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Medical student's attitudes and perceptions toward artificial intelligence applications

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ABSTRACT

To evaluate medical students' perceptions in radiology and medical applications of artificial intelligence (AI). Students at 10 prestigious medical schools were issued an online survey that was created using Survey Monkey. It was divided into many parts with the goal of assessing the students' past understanding of AI in radiology and beyond as well as their attitudes about AI in medicine more generally. Anonymity of the respondents was protected. A total of 263 students—166 female and 94 male—with a median age of 23—replied to the survey. Concerning 52 percent of respondents were aware of the current debate about AI in radiology, while 68 percent said they were ignorant of the underlying technology. abnormalities in radiological scans, but they believed that AI would not be able to provide a definitive diagnosis (56 percent). In contrast to claims that human radiologists would be displaced, the majority (77 percent and 86 percent) believed that AI would revolutionize and enhance radiology (83 percent). Over two-thirds of respondents felt that medical education must include AI (71 percent). Male and tech-savvy respondents had higher levels of confidence in the advantages of AI and lower levels of fear of these technologies in sub-group analyses. In conclusion, Contrary to what has been mentioned in the media, medical students are aware of the possible applications and effects of AI on radiology and medicine and do not worry that it will replace human radiologists. The situations in which artificial intelligence has reportedly substituted human radiologists are known to medical students. Since it is their duty, the field of radiology must take the initiative in teaching students about these freshly developed tools.

Keywords: Artificial, Attitudes, Intelligence, Students, Perceptions.

INTRODUCTION

The subfields of artificial intelligence (AI), and more especially deep learning, have attracted a substantial amount of attention in the medical specialty of radiology over the course of the most recent few years (Carlos et al., 2018; Erickson et al., 2017). the majority of applications for these approaches have included visual work, such as the categorization of pictures (for example, the diagnosis of chest X-rays) or the automated segmentation of areas of interest in an image (for example, the segmentation of tumor tissue in brain MRI) (Lakhani & Sundaram, 2017). Even the most important news sites discussed these issues. Most notably, a number of publications echoed the assertion that computers may beat human radiologists in recognizing pneumonia, which was one of the most notable claims (Pinto Dos Santos et al., 2019). Even before these most recent developments, a number of well-known people (such as Geoffrey Hinton) had speculated that in the future, radiology as a subspecialty might be replaced by specialized algorithms capable of reading images as well as or even better than human observers. Then, respected radiologists & scientists shared details of encounters with residents & medical students who were worried that finishing radiology training would be a bad career decision at scientific conferences and even on social media (Pinto Dos Santos et al., 2019) . Recent discussions on these topics have been considerably less heated, and more careful consideration is being given to the problems that radiology will undoubtedly face as commercially accessible AI solutions become more prevalent. It is unclear, however, if general medical students are worried that AI may replace the radiologist or any other doctor. Nothing is known about how medical students perceive AI and deep learning outside of the anecdotal cases

mentioned above. We performed a multicenter survey of medical students to determine their opinions on AI in radiography in particular and medicine in general in order to solve this problem. We also investigated whether these students were anxious that radiologists or other medical professionals were soon be replaced by technology.

METHODOLOGY

With the help of the online application SurveyMonkey, we created an electronic survey (SurveyMonkey Europe UC). The questionnaire included multiple parts that dealt with various topics (see Tables 1, 2, 3, 4 and 5). The first part of the activity was designed to ascertain whether or not the students were familiar with the terms "deep learning" and "artificial intelligence" in reference to radiography and whether or not they considered they had a basic comprehension of the technology that was being used. The second segment began with a claim that AI was already being used in reasonably popular software, such as spam filters, algorithms for recommendation, and voice and text recognition. The next question was if the respondents had previously heard about this through friends, relatives, the media, lectures, or social media. In the third and fourth portions, students were given a four-point Likert scale and asked to rate the extent to which they agreed with the numerous assertions that were presented to them (completely disagree, somewhat disagree, somewhat agree, or agree totally)(Likert, 1932). While the third part focused on particular AI uses in radiology, the fourth component took a wider approach and attempted to evaluate the students' overall concern about algorithms taking the place of radiologists and other medical professionals. The last set of questions asked about the demographics of the respondents and one about whether they thought of themselves as tech-savvy or not. Medical students were informed about the survey through email and social media. Participation was optional and unrelated to the students' academic obligations. The survey's findings will be utilized for additional statistical analysis and scientific publishing, the students were told. Anonymity of respondents was intentionally assured.

After the deadline for submitting completed questionnaires had passed, the findings may be downloaded as a CSV file. For the purpose of simplifying descriptive statistics, the categories 'disagree fully' and 'somewhat disagree' were combined into a single category called disagreement, whereas the categories 'agree entirely' and 'rather agree' were combined into a single category called agreement. In every other kind of statistical study, the original categories have been kept intact. R 3.4.0 and RStudio 1.0.136 were used for the statistical analyses. We used the Wilcoxon signed rank test to compare the response distribution across subgroups. Statistical significance was defined as a p-value of 0.05. Utilizing the ggplot2 software, the figures were plotted (Wickham, 2009).

RESULT

A total of 263 medical students took the time to answer to the questionnaire over the course of two weeks. There were 166 females and 94 males among these respondents, with 3 persons not indicating their gender. These responders were aged 23 on average. Nearly two-thirds (63.1%) of respondents said they were tech savvy (Table 1)

Table 1: Demographics & self-reported tech savvy make up the fifth section of the questionnaire.

	Agree entirely	agree rather	disagree rather	Disagree entirely	N/A
I believe myself to be technologically savvy.	22.8%	40.3%	29.3%	6.5%	1.1%
	Median	Quartiles	Min/max		N/A
Age	23	21/26	19/58		13/263
Gender	Male	Female			N/A
	166	94			1.1%

The majority of those surveyed were aware that radiology uses AI (52.5 percent yes vs. 46.8 percent no). 33% of those surveyed were familiar with the underlying technology (30.8 percent yes vs. 68.1 percent no). There was a statistically significant difference between respondents who identified as tech-savvy and those who identified as male and female in both questions (all comparisons p 0.001 Table 2). More men and tech-savvy respondents were inclined to answer affirmatively.

Table 2: The 1st portion on the questionnaire about AI and deep learning in radiology.

The radiological community is now debating deep learning and artificial intelligence.				
	YES	NO	N/A	P-VALUES (MALE/FEMALES)
Were you familiar with these radiology subjects already?	52.5%	46.8%	0.8%	< 0.001 / <0.001
Are you intimately familiar with the fundamentals of the technology involved in these topics?	30.8%	68.1%	1.1%	< 0.001 / <0.001

85.2 percent of respondents who were asked whether they had heard of AI in their everyday lives indicated they had, mostly via the media but also through social media (65.8 % yes). Only a slightly smaller percentage (54.9%) had previously heard of AI in university lectures or through family and friends (61.2 percent yes). While there was no difference when questioned about tech-savvy, male respondents were significantly more likely than female respondents to answer "yes" to both questions ($p=0.026$ & $p=0.014$, respectively) (Table 3).

Table 3: Previous exposure to the topic of AI as a whole from various sources is covered in the second section of the questionnaire.

Artificial intelligence is already used in other applications that we use on a daily basis, such as spam filters, speech/text recognition, and recommendation algorithms. You knew about it, right.?				
	Yes	No	N/A	p-values
From the media	85.2%	13.3%	1.5%	0.788
From the social media	65.8%	29.3%	4.9%	0.056
From lectures	55.9%	39.5%	4.6%	0.790
From friends/family	61.2%	33.1%	5.7%	0.082%

Radiology-specific inquiries might help AI discover imaging problems (83.7 percent agreement vs. 15.2 percent disagreement). A slim majority said AI can't identify patients from images (42.2 percent agreement vs. 56.7 percent disagreement). Male and computer-savvy increased agreement (p -values between 0.017 and 0.001). Most students thought AI could recommend imaging examinations (56.7 percent agreement vs. 41.4 percent disagreement). Table 4 displays findings.

Table 4: 3rd portion of questionnaire Application for artificial intelligence in radiology

What possible applications do you see for AI in radiology?						
	Agree entirely	Rather agree	Rather disagree	Disagree entirely	N/A	p-values (male vs. female/tech-savvy vs. non-tech-savvy)
automated pathology detection in imaging tests	40.3%	43.4%	13.7%	1.5%	1.1%	<0.001/0.001
Automated diagnosis in imaging exams	12.2%	30.0%	46.4%	10.3%	1.1%	<0.001/0.017
Automated indication of appropriate imaging exams	13.3%	43.4%	34.2%	7.2%	1.9%	0.736 / 0.633

Most respondents rejected that human doctors in general (96.6%) and radiologists may be replaced in the near future, although agreeing that AI would change radiology (77.2%) and medicine (73%) (82.9 percent disagreement). Although less than half of respondents claimed that recent advances in AI increased their fascination with radiology or medicine, one-third of respondents (37.7% agreement) were somewhat troubled by them (30.8 percent and 44.5 percent , respectively). However, the majority (85.8%) believed that the use of AI

will improve both radiology and medicine in general (83.6 percent agreement). In furthermore, 70.1 percent of respondents said that medical schools should teach AI. More comprehensive results are shown in Table 5.

Table 5: Fourth questionnaire question: Perceptions, AI and deep learning in radiology and medicine

How true, in your view, are the following claims?						
	Agree entirely	Rather agree	Rather disagree	Disagree entirely	N/A	p-values male/female)
AI will revolutionize radiology	28.9%	48.3%	20.5%	0.4%	1.9%	<0.001/<0.001
In general AI will revolutionize medicine	35.7%	37.3%	20.9%	4.2%	1.9%	<0.001/<0.001
In the near future, human radiologists will be replaced.	2.3%	12.9%	47.2%	35.7%	1.9%	0.008 / 0.788
The non-interventional human doctor will be replaced in the near future.	0.8	5.7%	30.0%	61.6%	1.9%	0.258 / 0.982
In the near future, every doctor will be replaced	0.4%	1.1%	15.6%	18.0%	1.9%	0.375 / 0.903
These developments frighten me	10.7%	27.0%	39.5%	20.5%	2.3%	<0.001/0.027
These advancements excite my interest in radiology.	8.0	22.8	42.6	24.3	2.3	0.612 / 0.001
These recent advancements have increased my interest for medicine in general.	11.8%	32.7%	38.4%	15.2%	1.9%	<0.001/0.002
There will never be a day when artificial intelligence will render human doctors obsolete.	51.7%	27.8%	14.5%	4.2%	1.9%	0.868 / 0.528
Artificial intelligence will improve radiology	27.8%	58.6%	10.6%	0.8%	2.3%	<0.001/0.013
Artificial intelligence will improve medicine in general	27.4%	56.3%	12.9%	1.5%	1.9%	<0.001/<0.001
Medical training should include artificial intelligence	24.7	46.4%	20.5%	4.9%	3.4%	<0.001/<0.001

Males and more tech-savvy respondents tended to be more confident about the influence of technology on radiology and medicine, less apprehensive, and more interested in AI becoming part of medical training (Figs. 1 and 2).

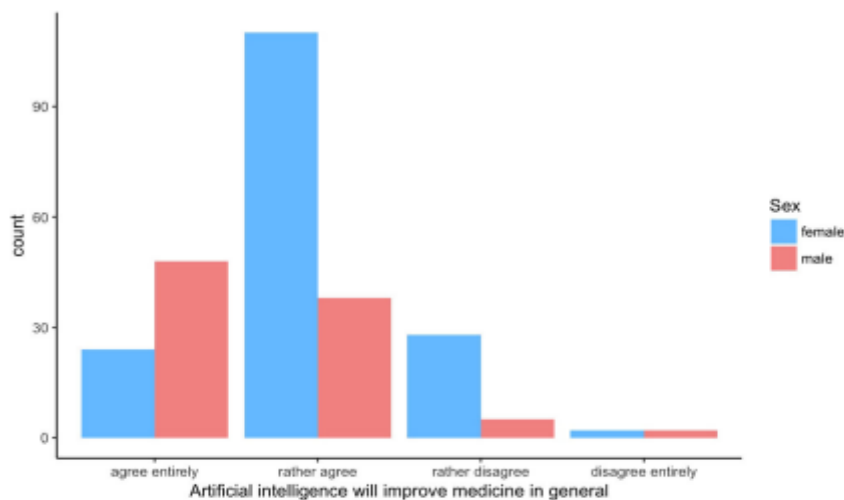


Figure1

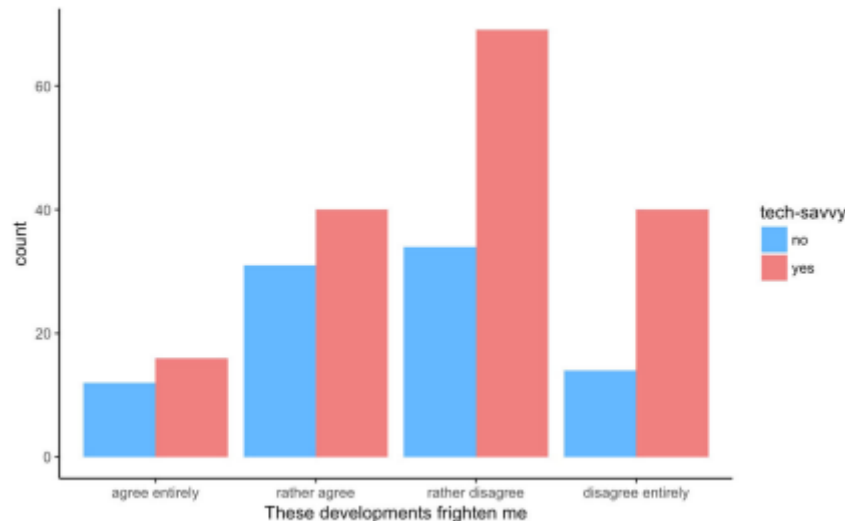


Figure2

Figure 2 shows an example of the distribution of responses to the questionnaire, with comparisons made for different self-reported levels of technological savvy. Those who were more knowledgeable about technology expressed less concern about the potential adverse effects of AI in medicine.

DISCUSSION

There is no question that AI and deep learning will have a significant influence on the direction that radiology and medicine in general are headed in the future (De Bruijne, 2016; Syeda-Mahmood, 2018). It appears radiologists were most worried about losing their careers in the near future when these themes initially came up at different scientific gatherings. As a result, anecdotal accounts of students in their last year who feared radiology training might not be the best career option were shared. Apart from these experiences, however, there has not been a thorough study of medical students' attitudes about AI in medicine and radiology.

The majority of medical students had heard of artificial intelligence (AI), half of those surveyed knew it had been addressed in radiology. However, most of them did not necessarily comprehend the fundamental technical concepts behind AI. Most students didn't believe algorithms could deliver perfect diagnoses in imaging examinations, but they were certain AI could automatically identify abnormalities and suggest relevant investigations. However, we discovered that the vast majority of students were confident that there would still be a need for human doctors and radiologists in the near future, in contrast to accounts of terrified students being unwilling to select radiology training. Surprisingly, more than half of the respondents said that recent advancements had not made them more enthusiastic about radiography or medicine. The intended meaning of this specific question was, regrettably, not very obvious. Responses could be viewed as indicating that respondents aren't quite sure they want to pursue these subjects given recent advancements in AI.

Even though this result is not entirely clear, it is possible to draw the conclusion that respondents' enthusiasm for medicine and radiology has largely remained the same. In fact, a small percentage of respondents even claimed that it risen their excitement when mixed with the reaction that they did not fear being replaced by AI. Even though this result is not entirely clear, it is possible to draw this conclusion. Even though everyone agrees that this change will make the industry better, medical students know that AI will likely change radiology and medicine in general in the coming years. It is yet unknown whether these expectations are realistic and which areas of radiology and medicine will experience the benefits (or drawbacks) of using AI first. Data suggests that properly trained algorithms may perform comparable to humans in certain situations, and impressive results have already been achieved. (for example, outside of the radiology industry, Google's research on the diagnosis of retinopathy and Stanford's study on the detection of skin cancer) (Esteva et al., 2017, Gulshan et al., 2016)

However, there is still a long way to go until AI is completely incorporated into clinical operations. The fear of a total replacement has given way to a more nuanced stance in recent months about AI in radiology: BAI won't replace radiologists, but AI-using radiologists will. Future generations of radiologists and physicians will need to understand deep learning and AI. Gender and self-reported tech competence affected opinions and comprehension of AI and deep learning. Given the enormous potential influence these technologies might have on the future of radiology and medicine, it is imperative to include fundamental instruction in these areas in undergraduate and postgraduate medical curricula, ideally balancing out the discrepancies. It's interesting to

note that the respondents to our research seemed to be aware of this and voiced a desire for themes of this kind to be included in medical education(Yüzbaşıoğlu, 2021) .

CONCLUSION

It should be understood, however, that there are certain limitations on this research, and it may not be able to apply the findings to other nations or other training curricula. Additionally, because we only looked at medical students' attitudes, it may be claimed that postgraduate students or even more experienced doctors do not share the students' rather upbeat views. Investigating these other groups as well would be a potentially fascinating area for more research, in order to also address their unique issues. Additionally, it could be interesting to particularly investigate if those who are less certain about how AI will affect radiology have a propensity to avoid radiology training. However, this aspect should be carefully considered in the context of all students with an interest in radiology training, and it should be distinguished from other aspects of a person's personality that may play a role in influencing that individual's choice to pursue a particular field of expertise. As a result, radiology should take the lead in presenting these state-of-the-art technologies to undergraduate students while stressing the unique issues that may subsequently develop. Radiology was one of the first subspecialties to really address how AI is affecting medicine. More particular, it's critical to transmit a fundamental understanding of the technological foundations of AI in radiology and medicine, including what sorts of data are required tasks and how AI algorithms should be assessed.

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