PERCEPTIONS AND KNOWLEDGE OF MEDICAL STUDENTS ABOUT ARTIFICIAL INTELLIGENCE (AI) IN RADIOLOGY

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Abstract: **The use of Artificial Intelligence (AI) in healthcare system has been widely used especially in the branch of radiology. Therefore, it is important for medical students to know about the uses of AI in radiology. A questionnaire using Google Forms was created with questions that were made to assess the perceptions and knowledge of medical students about AI in radiology. This questionnaire was distributed among preclinical medical students from Udayana University, Bali. Respondents from this survey were 222 medical students from semester 3, semester 5 and semester 7. The perceptions and knowledge of medical students about artificial intelligence in radiology will be identified by distributing a questionnaire for them to fill up. Out of the 222 respondents, 170 respondents who knew about AI before taking the survey were required to answered the questions about their perceptions and knowledge about AI in radiology. The anonymity of respondents were ensured. The results were obtained from the analysis of Google Form. The conclusion is that majority of the preclinical medical students were interested to learn more about AI in radiology. Most of them agreed that AI gives advantages to radiology by saving time and workload yet they do not think that AI will replace the jobs of radiologists in the future.**

Keywords: **Medical students, Artificial Intelligence, Radiology, Perceptions and Knowledge, Artificial intelligence in radiology.**

1. INTRODUCTION

Radiology is branch of medical field which is important to diagnose various disease. The diagnosis of a disease is very crucial in the medical field in order to provide treatment for the patients. With the help of radiology, early diagnosis can save many lives. As radiology is also known as diagnostic imaging, the technology has been improving from time to time. Radiology is a field of medicine covers two areas which are diagnostic radiology and interventional radiology. Diagnostic radiology helps health care providers see structures inside the body.[1]

Lately, there have been developments in the radiology field using artificial intelligence. Artificial intelligence (AI) is a widely ranged branch of computer science concerned with building smart machines which are capable of performing tasks that require human intelligence. The term artificial intelligence is used to describe machines that display cognitive functions that humans associate with the human minds which are usually applied for problem solving or even in learning process.[2] The use of artificial intelligence (AI) in the radiology field involves 'machine learning' which can optimize the workflow of radiologists, facilitate in quantitative radiology, and assist in discovering genomic markers. Although there is currently small evidences to support the routine use of AI algorithms in the current clinical practices, it is expected that when there is increase in the academic and industry interest, validated use cases for AI tools in radiology will most likely

come up rapidly. As the field of healthcare artificial intelligence (AI) continues to broaden, there is an increase in need for clinicians and medical students have knowledge about AI. A medical career requires continuous learning process, which means medical students and clinicians must be aware of the developments in the medical field. This is why the perceptions and knowledge of medical students towards artificial intelligence (AI) in radiology field is important. It is important to understand the perspectives of medical students towards artificial intelligence in radiology to ensure whether medical schools should emphasis on preparing their students with essential knowledge on novel digital tools which includes machines of artificial intelligence (AI).[3]

2. MATERIALS AND METHODS

This study is a descriptive study with cross-sectional approach where the data's measurement is only be done once. The aim of this study is to observe the perceptions and knowledge of medical students about artificial intelligence (AI) in radiology. This research will be making questionnaires in Google Forms to avoid direct contact with the participants in this time of COVID-19 pandemic era. There is only one set of variable in this research which is the perceptions and knowledge of medical students about artificial intelligence in radiology.

The target population of this study is all the medical students in Bali. Same population that were used in this study are Udayana University's medical students. The batches involved will be students from batch 2018 to batch 2020 in Medical faculty. Sample of the study is the medical students from the same population. Medical students from Faculty of Medicine University Udayana, Bali who registered as batch 2018 to 2020 and voluntarily participated in the study. Medical students from University Udayana, Bali who refused to participate on the study about the perceptions and knowledge of medical students about artificial intelligence (AI) in radiology will be excluded from the study. The sampling method used in this study is purposive sampling. It benefits in giving all samples opportunity to participate in the research. Based on the Slovin's formula the sample size that was got was 399 respondents. But due to the considerations and limitations of the COVID-19 pandemic, the sample size that will be used will range from 150-200. Data collected through the questionnaire will be analysed through the analysis of the google form and the pie chart which is obtained from the responses. Based on the interpretation of the results, the researcher obtains the perceptions and knowledge of medical students about artificial intelligence in radiology. Then the data will be processed and presented in a table chart.

This research has received ethical eligibility permission from the Research Ethics Commission (KEP) of the Faculty of Medicine, Udayana University with letter number 2779/ UN14.2.2.VII.14/ LT/2021.

3. RESULTS

The distribution of questionnaire is done at the Faculty of Medicine Udayana University. The questionnaire was distributed randomly among undergraduate medical students from 3 different batches which were students from batch 2018, 2019 and 2020. A total number of 222 students were included in this study. The students were priorly informed and taken consent before proceeding. The students were allowed to participate in the study voluntarily without any compulsion. The research questionnaire was given online through Google Forms in order to prevent any direct contact with the participants during the time of COVID-19 pandemic. Before they start to fill up the questionnaire, a brief explanation about my questionnaire was given and they were allowed to ask any doubts regarding the questionnaire at any time. Most of the students took around 5 minutes to fill up the questionnaire. In three months, the required number of questionnaires were able to be collected. The questionnaire was made in bilingual which was in English language and Bahasa Indonesia. The grammar given was simple and accurate. Therefore, it was easy for them to fill up the questionnaire that was given to them. They were able to understand the questions rose. The data of the students was kept secret and private. Therefore, it was concluded that the students were able to understand and fill up the questionnaire that was given to them. The survey used is valid.

Gender Distribution

In this study, the total amount of participants who participated were 222 participants. From the result it shows a female predominance with the percentage of 59% while the percentage of male participants were 41%. The total number of female participants were 131 participants out of 222 participants. While the number of male participants were 91 out of the total number of 222 participants. Demographic distribution of participants gender is shown in Table 1 below.

Table 1: Gender Distribution

Gender	Amount	Persentage (%)
Male	91	41
Female	131	59

Batch Distribution

In this study, there were 3 batches that participated which are batch 2018, 2019 and 2020 who were medical students that belonged to Semester 3, Semester 5 and Semester 7 from the Medical Faculty of Udayana University. The percentage of participants who participated from batch 2018 was 68.9% which was 153 participants. The percentage of participants who participated from batch 2019 was 5.9% which was 13 participants. While the percentage of participants from batch 2020 were 25.2% which was 56 participants. Demographic distribution of participants batch is shown in Table 2 below.

Table 2: Batch Distribution

Batch	Amount	Persentage (%)
2018	153	68.9
2019	13	5.9
2020	56	25.2

Distribution of Response for Question 1

In this study, for the question "Did you know about Artificial Intelligence before taking this survey?" the percentage of participants who knew about artificial intelligence before taking the survey was 76.6% which was 170 participants. While the percentage of participants who did not know about artificial intelligence before taking the survey was 23.4% which was 52 participants. Demographic distribution of the responses for Question 1 is shown in Table 3 below.

Table 3: Distribution for question "Did you know about Artificial Intelligence before taking this survey?"

Responses	Amount	Persentage (%)
Yes	170	76.6
No	52	523.4

Distribution of Response for Question 2

In this study, for the question "Is Artificial Intelligence a new word to you?" the percentage of participants who agreed that artificial intelligence is a new word to them is 24.3% which were 54 participants. While the percentage of participants who disagreed that artificial intelligence is a new word to them is 75.7% which were 168 participants. Demographic distribution of the responses for Question 2 is shown in Table 4 below.

Table 4: Distribution for question "Is Artificial Intelligence a new word to you?"

Responses	Amount	Persentage (%)
Yes	54	24.3
No	168	75.7

Distribution of Response for Question 3

In this study, for the question "Would you be interested to learn about Artificial Intelligence?" the percentage of participants who were interested to learn about artificial intelligence is 86% which were 191 participants. While the percentage of participants who were not interested to learn artificial intelligence is 14% which were 31 participants. Demographic distribution of the responses for Question 3 is shown in Table 5 below.

Table 5: Distribution for question "Would you be interested to learn about Artificial Intelligence?"

Responses	Amount	Persentage (%)
Yes	191	86
No	31	14

Distribution of Response for Question 4

In this study, for the question "Do you think medical schools should teach about Artificial Intelligence?" the percentage of participants who think that medical schools should teach about artificial intelligence is 60.4% which were 134 participants. While the percentage of participants who think that medical schools should not teach about artificial intelligence is 39.6% which were 88 participants. Demographic distribution of the responses for Question 4 is shown in Table 6 below.

Table 6: Distribution for question "Do you think medical schools should teach about Artificial Intelligence?"

Responses	Amount	Persentage (%)
Yes	134	60.4
No	88	39.6

Distribution of Response for Question 5

In this study, for the question "If you know about Artificial Intelligence where did you gain this knowledge from?" the percentage of participants who gained knowledge about artificial intelligence outside medical school which was through mass media is 91.9% which were 204 participants. Next, the percentage of participants who gained knowledge about artificial intelligence in medical school syllabus is 5.4% which were 12 participants. While the percentage of participants who gained knowledge about artificial intelligence from this research is 2.7% which were 6 participants. Demographic distribution of the responses for Question 5 is shown in Table 7 below.

Table 7: Distribution for question "If you know about Artificial Intelligence where did you gain this knowledge from?"

Responses	Amount	Persentage (%)
Outside medical school	204	91.9
In medical school	12	5.4
From this research	6	2.7

Distribution of Response for Question 6

In this study, for question number 6 the responses were required to be filled by 170 participants who answered 'Yes' in Question 1 which were participants who knew about Artificial Intelligence before taking the survey. The percentage of participants who agreed that AI gives advantage to the medical field is 96.5% which were 164 participants. While the percentage of participants who disagreed that AI gives advantage to the medical field is 3.5% which were 6 participants. Demographic distribution of the responses for Question 6 is shown in Table 8 below.

Table 8: Distribution for question "Do you think Artificial Intelligence gives advantage to the medical field?"

Responses	Amount	Persentage (%)
Yes	164	96.5
No	6	3.5

Distribution of Response for Question 7

In this study, for question number 7 the responses were required to be filled by 170 participants who answered 'Yes' in Question 1 which were participants who knew about Artificial Intelligence before taking the survey. The percentage of participants who agreed that AI could give disadvantages to the medical field is 28.8% which were 49 participants. While the percentage of participants who disagreed that AI could give disadvantage to the medical field is 71.2% which were 121 participants. Demographic distribution of the responses for Question 7 is shown in Table 9 below.

Table 9: Distribution for question "Do you think Artificial Intelligence gives disadvantage to the medical field?"

Responses	Amount	Persentage (%)
Yes	49	28.8
No	121	71.2

Distribution of Response for Question 8

In this study, for question number 8 the responses were required to be filled by 170 participants who answered 'Yes' in Question 1 which were participants who knew about Artificial Intelligence before taking the survey. The percentage of participants who agreed that they agree for AI machines to make clinical decisions is 42.4% which were 72 participants. While the percentage of participants who disagreed for AI machines to make clinical decisions is 57.6% which were 98 participants. Demographic distribution of the responses for Question 8 is shown in Table 10 below.

Table 10: Distribution for question "Do you trust advance Artificial Intelligence machines to make clinical decisions?"

Responses	Amount	Persentage (%)
Yes	72	42.4
No	98	57.6

Distribution of Response for Question 9

In this study, for question number 9 the responses were required to be filled by 170 participants who answered 'Yes' in Question 1 which were participants who knew about Artificial Intelligence before taking the survey. The percentage of participants who accept AI to take over the job of radiologists is 23.5% which were 40 participants. While the percentage of participants who do not accept AI to take over the job of radiologists is 76.5% which were 130 participants. Demographic distribution of the responses for Question 9 is shown in Table 11 below.

Table 11: Distribution for question "Would you accept if Artificial Intelligence take over the job of the Radiologists?"

Responses	Amount	Persentage (%)
Yes	40	23.5
No	130	76.5

Distribution of Response for Question 10

In this study, for question number 10 the responses were required to be filled by 170 participants who answered 'Yes' in Question 1 which were participants who knew about Artificial Intelligence before taking the survey. The percentage of participants who agreed that AI machines saves time and reduces work load is 97.6% which were 166 participants. While the percentage of participants who disagreed that AI machines saves time and reduces work load is 2.4% which were 4 participants. Demographic distribution of the responses for Question 10 is shown in Table 12 below.

Table 12: Distribution for question "Do you think Artificial Intelligence machines save time and reduces work loads?"

Responses	Amount	Persentage (%)
Yes	166	97.6
No	4	2.4

Distribution of Response for Question 11

In this study, for question number 11 the responses were required to be filled by 170 participants who answered 'Yes' in Question 1 which were participants who knew about Artificial Intelligence before taking the survey. The percentage of participants who agreed that AI will benefit radiologists is 95.3% which were 162 participants. While the percentage of participants who disagreed that AI will benefit radiologists is 4.7% which were 8 participants. Demographic distribution of the responses for Question 11 is shown in Table 13 below.

Table 13: Distribution for question "Do you think Artificial Intelligence will benefit Radiologists?"

Responses	Amount	Persentage (%)
Yes	162	95.3
No	8	4.7

Distribution of Response for Question 12

In this study, for question number 12 the responses were required to be filled by 170 participants who answered 'Yes' in Question 1 which were participants who knew about Artificial Intelligence before taking the survey. The percentage of participants who agreed that AI machines can be dangerous is 62.4% which were 106 participants. While the percentage of participants who disagreed that AI machines can be dangerous is 37.6% which were 64 participants. Demographic distribution of the responses for Question 12 is shown in Table 14 below.

Table 14: Distribution for question "Do you think Artificial Intelligence machines can be dangerous?"

Responses	Amount	Persentage (%)
Yes	106	62.4
No	64	37.6

4. DISCUSSION

In this survey, 222 medical students from different academic years from Faculty of Medicine Udayana University were included to answer a questionnaire which were distributed to them through Google Forms from the month of September 2021 to November 2021. In this survey it is recorded that student's name, gender, academic year, knowledge about AI and perceptions about AI in radiology.

The predominant gender of students who participated in this study were female participants with 59% which were 131 participants while male participants with 41% which were 91 participants out the 222 total participants. The major batch of students who participated in this study was from academic year 2018 with 68.9% which were 153 participants. The least batch of students who participated were from academic year 2019 with 5.9% which were 13 participants. The students who participated from academic year 2020 were of 25.2% which were 56 participants.

Among 222 respondents, 170 of them knew about AI before taking this survey. 44.7% of them were male participants and 55.3% of them were females. While, 52 other participants answered that they did not know about the existence of AI. Based on a similar survey done, it highlighted the fact that 37.4% of medical students are in dark about the knowledge and prospects of AI in health care.[4]

The percentage of participants who disagreed that it was their first time discovering the word 'artificial intelligence' was 75.7% which shows that many of them knew about the existence of artificial intelligence. Meanwhile, the percentage of participants who agreed that AI was a new word to them was 24.3%. This shows that there are quite a number of medical students who do not know about the existence of AI. Another challenge in learning AI in medical students is their lack of computer knowledge as computer science is not taught as a subject in pre- medical school for students pursuing medicine.[4]

We found that 86% of participants were interested to learn about AI in this study. Nevertheless, the quest to learn more about AI persists in the majority of students with the general agreement that incorporation of basic training in AI into undergraduate medical curriculum is strongly needed.[4] In addition, when our study was conducted and participants were asked if medicals schools should teach and include artificial intelligence in their syllabus, a majority of 60.4% agreed to it.

Most participants in our study said that 91.9% learned about artificial intelligence outside of medical school through mass media, this percentage could be high because of the easy access we have to smartphones and the internet today. Another 5.4% of participants from this study said that they knew about artificial intelligence through medical school and 2.7% of participants discovered about AI from participating in this research. Another similar study that was conducted in the US also said that a majority of 57% students obtained their information about AI from online articles.[5] This shows that basic knowledge about AI should be included in undergraduate medical curriculum is needed for every student to have a brief knowledge about it.

When the participants of our study were asked if AI gives advantages to the medical field, a majority of 96.5% who knew about AI agreed that it does give advantages to the medical field. Another similar study said that their respondents agreed that AI could potentially detect pathologies in radiological examinations.[6] Next, when the participants of our study were asked if AI gives disadvantages to the medical field, 71.2% said that it will not give disadvantages to the medical field.

The participants of our research were asked if they trust advance AI machines to make clinical decisions and 42.4% agreed that they would trust AI machines to make clinical decisions while 57.6% said that they would not trust. In study by Pinto et al[6] a majority of participants agreed that AI will revolutionise and improve radiology. This is because artificial intelligence can help radiologists by rapidly analysing images and data registries, achieve better understanding of patient's condition, increase their clinical role, and become a part of the core management team.[7]

A majority of 76.5% of participants from our research said that they would not agree for AI machines to take over the jobs of radiologists. This could be because medical students may have a fear of being replaced in the future. In fact, the question in today's world now is not about replacing the radiologists, but artificial intelligence has the potential to improve the capabilities, efficiency, and accuracy of radiologists and improve patient outcome by intelligent protocol of imaging equipments to reduce unnecessary imaging studies.[7]

Furthermore, the respondents of our research were also asked if they think that AI machines saves time and reduces the workload of radiologist and a huge majority of 97.6% agreed to it. Next, 95.3% participants from our study think that AI will benefit radiologists. The survey by Pinto et al[6] supported that according to the participants from their research majority agreed that AI will revolutionise and improve radiology. The students who participated in our study were asked if they think AI machines can be dangerous and 62.4% said that AI machines are dangerous. This could be because they lack exposure to how AI machines work and function in the radiology field.

This study has limitations, namely this is a descriptive study that was done to evaluate the perceptions and knowledge of medical students about artificial intelligence (AI) in radiology in Medical Faculty of Udayana University. The survey was done online to avoid direct contact with participants due to the COVID-19 pandemic. This survey was conducted among pre-clinical undergraduate medical students and it did not include final year undergraduate students and postgraduate students who may have more knowledge and exposure. Although the number of students from 3 batches are more than the sample that was taken in this study, the data was only able to be collected among 222 because of the limitations due to the COVID-19 pandemic. These can be the limitation of my study. Nevertheless, the results of this study can be perceived on a larger scale because students from 3 different academic years were involved as participants.

5. CONCLUSION

A descriptive study was done to study the perceptions and knowledge of medical students about artificial intelligence in radiology. Based on the participants that fulfill or are within the inclusion and exclusion criteria of the study from batch 2018, 2019 and 2020 with a total of 222 students were included in this study from Medical Faculty of Udayana University.

From the 222 recorded participants from batch 2018-2020, there were 170 participants who knew about artificial intelligence (AI) before participating in the survey. It showed that 94 of the participants who knew about AI were females while 76 of them were males. Most of the students knew about AI before taking the survey but there was also a reasonable percentage of 23.4% who did not know about AI. This maybe due to the lack of AI curriculum in medical school syllabus. The same goes to the 24.3% of participants who said that AI is a new word to them in this survey. It was recorded that majority of the participants are interested to learn more about AI and most of them agreed that medical schools should include topics related to AI into their syllabus. This is because majority of them learned about AI from outside of medical school through the internet and other mass media. And those who did not know about AI recorded that they discovered about AI through this study. Majority of the participants think that AI gives advantages to the medical field. Because AI could contribute a lot to the healthcare system. About 57.6% of participants recorded that they trust AI machines to make clinical decisions. Yet, about 76.5% would not accept AI to take over the jobs of radiologists. This may be because there is no guarantee that machines will not make any mistakes at all in reading images and making clinical decisions. A huge majority of 97.6% of participants said that AI machines help to save time and reduce workload. This is because artificial intelligence has the potential to improve the capabilities, efficiency, and accuracy of radiologists and improve patient outcome by intelligent protocol of imaging equipments. Most participants do not agree that AI will replace the jobs of radiologists. This is because they think that a doctor's knowledge and experience is still needed in making clinical decisions and cross check the inputs provided by AI machines. Many participants also think that AI machines can be dangerous. This is probably due to the lack of AI curriculum in medical school and they are unsure of how AI machines work and operate.

The outcomes of the findings are that most medical students think that AI machines help to save time and reduce workload of radiologists and they also think that AI will highly benefit radiologists in their job. There were also a decent number of participants who think that AI machines can be dangerous to trust.

6. RECOMENDATION

Further relative research should be done with bigger sample subject with varied location of research that includes final year undergraduate students and postgraduate students. Furthermore, more studies should be carried out evaluate the perceptions and knowledge of medical students all over Indonesia. Medical students should be taught and equipped with basic knowledge about artificial intelligence (AI) in medical school curriculum because the growth of computer and technology has been developing dramatically. This will ensure that they are up to date with the current changes.

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