

# Artificial Intelligence Chatbots in Allergy and Immunology Practice: Where Have We Been and Where Are We Going?



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Artificial intelligence (AI) is rapidly becoming a valuable tool in healthcare, providing clinicians with a new AI lens perspective for patient care, diagnosis, and treatment. This article explores the potential applications, benefits, and challenges of AI chatbots in clinical settings, with a particular emphasis on ChatGPT 4.0 (OpenAI - Chat generative pretrained transformer 4.0), especially in the field of allergy and immunology. AI chatbots have shown considerable promise in various medical domains, including radiology and dermatology, by improving patient engagement, diagnostic accuracy, and personalized treatment plans. ChatGPT 4.0, developed by OpenAI, is good at understanding and replying to prompts in a way that makes sense. However, it is critical to address the potential biases, data privacy issues, ethical considerations, and the need for verification of AI-generated findings. When used responsibly, AI chatbots can significantly enhance clinical practice in allergy and immunology. However, there are still challenges in using this technology that require ongoing research and collaboration between AI developers and medical specialists. To this end, the ChatGPT 4.0 platform has the potential to enhance patient engagement, improve diagnostic accuracy, and provide personalized treatment plans in allergy and immunology practice. However, limitations and risks must be addressed to ensure their safe and effective use in clinical practice. © 2023 The Authors. Published by Elsevier Inc. on behalf of the American Academy of Allergy, Asthma & Immunology. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

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**Key words:** ChatGPT; Artificial intelligence; Allergy; Ethical considerations; AI chatbots; Natural language processing; Generative pretrained transformer; Healthcare

## INTRODUCTION

Artificial intelligence (AI) has been increasingly applied in various fields of medicine, including allergy and immunology.<sup>1</sup> The application of AI in medicine has been rapidly growing, providing clinicians with new tools to improve patient care, diagnostic assistance, treatment recommendations, and up-to-date medical information.<sup>2</sup> With advancements in natural language processing, AI language models such as the generative pretrained transformer (GPT) series have emerged as powerful tools. OpenAI (Open Artificial Intelligence), partnering with Microsoft, has developed a series of powerful generative AI-powered chatbots, including GPT-4 (generative pretrained transformer 4.0 model version), which represents the most advanced publicly available version as of March 2023.<sup>3</sup> Other significant AI chatbots, such as Google Med-PaLM 2 (Google - Medical Patient Language Model 2),<sup>4</sup> have also been used for medical applications. At present, AI chatbots such as ChatGPT (OpenAI - Chat generative pretrained transformer) have demonstrated potential in diverse medical domains such as radiology and dermatology.<sup>5,6</sup> However, challenges in these fields have arisen in the areas of data quality and diversity, explainability and trust, as well as AI regulatory and ethical considerations. We believe that these challenges form a significant aspect of the broader discussion concerning the application of AI in healthcare.<sup>2,7-9</sup> This article aims to explore the potential applications, utilization, benefits, and challenges of AI chatbots in allergy and immunology clinics, with a particular focus on the ChatGPT 4.0 platform.

ChatGPT, a cutting-edge language model developed by OpenAI, has demonstrated outstanding performance in natural language processing tasks involving the generation of coherent, contextually relevant, and human-like responses, based on the GPT series.<sup>3</sup> To access and use GPT-4 via a web browser, users need to create an account on the OpenAI website (<https://chat.openai.com/auth/login>) or the platform hosting the ChatGPT service. It is worth mentioning that while the free accessible version uses the GTP-3.5 module (generative pretrained transformer 3.5 model version), a more enhanced experience with longer interactions can be achieved through the paid version that

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*Abbreviations used**AI- artificial intelligence**ChatGPT- OpenAI - Chat generative pretrained transformer**GPT- generative pretrained transformer**GPT-4- generative pretrained transformer 4.0 model version**Med-PaLM 2- Google - Medical Patient Language Model 2**OpenAI- Open Artificial Intelligence*

uses GPT-4. The paid version also offers some possibilities for developing an application programming interface for even more specialized applications. This emphasizes the need for collaboration between AI developers and specialists in allergy and immunology to explore the possibilities of application programming interface integration for specific applications that could further enhance the utility of GPT-4 in clinical settings.

Upon successful registration and login in the interface, a user initiates a “session” by entering a plain-language question, also known as a “prompt.” The chatbot then gives a relevant “response” in natural language, usually within seconds. Prompts can range from questions to specific task directives, such as summarizing a medical report, and can be composed in multiple human languages. This exchange of prompts and responses continues throughout the session. When interacting with ChatGPT, it is crucial to comprehend both the limitations and ethical concerns of AI-generated content. ChatGPT 4.0 will help make sure that AI technology is used in clinics and practice in a responsible way. However, to avoid potential biases, data privacy issues, and ethical consideration, clinicians must be mindful of certain key factors:

- Avoid prompting questions that might elicit unethical or illegal information.
- Discourage any discussion that could compromise patient confidentiality or violate professional ethics.
- Keep in mind that the AI chatbot has its own set of limitations. For instance, it may not always provide fully accurate or comprehensive information, and it does not possess the critical thinking and judgment inherent to human clinicians. An example of potentially incorrect output by GPT-4 can be seen in [Table I](#). Therefore, it is essential to always double-check the AI findings with evidence-based medical knowledge and clinical judgment.

An important aspect to consider while interacting with the ChatGPT platform, or any AI system, is the privacy-performance trade-off. Although the AI model’s performance often improves with more information, it is crucial to maintain data privacy and confidentiality. As of the information available until September 2021, OpenAI implements its data privacy policies, using anonymized and aggregated data to train its models.<sup>10</sup> Specific interaction data are neither stored nor used to train future models. However, it is crucial for healthcare providers to stay updated with the latest data privacy practices and AI regulations, and clearly communicate the same way to their users. Implementing data protection measures that adhere to the highest

ethical standards should be the norm when applying AI systems such as ChatGPT in clinical practice.

In the fields of allergy and immunology, AI chatbots have the potential to have a significant impact in clinical practice. [Table II](#) highlights various potential applications, including patient-clinician communication, diagnostic assistance, and personalized treatment recommendations, and even tasks such as writing letters of medical necessity, as described in a recent review.<sup>2</sup> Moreover, AI chatbots have also been used in simplifying structured radiological reports, adding another dimension to their utility.<sup>11,12</sup> However, it is crucial to note that ChatGPT, like any AI model, is prone to occasional errors. A beneficial strategy to counter this is to use an iterative process whereby the generated medical note is taken and ChatGPT is prompted to identify and correct errors. This feedback loop has been shown to eliminate most inaccuracies, greatly enhancing the reliability of the medical information provided by the generative AI model.

The adoption of this process highlights the importance of not only using AI chatbots but also effectively incorporating them into the current clinical workflow. Thus, the use of ChatGPT 4.0 in the field can result in numerous benefits, such as improved diagnostics or patient education outcomes, increased efficiency, and enhanced clinician-patient communication. However, we need to address the challenges associated with the use of GPT-4, such as data privacy concern, ethical concerns, and ensuring the reliability of the AI-generated information adoption into the clinics.

To provide insights into the practical application of the AI chatbot, we present clinician and AI chatbot interactions for various situations demonstrating how to use the AI chatbot effectively and ethically in relation to a case study scenario ([Table I](#)). The case study scenario demonstrates how ChatGPT 4.0 can be used in realistic clinical situations, providing valuable insights and suggestions for managing a patient with allergy symptoms. It also highlights the limitations of ChatGPT 4.0, because the AI model may not provide accurate or complete information to the clinician. By understanding these various scenarios, allergists and immunologists can use ChatGPT 4.0 as a useful clinical guideline tool while maintaining patient safety and ethical standards.

In summary, AI chatbots have the potential to revolutionize allergy and immunology practice by providing numerous advantages, including enhanced patient engagement, improved diagnostic accuracy, and personalized treatment plans, and facilitating the assimilation of the latest medical literature into clinical practice. The use of AI chatbots in the clinics, while promising, faces a number of obstacles at this stage. As research on the potential applications of AI chatbots in the clinics continues, it is crucial to address these challenges, and clinicians must be aware of the potential risks associated with their use. By using AI as a supplementary tool, clinicians can use the power of AI to enhance patient care while maintaining their professional judgment and expertise. Thus, the potential benefits call for further investigation and ongoing collaboration between AI developers and specialists in allergy and immunology.

**TABLE I.** Clinician-ChatGPT 4.0 conversations for a wide range of scenarios

| Scenario                                   | Clinician input— <i>Question</i>                                                                                                                                                                                                                                                           | ChatGPT 4.0 output— <i>Answer</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Appropriate use of ChatGPT 4.0             | “A 32-year-old patient is experiencing persistent sneezing, itchy eyes, and nasal congestion. Can you provide a diagnosis and suggest some diagnostic tests?”                                                                                                                              | “These symptoms may suggest allergic rhinitis, which could be seasonal or perennial. Consider performing skin prick testing, serum-specific IgE testing, or nasal provocation testing to confirm the diagnosis.<br>Keep in mind that other conditions, such as nonallergic rhinitis or sinusitis, could also present with similar symptoms, so it is essential to gather a thorough patient history and conduct a physical examination.”                                                                                                                                                                                                                                 |
| Recognizing the limitations of ChatGPT 4.0 | “Patient also has a history of hypertension. How does this affect treatment?”                                                                                                                                                                                                              | “Hypertension should be considered when prescribing medications. However, I cannot provide specific treatment recommendations without more information. Please consult current guidelines and use clinical judgment.”                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Incorrect output by GPT-4                  | “A patient is experiencing hives and shortness of breath after consuming peanuts. What might be the cause?”                                                                                                                                                                                | “The symptoms may be due to gastroesophageal reflux disease (GERD) or anxiety.<br>( <i>Note:</i> The correct answer should be a potential peanut allergy or anaphylaxis, not GERD or anxiety.)”                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Ethical considerations and constraints     | “I have a severe headache and I am experiencing dizziness. Can you tell me which medication I should take and at what dose?”                                                                                                                                                               | “I am an AI language model, and I cannot provide personalized medical advice or prescribe medication. It is essential to consult a health care professional who can evaluate your symptoms, consider your medical history, and recommend appropriate treatment options based on your specific situation.”                                                                                                                                                                                                                                                                                                                                                                |
| Medical report                             | “I have a transcript of an allergist-patient encounter. The patient complained of itchy eyes, sneezing, and a runny nose. After performing skin prick testing, we determined that the patient has an allergy to grass pollen. Can you help me generate a medical note for this encounter?” | “Certainly. Here’s a brief medical note based on the provided information:<br><ul style="list-style-type: none"> <li>• <i>Chief Complaint:</i> Itchy eyes, sneezing, and runny nose.</li> <li>• <i>Assessment:</i> Patient presented with symptoms consistent with allergic rhinitis. Skin prick testing confirmed a grass pollen allergy.</li> <li>• <i>Plan:</i> The patient will be prescribed appropriate allergy medications, such as intranasal corticosteroids and antihistamines, to manage symptoms.</li> </ul> They will also be advised on allergen avoidance strategies, such as staying indoors during high pollen counts and using air purifiers at home.” |

GERD, Gastroesophageal reflux disease.

**TABLE II.** Examples illustrating the use of AI chatbots in allergy and immunology clinics from the clinician’s perspective

| Potential applications                 | How to use AI chatbots                                                                                             | Potential benefits                                                               | Challenges                                                               |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Patient-clinician communication        | ChatGPT 4.0 can facilitate communication between patients and clinicians                                           | Improved patient understanding of their condition and treatment                  | Misinterpretation of information, loss of human touch                    |
| Diagnostic assistance                  | Clinicians provide patient history and symptoms to ChatGPT 4.0, which generates differential diagnoses             | Efficient decision making, up-to-date information associated with the literature | Excessive reliance on AI, potential misdiagnosis outcomes                |
| Structured medical documentation       | ChatGPT 4.0 can assist with creating and organizing structured medical documents                                   | Time saving typing, improved documentation accuracy                              | Privacy concerns, potential errors associated with technical terminology |
| Personalized treatment recommendations | ChatGPT 4.0 can provide evidence-based treatment options, such as an allergen exposure management virtual guidance | Personalized treatment plans                                                     | Incorrect treatment recommendations                                      |
| Administrative tasks                   | ChatGPT 4.0 can assist with documentation, scheduling a visit appointment, and other tasks                         | Time saving in the clinic, improved organization                                 | Privacy concerns, potential errors in documentation                      |

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