AI and Cancer Care

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AI WAS a highlight of the 2025 European Society for Medical Oncology (ESMO) Congress, held in Berlin, Germany, with sessions focused on how it works and its potential impact on clinical oncology. One such session, entitled 'ChatGPT and Cancer Care' provided a timely exploration of AI's capabilities in cancer care, as well as the practical and ethical considerations that come with integrating these tools into clinical practice.

LARGE LANGUAGE MODELS AND AI AGENTS IN ONCOLOGY

Jakob Kather, TU Dresden, University of Heidelberg, Germany, opened the session by exploring the world of large language models (LLM) and AI agents in oncology. Stating that AI is already an active part of clinical practice, Kather noted that several AI-driven medical devices have received regulatory approval and are now certified for patient use. Most of these applications focus on image analysis and interpreting X-rays, pathology slides, or endoscopy videos. However, Kather emphasised that each of these systems is built to perform a single, highly specific task on a single data type. This task-specific design limits scalability in clinical settings, where hundreds of different analytic processes occur routinely, each potentially requiring its own dedicated AI system.

First launched in 2022, ChatGPT (OpenAI, San Francisco, California, USA) is now a household application, and has transformed the way we receive and consume information. Kather noted the improvements seen in speed, accuracy, and utility of these LLMs over time as they have gathered more information. In terms of use, there are typically three types of interaction with LLMs. The first, and most basic interaction, is called 'zero-shot', which comprises a simple question and response, and uses the embedded knowledge the model was trained on. The second approach, which is more common with recent models, is where LLMs scan the internet for relevant sources to incorporate into the answer. Issues with this, as flagged by Kather, are that it can often pull out-of-date or unrelated information. This can negatively influence the output. Finally, the interaction recommended for enhanced accuracy involves the user asking a direct question with an attached file for the LLM to draw additional information from in its answer.

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In closing, Kather emphasised that the medical oncology community must approach emerging technologies with optimism, while upholding the principles of evidence-based medicine. He stated that, whenever claims are made about a new technology enhancing our understanding of cancer or improving patient empowerment, it is essential that rigorous clinical trials are conducted to thoroughly test and validate those claims.

LARGE LANGUAGE MODELS FOR DRUG DEVELOPMENT AND CANCER THERAPY

Opening his talk, Loic Verlingue, Centre Léon Bérard, Centre de Recherche en Cancérologie de Lyon, France, shared the benefits that clinical trials offer, namely increasing access to innovative treatments for patients, providing physicians with expertise on new treatments, and improving the economic benefit for societies.

According to Verlingue, there are approximately 9,000 FDA-approved small molecule drugs, but there are thought to be 1,062 potential pharmaceutical compounds. There are also believed to be 20,244 human proteins, but the 3D structure is only known for approximately 6,200 of them, and there are only approximately 2,700 that could act as potential drug targets. As stressed by Verlingue, the use of AI is therefore imperative to predict the structure of proteins and also screen for novel pharmaceuticals.[1]

As an initial example, Verlingue discussed Cell2Sentence (C2S; Google, Mountain View, California, USA; Yale University, New Haven, Connecticut, USA), a novel computational method that converts single-cell gene expression data into textual representations known as 'cell sentences'. Using this framework, researchers trained a family of LLMs, named C2S-Scale, on approximately 50 million single-cell profiles and their associated texts.[2]

To evaluate the platform's ability to support novel biological discovery, the authors conducted a virtual drug screen using C2S-Scale. They simulated the effects of roughly 4,000 drug candidates on single-cell data under a specific condition: identifying a drug that could enhance immune signalling in cancer cells that exhibit low interferon levels, which are insufficient on their own to induce antigen presentation. The model identified silmitasertib, a casein kinase 2 inhibitor, predicting that it would enhance major histocompatibility complex Class I-mediated antigen presentation (HLA-A, HLA-B, HLA-C), but only in the context of an already activated immune response. This distinction is important, as it indicates that silmitasertib does not initiate immune activation itself, but rather amplifies it once interferon has already triggered the response.[2]

Verlingue then raised an important question: while these AI models may be effective at generating new therapeutic drugs, how well do these approaches translate in the clinical setting? Citing a 2024 study,[3] and the first analysis of the clinical pipeline of AI-native biotech companies, it was reported that, in Phase 1, AI-discovered molecules had an 80–90% (21/24) success rate of drugs meeting their clinical endpoint, which is higher than the classical success

rate of 40–60%. This is a promising statistic suggesting that AI-generated drug candidates may progress through early clinical stages more efficiently and with greater precision than traditionally developed therapies.

Looking more broadly, Verlingue then discussed the global landscape for oncology clinical trials, and how LLMs can assist in their design and recruitment. Analysing data from 87,748 clinical trials conducted between 2000–2021 across high-income, upper-middle income, lower-middle income, and low-income countries, a 2024 study reported that, despite an absolute mean annual rise of 266.6 trials, there had been no new trials initiated by 2024.[4] These delays may be attributed to several factors, such as patient availability, industry funding, or clinical infrastructure. To address this challenge, he suggested that AI could assist in matching patients to potential clinical trials, helping to increase attrition rates from 8% to over 20%.

Finally, Verlingue spoke on Evo 2 (Arc Institute, Palo Alto, California, USA; Nvidia, Santa Clara, California, USA),[5] a new, large-scale, generative AI model that analyses and generates DNA, RNA, and protein sequences to predict protein function, identify pathogenic mutations, and even design new genomes. Trained on 9.3 trillion DNA base pairs from genomes spanning all domains of life, it represents one of the largest biological models ever built, assessing the functional impact of mutations, including in the non-coding regions, splice sites, and clinically relevant genes, without the need for task-specific fine-tuning.

AGENTIC AI IN ONCOLOGY

Closing this timely session, Daniel Truhn, University Hospital Aachen, Germany, summarised the strengths and limitations of AI implementation in oncology. Highlighting findings from a 2023 study on the use of AI chatbots for cancer treatment recommendations,[6] Truhn noted a staggeringly high number of inaccuracies. The study reported that 13 of 104 (12.5%)

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responses contained hallucinations, meaning recommendations that did not align with any formal clinical guidelines. Furthermore, while the chatbot provided at least one recommendation for 102 of

the 104 prompts (98%), 35 of those 102 responses (34.3%) included one or more treatments that were not concordant with clinical guidelines.[6]

Since 2023, have we seen improvements in the use of AI in clinical decision-making in oncology? In a study published this year,[7] researchers set out to evaluate an AI agent tailored to interact with and draw conclusions from multiple patient data. It was evaluated on 20 realistic multimodal patient cases and demonstrated an 87.5% accuracy, drawing clinical conclusions in 91.0% of cases and accurately citing relevant guidelines in 75.5% of the time.[7]

Speaking more broadly, Truhn commented on the tone of AI models and their increasing confidence in generated outputs. He noted that, historically, these models were designed to satisfy the user and could easily alter their responses if challenged. However, with the development of more advanced systems, there is now greater assurance and consistency in their answers.

In closing, Truhn remarked: "You now know about AI, and you have the tools available, or if you don't, you will soon. What matters is how you use these tools, that you use them responsibly, and that you help us continue to develop them."

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CONCLUSION

At a time where AI is increasingly utilised in all aspects of people's lives, this session served as a useful reference point. The presentations underscored that, while AI offers faster, more accurate insights, human oversight remains essential to ensure reliability, ethical use, and patient safety. The future of oncology will likely be shaped by a hybrid model, combining the speed and scalability of AI with the expertise and judgment of clinicians.

References

1. Rifaioglu AS et al. Recent applications of deep learning and machine intelligence on in silico drug discovery: methods, tools and databases. Brief Bioinform. 2019;20(5):1878-912.
2. Rizvi et al. Scaling large language models for next-generation single-cell analysis. bioRxiv. 2025;DOI:10.1101/2025.04.14.648850.
3. Jayatunga MK et al. How successful are AI-discovered drugs in clinical trials? A first analysis and emerging lessons. Drug Discov Today. 2024;29(6):104009.
4. Izarn F et al. Globalization of clinical trials in oncology: a worldwide quantitative analysis. ESMO Open. 2025;10(1):104086.
5. Brixi GB et al. Genome modeling and design across all domains of life with Evo 2. bioRvix. 2025;DOI:10.1101/2025.02.18.638918.
6. Chen S et al. Use of artificial intelligence chatbots for cancer treatment information. JAMA Oncol. 2023;9;(10):1459-62.
7. Ferber D et al. Development and validation of an autonomous artificial intelligence agent for clinical decision-making in oncology. Nat Cancer. 2025;6:1337-49.