# Transformative Role of AI in Medicine

WASHINGTON Medical Commission
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In today's media landscape, whether you're scrolling through news updates or delving into print articles, the pervasive narrative surrounding Artificial Intelligence (AI) invariably emerges, depicting its profound impact on various aspects of our world. From discussions of how AI is "changing" and "revolutionizing" to "transforming" diverse functions, industries, careers, and professions, nowhere is this narrative more prominent than in the medical industry. AI is an umbrella term used to describe the use of computers and technology to simulate intelligent behavior and critical thinking akin to human capabilities.[1] With the integration of AI in health care, patient care and clinical outcomes have experienced significant improvements, and the delivery of health care services has undergone optimization, ushering in a new era of efficiency and innovation.

AI applications that have revolutionized medicine:

- Clinical Decision Support Systems (CDSS): AI enhanced CDSS offers evidence-based recommendations, guidelines, and alerts to health care providers at the point of care.[2] By integrating patient data, medical literature, and best practices, CDSS assist clinicians in making informed decisions, reducing diagnostic errors, and improving patient outcomes[3]. Under the categories of basic preventive reminders and drug interaction alerts in primary care, CDSS is used routinely 68% and 100% of instances when the practice is entirely EMR/her based.[4]
- Diagnostic Imaging Interpretation: AI algorithms are used to analyze medical imaging data, including X-rays, MRI scans[5], CT scans, and mammograms, to assist radiologists and clinicians in interpreting images, detecting abnormalities, and diagnosing diseases such as cancer, fractures, and cardiovascular conditions.[6] AI-driven image analysis tools can improve diagnostic accuracy, reduce interpretation time, and prioritize cases for review, leading to earlier detection and intervention.[7]
- Precision medicine: AI facilitates the development of personalized treatment plans based on individual patient characteristics, including genetic makeup, medical history, and lifestyle factors.[8] By analyzing large datasets and clinical research, AI algorithms predict treatment efficacy, identify disease biomarkers, and optimize therapeutic interventions for precision medicine approaches.[9],[10],[11],[12]
- Healthcare Predictive Analytics: Predictive analytics tools analyze patient data to identify patterns, trends, and risk factors associated with adverse health outcomes.[13],[14] These tools aid in anticipating patient deterioration, preventing hospital readmissions, and optimizing resource allocation for improved care coordination and delivery efficiency.[15],[16]
- Natural Language Processing (NLP): NLP algorithms process and analyze unstructured clinical text data, including physician notes, discharge summaries, and medical literature, to extract valuable information, insights, and trends.[17] NLP applications enable health care organizations to automate documentation processes, extract clinical data for research purposes, and improve information retrieval for evidence-based decision-making.[18],[19]
- Remote monitoring and telemedicine: AI-enabled telemedicine platforms and remote monitoring systems enable patients to access health care services remotely, facilitating virtual consultations, remote diagnosis, and chronic disease management.[20] AI algorithms analyze real-time patient data from wearable devices and remote sensors to detect early warning signs of health deterioration, enabling proactive interventions and personalized care delivery.[21],[22]
- Drug Discovery and Development: machine learning and computational modeling are increasingly being used in drug discovery, development, and marketing.[23] AI algorithms analyze vast molecular structures, quickly predict drug interactions, and identify potential therapeutic targets, accelerating the life cycle of pharmaceutical products and reducing the time and cost associated with bringing new drugs to market.[24],[25],[26]

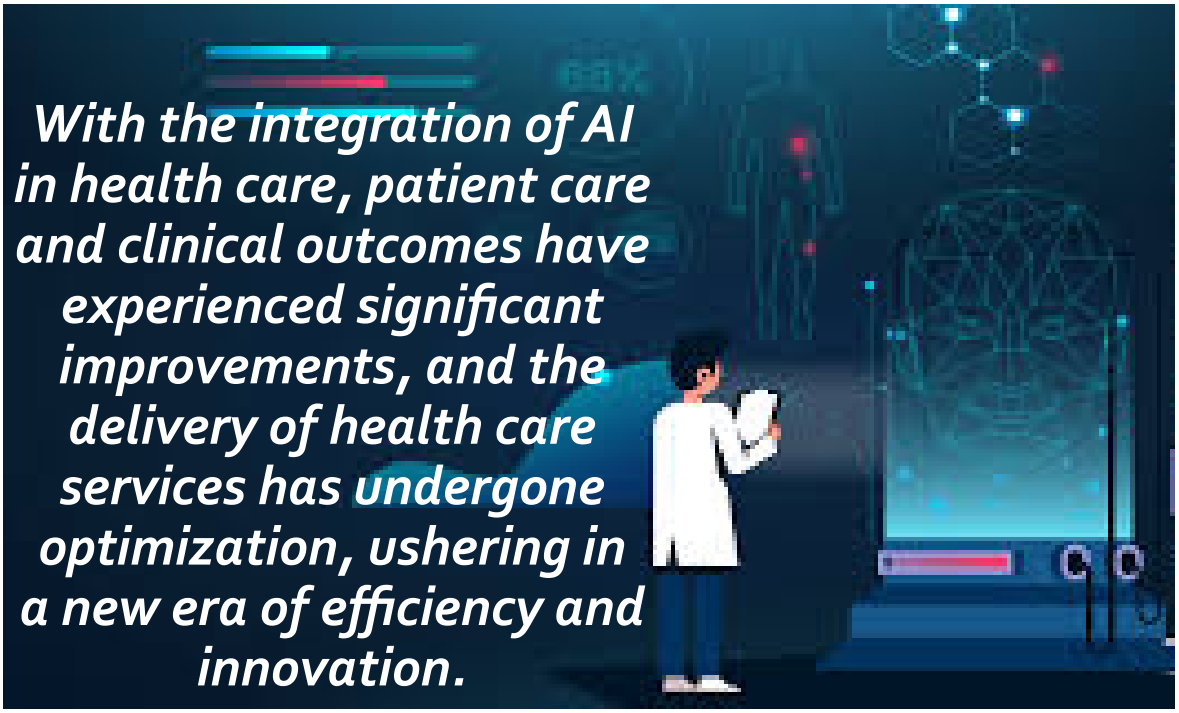
## Transformative Role of AI in Medicine

The rapid advancement of machine learning models is expediting the incorporation of AI in medicine. To maximize its advantages and promote equitable access, it's essential to address challenges that come with full adaptation.[27] Health care data fragmentation and disparate storage poses challenges related to data quality, accessibility, interoperability as well as privacy.[28] Bias related to AI algorithm should also be considered as it could contribute to healthcare disparities.[29],[30] Ethical and safety considerations should also be studied with regulatory agencies.[31],[32] The WMC is leading the way in developing an AI in Medicine policy to navigate these challenges and ensure the responsible and ethical use of AI in medicine.

**Stay informed:**

- Online Courses and Resources: enroll in online courses, webinars, and educational platforms dedicated to AI in medicine. These courses cover topics such as machine learning, data analytics, and AI applications in healthcare. Platforms like Coursera and The American Board of Artificial Intelligence in Medicine (ABAIM) offer courses specifically designed for healthcare professionals interested in learning about AI.
- Professional Workshops and Conferences: Attending workshops, seminars, and conferences focused on AI in medicine provides doctors with opportunities to learn from experts in the field, explore cutting-edge research, and engage in discussions about the latest advancements and best practices. Many medical associations and professional organizations host conferences and events on AI and healthcare innovation.
  - *Changing healthcare one connection at a time* Gaylord Palms, Florida, May 29 - 31 2024
  - International Conference on Machine Learning (ICML) 2024
  - Mayo Clinic Platform Conference
  - Machine Learning for Healthcare 2024
  - Bio-IT World Conference & Expo 23rd Annual Expo
- Network and Participate: Collaborating with research university faculty offers valuable insights and perspectives on its applications in medicine. Participate in UW medicine interdisciplinary research, join AI-focused working groups or forums, and network with professionals from diverse backgrounds to gain a deeper understanding of AI technologies and their implications for healthcare. Participate in the Washington State Medical Association to develop a position and guidelines that define AI.

*Refrences for this article are avalaible on page 25*



Endnotes

1 Amisha, Malik, P., Pathania, M., & Rathaur, V. K. (2019). Overview of artificial intelligence in medicine. Journal of family medicine and primary care, 8(7), 2328–2331. https://doi.org/10.4103/jfmpc.jfmpc_440_19

2 van Baalen, S., Boon, M., & Verhoef, P. (2021). From clinical decision support to clinical reasoning support systems. Journal of evaluation in clinical practice, 27(3), 520–528. https://doi.org/10.1111/jep.13541

3 Amann, J., Vayena, E., Ormond, K. E., Frey, D., Madai, V. I., & Blasimme, A. (2023). Expectations and attitudes towards medical artificial intelligence: A qualitative study in the field of stroke. PloS one, 18(1), e0279088. https://doi.org/10.1371/journal.pone.0279088

4 Jing, X., Himawan, L., & Law, T. (2019). Availability and usage of clinical decision support systems (CDSSs) in office-based primary care settings in the USA. BMJ health & care informatics, 26(1), e100015. https://doi.org/10.1136/bmjhci-2019-100015

5 Uysal, G., & Ozturk, M. (2020). Hippocampal atrophy based Alzheimer's disease diagnosis via machine learning methods. Journal of neuroscience methods, 337, 108669. https://doi.org/10.1016/j.jneumeth.2020.108669

6 Matsoukas, S., Scaggiante, J., Schuldt, B. R., Smith, C. J., Chennareddy, S., Kalagara, R., Majidi, S., Bederson, J. B., Fifi, J. T., Mocco, J., & Kellner, C. P. (2022). Accuracy of artificial intelligence for the detection of intracranial hemorrhage and chronic cerebral microbleeds: a systematic review and pooled analysis. La Radiologia medica, 127(10), 1106–1123. https://doi.org/10.1007/s11547-022-01530-4

7 Matsoukas, S., Scaggiante, J., Schuldt, B. R., Smith, C. J., Chennareddy, S., Kalagara, R., Majidi, S., Bederson, J. B., Fifi, J. T., Mocco, J., & Kellner, C. P. (2022). Accuracy of artificial intelligence for the detection of intracranial hemorrhage and chronic cerebral microbleeds: a systematic review and pooled analysis. La Radiologia medica, 127(10), 1106–1123. https://doi.org/10.1007/s11547-022-01530-4

8 Johnson, K. B., Wei, W. Q., Weeraratne, D., Frisse, M. E., Misulis, K., Rhee, K., Zhao, J., & Snowdon, J. L. (2021). Precision Medicine, AI, and the Future of Personalized Health Care. Clinical and translational science, 14(1), 86–93. https://doi.org/10.1111/cts.12884

9 Hamamoto, R., Koyama, T., Kouno, N., Yasuda, T., Yui, S., Sudo, K., Hirata, M., Sunami, K., Kubo, T., Takasawa, K., Takahashi, S., Machino, H., Kobayashi, K., Asada, K., Komatsu, M., Kaneko, S., Yatabe, Y., & Yamamoto, N. (2022). Introducing AI to the molecular tumor board: one direction toward the establishment of precision medicine using large-scale cancer clinical and biological information. Experimental hematology & oncology, 11(1), 82. https://doi.org/10.1186/s40164-022-00333-7

10 Ahmed, Z., Mohamed, K., Zeeshan, S., & Dong, X. (2020). Artificial intelligence with multi-functional machine learning platform development for better healthcare and precision medicine. Database : the journal of biological databases and curation, 2020, baaa010. https://doi.org/10.1093/database/baaa010

11 Mohsin, S. N., Gapizov, A., Ekhator, C., Ain, N. U., Ahmad, S., Khan, M., Barker, C., Hussain, M., Malineni, J., Ramadhan, A., & Halappa Nagaraj, R. (2023). The Role of Artificial Intelligence in Prediction, Risk Stratification, and Personalized Treatment Planning for Congenital Heart Diseases. Cureus, 15(8), e44374. https://doi.org/10.7759/cureus.44374

12 Tsopra, R., Fernandez, X., Luchinat, C., Alberghina, L., Lehrach, H., Vanoni, M., Dreher, F., Sezerman, O. U., Cuggia, M., de Tayrac, M., Miklasevics, E., Itu, L. M., Geanta, M., Ogilvie, L., Godey, F., Boldisor, C. N., Campillo-Gimenez, B., Cioroboiu, C., Ciusdel, C. F., Coman, S., ... Burgun, A. (2021). A framework for validating AI in precision medicine: considerations from the European ITFoC consortium. BMC medical informatics and decision making, 21(1), 274. https://doi.org/10.1186/s12911-021-01634-3

13 Shaban-Nejad, A., Michalowski, M., & Buckeridge, D. L. (2018). Health intelligence: how artificial intelligence transforms population and personalized health. NPJ digital medicine, 1, 53. https://doi.org/10.1038/s41746-018-0058-9

14 Tran, N. K., Kretsch, C., LaValley, C., & Rashidi, H. H. (2023). Machine learning and artificial intelligence for the diagnosis of infectious diseases in immunocompromised patients. Current opinion in infectious diseases, 36(4), 235–242. https://doi.org/10.1097/QCO.0000000000000935

15 Moss, T. J., Clark, M. T., Calland, J. F., Enfield, K. B., Voss, J. D., Lake, D. E., & Moorman, J. R. (2017). Cardiorespiratory dynamics measured from continuous ECG monitoring improves detection of deterioration in acute care patients: A retrospective cohort study. PloS one, 12(8), e0181448. https://doi.org/10.1371/journal.pone.0181448

16 Keim-Malpass, J., Clark, M. T., Lake, D. E., & Moorman, J. R. (2020). Towards development of alert thresholds for clinical deterioration using continuous predictive analytics monitoring. Journal of clinical monitoring and computing, 34(4), 797–804. https://doi.org/10.1007/s10877-019-00361-5

17 Hossain, E., Rana, R., Higgins, N., Soar, J., Barua, P. D., Pisani, A. R., & Turner, K. (2023). Natural Language Processing in Electronic Health Records in relation to healthcare decision-making: A systematic review. Computers in biology and medicine, 155, 106649. https://doi.org/10.1016/j.compbiomed.2023.106649

18 Chung, P., Fong, C. T., Walters, A. M., Yetisgen, M., & O'Reilly-Shah, V. N. (2023). Prediction of American Society of Anesthesiologists Physical Status Classification from preoperative clinical text narratives using natural language processing. BMC anesthesiology, 23(1), 296. https://doi.org/10.1186/s12871-023-02248-0

19 Lee, J., Yoon, W., Kim, S., Kim, D., Kim, S., So, C. H., & Kang, J. (2020). BioBERT: a pre-trained biomedical language representation model for biomedical text mining. Bioinformatics (Oxford, England), 36(4), 1234–1240. https://doi.org/10.1093/bioinformatics/btz682

20 Sharma, S., Rawal, R., & Shah, D. (2023). Addressing the challenges of AI-based telemedicine: Best practices and lessons learned. Journal of education and health promotion, 12, 338. https://doi.org/10.4103/jehp.jehp_402_23

21 Bellini, V., Valente, M., Gaddi, A. V., Pelosi, P., & Bignami, E. (2022). Artificial intelligence and telemedicine in anesthesia: potential and problems. Minerva anestesiologica, 88(9), 729–734. https://doi.org/10.23736/S0375-9393.21.16241-8

22 Ellahham S. (2020). Artificial Intelligence: The Future for Diabetes Care. The American journal of medicine, 133(8), 895–900. https://doi.org/10.1016/j.amjmed.2020.03.033

23 Sarkar, C., Das, B., Rawat, V. S., Wahlang, J. B., Nongpiur, A., Tiewsoh, I., Lyngdoh, N. M., Das, D., Bidarolli, M., & Sony, H. T. (2023). Artificial Intelligence and Machine Learning Technology Driven Modern Drug Discovery and Development. International journal of molecular sciences, 24(3), 2026. https://doi.org/10.3390/ijms24032026

24 Paul, D., Sanap, G., Shenoy, S., Kalyane, D., Kalia, K., & Tekade, R. K. (2021). Artificial intelligence in drug discovery and development. Drug discovery today, 26(1), 80–93. https://doi.org/10.1016/j.drudis.2020.10.010

25 Vatansever, S., Schlessinger, A., Wacker, D., Kaniskan, H. Ü., Jin, J., Zhou, M. M., & Zhang, B. (2021). Artificial intelligence and machine learning-aided drug discovery in central nervous system diseases: State-of-the-arts and future directions. Medicinal research reviews, 41(3), 1427–1473. https://doi.org/10.1002/med.21764

26 Decherchi, S., & Cavalli, A. (2020). Thermodynamics and Kinetics of Drug-Target Binding by Molecular Simulation. Chemical reviews, 120(23), 12788–12833. https://doi.org/10.1021/acs.chemrev.0c00534

27 Rajpurkar, P., Chen, E., Banerjee, O., & Topol, E. J. (2022). AI in health and medicine. Nature medicine, 28(1), 31–38. https://doi.org/10.1038/s41591-021-01614-0

28 Manrique de Lara, A., & Peláez-Ballestas, I. (2020). Big data and data processing in rheumatology: bioethical perspectives. Clinical rheumatology, 39(4), 1007–1014. https://doi.org/10.1007/s10067-020-04969-w

29 Gichoya, J. W., Thomas, K., Celi, L. A., Safdar, N., Banerjee, I., Banja, J. D., Seyyed-Kalantari, L., Trivedi, H., & Purkayastha, S. (2023). AI pitfalls and what not to do: mitigating bias in AI. The British journal of radiology, 96(1150), 20230023. https://doi.org/10.1259/bjr.20230023

30 Banerjee, I., Bhattacharjee, K., Burns, J. L., Trivedi, H., Purkayastha, S., Seyyed-Kalantari, L., Patel, B. N., Shiradkar, R., & Gichoya, J. (2023). "Shortcuts" Causing Bias in Radiology Artificial Intelligence: Causes, Evaluation, and Mitigation. Journal of the American College of Radiology : JACR, 20(9), 842–851. https://doi.org/10.1016/j.jacr.2023.06.025

31 Čartolovni, A., Tomičić, A., & Lazić Mosler, E. (2022). Ethical, legal, and social considerations of AI-based medical decision-support tools: A scoping review. International journal of medical informatics, 161, 104738. https://doi.org/10.1016/j.ijmedinf.2022.104738

32 Balthazar, P., Harri, P., Prater, A., & Safdar, N. M. (2018). Protecting Your Patients' Interests in the Era of Big Data, Artificial Intelligence, and Predictive Analytics. Journal of the American College of Radiology : JACR, 15(3 Pt B), 580–586. https://doi.org/10.1016/j.jacr.2017.11.035