Artificial Intelligence in Cancer Detection and Treatment

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Introduction

Oncology tools based on Artificial Intelligence (AI) often use medical images and genomic information to help identify and classify cancer. This allows clinicians to make treatment decisions based on how a patient is likely to respond (Bhinder et al., 2021; Hunter et al., 2022; Khosravi et al., 2025). Cancer continues to be a major global health problem, with close to 20 million new cases and 9.7 million deaths estimated worldwide in 2022 (Bhinder et al., 2021; Bray et al., 2024). At the same time, AI has become integrated into cancer research and clinical care, with advances in machine learning, computing power, and the large clinical datasets contributing to its development in oncology (Bhinder et al., 2021). The number of cancer cases is also expected to increase in the future, with around 35 million new cases by 2050 (Bray et al., 2024). Since treatment outcomes generally improve when cancer is detected early, oncology has become an important area where AI is being developed for diagnosis and treatment planning (Bhinder et al., 2021; Crosby et al., 2022). This article looks at how AI-based cancer detection and treatment tools work, their benefits and limitations, and how they may either minimize or contribute to mismedicine.

What They Are and How They Work

Modern oncology tools use advanced data analysis to recognize patterns in medical information related to cancer diagnosis and prognosis (Swanson et al., 2023; Wei et al., 2023). These technologies help identify the presence and type of cancer, as well as predict how the disease might progress over time (El Naqa et al., 2023; Swanson et al., 2023; Wei et al., 2023). They can also evaluate how a patient is likely to respond to specific therapies, including cancer drug treatments and immunotherapy (El Naqa et al., 2023; Niraula et al., 2023; Wei et al., 2023). By analyzing medical images, pathology slides, molecular profiles, and clinical records, they learn to spot important details linked to patient outcomes (Niraula et al., 2023; Swanson et al., 2023; Wei et al., 2023). As a result, they can detect tumours and estimate a patient's response to different treatments (El Naqa et al., 2023; Niraula et al., 2023; Swanson et al., 2023). This can support clinicians in making more personalized treatment decisions while improving the consistency of cancer diagnosis (Niraula et al., 2023; Swanson et al., 2023; Wei et al., 2023).

The quality of these predictions, however, depends on more than just the technology itself (El Naqa et al., 2023; Niraula et al., 2023; Wei et al., 2023). If the data used for training AI does not reflect the diverse patient population, or if the system is used in a setting different from where it was developed, its accuracy might be reduced (Niraula et al., 2023; Wei et al., 2023). This is why AI-based tools are meant to support clinical decision-making, not replace the expertise and judgment of healthcare professionals (El Naqa et al., 2023; Niraula et al., 2023).

Benefits and Clinical Relevance

One major benefit of these new cancer tools is their potential to improve early cancer recognition (Huhulea et al., 2025; Tiwari et al., 2025; Wang et al., 2026). Reviews of the field show that some systems have achieved strong performance in imaging and pathology tasks, and have reached a high level of accuracy in specific diagnostic settings (Huhulea et al., 2025; Khalighi et al., 2024; Ogut, 2025). This can help clinicians identify cancer earlier, allowing treatment to begin sooner which improves the chances of successful outcomes (Huhulea et al., 2025; Song & Liang, 2024).

These tools may also be useful where cancer care is especially complex or specialist resources are limited (Grant et al., 2026; Huhulea et al., 2025; Pallumeera et al., 2025). In places where clinicians need to combine imaging, pathology, genomics, and treatment information, these systems can help organize details and guide more individualized decisions (Hsu et al., 2025; Riaz et al., 2025; Tiwari et al., 2025). This is important because timely diagnosis and appropriate treatment planning are key parts of improving cancer outcomes (Tiwari et al., 2025; Zheng et al., 2023). When used carefully, these new tools can help doctors make better decisions and may allow them to find and treat illnesses sooner or more accurately (Grant et al., 2026; Riaz et al., 2025).

Limitations, Risks, and Mismedicine

It is important to consider the limitations of these cancer tools (Riaz et al., 2025; Wang et al., 2025). One of the most serious concerns is bias related to the data used to build them, which can limit how well they work for different groups of people (Kolla & Parikh, 2024; Tiwari et al., 2025; Wang et al., 2026). If the information used to develop these tools does not represent a wide range of patients or real clinical environments, the system may be less reliable for people who are already underserved by healthcare (Grant et al., 2026; Hunter et al., 2022; Papageorgiou et al., 2025).

Another concern is overconfidence in technology (Wang et al., 2025). If clinicians rely too heavily on a system's recommendations, an incorrect or poorly explained output may influence their decisions in a way that harms the patient (Kolla & Parikh, 2024; Wang et al., 2025). While technology can help in some situations, it can also create problems when these tools are used without strong validation or careful monitoring (Pallumeera et al., 2025; Papageorgiou et al., 2025). There are also broader concerns about the research base, since many studies remain experimental and do not yet show clear improvements in patient outcomes (Chang et al., 2025; Ogut, 2025; Zheng et al., 2023).

These concerns connect directly to the idea of mismedicine, which is when medical care does not match a patient's needs. AI-based oncology tools could help reduce mismedicine by supporting earlier detection, improving diagnostic consistency, and helping clinicians make more informed decisions (Kolla & Parikh, 2024). At the same time, they could contribute to mismedicine if biased data lead to inaccurate predictions, if systems are used in settings where they have not been properly tested, or if healthcare organizations adopt these tools before they are validated for all patient groups (Fountzilas et al., 2025; Grant et al., 2026; Kolla & Parikh, 2024).

Conclusion

AI-based cancer detection and treatment tools represent an important development in modern healthcare (Bhinder et al., 2021; Tiwari et al., 2025). They show a lot of promise in supporting earlier cancer detection, improving diagnosis and treatment planning, and strengthening clinical decision support in some settings (Tiwari et al., 2025). However, their limitations are significant, including potential bias, limited testing, lack of consideration for underserved communities, and the risk of overreliance on AI recommendations (Tiwari et al., 2025; Wang et al., 2025). These issues make cancer technology a strong example of how innovation can either reduce or contribute to mismedicine. Moving forward, healthcare systems and researchers should focus on thorough testing across all patient groups and continued clinician oversight to reduce the risk of mismedicine (Grant et al., 2026; Riaz et al., 2025; Wang et al., 2025).

Q&A

How does artificial intelligence help doctors diagnose cancer?

Artificial intelligence can analyze medical images, pathology slides, genomic information, and clinical records to recognize patterns that may indicate cancer (Chang et al., 2025; Kolla & Parikh, 2024; Riaz et al., 2025). This information helps clinicians detect cancer, predict patient outcomes, and make more informed treatment decisions (Chang et al., 2025; Huhulea et al., 2025; Kolla & Parikh, 2024; Riaz et al., 2025).

Why is AI considered a support tool instead of a replacement for doctors?

Although AI can process large amounts of medical data quickly and accurately, it cannot replace the experience and clinical judgment of healthcare professionals (Riaz et al., 2025). Doctors must still consider a patient's medical history, symptoms, test results, and personal circumstances before making a diagnosis or choosing a treatment (Riaz et al., 2025).

How can AI improve cancer care for patients?

AI has the potential to improve cancer care by detecting cancer earlier, increasing diagnostic accuracy, supporting more personalized treatment plans, and helping clinicians interpret complex medical information more efficiently (Chang et al., 2025; Huhulea et al., 2025; Riaz et al., 2025).

What factors can affect how accurate an AI system is?

The accuracy of an AI system depends on several factors, including the quality of the data used for training, whether different patient populations are represented, how well the system has been tested, and the clinical setting where it is used (Chang et al., 2025; Kolla & Parikh, 2024; Riaz et al., 2025). Even a well-designed system may produce unreliable results if these factors are not considered (Chang et al., 2025; Huhulea et al., 2025; Kolla & Parikh, 2024; Riaz et al., 2025).

Why is careful testing important before AI tools are widely used in healthcare?

Careful testing helps ensure that AI systems are safe and effective for different patient populations and healthcare settings (Chang et al., 2025; Huhulea et al., 2025; Riaz et al., 2025). Without proper validation, biased or unreliable systems could contribute to incorrect diagnoses or treatment decisions, increasing the risk of mismedicine (Chang et al., 2025; Huhulea et al., 2025; Kolla & Parikh, 2024).

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