

LETTER TO THE EDITOR

A large language model artificial intelligence for patient queries in atopic dermatitis

Dear Editor,

Atopic dermatitis (AD) is the most common chronic inflammatory skin condition with a staggering global burden of disease. Despite advances in treatment, patients with AD suffer from lower quality of life and poor treatment satisfaction, with over half of self-identified moderate-to-severe AD patients reporting inadequate disease control.¹ Management of AD requires participation by the patient and physician and is increasingly complex and multifaceted.

Quality therapeutic patient education, regardless of its source, can improve treatment adherence and patient quality of life.² Patients rely on physicians for guidance and often utilize electronic communications for answers to medical questions. Though convenient, the number of messages physicians receive continues to rise towards unsustainable levels.³ Large language models like Chat-Generative Pre-Trained Transformer (ChatGPT) have become a novel resource for patients and caregivers. As a form of artificial intelligence (AI), ChatGPT serves as a conversational chatbot trained in a broad range of internet sources, with the ability to use reinforcement learning from human user feedback.⁴ A recent study evaluated the ability of ChatGPT to provide quality and empathetic responses to patient questions posted to a social media forum as compared to physician responses.⁵ It found that the ChatGPT responses were rated significantly higher in both quality and empathy compared to physician responses.⁵ These findings suggest there may be utility for AI in drafting electronic communications to patients, and perhaps more importantly, some reassurance about what to expect when patients inevitably ask their questions directly to such AI. In an open study evaluating the reliability of ChatGPT responses, we submitted 99 common questions from AD patients to the most currently available model, ChatGPT-4. The questions were

supplied by an international group of 11 dermatologists in which each dermatologist contributed up to 10 questions that their patients commonly asked. The questions included inquiries regarding the aetiology, management and consequences of AD. The ChatGPT responses were independently evaluated by a group of international dermatologists experts in therapeutic patient education.² The questions were input into ChatGPT-4 in English and the responses were also evaluated in English. The overall quality and reliability of ChatGPT's responses were assessed using the Likert scale from 1 to 10, 10 being best, and were flagged for harmful information. The graded responses were averaged and ranged from 8.18 to 10, indicating high levels of evaluator satisfaction. Standard deviations ranged from 0 to 1.76. See [Table 1](#) for a list of representative questions and responses generated by ChatGPT-4. [Figure 1](#) demonstrates the graded responses per dermatologist. There was overwhelming reliability of the responses provided by ChatGPT to the wide-ranging questions frequently asked by patients. Importantly, most responses acknowledged that it was not a physician and directed users to a healthcare provider. Though no responses were flagged for dangerous information, lower scores were reported for incomplete answers or where advice deviated from evidence-based medicine. In this paper, we make an initial measurement of the quality and reliability of the answers generated by AI to some frequently asked patient questions. ChatGPT-4 provided thorough, high-quality responses without any special priming or additional information. Given the increasing demands on physicians, AI is poised to become a valuable resource. Patients are likely already utilizing AI for medical information—or soon will be—and knowledge about the quality of responses from different Large Language Models may help inform clinicians and patients alike.

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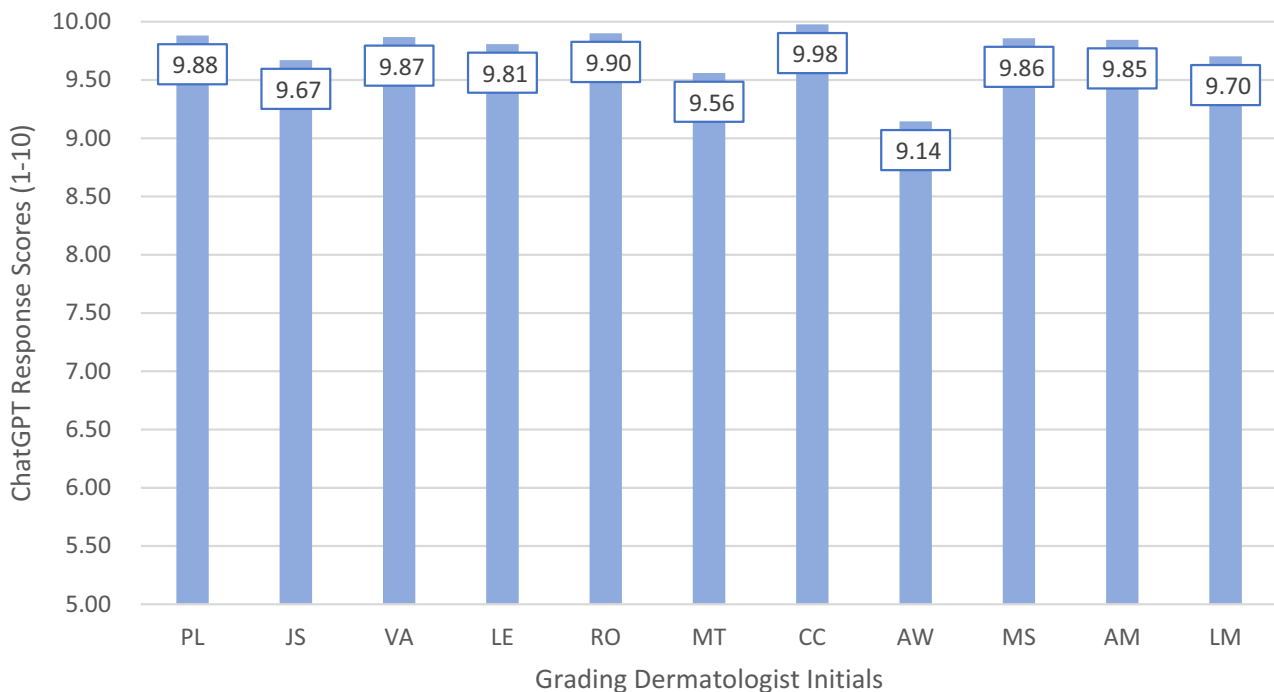
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TABLE 1 Five questions about atopic dermatitis posed to ChatGPT-4.

| Question | ChatGPT response (verbatim) | Mean score | Standard deviation |
|---|---|------------|--------------------|
| What causes eczema? I would like to know more about eczema? | Eczema, also known as atopic dermatitis, is a chronic skin condition characterized by red, itchy and inflamed skin. The exact cause of eczema is not completely understood, but it is believed to result from a combination of genetic, environmental and immunological factors. Genetic factors: People with a family history of eczema, asthma or hay fever (atopic diseases) are more likely to develop eczema. Certain gene mutations, such as those affecting the filaggrin protein, have been associated with an increased risk of developing the condition. Filaggrin plays a critical role in maintaining the skin's protective barrier. Environmental factors: Exposure to irritants (e.g. soaps, detergents, perfumes) or allergens (e.g. pollen, pet dander, certain foods) can trigger or worsen eczema symptoms. Additionally, weather conditions like extreme temperatures or low humidity can cause skin dryness, further aggravating the condition. Immune system dysfunction: an overactive immune system response is believed to play a role in eczema development. This overreaction can lead to inflammation and damage to the skin barrier, resulting in the characteristic symptoms of eczema. Skin barrier dysfunction: eczema-prone skin is often more susceptible to dryness and irritation, as it tends to have a weaker barrier function. This allows allergens and irritants to penetrate the skin more easily, triggering inflammation and itchiness. Eczema can vary in severity and may present differently from person to person. Common symptoms include dry, itchy and red skin, along with recurring rashes. Eczema often appears in infancy or early childhood, although it can develop at any age. Treatment typically involves managing symptoms with emollients, topical corticosteroids and other medications as well as avoiding triggers and maintaining a healthy skincare routine | 10 | 0 |
| How to treat eczema flare-ups, can they be prevented? | Treating eczema flare-ups involves addressing the immediate symptoms and taking steps to reduce the frequency and severity of future flare-ups. While it may not be possible to completely prevent eczema flare-ups, you can reduce their occurrence and severity by managing your condition effectively. To treat eczema flare-ups: use topical medications: apply topical corticosteroids, calcineurin inhibitors or PDE4 inhibitors as prescribed by your healthcare professional to help reduce inflammation, redness and itching. Keep your skin moisturized: regularly apply a fragrance-free, hypoallergenic moisturizer designed for sensitive skin to maintain the skin barrier and prevent dryness. Manage itching: use over-the-counter anti-itch creams or oral antihistamines to help alleviate itching and reduce the urge to scratch, which can worsen your flare-up. Apply cool compresses: place a cool, damp cloth over the affected area for 15–20 min to help soothe itching and reduce inflammation. Follow your healthcare professional's advice: if you are prescribed any medications or treatments for eczema, follow the instructions provided by your healthcare professional. To prevent eczema flare-ups: maintain a consistent skincare routine: use gentle, fragrance-free cleansers and moisturizers designed for sensitive skin to keep your skin healthy and hydrated. Avoid triggers: Identify and avoid irritants and allergens that may exacerbate your eczema, such as harsh soaps, fragrances, certain fabrics and allergenic substances. Manage stress: Stress can worsen eczema symptoms and trigger flare-ups. Incorporate stress management techniques, such as deep breathing, meditation or yoga, into your daily routine. Maintain a healthy lifestyle: eating a balanced diet, exercising regularly and getting enough sleep can help support your overall health and immune system, which may contribute to better eczema management. Monitor your skin: keep an eye on your skin and note any changes or worsening symptoms. Consult your healthcare professional if you have concerns or if your condition does not improve with self-care measures. By consistently following these strategies and working closely with your healthcare professional, you can help minimize the frequency and severity of eczema flare-ups | 10 | 0 |
| How to overcome the isolation I am in because of my eczema? | Living with eczema can sometimes lead to feelings of isolation, self-consciousness or embarrassment, but there are ways to cope with these challenges and improve your quality of life: Connect with others: seek out support groups or online communities where people share their experiences with eczema. Connecting with others who understand your situation can help you feel less alone and provide valuable insights into managing the condition. Educate yourself and others: learn as much as you can about eczema and share your knowledge with friends and family. This can help them understand your situation better and reduce any misconceptions or stigmas associated with the condition. Maintain open communication: Talk openly with your loved ones about your feelings and experiences. Let them know how they can support you and what you need from them. Focus on self-care: Take care of your mental and emotional well-being by engaging in activities that bring you joy and relaxation. This could include hobbies, exercise or spending time with loved ones. Seek professional help: If your feelings of isolation or other emotional challenges become overwhelming, consider talking to a mental health professional, such as a therapist or counsellor, who can help you develop coping strategies and build resilience. Set realistic expectations: Understand that managing eczema is an ongoing process, and there may be ups and downs along the way. Accepting this reality can help you maintain a balanced perspective and reduce feelings of isolation. Focus on your strengths and accomplishments: Acknowledge your achievements and positive qualities and remind yourself that you are more than your eczema. Build a support network: surround yourself with supportive and understanding people, including friends, family and healthcare professionals, who can provide encouragement and assistance. Advocate for yourself: do not be afraid to speak up about your needs and ask for accommodations when necessary, whether it is at work, school or in social settings | 10 | 0 |

TABLE 1 (Continued)

| Question | ChatGPT response (verbatim) | Mean score | Standard deviation |
|--|--|------------|--------------------|
| How long should I treat my AD? | Atopic dermatitis (AD) is a chronic condition, and the duration of treatment depends on various factors, including the severity of your symptoms, your response to treatment and the frequency of flare-ups. Since there is no definitive cure for AD, the primary goal of treatment is to manage symptoms, prevent flare-ups, and maintain the skin's barrier function. The duration of treatment for AD may vary from person to person. Some individuals may experience periods of remission, during which their symptoms are absent or significantly reduced, while others may have persistent symptoms that require ongoing management. In general, treatment for AD should continue as long as it effectively manages your symptoms and improves your quality of life. Your healthcare provider will regularly evaluate your treatment plan and make adjustments as needed to ensure that you are receiving the most appropriate care for your condition. It is essential to work closely with your healthcare provider to monitor your AD and discuss any concerns or questions you may have about your treatment plan. They will help you determine the best course of action for managing your AD and provide guidance on how to adjust your treatment plan over time as your needs and circumstances change | 9.91 | 0.30 |
| What are the most effective moisturizers for AD? | When choosing a moisturizer for atopic dermatitis (AD), it is essential to look for products that are gentle, fragrance-free, hypoallergenic and specifically formulated for sensitive or eczema-prone skin. Creams and ointments are generally more effective at providing and retaining moisture compared to lotions. Here are some key features to look for when selecting a moisturizer for AD: fragrance-free: fragrances can be irritating to sensitive skin and may worsen AD symptoms. Look for moisturizers labelled as 'fragrance-free' or 'unscented'. Hypoallergenic: hypoallergenic moisturizers are formulated to minimize the risk of causing allergic reactions, making them suitable for sensitive skin. Non-comedogenic: non-comedogenic moisturizers are less likely to clog pores, which can be important if you have acne-prone skin in addition to AD. High lipid content: moisturizers with a high lipid content, such as ointments and creams, are more effective at providing and retaining moisture. They can help repair the skin's barrier function and lock in hydration. Ingredients with skin barrier repair properties: look for moisturizers containing ingredients such as ceramides, glycerin and hyaluronic acid, which help repair and maintain the skin's barrier function. Some well-known brands and products often recommended for people with AD include CeraVe Moisturizing Cream, Vanicream Moisturizing Cream, Eucerin Eczema Relief Cream, Aveeno Eczema Therapy Daily Moisturizing Cream, La Roche-Posay Lipikar Balm AP+ Intense Repair Moisturizing Cream. Remember that individual preferences and skin reactions can vary, so it may take some trial and error to find the most effective moisturizer for your specific needs. Consult your healthcare provider for personalized recommendations and guidance on developing a skincare routine tailored to manage your AD effectively | 9.18 | 1.08 |

**FIGURE 1** ChatGPT-graded responses per expert dermatologist.

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CONFLICT OF INTEREST STATEMENT

VA has been an investigator and/or consultant to Abbvie, Eli Lilly and Pfizer. LE has served as a scientific adviser, consultant and/or clinical study investigator for AbbVie, Amgen, Aslan, Arcutis, Dermavant, Eli Lilly, Forté, Galderma, Ichnos, Incyte, LEO Pharma, Novartis, Ortho Dermatologics, Pfizer, Regeneron and Sanofi Genzyme. LM Pfizer, Novartis, Sanofi, Abbvie, Lilly, Galderma, Amgen, Incyte, Leo Pharma, Dermira and AstraZeneca. RLO has been an investigator and/or consultant for Bayer, Eli Lilly, Abbvie, Sanofi and Amgen. MSA is employed by Pierre Fabre. MT has been a speaker and/or consultant and/or investigator and/or participant of the Advisory Board for Abbvie, Bausch Health, Bioderma, Eli Lilly, La Roche posay, Leo pharma, Mead Johnson, Novartis, Pfizer, Pierre Fabre, Pfizer, Mead Johnson and Sanofi Genzyme. PL reported receiving grants from AOBiome, Regeneron/Sanofi Genzyme and AbbVie; personal fees from Regeneron/Sanofi Genzyme, Leo, Eli Lilly, Pfizer, Galderma, L'Oreal, Almirall, ASLAN Pharma Advisory board, Dermavant, Pierre Fabre, Menlo Therapeutics, IntraDerm, Exeltis, AOBiome, Arbonne and Amyris; stock options from Microcos and other royalties from patented product from Theraplex. The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

DISCLAIMER

There are limitations to the conclusion in that the answers may differ with differences in the formulation of questions, over time or with different versions of AI chat systems.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

Not applicable.

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REFERENCES

1. Lio P, Mackie D, Bates D, Mulvihill E, Patel M, Kim Y, et al. Burden, control, and treatment of moderate to severe atopic dermatitis in 2021: a United States patient survey study. *J Drugs Dermatol.* 2023;22(2):119–31.

2. Eichenfield LF, Kusari A, Han AM, Barbarot S, Deleuran M, Lio P, et al. Therapeutic education in atopic dermatitis: a position paper from the international eczema council. *JAAD Int*. 2021;3:8–13.
3. Arndt BG, Beasley JW, Watkinson MD, Temte JL, Tuan W-J, Sinsky CA, et al. Tethered to the EHR: primary care physician workload assessment using EHR event log data and time-motion observations. *Ann Fam Med*. 2017;15(5):419–26.
4. Christiano PF, Leike J, Brown T, Martic M, Legg S, Amodei D. Deep reinforcement learning from human preferences. *Adv Neural Inf Process Syst*. 2017;30:1–7. <https://proceedings.neurips.cc/paper/7017-deep-reinforcement-learning-from-human-preferences>
5. Ayers JW, Poliak A, Dredze M, Leas EC, Zhu Z, Kelley JB, et al. Comparing physician and artificial intelligence chatbot responses to patient questions posted to a public social media forum. *JAMA Intern Med*. 2023;183:589–96.