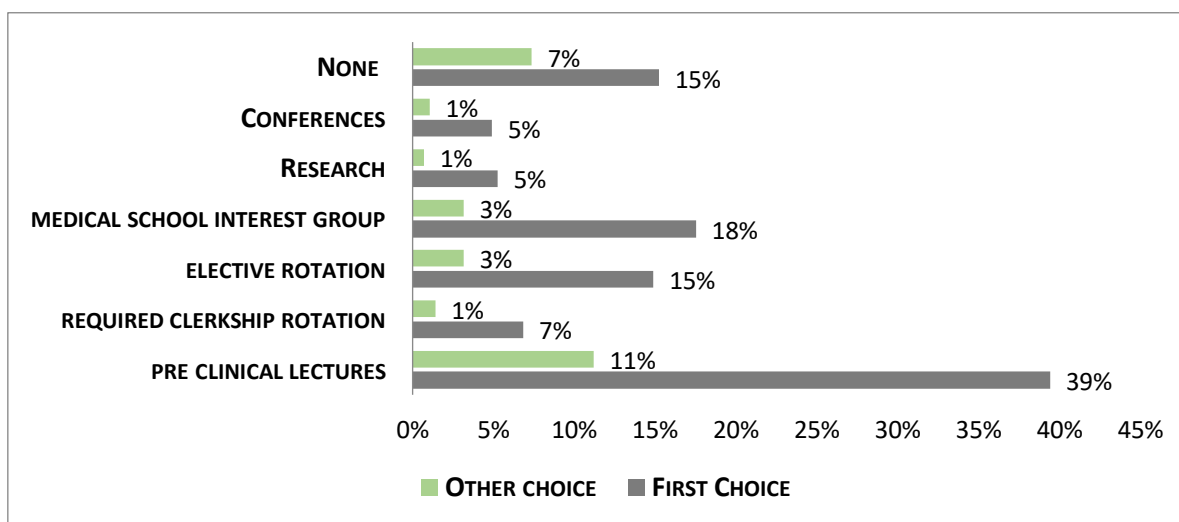
Figure 2: Respondents preferences about various ways to impart AI education in radiology
Logistic regression analysis demonstrated that female is significantly associated with an increased risk of changing radiology as a chosen stream due to AI by 1.68 times(COR=1.68)

			95% CI	
Variable	P value	COR	Lower limit	Upper limit

Gender				
Male (ref.)				
Female	0.012	1.68	1.123	2.514

Table 4: Logistic regression analysis of independent predictors of changing radiology as a preferred specialty due to artificial intelligence. COR = Crude odds ratio, OR = estimated odds ratio, 95% CI = a 95% confidence interval.

No significant difference could be noted in any of the groups based on Mann-Whitney U test as in fig 3.
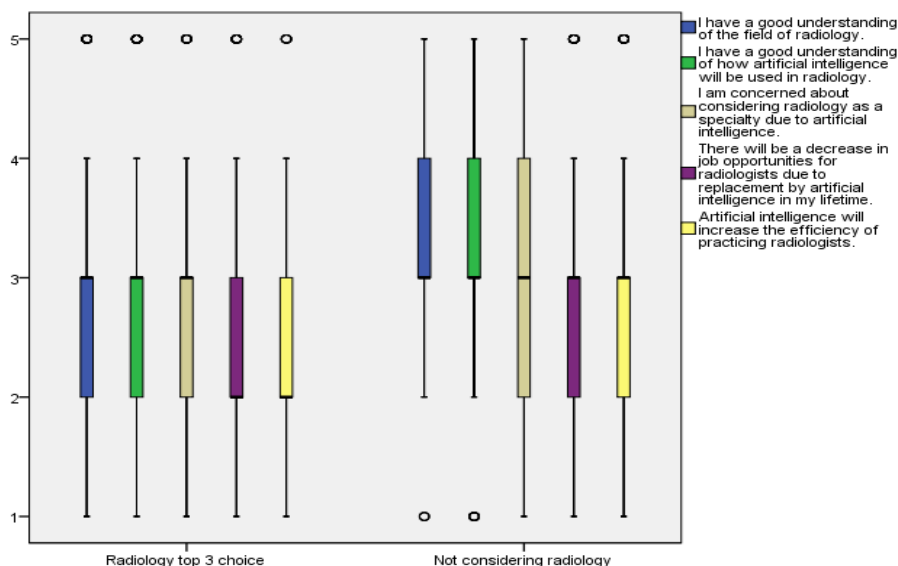
Figure 3: Subjective opinions of respondents on radiology specialty and AI based Radiology ranking, on a 5-point Likert scale.

DISCUSSION

The practice of radiologists has been definitely affected by the rapid pace of advancements made in medicine and specially radiology. Mundane work has significantly increased in volume and is done efficiently with the help of AI. Howeverin complicated cases, AI will not be helpful. Future medical students those who wants to pursue radiology need to get well acquainted with the use of AI in medicine, impact of AI and various implications of AI in the branch of radiology.

Above study was carried out with the purpose to assess the effect of AI on medical student's preference of considering radiology as a future specialty.

In this study, total 571 medical students of fourth year (41%) and fifth year medicine (59%) participated. Of these 444 students (77.8%) ranked radiology as one of their foremost upper three choices.

48.9%(279) of medical students expressed their interest in diagnostic radiology. This study showed that 223 (77.2%) students had exposure to radiology through pre clinical lectures, 42 (89.4%) through rotation postings, 85(82.5%) through elective rotation ,30(80.2%)through research, 33 (97.1%) through conferences. These results were expected as radiology is already a part of medicine syllabus in medical schools.

About 132 (84.6%) medical students has heard regarding use of AI in radiology from radiology attending residents; 50 (86.2%) heard from non radiology attending residents; 80 (76.2%) heard from academic journals and 161 (73.9%) heard regarding use of AI in radiology from media/internet.

This is because plenty of interactions taking place due to easy availability of means of communication devices and one on one interaction before opting for post graduate studies.

In our study, students who strongly agreed to have good understanding of radiology were 10.9%.

Furthermore 11.6% of them strongly agree to have good understanding of AI usage in radiology.

In similar studies conducted in Saudi arabia and Canada (4,5) approximately 45% and 20.4% respectively agreed that they have a good perception of AI usage in radiology. These results are variable.

In our study, 41.2% of medical students selected radiology as their preferred first choice when assisted with AI and 35% students when not assisted with AI. In a study by Gong et al (5) 21.7% (70/322) ranked radiology as the topmost choice and 41.3% (133/322) among the top three choices.

39% of student participants who selected radiology as their first preferred choice regarded pre clinical lectures to be useful to learn about use of AI in radiology. This is harmonious with previous studies conducted in United States of America (6) and Jazan university SAU (4).

In our study, female is significantly associated with an increased risk of changing radiology as a chosen stream due to AI by 1.68 times. This was consistent with a study by Hakami et al.(4)

Many studies in recent literature suggest that the female gender is less concerned about radiology as a chosen specialty than men did (7,8,9,10)

In a study by Hakami et al(4), 16.8% medical students agree that they are concerned about considering radiology as a career specialty due to AI. In a study of 2020 in Riyadh 44.8% students agreed that AI would shrink the number of radiologists needed (11) in future.

In a study by Gong et al (5) one sixth of medical participants who preferred radiology as their top choice earlier, have been demoralized from pursuing radiology as they were concerned about impact of AI.

On the contrary, in another study (12) it was observed that majority of medical students believed that in the time to come there will be demand for human physicians and radiologists even in the presence of AI.

In a review paper by European society of radiology, it is said that AI would not substitute radiology , on the contrary with AI radiology will get better and maximize radiologists worth. At the same time radiologists have to train themselves on AI, collaborate with AI research workers to guarantee the use of AI for the optimum benefit of patients.(13,14,16).

A survey conducted by American college of radiology in April 2019, showed 7% decrease in need of radiology residency courses in 2018 compared with the previous year. However role of AI for this reduced demand is not clarified. (5,17)

In conclusion ,our primary results are largely congruous with the previously studies conducted in SAU, Riyadh(2). Canada (5), Germany (12), Brazil (17), United Kingdom(15),USA (18). All these studies conclude that AI has a damaging prejudicial effect on students preference for radiology.

Our study is one of its kind in India. This study is expected to help the radiologists to know that deep gap exists in the perception and learning of students regarding AI. These kind of studies compel the radiologists to address this gap and to undertake steps to fill it.

Few limitations are observed in this study. First limitation is that only specific group of medical students pursuing their fourth and fifth year MBBS course in Sharda university and Delhi university were included in this study. This may limit extrapolation of the findings across to the wider base of medical students or heterogeneous educational backgrounds. It would be helpful if future studies are conducted to increase the sample size with different and varied educational backgrounds. Second limitation was this was a Google survey with a questionnaire. The responders may have their own prejudices. The questionnaire design may have its inbuilt restrictions. These prejudices and integral restrictions may affect the quality and dependability of the accumulated data. We need to consider these deficiencies while reading this data. Thirdly, the questionnaire did not investigate the effect of AI on medical school Syllabus. Hence future studies inquiring in detail all these constituents are needed.

CONCLUSION

Our study unveiled that most of the students are well aware of AI and they are exposed to AI in one way or other. Students did prefer radiology as their likely specialty for post graduation course but this percentage reduced when AI was integrated. More such studies are encouraged to be produced on this topic so as to provide ground and proof to this topic. In addition, to eliminate the prejudices of medical students and to create awareness regarding AI, conferences, seminars, webinars, pre-clinical lectures need to be organized at various levels.

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