ARTIFICIAL INTELLIGENCE & ONCOLOGY

Impact and Implications

An Ipsos Point of View

Jennifer Kennedy, Eric Blouin, Chinaza Eze, Aaron Kanarvogel, Elizabeth Machado, Sibi Raja

11/6/2023

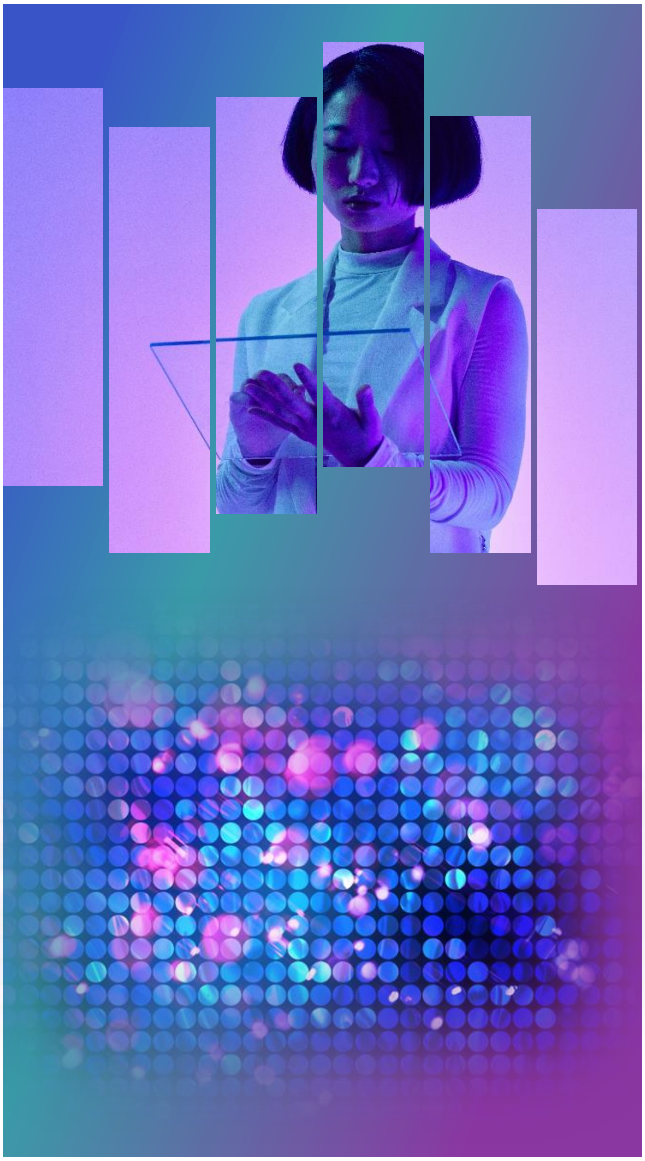
Artificial Intelligence & Cancer Care

Where are we now? Where are we headed?

Authors: Jennifer Kennedy, Eric Blouin, Chinaza Eze, Aaron Kanarvogel, Elizabeth Machado, Sibi Raja

Artificial Intelligence (AI) and Machine Learning (ML) are revolutionizing various aspects of our world, transforming the way we live, work, and interact. This rapidly advancing technology has the potential to make a significant impact across diverse industries, including healthcare. If we look specifically at the treatment of cancer, AI holds the promise to streamline workflows for clinicians (pathologists, radiologists, dermatologists, oncologists, nurses), as well as biopharmaceutical developers and manufacturers, while also improving patient care. In fact, AI is already being used alongside human medical expertise across several types of cancers to: (1) aid in early detection and diagnosis of cancer, (2) assist in treatment planning and patient care management, and (3) accelerate & optimize the therapeutics development and management lifecycle.

This paper will look at these current applications in more detail and hypothesize where the road will lead in the not-so-distant future.



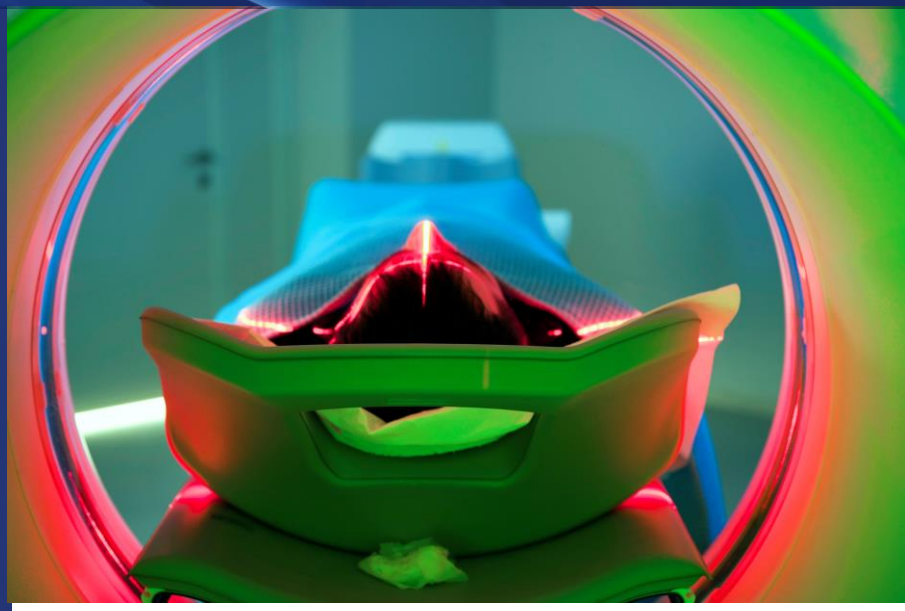
Aid in early detection and diagnosis of cancer

AI-based computer-aided detection (CADe) is currently used to review and interpret mammograms, Magnetic Resonance Imaging (MRIs), Computed Tomography (CT) scans, etc. for the early detection of cancers. It aids in distinguishing between cancerous and benign growths and can predict the aggressiveness of the detected cancer. In lung cancer, AI tools like Sybil have been used to predict an individual's future risk of lung cancer from a single scan, reducing the need for follow-up scans or biopsies among low-risk patients.[1] Convolutional neural networks are machine learning algorithms that analyze grid-like structured data and are widely used for image recognition and classification.[2] These have been utilized to predict non-small cell lung cancer (NSCLC) tumor histology from CT data, distinguishing between different histopathologic subtypes in NSCLC.[3] The early detection of melanomas and other skin cancers has also made strides.

Within cancer diagnostics, the use of AI has been shown to speed cancer detection and reduce the rate of false positives and false negatives. For example, AI has led to more efficient detection of breast cancer, with studies showing a 20% increase in detection when using AI in combination with a radiologist's evaluation, compared with mammograms evaluated by two radiologists without using AI.[4] In colorectal cancer, AI has been used in colonoscopy procedures to aid in the real-time detection of polyps, which may develop into colorectal cancer.[5] The implication of real-time detection during investigative procedures such as these could be the immediate surgical removal of the suspicious tissue rather than requiring a patient to return for a second procedure.

There is no established screening protocol for pancreatic cancer, and only one newly available screening test (the multi-cancer early detection test from Grail, which can screen for pancreatic cancer among 50 other tumor types). The application of AI for the early detection of pancreatic cancer has involved the analysis of large-scale health data to identify subtle patterns that might suggest the early stages of this often-deadly disease.[6]

Assist in treatment planning and patient care management



AI is being used to profile tumors, including aiding the analysis of a tumor's genomic profile and predicting its behavior, disease progression, survival, optimal therapy and treatment response.[7] For radiologists, this can mean a significant reduction in workload, which is particularly meaningful in regions with a shortage of radiologists. It can also help to better plan radiation therapy by predicting how the radiation dose should be distributed to kill tumor cells while sparing healthy tissues. Tools such as xCures allow advanced cancer patients and their oncologists to make informed decisions about alternative treatment options based on their individual diagnostics that would be difficult to discover through traditional means.

AI can also assist oncologists by monitoring their patients' health data and alerting them about any significant changes warranting intervention. This has been done through the Advanced Symptom Management System (ASyMS), which provides real-time 24-hour monitoring and management of chemotherapy toxicity (see figure 1 below). In a multicenter clinical trial in Europe, ASyMS demonstrated efficacy across five countries for reducing symptom burden and improving health related quality of life for patients with breast cancer, colorectal cancer, Hodgkin's disease, or non-Hodgkin's lymphoma during the course of their chemotherapy.[8]

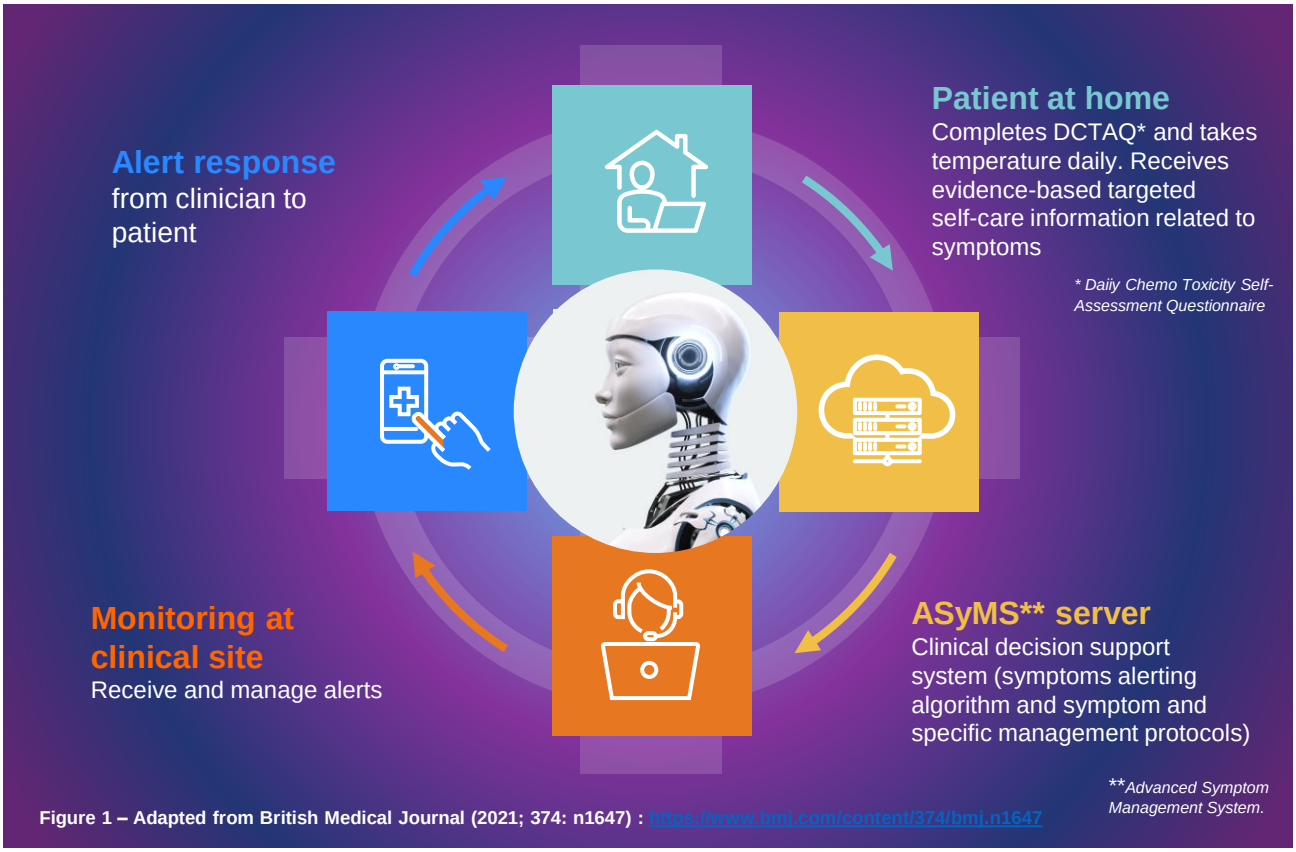


Figure 1 – Adapted from British Medical Journal (2021; 374: n1647) : https://www.bmj.com/content/374/bmj.n1647

Other applications for AI in healthcare more broadly will also affect the world of oncology through improving quality of care and efficiency in treatment workflows, as well as streamlining operational processes. For example, tools such as OpenAI's GPT-4 and Google's Med-PaLM 2 large language models (LLM) for the medical field offer oncology clinicians benefits such as automatically generated email drafts, the identification of trends within medical records, understanding rich medical texts, and the provision of answers to complex medical questions.[10,11,] An example of how AI can streamline operational processes is Google Cloud's AI-enabled Claims Acceleration Suite.[12] This tool focuses on streamlining health insurance prior authorization and claims processes. Improving workflow efficiencies has the potential to lower costs, but of course will be dependent on the cost of the tools themselves and how frequently they're used.

ACCELERATE & OPTIMIZE THE THERAPEUTICS DEVELOPMENT AND MANAGEMENT LIFECYCLE

For biopharmaceutical developers, AI can be used to improve quality and/or streamline processes throughout the entire drug lifecycle, from drug discovery through to post-approval drug management stages. AI is accelerating and optimizing the activities involved with research and development of new therapeutics by helping to identify potential new cancer drugs and by supporting the acquisition and transformation of data. Superior product design is a particularly exciting manifestation of the use of AI in R&D. For example, through the combination of formulation discovery and generative AI, molecule properties can be predicted and optimized for prospective mRNA-based and lipid nanoparticles therapeutics. It also aids in the design of pre-clinical and clinical trials. For example, AI is used to reduce and refine the use of animal models in preclinical trials and assist in patient selection in clinical trials.[14]

Not only is AI streamlining the drug research and development process for manufacturers, but it is also supporting them with the marketing-authorization and post-authorization stages.[15] For example, AI applications can assist with the recording and analysis of data that must be submitted to regulatory authorities for marketing authorization, such as the data to be included in the product information document. Once marketing authorization is obtained, AI tools can be used to aid adverse event report management and signal detection.

What's next?

With new technologies come regulatory challenges. The challenges posed by AI include matters such as a general lack of understanding AI/ML algorithms, their design and potential biases, the risk of technical failures, and broader implications of AI in medicine development and health. However, the benefits that AI has to offer in oncology, alongside compelling data demonstrating these, are likely to result in more and more FDA / EMA approved products. In turn, these formal approvals will drive utilization of these revolutionary software solutions and much needed revenue for the organizations that have developed and own them.

AI should be viewed as a new tool that will accelerate the diagnosis cycles

The FDA has already approved the first AI diagnostic system that provides a screening decision, for diabetic retinopathy, without the need for a clinician to also interpret the image or result.16 It does not therefore seem like a far cry that this may also occur for AI solutions within oncology. This may be interpreted by healthcare professionals as a threat to their livelihoods, or alternatively as a much-needed helping hand in the current context of an ageing population with increasing cancer prevalence, coupled with increasing provider burnout and a diminishing workforce. In our opinion, AI should be viewed as a new tool that will accelerate the diagnosis cycles while bridging the gap (through automation) to an increasingly overloaded community of experienced professionals.

[1] ASCO Reading Room | Does AI Know and See All in Lung Cancer? | MedPage Today

[2] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10252190/

[3] Deep learning classification of lung cancer histology using CT images | Scientific Reports (nature.com)

[4] AI-supported mammogram screening increases breast cancer detection by 20%, study finds | CNN

[5] AI Tool Predicts Colon Cancer Survival, Treatment Response | Harvard Medical School

[6] https://hms.harvard.edu/news/ai-predicts-future-pancreatic-cancer

[7] AI Tool Predicts Colon Cancer Survival, Treatment Response | Harvard Medical School

[8] https://xcures.com/

[9] https://www.bmj.com/content/374/bmj.n1647

[10] https://arstechnica.com/information-technology/2023/04/gpt-4-will-hunt-for-trends-in-medical-records-thanks-to-microsoft-and-epic/

[11] https://www.firstwordhealthtech.com/story/5727506

[12] Google Cloud Unveils New AI-enabled Claims Acceleration Suite to Streamline Health Insurance Prior Authorization and Claims Processing, Helping Experts Make Faster, More Informed Decisions - Apr 13, 2023 (googlecloudpresscorner.com)

[13] Moderna links up with IBM to bring AI, quantum computing to mRNA medicines | FirstWord Pharma +

[14] Reflection paper on the use of artificial intelligence in the lifecycle of medicines | FirstWord Pharma +

[15] Reflection paper on the use of artificial intelligence in the lifecycle of medicines | FirstWord Pharma +

[16] https://www.fda.gov/news-events/press-announcements/fda-permits-marketing-artificial-intelligence-based-device-detect-certain-diabetes-related-eye