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Editorial

Artificial Intelligence in Cancer Management: Promise, Pragmatism, and Preparedness

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Artificial intelligence is transforming cancer detection, treatment planning, and decision support, yet its rapid adoption risks outstripping validation, ethical safeguards, and economic sustainability. Key challenges include algorithmic bias, generalizability failures, opaque liability, and high implementation costs. Responsible integration demands clinician involvement, fairness-aware development, dynamic consent, and adaptive reimbursement. AI will augment, not replace oncologists, but its success hinges on rigorous governance and patient-centered scrutiny.

Introduction

The integration of artificial intelligence (AI) into oncology is rapidly transitioning from speculative potential to clinical reality. Across the cancer care continuum, from early detection to survivorship, AI-enabled systems are beginning to influence clinical workflows, research pipelines, and health policy. However, the pace of technological progress has outstripped our capacity to rigorously assess these innovations, govern them ethically, and sustain them economically. For the oncology community, two urgent priorities now stand side by side: leveraging AI’s transformative power, and guarding against fresh sources of bias, inequity, and overdependence on opaque algorithms. In this editorial, we explore the main ways AI is reshaping cancer care from early detection and diagnosis to treatment planning, response assessment, decision support, and the accompanying ethical, regulatory, and economic considerations [1, 2].

AI in Cancer Detection and Diagnosis

Early detection is one of the most impactful levers in improving cancer outcomes. AI has shown particular promise in various aspects of early detection and diagnosis of cancer. Deep learning models applied to radiology and nuclear medicine can detect subtle, preclinical changes that often elude human perception. In breast cancer, AI-based mammography interpretation tools have demonstrated performance comparable to, and in some cases better than, that of individual radiologists in identifying early lesions [3]. Comparable advances are underway in lung nodule detection on computed tomography (CT) [4], prostate lesion characterization on magnetic resonance imaging (MRI) [5]. Radiomics combined with machine learning offers the ability to distinguish benign from malignant lesions, stratify patient risk, and predict therapeutic response. Importantly, these tools are increasingly supporting triage and workload prioritization by flagging high-risk cases for expedited review [6].

By integrating whole-slide imaging with AI-based histopathologic analysis, automated detection of mitotic figures, tumor grading, and identification of lymph node micro-metastases becomes feasible. Such approaches not only reduce inter-observer variability but also free pathologists to concentrate on diagnostically challenging areas instead of routine screening [7]. AI methods are also increasingly being applied to genomic, transcriptomic, proteomic, and methylation data for early cancer detection and minimal residual disease assessment. In liquid biopsy, machine learning models help interpret complex patterns in cell-free DNA or circulating tumor cells, potentially enabling earlier identification of disease recurrence and treatment resistance [8].

However, despite impressive performance in controlled settings, the real-world generalizability of these systems remains a concern. Factors such as dataset shifts, variations in imaging protocols, and population heterogeneity can materially affect AI accuracy. Rigorous external validation, continuous performance monitoring, and transparent reporting are therefore essential.

AI in Treatment Planning and Modalities

AI is also reshaping how we select and deliver cancer therapies, spanning surgery, radiotherapy, systemic treatments, and multimodal care. AI-driven auto-segmentation of organs at risk and target volumes can substantially reduce contouring time, potentially increasing access to high-quality radiotherapy. Optimization algorithms support personalized dose distributions that maximize tumor control while minimizing toxicity. Adaptive radiotherapy is increasingly dependent on AI for rapid image interpretation and plan adaptation. By integrating clinical data, tumor genomics, and treatment histories, machine learning models can predict responses to chemotherapy, targeted therapies, and immunotherapies. These models offer the potential to identify patients most likely to benefit from particular agents or combinations, and to spare others from ineffective or highly toxic regimens. Beyond treatment selection, AI is also being used to design and prioritize new drug candidates, optimize trial eligibility criteria, and discover novel biomarkers. AI-enhanced navigation systems and robotics may enable more precise surgical resections, improved margin assessment, and better lymph node mapping, while intraoperative decision support, such as AI-based interpretation of frozen sections or real-time fluorescence imaging could further advance oncologic surgery. Nevertheless, the clinical impact of these tools must be assessed not merely by technical accuracy, but by patient-centered outcomes: survival, quality of life, functional status, and treatment-related morbidity [2, 9].

AI-Based Clinical Decision Support Systems (CDSS) in Oncology

AI-driven CDSS are increasingly embedded into electronic health records and oncology information systems, aiming to support evidence-based decision making. By estimating individualized risks of recurrence, metastasis, treatment-related toxicity, and competing mortality, predictive models can help inform decisions around adjuvant therapy, how intensively to surveil, and when to integrate palliative care. In practice, AI can help clinicians keep pace with complex, ever-changing guidelines, offering patient-specific suggestions on regimen selection, dosing adjustments, and supportive care. For busy oncology clinics, these tools may reduce oversights and mistakes, helping to deliver more consistent, high-quality care. By analyzing patient-reported outcomes, wearable sensor data, and telemedicine interactions, AI can detect early signs of clinical deterioration, treatment toxicity, or psychosocial distress. The timely interventions enabled by such systems may, in turn, reduce emergency visits, hospitalizations, and treatment interruptions. Nevertheless, these decision support tools should be viewed as augmentative, not substitutive. The clinician’s role, contextualizing algorithmic output in light of comorbidities, patient preferences, social determinants, and individual values, remains indispensable [10, 11].

Ethical Considerations

The ethical landscape of AI in oncology is complex and evolving. Several key issues demand systematic attention. Data governance, privacy, and consent are some of the main subjects in this regard. Because the large-scale datasets that fuel AI development frequently include sensitive genomic and longitudinal care information, robust de-identification, secure storage, and responsible data sharing are essential. Dynamic consent models, which give patients ongoing control over the use of their data, may offer a better fit with the ethical commitments to autonomy and transparency. When AI models are trained on non-representative datasets, they risk embedding and potentially amplifying existing disparities. The underrepresentation of certain ethnic groups, socioeconomic strata, or rare cancer subtypes can lead to systematically worse performance for those populations. Addressing this requires fairness-aware model development, stratified reporting of performance metrics, and targeted efforts to enrich data diversity, without which we risk worsening inequities in cancer outcomes. Furthermore, determining responsibility when AI-assisted decisions result in harm remains an unresolved challenge. Clear frameworks are needed to define the roles and responsibilities of developers, institutions, regulators, and clinicians. Ultimately, AI tools should be positioned as decision-support systems, with clinicians retaining both authority and accountability. At the same time, legal and regulatory structures must reflect the shared nature of risk [12, 13].

Economic Impact: Eficiency, Cost, and Value

Rather than relying on simplistic stories of cost savings, a true understanding of AI’s economic impact in cancer care must rest on a more nuanced appraisal of value. By taking over repetitive tasks like triaging images, contouring, documenting, and scheduling, AI can help streamline daily workflows. That, in turn, may ease clinician burnout and create more room for complex decisions and meaningful patient conversations. In settings where specialists are in doubt, AI could also help fill some of the gaps, making timely diagnosis and treatment more accessible. Some AI tools may reduce unnecessary imaging, biopsies, or hospitalizations by improving risk stratification and enabling earlier detection of complications. Yet the development, validation, integration, and maintenance of AI systems come with substantial upfront and recurring costs. Robust health economic evaluations, accounting for infrastructure, training, licensing, and downstream effects are therefore essential to determine true cost-effectiveness [14].

Payers and regulators must adapt to recognize and appropriately reimburse AI-enabled services. Misaligned incentives, for example, rewarding volume of procedures rather than outcomes could either hinder the adoption of beneficial AI tools or encourage overuse of low-value technologies [15].

Charting a Responsible Path Forward

To fully realize AI’s potential in cancer management, the oncology community must adopt a strategic, multidisciplinary, and patient centered approach.

• Clinicians need to be actively involved in designing, validating, and implementing AI tools, ensuring they address real clinical needs and fit smoothly into everyday workflows.

• Data scientists and engineers should prioritize robust methodology, fairness, and transparency over chasing benchmark driven performance alone.

• Health systems and policymakers must create regulatory and reimbursement frameworks that encourage innovation while safeguarding patient welfare and equity.

• Patients and advocacy groups ought to be engaged as partners in conversations about data use, consent, and the acceptable trade offs between innovation and risk.

AI will not replace oncologists. Rather, oncologists who learn to leverage AI effectively may deliver more precise, efficient, and compassionate care than those who do not. But uncritical adoption carries genuine risks. Our responsibility is to maintain a posture of informed enthusiasm, embracing AI’s opportunities while subjecting every tool to rigorous scientific, ethical, and economic scrutiny.

The future of AI in cancer management will be shaped less by the speed of technological progress than by the quality of our collective governance. If we proceed thoughtfully, AI can become a powerful ally in our enduring effort to prevent, detect, and treat cancer more effectively and equitably.

References

References

1. Wang M, Chang W, Zhang Y. Artificial Intelligence for the Diagnosis and Management of Cancers: Potentials and Challenges. *MedComm.* 2025; 6(11)DOI
2. Cheng CH, Shi S. Artificial intelligence in cancer: applications, challenges, and future perspectives. *Molecular Cancer.* 2025; 24(1)DOI
3. Caldas FAA, Caldas HC, Henrique T, Jordão PHF, Fernandes-Ferreira R, Souza DRS, Bauab SDP. Evaluating the performance of artificial intelligence and radiologists accuracy in breast cancer detection in screening mammography across breast densities. European Journal of Radiology Artificial Intelligence,. *2.* 2025;100013. DOI
4. Dominik H, Christoph M, Marco K, Sören W, Marc F, Manfred R. Simultaneous Identification and Classification of Lung Nodules in CT Images - A Hierarchical Network Approach. *Procedia Computer Science.* 2025; 270DOI
5. Alzate-Grisales JA, Mora-Rubio A, Peán-Teruel M, Beltrán AN, Torres CR, García JMO, et al. Clinically significant prostate cancer detection with deep learning in a multi-center magnetic resonance imaging study. *Sci Rep.* 2026; 16(1)DOI
6. Liu L, Xu J, Ji Y, Yan T, Pan H, Wang S, Shi Z, et al. Multimodal CT radiomics combined with machine learning algorithms to differentiate benign from malignant pulmonary nodules. *Digital Health.* 2026; 12DOI
7. Jabin A, Kirar JS, Ahmad S. AI-based methods for modelling whole-slide imaging data in cancer diagnosis and transcriptome profile prediction. *BMC Artificial Intelligence.* 2025; 1(1)DOI
8. Eskandar K. Artificial intelligence and multi-omics integration in liquid biopsy for genitourinary cancers: a systematic scoping review. *International Urology and Nephrology.* 2025. DOI
9. Bulić L, Brlek P, Hrvatin N, Brenner E, Škaro V, Projić P, et al. AI-Driven Advances in Precision Oncology: Toward Optimizing Cancer Diagnostics and Personalized Treatment. AI. *7.* 2026; 1:11. DOI
10. Elhaddad M, Hamam S. AI-Driven Clinical Decision Support Systems: An Ongoing Pursuit of Potential. *Cureus.* 2024; 16(4)DOI
11. Hrishikesh K, Pravin S. AI-driven clinical decision support systems: Revolutionizing medication selection and personalized drug therapy. *Advances in Integrative Medicine.* 2025; 12(4):100529. DOI
12. Farasati Far B. Artificial intelligence ethics in precision oncology: balancing advancements in technology with patient privacy and autonomy. *Exploration of Targeted Anti-Tumor*

Therapy. 2023; 4(4)DOI

13. Hantel A, Clancy DD, Kehl KL, Marron JM, Van Allen EM, Abel GA. A Process Framework for Ethically Deploying Artificial Intelligence in Oncology. *Journal of Clinical Oncology: Official Journal of the American Society of Clinical Oncology.* 2022; 40(34)DOI
14. Liang G, Fan W, Luo H, Zhu X. The emerging roles of artificial intelligence in cancer drug development and precision therapy. *Biomedicine & Pharmacotherapy = Biomedecine & Pharmacotherapie.* 2020; 128DOI
15. Tun HM, Rahman HA, Naing L, Malik OA. Health economics evaluation of artificial intelligence in the field of oncology: a scoping review. *Health Economics Review.* 2026; 16(1)DOI