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ADVANCING CANCER CARE THROUGH ARTIFICIAL INTELLIGENCE

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ABSTRACT

Artificial Intelligence is revolutionizing the field of cancer care by enhancing early detection, improving diagnostic precision, and supporting personalised treatment plans. Using advanced algorithms such as machine learning and deep learning. Artificial intelligence can process complex medical data from imaging, pathology, and genomic sources to deliver fast and more accurate clinical awareness. In cancer screening, AI tools detect early lesions in radiological and histopathological images with high sensitivity, reducing human error and diagnostic delays.[4–6,12] In precision oncology, AI integrates multi-omics data, helping predict therapy response and resistance to optimize treatment plans.[9,10] It also supports radiation oncology through automated planning and real-time adjustments.[7,8,16] Despite its success, challenges persist, including data privacy, model transparency, and ethical issues.[1–3,14,15] Explainable AI and collaborative learning are emerging to address these gaps. This review discusses AI's growing role in the cancer-care continuum, emphasizing its applications, challenges, and future directions. It provides a simplified yet complete overview for students and researchers to understand how AI can make cancer more precise, accessible, and patientcentered.[1–3,7,9,10]

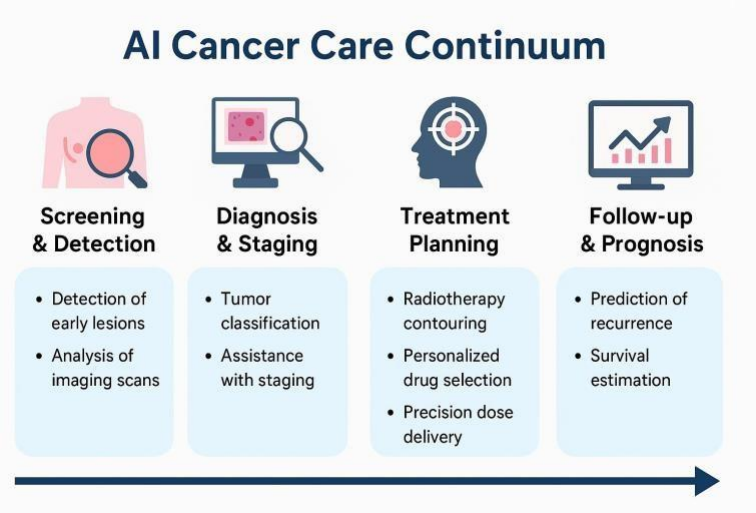
KEYWORDS: Artificial intelligence; Cancer; Deep learning; Diagnosis; Machine learning; Multi-omics; Oncology; Pathology; Precision oncology; Radiology; Radiotherapy; Screening.

INTRODUCTION

Cancer remains one of the leading causes of death worldwide, that is of nearly 10 million deaths annually (WHO, 2024). Despite advances in diagnostics and therapies, early detection and individualized treatment remain challenges.[1,2,4,6]

Artificial Intelligence (AI) represents a technological breakthrough capable of transforming oncology by assisting clinicians with data-driven, precise, and timely decisions.[1,11]

The Need for AI in Cancer Care: The massive growth of medical data and limited human expertise highlight the necessity for AI-based systems that enhance workflow efficiency and accuracy.[5,6,12]



AI in the Oncology Workflow: AI supports screening, diagnosis, treatment, and prognosis phases of cancer care, optimizing outcomes for patients.[4,5,12]

AI, Data Integration, and Precision Oncology: Multi-omics integration using AI enables therapy prediction and personalized medicine.[9,10,23]

Challenges in Trust and Explainability: The 'black-box' nature of AI necessitates the use of explainable AI for transparency.[2,3,18]

Ethical and Data-Sharing Innovations: Federated learning ensures privacy while improving collaborative AI development.[5,13,14]

Purpose of This Review: This review summarizes AI's applications, limitations, and future directions in simple, student-friendly language.[1–3,6,9,10]

APPLICATIONS OF AI IN CANCER CARE

Table 1: Applications of AI in Cancer Care.

Stage	Applications	Techniques	Benefits
Screening	Mammogram/CT analysis	CNN,DL	Early detection
Diagnosis	Pathology analysis	Deep learning	Accurate classification
Treatment	Radiotherapy planning	Reinforcement Learning	Personalised care
Precision oncology	Multi -omics integration	Ml models	Therapy optimization
Monitoring	Recurrence prediction	Predictive AI	Prognostic accuracy

CHALLENGES AND ETHICAL CONSIDERATIONS

AI's integration into oncology presents ethical, technical, and clinical challenges. Issues like data bias, interpretability, and patient privacy persist.[2,3,14] Clinicians must understand AI outputs to ensure safe and ethical decision-making.[15] Explainable AI (XAI) and federated learning approaches offer solutions.[13,14,18]

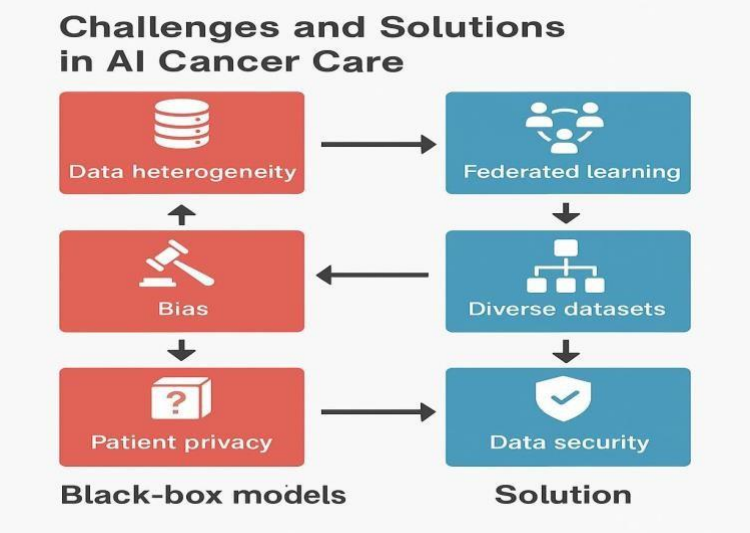


Table 2: Advantages and Challenges of Ai In Oncology.

Aspects	Advantages	Challenges
Accuracy	Improved diagnostic precision	Dependent on dataset quality
Workflow	Reduced analysis time	Integration complexity
Precision medicine	Personalised therapy	Explainability required
Privacy	Enables data security via FL	Ethical compliance needed

FUTURE PERSPECTIVES

AI's future in cancer care focuses on developing ethical, transparent, and inclusive technologies. Explainable AI, multi-modal integration, and low-cost models are expected to

dominate research.[2,3,18] Collaborative data-sharing frameworks will support equitable access to AI benefits globally.[1,2,15]

Table 3: Future Directions For Ai In Cancer Care.

Focus	Trends	Expected Impact
Explainable AI	Transparent models	Improved clinician trust
Federated learning	Secure collaboration	Data privacy preserved
Multi -modal fusion	Integrating imaging/genomics	Holistic analysis
Low-cost AI models	Affordable AI tools	Better accessibility
Ethical frameworks	Bias -free systems	Equitable outcomes

CONCLUSION

Artificial Intelligence has become a keystone of modern oncology, improving diagnostic accuracy and enabling personalized treatment.[1–3,7,9,10,15] AI-driven innovations like deep learning and multi-omics integration have redefined cancer diagnosis and therapy. However, achieving widespread trust and ethical integration remains a challenge. Through interdisciplinary collaboration, AI can bridge gaps in healthcare and ensure equal access for all patients. Its responsible application will continue shaping the future cancer care overall.

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REFERENCES

1. Cheng CH, Shi SS. Artificial intelligence in cancer: applications, challenges, and future perspectives. Molecular Cancer, 2025; 24(1): 274.
2. Riaz IB, Alnuhait MA, Johnson S, et al. Artificial intelligence across the cancer care continuum: opportunities and challenges. Cancer, 2025; 131(5): 1123–1138.
3. Mohamed YA, Ghazal TM, et al. Decoding the black box: Explainable artificial intelligence for cancer care. Computers in Biology and Medicine, 2025; 175: 108921.
4. Wang X, Xu Y, Zhang Z, et al. A pathology foundation model for cancer diagnosis and prognosis. Nature, 2024; 630(8012): 523–531.
5. Gjesvik J, Andersen J, Pedersen H, et al. Artificial intelligence scores predict subclinical breast cancer years before detection. JAMA Network Open, 2024; 7(4): e241567.
6. Branco PESC, da Silva AP, Pinto C, et al. Artificial intelligence in mammography: a systematic review and meta-analysis. Insights into Imaging, 2024; 15(3): 55–67.

7. Zafar F, Rahman F, Khan M, et al. Artificial intelligence in radiation oncology: a comprehensive review of applications and challenges. Cancers (Basel), 2025; 17(2): 248–261.
8. Kalsi S, Balakrishnan R, et al. The evolving role of artificial intelligence in radiotherapy. Radiotherapy and Oncology, 2024; 192(4): 45–57.
9. Li L, Zhang J, Xu W, et al. Multi-omics-based artificial intelligence for cancer research: current applications and future perspectives. Briefings in Bioinformatics, 2024; 25(2): bbae013.
10. Camps J, et al. AI-driven integration of multi-omics and imaging in cancer research. Journal of Pharmaceutical and Biomedical Analysis, 2025; 256(1): 115472.
11. Wang J, Lee S, et al. Artificial intelligence in cancer pathology: opportunities and challenges. Frontiers in Oncology, 2025; 15(2): 1124–1139.
12. McGenity C, Chen Y, et al. Diagnostic accuracy of artificial intelligence in digital pathology: a meta-analysis. NPJ Digital Medicine, 2024; 7(1): 103.
13. Schoenpflug LA, Müller J, et al. Federated learning in computational pathology: opportunities, challenges, and solutions. Patterns, 2024; 5(3): 100852.
14. Ankolekar A, Thomas P, et al. Advancing cancer research with federated learning: data privacy and collaboration in AI. NPJ Digital Medicine, 2025; 8(1): 177.
15. Froicu EM, Oprea C, et al. Artificial intelligence and decision-making in oncology: ethical and legal perspectives. Cancers (Basel), 2025; 17(6): 1553–1562.
16. Duke K, Alam R, et al. Artificial intelligence in radiation therapy: from imaging to outcomes. British Journal of Radiology AI., 2025; 6(3): e20240072.
17. Huhulea EN, Sethi N, et al. Explainable AI for oncology diagnostics: bridging trust and transparency. Frontiers in Artificial Intelligence, 2025; 8(1): 1216.
18. McGenity C, et al. Diagnostic accuracy of AI in digital pathology: a systematic metaanalysis. NPJ Digital Medicine, 2024; 7(3): 111–119.
19. Chang YW, Lee E, et al. Artificial intelligence computer-aided detection in breast cancer screening: a multicenter reader study. Nature Communications, 2025; 16(1): 1427.
20. Duke K, et al. Applications of artificial intelligence in radiation oncology: from contouring to outcomes. British Journal of Radiology AI., 2025; 6(2): e20240045.
21. Zhang J, Li F, Xu P, et al. Deep learning-driven multi-omics integration in cancer care. Briefings in Bioinformatics, 2025; 26(3): bbae033.