Jeffrey Yeh

Professor Minnillo

UWP 001

13 March 2023

Artificial Intelligence in Medicine: A Future of AI Doctors and Researchers?

Introduction

More than a century ago, the concept of artificial intelligence was first introduced in the science fiction Erewhon (Britannica). Since then, humanity has witnessed how this concept has turned into a reality. The rapid progression of artificial intelligence has resulted in its application in diverse societal and career settings, with famous examples such as self-driving cars, AlphaGo, and chat GPT (Haenlein). Out of its many applications, artificial intelligence in medicine is less talked about. Nevertheless, people would hold different views on the appropriate use of artificial intelligence, which also applies to artificial intelligence used specifically in medicine. While some believe that AIs “develop and advance a wide spectrum of fields [including medicine]”, others believe that “it is only a matter of time before humans are completely replaced in certain roles within the medical sciences” (Basu). This research will describe peoples' perceptions of the appropriate type and level of involvement artificial intelligence should have in different facets of the medical field.

Research Questions

- What type and level of involvement should AI have in the medical field?
- Does the use of AI in medicine follow the principles of bioethics?

Literature Review

The first application of artificial intelligence began early in the 1950s when machine learning AI was first introduced. This allowed AI to analyze a circumstance based on the patterns that it recognized. After analyzing the circumstance, AI learned it and applied its learning to similar situations. When applied to medicine, however, AI at the time was not advanced enough to perform personalized analysis and diagnosis for individual patients and instead could only perform general medical analysis through basic algorithms. Yet, the advancement of AI technology allowed modern AI to analyze complex algorithms and perform self-learning. Such advancement enabled it to be incorporated into clinical practice, including risk assessment, diagnosis, and workflow efficiency (Kaul).

An example of risk assessment that AI was involved in was the assessment of different groups of COVID-19 patients' mortality or morbidity rates. It tends to have a higher impact on the high-risk category groups including the elderly, and patients having pre-existing cardiopulmonary conditions. Even if a patient recovers from COVID, they may potentially still suffer from the COVID-19 side effects. The application of artificial intelligence has helped healthcare workers assess cardiovascular risk during and after COVID-19 times (Suri). An example of a diagnosis that AI was involved in is skin cancer. In conventional cutaneous oncology, skin cancer was confirmed via skin biopsy, an invasive approach that induced too many pains and scars if overused. Therefore, AI was implemented to perform skin imaging analysis for skin cancer diagnosis, and they were found to be more accurate than a typical doctor's analysis (Chu). Outside of clinical practice, AI was also involved in medical research. Drug discovery and development had always been a tedious and costly process that "typically costs 2.6 billion USD and takes 12 years on average" (Chan). The emerging AI technologies, when coupled with experimental technologies, were expected to decrease costs and speed up new drug discovery (Chan).

With AI's incorporation into different facets of medicine, people tended to either support or oppose increasing artificial involvement in medicine. Hence, an assessment of its bioethics would be important. A study by Andreia Martinho, Maarten Kroesen, and Caspar Chorus addressed such concerns as they investigated the perspectives of medical doctors from different specialties and backgrounds on the ethics of artificial intelligence (Martinho). While this study explored the specific views of medical doctors, my primary research filled the gaps in the literature by exploring the views of undergraduates with different majors to provide a different sample of views. My primary research, alongside other referenced studies in my paper, described different people's perspectives on the appropriate type and level of involvement artificial intelligence should have in different facets of the medical field.

Method

As part of my study, I designed a survey to be used as an instrument for assessing undergraduates' views on the appropriate type and level of involvement artificial intelligence should have in the medical field. The survey contained fourteen total questions of three different question types, which were demographic, Likert scale, and open-ended questions. The demographic asked for basic information about the respondents such as the year they were in and their major. The Likert-scale questions provided statements and ask if the respondents agree or disagree on a scale of 1 to 5: one– strongly disagree, two– agree, three– neutral, four– agree, and five– strongly agree. Open-ended questions asked for the respondents' perspectives on topics regarding the future of AI in medicine and the bioethics of AI in medicine. To collect my data, I pasted my survey link on a shared document containing a list of student surveys from my UWP 001 class for students to take in class. A total of eight UC Davis undergraduate students from my UWP1 class responded to the survey. Below is a table of their listed characteristics:

Year	Major	Intended pre-health?
1	Animal Science	Yes
2	Chemical Engineering	No
3	Entomology	No
3	Economics	No
2	Neurobiology, Physiology, and Behavior	Yes
2	Biological Sciences	No
1	Communications	Maybe
2	Political Science	No

I used multiple data analysis methods in my study. One of the methods was finding mean scores for different Likert scale questions and comparing them as a group. For example, I compare the response's mean score of statements regarding something done by an AI with statements regarding something done by a human. I did not use some statistical analysis methods such as t-tests, which ensured that the conclusion reached from the statistical analysis is statistically significant, or reliable, due to my study's small sample size (N=8). This could potentially cause the margin of error of my tests to become too big, which would decrease the power of my test to find a meaningful difference in my means. Eventually, this would likely stop me from reaching any conclusions with the data I have. Another way that I grouped my samples was that I performed individual analyses on my open-ended responses. I have decided to perform individual analysis over group analysis for the same reason– my small sample size.

Results

From the Likert-scale data I collected from my survey, I compared the mean score each respondent responded toward human involvement, AI involvement, or human involvement with AI assistance in different medical settings, which were medical research (*Figure 1*), diagnosis (*Figure 2*), and surgery (*Figure 3*). The Likert-scale questions provided statements and asked if the respondents agree or disagree on a scale of 1 to 5: one– strongly disagree, two– agree, three– neutral, four– agree, and five– strongly agree. Under all medical settings, as shown in figures 1, 2, and 3, human involvement had the highest mean score, human involvement with AI assistance had the second highest mean score, and AI involvement had the lowest mean score.

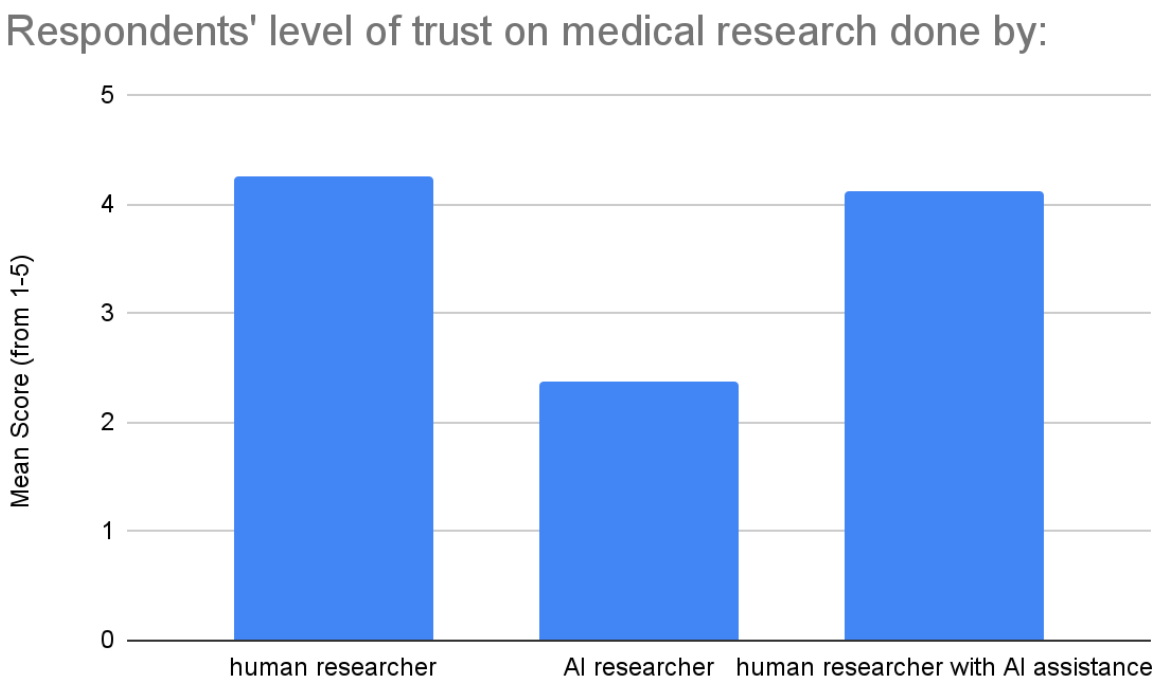

Figure 1: Mean score for the statements "I trust medical research findings done by a human researcher," "I trust medical research findings done by an AI researcher," and "I trust medical research findings done by a human researcher with AI assistance."

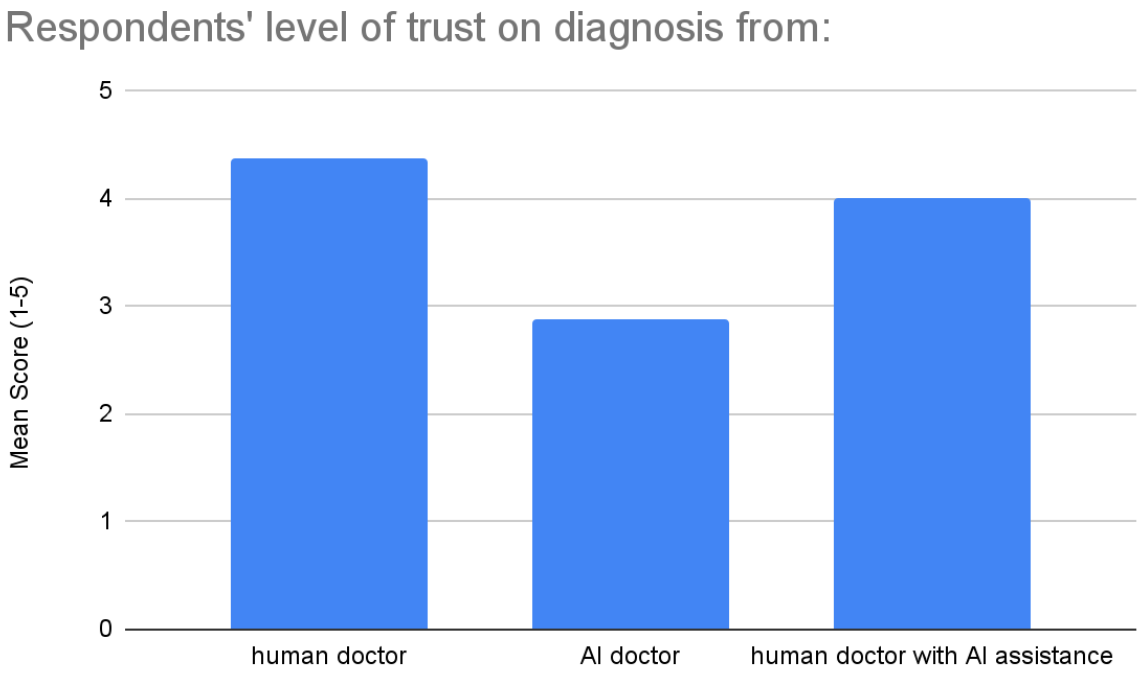

Figure 2: Mean score for the statements "If I were a patient, I would trust my diagnosis from a human doctor," "If I were a patient, I would trust my diagnosis from an AI doctor," and "If I were a patient, I would trust my diagnosis from doctor assisted by an AI."

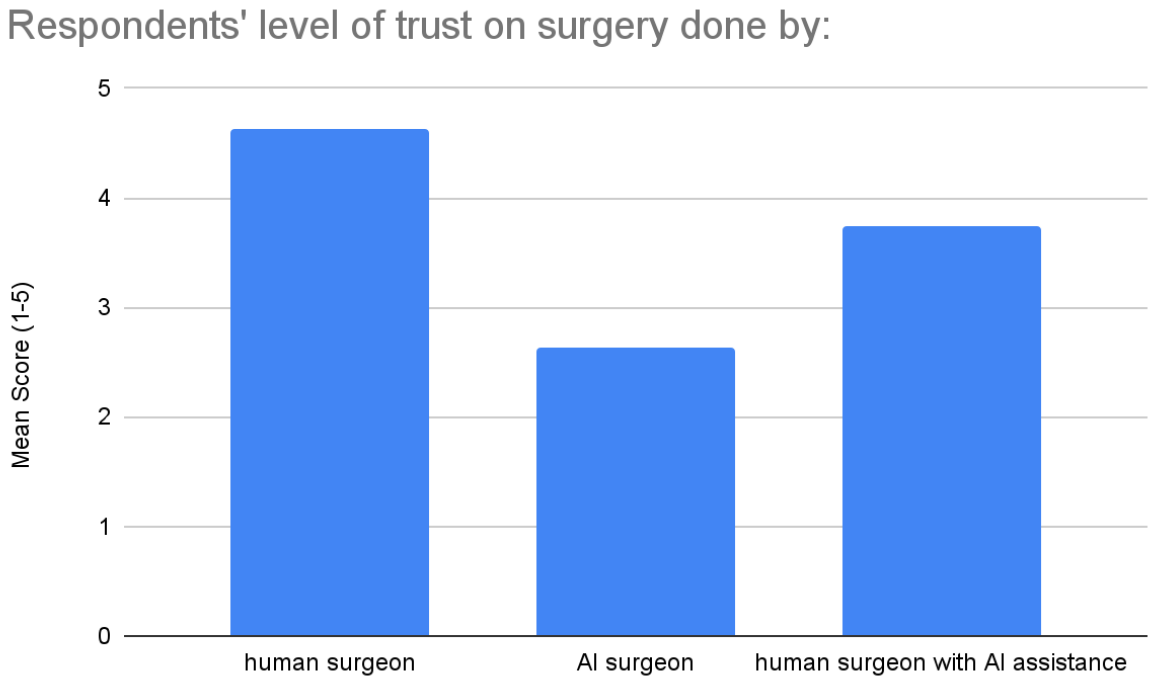

Figure 3: Mean score for the statements "If I were a patient, I would trust a human surgeon to perform my surgery," "If I were a patient, I would trust an AI robot surgeon to perform my surgery," and "If I were a patient, I would trust a surgeon to perform my surgery with assistance from an AI."

Aside from Likert-scale data, I also collected open-ended from two of the survey questions. For the question "What do you think AI in medicine will be like in the near future?", a common reoccurring theme from my responses was that AI will become more common and involved in the medical field. In addition, a lot of respondents who believed this went on to say that AI in medicine would be more prominent in fields that require less patient interaction such as pharmacy and research, and less prominent in fields that require more patient interaction such as nursing. For the question "If AI makes a mistake, who's fault is it? (E.g. Hospital/ institution or company that developed the AI/Other) Why?", half of the respondents believed that it would be the institution or company's fault while the other half were either unsure or believes

that it would is both the hospital and the institution or company's fault. The most common reason for believing that it would be the institution or company's fault is that they were the ones who develop the AI. Meanwhile, the most common reason for being unsure or believing that it would be both the hospital and the institution or company's fault was that medical workers would also be responsible for being over-reliant on the AI's decisions or for not catching the AI's error.

Discussion

The Likert-scale mean score comparison between human involvement, AI involvement, and human involvement in AI assistance indicated that the respondents generally trust human involvement in medicine the most, human involvement with AI assistance the second most, and AI involvement the least. The results of the study supplemented the findings from "A healthy debate: Exploring the views of medical doctors on the ethics of artificial intelligence," which surveyed Netherlands, Portugal, and the U.S. medical doctors of different specialties with similar questions. Both the undergraduate respondents from my survey and the medical doctors in the study generally do not have a negative outlook on the implementation of AI into medicine and believe that AI will become more involved in medicine in the future.

Furthermore, many medical doctors in the prior study believed that AI would help do many automatic and tedious tasks so that physicians could work more efficiently. This view was also seen in some open-ended responses I received. Still, medical doctors believed that they should still be the ones making the final calls in a medical decision process and be part of the technology design and training process (Martinho). A similar view was found in an open-ended response from my survey that the respondent "believe AI will have a more involved role, but only as an assistant to human researchers/doctors."

Conclusion

The purpose of this research was to describe peoples' perceptions of the appropriate type and level of involvement artificial intelligence should have in different facets of the medical field. With the rapid progression of artificial intelligence technology, it seemed inevitable that AI would become more and more involved in different facets of the medical field, such as risk assessment and diagnosis. The research question “what type and level of involvement should AI have in the medical field?” was answered in the majority of my study. Many participants believed that AI will become more common and involved in the medical field and should be more prominent in fields that require less patient interaction such as pharmacy and research. Although many participants in my study did not trust research, diagnosis, or surgery with AI involvement as much as those without AI involvement at the current stage, many of them held a positive outlook on applications of AI in medicine as supported by my study conducted on the UCD undergraduates.

Moreover, many medical doctors are willing to be actively involved in the incorporation of AI in medicine by becoming part of the technology design and training process, while securing their right to make final calls in a medical decision process. As the leading figures of the medical field, their optimistic perspectives and active involvement would likely impact the societal view on AI, thereby becoming more willing to trust the applications of AI in more facets of medicine. However, the research question “does the use of AI in medicine follow the principles of bioethics?” was barely addressed. Only one of my open-end questions on who should take responsibility when AI makes a mistake contained some ideas of bioethics. Hence, the bioethics of AI in medicine would be an important topic to be further researched in future studies. Further research on this topic could still use survey methods while including more survey questions that more directly relate to bioethics, such as “is the incorporation of AI in medicine ethical?”

Works Cited

Basu, Kanadpriya et al. “Artificial Intelligence: How is It Changing Medical Sciences and Its Future?.” *Indian journal of dermatology* vol. 65,5 (2020): 365-370. doi:10.4103/ijd.IJD_421_20

Britannica, The Editors of Encyclopaedia. "Erewhon". Encyclopedia Britannica, 27 Mar. 2018, https://www.britannica.com/topic/Erewhon.

Chan, HC Stephen, et al. "Advancing drug discovery via artificial intelligence." *Trends in pharmacological sciences* 40.8 (2019): 592-604. https://doi.org/10.1016/j.tips.2019.06.004

Chu, Yu Seong, et al. "Artificial intelligence in cutaneous oncology." *Frontiers in Medicine* (2020): 318. https://doi.org/10.3389/fmed.2020.00318

Haenlein, Michael, and Andreas Kaplan. “A Brief History of Artificial Intelligence: On the Past, Present, and Future of Artificial Intelligence.” *California Management Review*, vol. 61, no. 4, 2019, pp. 5–14., https://doi.org/10.1177/0008125619864925.

Kaul, Vivek, Sarah Enslin, and Seth A. Gross. "History of artificial intelligence in medicine." *Gastrointestinal endoscopy* 92.4 (2020): 807-812. https://doi.org/10.1016/j.gie.2020.06.040

Martinho, Andreia, Maarten Kroesen, and Caspar Chorus. "A healthy debate: Exploring the views of medical doctors on the ethics of artificial intelligence." *Artificial Intelligence in Medicine* 121 (2021): 102190. https://doi.org/10.1016/j.artmed.2021.102190

Suri, Jasjit S., et al. "Integration of cardiovascular risk assessment with COVID-19 using artificial intelligence." *Reviews in Cardiovascular Medicine* 21.4 (2020): 541-560. https://doi.org/10.31083/j.rcm.2020.04.236