

## COMMENTARY

# ChatGPT—A promising generative AI tool and its implications for cancer care

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## Plain Language Summary

- Since its launch, ChatGPT has taken the internet by storm and has the potential to be used broadly in the health care system, particularly in a setting such as medical oncology.
- ChatGPT is well suited to review and extract key content from records of patients with cancer, interpret next-generation sequencing reports, and offer a list of potential clinical trial options.

## KEYWORDS

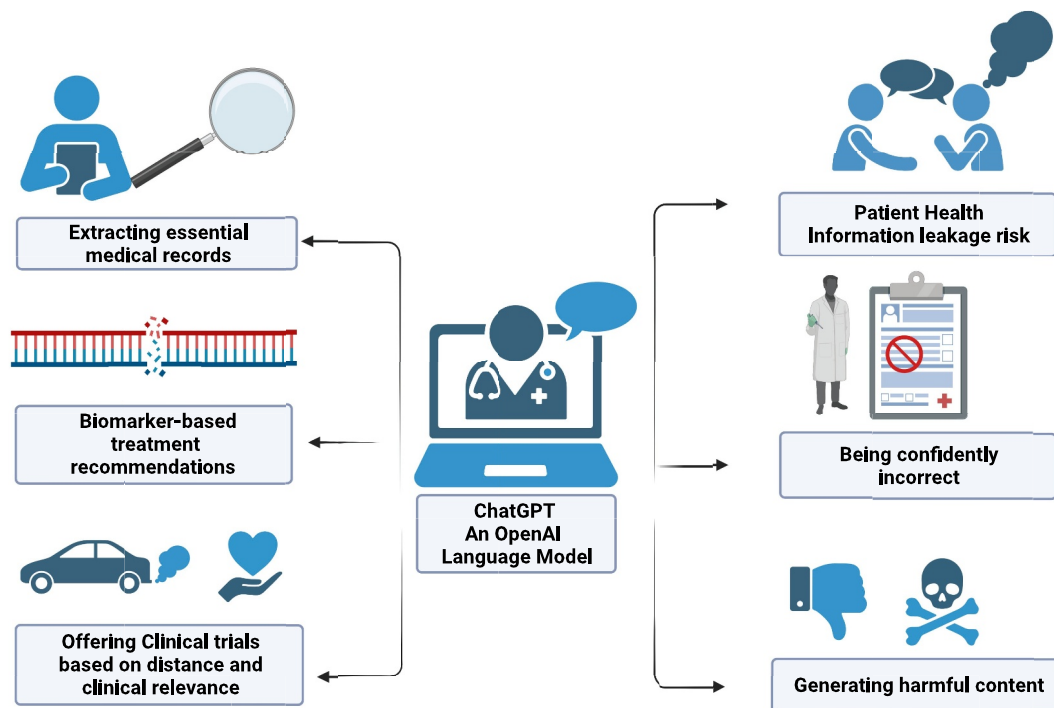
artificial intelligence (AI), cancer care, ChatGPT, oncology

## ChatGPT USHERS IN A NEW ERA

On November 30, 2022, OpenAI launched a ChatGPT (chat generative pretrained transformer), a novel natural language model able to interact with humans via a text-to-text, human-like conversational way.<sup>1</sup> ChatGPT has been trained with reinforcement learning from human feedback based on the original GPT-3.5 model trained from a large amount of text data from various sources such as common crawls, the internet, and articles. On March 13, the more powerful GPT-4 became available in the ChatGPT Plus paid subscription. Since its launch, it has become the focus of intense interest and has the potential to be used broadly in the health care system. Although it is an evolutionary landmark, it is essential to know the strengths and limitations of this artificial intelligence (AI) language model and the benefits and risks (Figure 1) it may pose to the medical community, as well as to consider some of its most appealing potential applications in health care.

## ChatGPT FOR EXTRACTION OF ESSENTIAL MEDICAL RECORDS

ChatGPT can be used to review and extract key content from the available patient records, group the data into different categories, and create a synopsis of a 1–2 paragraphs from a large collection of medical records. This will be a valuable tool for anywhere in medicine, particularly in a setting such as medical oncology, where management may extend for many years and sequential interventions. By distilling the large volume of patient-level data, ChatGPT can save a significant amount of physicians' time and increase productivity and efficacy. This service will be especially welcome for patients with a complicated cancer and other medical history who, after receiving multiple lines of treatment, then seek a second opinion from another center. ChatGPT can be used in such instances to distill a patient's current oncological diagnosis, biomarker profile, performance status, underlying comorbidities, prognostic markers, disease stage, and previous therapies.



**FIGURE 1** The pros and cons of ChatGPT.

Additionally, by extracting essential medical records, ChatGPT can also be used in natural language-generating roles with low-risk administrative tasks, such as producing letters to insurers seeking evidence-based authorization of requested therapies.

## REVIEWING A BIOMARKER PROFILE TO PRODUCE A SPECIFIC RECOMMENDATION

Oncology is developing rapidly, and it is very challenging for physicians to keep up with recent advances and approvals. Every year, hematology/oncology specialists learn about a wide range of new anticancer agents and new indications for existing drugs on the market. The practice of cancer care now increasingly entails “molecular oncology,” which has added a new dimension of escalated complexity, as directed by broad genetic testing of tumors.

Next-generation sequencing (NGS) has been widely used to identify novel and rare cancer mutations for the oncologist to make a treatment plan, but available evidence indicates that clinicians fall far short of realizing the profound potential of molecular selection,<sup>2</sup> and this is not improving significantly over time.<sup>3</sup> Although there are many barriers to optimal practice, one of the leading ones is the difficulty of busy oncologists, most not thoroughly trained in the details of genomic medicine, to identify every clinically relevant biomarker included in an NGS report that may reach 50 pages or more. Although current efforts to overcome these limitations presume to address this gap by anticipating that tens of thousands of oncologists will independently educate themselves on every clinically

relevant biomarker, this premise is untenable and consigns us to perpetual failure to capitalize on the potential benefits of broad biomarker testing.

Although it is possible to take some of this process out of the hands of oncologists by having NGS reports interpreted by molecular pathologists, molecular oncologists, and other dedicated experts running molecular tumor boards or offering commentary on NGS reports for clinical oncologists as a service, these approaches fail to scale to meet the demand of the majority of patients with a wide range of cancer types who need biomarker testing and interpretation.<sup>4</sup> Whereas we are far from having a subspecialist workforce available to provide universal support for biomarker interpretation, ChatGPT can be informed by the most expert level of interpretation and identification of clinically relevant biomarkers and then used to interpret oncology NGS reports and make appropriate recommendations. To this end, ChatGPT is expected to learn the real correlation between mutations (biomarkers) and treatment drugs, which is then validated by the human oncologist. This will help reduce the risk of overlooking essential important biomarkers and/or inappropriate treatment based on the wrong biomarker, such as recommending sotorasib for KRAS G12D or dabrafenib/trametinib for BRAF non-V600E mutation-positive solid tumors (Figure 2). Importantly, ChatGPT can be used as an inexhaustible resource of expertise that can be scaled to support an unlimited number of oncologists, essentially independent of their location. This can help address geographic disparities in access to optimal practice of molecular oncology.

UP

Can you please briefly explain how to treat early-stage breast cancer? (Answer in 3-5 sentences)



The treatment of early-stage breast cancer typically involves a combination of surgery, radiation therapy, and/or systemic therapy such as chemotherapy, hormone therapy, or targeted therapy. The specific treatment approach depends on several factors, including the stage and characteristics of the cancer, as well as the patient's overall health and preferences. Surgery is usually the first step in treatment and may involve a lumpectomy or mastectomy, followed by radiation therapy to reduce the risk of recurrence. Systemic therapy may be used before or after surgery to destroy any remaining cancer cells and reduce the risk of recurrence.



UP

How do you treat stage IV Lung cancer with sensitizing EGFR mutation? (Answer in 3-5 sentences)



The treatment of stage IV lung cancer with sensitizing EGFR mutation typically involves systemic therapy, which includes targeted therapy and/or chemotherapy. Targeted therapy with drugs like gefitinib, erlotinib, afatinib, or osimertinib is usually the first-line treatment for patients with sensitizing EGFR mutation-positive lung cancer. Chemotherapy may also be used in combination with targeted therapy or as a second-line treatment if targeted therapy is not effective. Immunotherapy and clinical trials may also be options for some patients. The choice of treatment depends on several factors, including the patient's overall health, the characteristics of the cancer, and the stage of the disease.



**FIGURE 2** Examples of screenshots from a real-time chat with ChatGPT.

## OFFERING A LIST OF POTENTIAL CLINICAL TRIAL OPTIONS ARRANGED BY DISTANCE AND CLINICAL RELEVANCE

Clinical trials are essential in advancing new treatments for cancer care. However, there are several barriers to clinical trial participation, including a lack of awareness of available clinical trials and knowledge of trial details relevant to the patient's clinical history and tumor type.<sup>5</sup> Additionally, a long distance from the cancer center may also preclude patients from participating in a clinical trial.<sup>6</sup> Travel distance not only affects clinical trial participation but can also affect cancer staging, appropriate treatment recommendation, and the

patient's quality of life.<sup>7</sup> In an ideal world, we want the best clinical trial option for our patients at the nearest cancer center. However, filtering and then prioritizing clinical trial options for a patient with cancer is a time- and labor-intensive process that requires interrogation of an extensive database.

ChatGPT can be used to interpret a detailed medical history of the patient alongside the full range of [ClinicalTrials.gov](https://ClinicalTrials.gov) content to offer a list of potential clinical trial options for which that patient is likely to be eligible. Depending on the patient's requirements and needs, the list should be arranged by distance and clinical relevance/promise. It should also screen for current recruitment status and eligibility.

UP

What are the treatment options for stage IV HER-mutant non-small cell lung cancer? (Answer in 3-5 sentences)



The treatment options for stage IV HER-mutant non-small cell lung cancer typically include systemic therapy, which may involve targeted therapy, chemotherapy, immunotherapy, or a combination of these treatments. Targeted therapy with drugs such as afatinib, neratinib, or trastuzumab deruxtecan may be used as a first-line treatment. Chemotherapy may also be used in combination with targeted therapy or as a second-line treatment if targeted therapy is not effective. Immunotherapy may be an option for some patients with advanced lung cancer. Clinical trials may also be available for patients with HER2-positive NSCLC. The choice of treatment depends on several factors, including the patient's overall health, the characteristics of the cancer, and the stage of the disease.



UP

Can I take prednisone while I am on Adagrasib? (Answer in 3-5 sentences)



The use of prednisone and adagrasib together may depend on the specific type and stage of cancer being treated, as well as other factors such as the patient's overall health and any other medications they may be taking. In some cases, the use of prednisone may be necessary to manage certain side effects of adagrasib, such as inflammation. It is important to discuss the use of prednisone or any other medication with your healthcare provider. They can provide guidance on the most appropriate treatment plan for your specific situation and monitor for any potential drug interactions or side effects.



UP

What are the drugs approved for KRAS G12C mutant lung cancer? (please answer in 3 sentences)



There are three drugs approved by the FDA for the treatment of KRAS G12C mutant non-small cell lung cancer. They are sotorasib (Lumakras), adagrasib (MRTX849), and amivantamab-vmjw (Rybrevant). These drugs are targeted therapies that inhibit the activity of the KRAS G12C protein and have been shown to be effective in treating advanced NSCLC in certain patient populations.



FIGURE 2 (Continued)

Very recently, OpenAI has implemented initial support for plugins in ChatGPT.<sup>8</sup> Plugins are tools specifically designed for end users to safely execute functionality, access up-to-date information,

and use third-party services via ChatGPT's natural language conversation-based interface. As of today, a dozen plugins have already been developed that allow users to do things such as book

travel, order from local grocery stores, make reservations, and so forth, which turns ChatGPT into a powerful virtual assistant. In particular, ChatGPT is limited to content made available online up to 2021 but with a “blind spot” of years of events since that time. With so many advances in oncology occurring every year and a need to assess molecular and clinical trial databases in real time, ChatGPT’s plugins have the ability to encode information on a longitudinal basis. As such, ChatGPT plugins hold great promise to advance cancer care.

## MAJOR CHALLENGES

Despite the clear potential of ChatGPT and similar AI generative content technologies to overcome major bottlenecks in cancer care, the current version has several critical limitations. At the present time, ChatGPT is not compliant with the Health Insurance Portability and Accountability Act (HIPAA); there is therefore a potential risk of leaking patient health information such as names, phone numbers, geolocations, and other identifying information and a breach of patient privacy if direct patient information is incorporated to generate a summary of care, evidence-based recommendations of molecularly selected therapy, or clinical trial recommendations. Additionally, no informed consent is enforced in using ChatGPT to collect and develop patient responses, which potentially violates the patient’s legal rights. ChatGPT, like other AI chatbots, is trained on massive amounts of textual information from the internet, which can be contaminated with misinformation and integrated bias against socially vulnerable groups (such as females, the elderly, and Blacks). As such, it can perpetuate these biases and sometimes provide incorrect or even harmful information to patients.<sup>1</sup> Finally, ChatGPT is vulnerable to adversaries. The 100-trillion-parameter GPT-4 is a black box pretrained natural language model (PTM) in that neither model/parameter information nor training details are hidden. Recent studies have revealed the potential risk of PTMs in giving incorrect, toxic, and/or harmful information under adversarial soft prompting (Figure 2).<sup>9</sup>

## CONCLUSIONS

ChatGPT and similar platforms offer the potential to profoundly improve several areas of health care generally and oncology specifically. Within the realm of cancer care, ChatGPT plugins are well suited to extract the key aspects of the workup and management of a patient’s cancer from a large collection of medical documentation, which efficiently facilitates a condensed, highly valuable summary from a bloated chart. It is extremely well suited to apply a complex algorithm to interpret NGS testing reports by recognizing clinically relevant biomarkers to produce a customized translation to clinical recommendations for the oncologist end user

who struggles to maintain the knowledge base required for this task, and does this across a broad geography and for a far larger patient population than can be served by the very limited number of human experts available to assist. ChatGPT could also be refined to review a patient’s clinical features and prior therapies, cross-reference these against the universe of clinical trials potentially available to that patient, and then provide a list of options prioritized by geography, trial characteristics, or other features.

Although promising, ChatGPT in its current incarnation remains hobbled by its lack of HIPAA compliance, its inherent biases generated by using the internet as its source, and vulnerability to adversarial prompting. These limitations make ChatGPT an infeasible solution at the moment to the identified use cases in clinical oncology. However, there is good reason to be hopeful that future iterations will overcome these barriers to become an invaluable tool for cancer care.

## AUTHOR CONTRIBUTIONS

**Dipesh Uprety:** Conceptualization, validation, writing—original draft, and writing—review and editing. **Dongxiao Zhu:** Conceptualization, validation, writing—original draft, and writing—review and editing. **Howard (Jack) West:** Conceptualization, validation, writing—original draft, and writing—review and editing.

## CONFLICT OF INTEREST STATEMENT

Dipesh Uprety is on the advisory boards of Daiichi Sankyo, Sanofi, AstraZeneca, and Jazz Pharmaceuticals. Howard (Jack) West has received consulting fees from AbbVie, Amgen, AstraZeneca, Boehringer Ingelheim, Daiichi Sankyo, Genentech/Roche, Merck, Mirati, Regeneron, Summit Therapeutics, and Takeda and payment or honoraria from AstraZeneca, Merck, and Mirati, and is on the Data Safety Monitoring Board for Genentech/Roche. The other author declares no conflicts of interest.

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