Original Research Paper

Enhancing the Ethical Competence of Artificial Intelligence in Healthcare: Outcomes of a Multi-disciplinary Collaborative Workshop

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ABSTRACT

Background: The integration of Artificial Intelligence (AI) in healthcare is transforming medical diagnostics, treatment personalization, and operational efficiencies, yet it introduces ethical concerns and demands multidisciplinary knowledge among healthcare professionals. To address this, the **CONNECT** with **AI**" (**C**ollaborative **O**pportunity to **N**avigate and **N**egotiate **E**thical **C**hallenges and **T**rials with **A**rtificial **I**ntelligence) workshop was organized to enhance understanding and address the ethical challenges associated with AI in healthcare.
Methodology: This study was conducted with multi-disciplinary participants who attended the workshop. Data were collected using pre-and post-workshop confidence level assessments and feedback on various workshop sessions. Statistical analyses of the data were performed using SPSS to evaluate the impact of the workshop on participants' confidence and understanding of AI in healthcare.
Results: There was a significant increase in confidence levels post-workshop across all domains,

particularly in understanding the ethical principles and informed consent processes involving AI technologies in healthcare. Feedback scores indicated high satisfaction with the quality of the presentations, level of interaction, and depth of content, emphasizing the workshop's effectiveness in addressing the complexities of AI applications.
Conclusions: The "CONNECT with AI" workshop significantly improved participants' understanding and confidence in applying AI in healthcare settings, while also highlighting the necessity of ongoing education in AI ethics and regulations. The findings advocate for continued interdisciplinary education to prepare healthcare professionals for the ethical integration of AI technology.
Keywords: Artificial Intelligence, Healthcare, Ethics, Interdisciplinary Education, Workshop Evaluation, AI Confidence.

(Received – 4th February 2024, Peer Review Done – 19th February 2024, Accepted – 25th February 2024).

Introduction

Artificial Intelligence (AI) is a branch of computer science dedicated to creating systems capable of performing tasks that typically require human intelligence [1]. These tasks include learning, reasoning, problem-solving, perception, and language understanding. AI technologies, such as machine learning, natural language processing, and robotics, are increasingly pervasive across various sectors [2].

In healthcare, AI is revolutionizing the field by improving diagnostics, enhancing treatment personalization, and optimizing operational efficiencies. AI-driven tools can analyse complex medical data, assist in early disease detection, and predict patient outcomes more accurately [3-4]. Additionally, AI is integral to developing personalized medicine, enabling treatments tailored specifically to individual patients based on their genetic makeup and lifestyle [5].

However, the integration of AI in healthcare brings substantial ethical concerns. Issues such as data privacy, informed consent, and potential biases in AI algorithms must be addressed to prevent inequalities and maintain trust in healthcare systems [6-7]. Moreover, the accountability for AI-driven decisions in medical settings remains a critical challenge, as it involves determining the responsibility between human clinicians and AI systems [8-9].

Given the complexity and potential risks associated with AI in healthcare, there is a pressing need for multidisciplinary training. Healthcare professionals must be equipped not only with knowledge of AI technology but also with the ethical frameworks and legal considerations surrounding its use [10-11]. Interdisciplinary collaboration among technologists, ethicists, clinicians, and legal experts is essential to navigate the challenges posed by AI.

To address these issues, the "CONNECT with AI" (Collaborative Opportunity to Navigate and Negotiate Ethical Challenges and Trials with Artificial Intelligence) workshop was organized from April 2-4, 2024, at the SRM Medical College Hospital and Research Centre, SRM Institute of Science & Technology SRM Nagar, Kattankulathur, Chengalpattu District, Tamil Nadu, India. This 3-day event brought together experts from various disciplines. The workshop aimed to foster understanding and collaboration among professionals to effectively integrate AI in healthcare while addressing ethical concerns and promoting best practices.

Methodology

Study Design and Setting: This study assesses the "CONNECT with AI" workshop outcomes—a 3-day event aimed at navigating ethical challenges in AI, held at the SRM Medical College Hospital and Research Centre, SRM Institute of Science & Technology SRM Nagar, Kattankulathur, Chengalpattu District, Tamil Nadu, India.

Study Participants: Volunteers from various multi-institutional, interdisciplinary, and interprofessional backgrounds participated in this study. All provided informed consent, and their involvement was entirely voluntary. The professional backgrounds of participants included Medicine, Dentistry, Nursing, Allied Health Sciences, Engineering & Technology, and Law. The participants were organized into 10 groups, each consisting of one professional from each of the six disciplines mentioned.

Data Collection:

1. **Assessment of Confidence Levels:** To evaluate participants' confidence in applying AI across various fields, a 10-item validated questionnaire was administered before and after the workshop. This questionnaire used a 5-point Likert scale ranging from "1 - Not at all confident" to "5 - Extremely confident."
2. **Workshop Feedback:** Participants were asked to rate each session on a 10-point scale across five dimensions: quality of the presentations, level of interaction during the sessions, effectiveness of group discussions and activities, depth of content, and expertise of the speakers.

Data Analysis: The statistical analysis included descriptive univariate assessments of continuous variables, represented through their mean and standard deviation. T-tests and Analysis of Variance (ANOVA) evaluated differences among these variables. The Statistical Package for Social Sciences (SPSS, version 17) for Microsoft Windows, by SPSS Inc., USA, was the tool used for these analyses. A p value of less than 0.05 was deemed statistically significant. Qualitative analysis included thematic and content analysis of the recorded transcripts in Focus Group Discussions.

Ethical Considerations: The study was conducted following ethical guidelines approved by the institutional review board. Participants were informed about the study's objectives and purpose of data utilization. Their participation was voluntary, and confidentiality was assured with data anonymization. Written informed consent was obtained from all participants.

Results

Assessment of Confidence levels:

The confidence levels regarding the use of AI before and after the workshop were measured on a 5-point Likert scale, with 1 indicating "Not at all confident" and 5 indicating "Extremely confident." and the mean confidence scores were calculated. There was a significant improvement in their confident levels with $p<0.0001$. Figure 1 showcases the results of a survey assessing confidence levels. Before the workshop, the participants generally reported lower confidence across all areas, with scores ranging between 1.6 and 2.4. The lowest pre-workshop confidence is in "Knowledge of the current challenges AI faces in healthcare applications" (1.7). After the workshop, there is a noticeable increase in confidence across all domains. The mean scores range from 4.0 to 4.8, showing a significant improvement. The areas where participants felt most confident after the workshop are "Understanding of the informed consent process when AI technologies are involved in healthcare" and "Understanding of the ethical principles governing AI in healthcare," both scoring 4.8. The area with the lowest post-workshop confidence is "Knowledge of the current regulations and guidelines surrounding AI in healthcare," with a mean score of 4.0.

"CONNECT with AI" Workshop Feedback:

Table 1 presents feedback scores for various sessions conducted over a three-day workshop on the application of AI in healthcare and its ethics. Each session is evaluated across five dimensions: Quality of Presentation, Interaction during Session, Effectiveness of Group Discussions and Activities, Depth of Content Provided, and Expertise of Speaker on a 10-point rating scale. Overall, the consistently high ratings across all sessions underscore the workshop's effectiveness in addressing the complexities of applying AI in healthcare, facilitating engaging and informative discussions, and providing participants with a deep understanding of the subject matter from both a technical and ethical standpoint.

Discussion

The "CONNECT with AI" workshop, hosted at the SRM Institute of Science & Technology, served as a critical platform for facilitating interdisciplinary learning among professionals from various sectors, particularly healthcare. This study provided a rigorous evaluation of the workshop, revealing significant insights into the educational impact of such initiatives on participants' understanding of AI's ethical, legal, and practical dimensions.

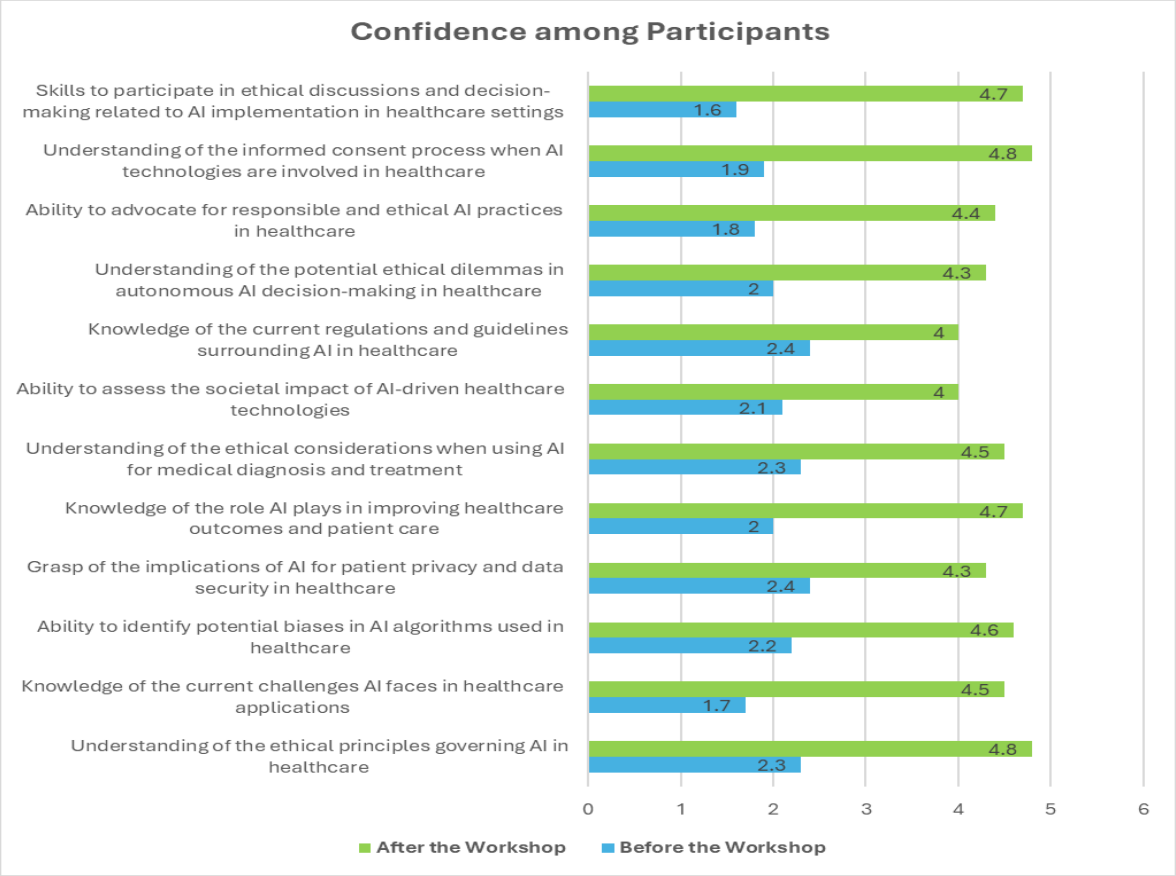

Figure 1: Confidence levels of participants before & after the workshop

Table 1: "CONNECT with AI" Workshop Feedback

Day/Session	Quality of Session	Interaction during session	Effectiveness of group activities and discussions	Depth and Quality of Content	Expertise of Presenter
Day 1					
Introduction to AI	9.2	9.3	8.6	8.8	8.6
Introduction to Ethical Principles	9.5	8.7	8.5	8.9	8.6
Ethical Principles of AI in Healthcare	8.8	8.6	9.3	8.7	9.0
Case Discussions of Ethical Principles	8.7	9.5	8.9	9.6	9.5
Day 2					
Ethical Frameworks for AI Implementation	9.5	9.3	9.5	9.6	9.5
Debate session Human Vs AI Judgement	9.0	9.3	9.2	9.3	9.0
Ethical principles in development, validation and deployment phases	9.1	9.2	8.5	8.7	9.3
Case Discussion on Strategies for Responsible AI implementation	9.4	9.2	8.9	9.2	9.0
Day 3					
Regulations & Policies of AI in healthcare	9.4	9.6	9.5	9.3	9.2
Group Presentation & Discussion	9.2	9.5	9.6	8.7	9.1

Statistical analyses demonstrated a notable improvement in participants' confidence levels regarding the application of AI in healthcare post-workshop, suggesting that the workshop effectively addressed initial uncertainties and knowledge gaps. Initially, the lower confidence levels among participants could largely be attributed to the relatively new presence of AI in clinical settings and the inherent complexities of AI technologies. The significant rise in confidence post-workshop underscores the value of structured, interactive, and comprehensive educational interventions in demystifying AI and enhancing proficiency among healthcare professionals [12-13].

Critically, the workshop curriculum was not limited to theoretical knowledge but emphasized real-world applications, ethical dilemmas, and regulatory frameworks. This holistic approach ensured that participants could grasp the multifaceted nature of AI in healthcare, appreciating not only its potential to transform patient care but also the ethical considerations that it necessitates [14]. The emphasis on data privacy, informed consent, and the mitigation of algorithmic biases is particularly noteworthy, as these areas are fundamental to the responsible use of AI in healthcare. By equipping participants with a deep understanding of these issues, the workshop contributed to fostering ethical AI practices that prioritize patient rights and equity [15-16].

Feedback from participants further corroborated the effectiveness of the workshop. High ratings across various sessions concerning the quality of presentations, interaction levels, and depth of content reflected the workshop's success in meeting the diverse educational needs of an interdisciplinary audience. Such feedback not only highlights the participants' engagement and satisfaction but also supports the effectiveness of the workshop's instructional design and delivery [17-18].

Nevertheless, the persistence of lower confidence in understanding current regulations and guidelines post-workshop signals a critical area for further improvement. As AI technologies continue to evolve, so too must the regulatory frameworks that govern their use. This dynamic landscape requires ongoing educational efforts to ensure healthcare professionals remain adept at navigating future challenges. The need for continuous professional development is imperative to keep pace with technological advancements and regulatory changes.

Conclusion

The "CONNECT with AI" workshop not only enhanced participants' confidence in using AI but also played a crucial role in shaping their understanding of the ethical, legal, and practical challenges involved. The findings suggest that such interdisciplinary workshops are invaluable in preparing healthcare professionals for the ethical integration of AI into clinical practice. They also highlight the need for ongoing education and policy development to ensure that AI is used responsibly and effectively to enhance patient care without compromising ethical standards or equity in healthcare access.

REFERENCES

1. Gupta R, Srivastava D, Sahu M, Tiwari S, Ambasta RK, Kumar P. Artificial intelligence to deep learning: machine intelligence approach for drug discovery. Mol Divers 2021;25(3):1315-60.
2. Ossowska A, Kusiak A, Świetlik D. Artificial Intelligence in Dentistry-Narrative Review. Int J Environ Res Public Health 2022;19(6):3449.
3. Mintz Y, Brodie R. Introduction to artificial intelligence in medicine. Minim Invasive Ther Allied Technol 2019;28(2):73-81.
4. Hamet P, Tremblay J. Artificial intelligence in medicine. Metabolism 2017;69S:S36-40.
5. Jiang F, Jiang Y, Zhi H, et al. Artificial intelligence in healthcare: past, present and future. Stroke Vasc Neurol 2017;2(4):230-43.
6. Stanfill MH, Marc DT. Health Information Management: Implications of Artificial Intelligence on Healthcare Data and Information Management. Yearbook Med Inform. 2019;28(1):56-64.
7. Yu KH, Beam AL, Kohane IS. Artificial intelligence in healthcare. Nat Biomed Eng 2018;2(10):719-31.
8. Aung YYM, Wong DCS, Ting DSW. The promise of artificial intelligence: a review of the opportunities and challenges of artificial intelligence in healthcare. Br Med Bull 2021;139(1):4-15.

9. Alowais SA, Alghamdi SS, Alsuhebany N, et al. Revolutionizing healthcare: the role of artificial intelligence in clinical practice. BMC Med Educ 2023;23(1):689.
10. Whicher D, Rapp T. The Value of Artificial Intelligence for Healthcare Decision Making-Lessons Learned. Value Health 2022;25(3):328-30.
11. Morley J, Machado CCV, Burr C, et al. The ethics of AI in health care: A mapping review. Soc Sci Med 2020;260:113172.
12. Zhang J, Zhang ZM. Ethics and governance of trustworthy medical artificial intelligence. BMC Med Inform Decis Mak 2023;23(1):7.
13. Elendu C, Amaechi DC, Elendu TC, et al. Ethical implications of AI and robotics in healthcare: A review. Medicine (Baltimore) 2023;102(50):e36671.
14. Ueda D, Kakinuma T, Fujita S, et al. Fairness of artificial intelligence in healthcare: review and recommendations. Jpn J Radiol 2024;42(1):3-15.
15. Racine E, Boehlen W, Sample M. Healthcare uses of artificial intelligence: Challenges and opportunities for growth. Healthcare Manage Forum. 2019;32(5):272-5.
16. Antes AL, Burrous S, Sisk BA, Schuelke MJ, Keune JD, DuBois JM. Exploring perceptions of healthcare technologies enabled by artificial intelligence: an online, scenario-based survey. BMC Med Inform Decis Mak 2021;21(1):221.
17. Saw SN, Ng KH. Current challenges of implementing artificial intelligence in medical imaging. Phys Med 2022;100:12-7.
18. Rogers WA, Draper H, Carter SM. Evaluation of artificial intelligence clinical applications: Detailed case analyses show value of healthcare ethics approach in identifying patient care issues. Bioethics 2021;35(7):623-33.

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Acknowledgements: We would like to thank and acknowledge SRM Institute of Science & Technology SRM Nagar, Kattankulathur - 603 203, Chengalpattu District, Tamil Nadu, India., for the support and cooperation in conducting this workshop.

Conflict of interest: Nil
Funding: Nil