Broadening the scope of artificial intelligence in oncology

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The Lancet Regional Health - Americas 2023;25: 100573
Published Online xxx
https://doi.org/10.1016/j.lana.2023.100573

Recent advances within the realm of artificial intelligence (AI) in oncology have focused on areas such as risk stratification and predictive diagnostics. While we acknowledge that techniques such as convolutional neural networks lend themselves to applications in radiology and screening, the integration of multi-modal data in oncology is crucial as we evaluate each patient by combining outputs from various sources including genomics, radiology, and digital pathology in order to guide treatment. We therefore write to highlight additional areas that should be urgently considered as the role of AI in medicine expands.

Analytic approaches leveraging AI can interrogate vast amounts of multidimensional information collected from multi-omics technologies, integrating imaging, clinical and treatment history, digital pathology, genomics, and sociodemographic factors.[1] Early integration of multi-omics has been promising. AI-based methods have allowed for the development of algorithms that can integrate various histopathologic data to better measure and identify tumor cell microsatellite instability, which in turn predicts response to immunotherapy in patients with gastric cancer. Deep-learning algorithms have been able to integrate data from multiple sources including blood tests, serial imaging, and baseline medical evaluations to predict immunotherapy response in patients with non-small cell lung cancer.[1] Finally, AI-derived pathology-based biomarkers have been used to anticipate and quantify the benefits of androgen deprivation therapy in localized prostate cancer, potentially sparing a large proportion of patients the added costs and toxicities of unnecessary treatment.[2] Deep-learning algorithms have an unparalleled ability to assess salient associations that may not be readily apparent otherwise, thereby empowering us to integrate the findings from multi-modal data to guide patient-tailored precision therapy.

As the use of AI to analyze large volumes of data rises, we must also consider its role in promoting cancer equity. Many AI algorithms are limited in their generalizability due to lack of diversity in their training datasets; this limitation introduces bias into the AI models.[3] Ensuring that the data we use to train models come from diverse patient cohorts will better allow us to deliver personalized care that is both equitable and less biased.[4] We must also harness the power of AI to scale up access to care for patients living in areas with limited access to healthcare providers. The development of AI models that carry out quick and accurate imaging analysis can allow for early detection of cancer. AI applications in remote patient monitoring may improve access for patients who experience geographic barriers to care. Multi-omics analyses may facilitate integration of data from more diverse and global patient cohorts.

We underscore that data that are used to train AI reflect societal biases, reflecting the social determinants of health. Patient outcomes are influenced not just by clinical factors, including the disease phenotype, but by how the patient is “perceived” by the health system. Factors such as sex and race concordance between the patient and the providers, for example, affect quality of care. Provider bias is not so easily discerned in health records.[5] The ability of machine learning to detect associations between features when structural issues that shape clinical trajectory are poorly represented in the data (and little understood by the AI developers) risks perpetuating health disparities.

If designed by a diverse team of developers, the potential scope of AI in cancer care ranges far beyond screening and early diagnosis. We call on providers to pursue efforts to understand the data better—integrating multi-omics approach as well as social determinants of health—so that we can expand the scope of powerful computational tools in oncology.

Contributors

Revathi Ravella, MD: writing–original draft. Edward Christopher Dee, MD: conceptualization, writing–review and editing. Chiara Corti, MD: writing–review and editing. Leo Anthony Celi, MD MS MPH: writing–review and editing. Puneeth Iyengar, MD PhD: conceptualization, supervision, writing–review and editing.

Declaration of interests

None to declare.

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Acknowledgements
RR, ECD, and PI are funded in part through the NIH/NCI Support Grant P30 CA008748.

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