

The Journal of Allergy and Clinical Immunology

Reply to Dages, et al. You Ain't using it right: Artificial intelligence progress in allergy.

--Manuscript Draft--

Manuscript Number:	
Article Type:	Correspondence re: Published Articles
Section/Category:	Correspondence
Keywords:	AI, allergy, chatgpt, programming
Corresponding Author:	Dylan Lawless, PhD Lausanne, VD SWITZERLAND
First Author:	Dylan Lawless, PhD
Order of Authors:	Dylan Lawless, PhD
Manuscript Region of Origin:	SWITZERLAND

Dear Editor,

We present our playful yet serious response to Dages et al.'s letter on AI limitations in allergy, specifically the AI model, ChatGPT. Our lighthearted title, "*You Ain't using it right: Artificial intelligence progress in allergy*," belies our intent to show how AI tools can be used differently to yield reliable, factual information that can enhance the field of medical sciences. We demonstrate by using AI to build a computer program to download and analyse PubMed sources, summarise the content, provide supporting primary evidence, and produce figures to enlighten the reader. We believe that the correct and increasingly automated application of AI can revolutionize its use in medicine, catalyzing its evolution to deliver significant benefits. Therefore, while caution is required, we should not default to dismissing the power of these new tools.

Kind Regards,
Dylan Lawless, PhD

Department of Intensive Care and Neonatology, University Children's Hospital Zurich, University of Zürich, and Global Health Institute, School of Life Sciences, Ecole Polytechnique Fédérale de Lausanne, Switzerland.
Dylan.Lawless@epfl.ch

Reply to Dages, et al. You Ain't using it right: Artificial intelligence progress in allergy.

To the Editor:

We (ChatGPT and I) read with interest the letter by Dages et al., regarding the limitations of the AI tool ChatGPT [1]. We concur that the tool did not accurately address their query on cefazolin administration in a penicillin-allergic patient. However, we believe this outcome reflects the current limitations of the tool's use as a search engine rather than the AI model itself. We fully agree that their submission is typical and acknowledge that results can often deviate convincingly from what is expected. Their report is thus an important cautionary example.

Since language models generate responses based on data likelihood, not factual accuracy, it is important that we understand their function to use them effectively.

To demonstrate, we used ChatGPT v4 for a more complex approach to answer the author's same question. We propose that one must (for now) explicitly ask queries such as "Can we automate downloads from PubMed, analyze the content, and interpret the result concerning the safety of cefazolin for penicillin-allergic patients?".

We began by asking "what R package is able to query PubMed and return abstracts?" (R being our programming language of choice). ChatGPT automatically generated R code which could gather relevant abstracts from PubMed using our keywords. From here we incrementally asked for additional code to process and interpret the information.

The full code set provided us with an R computer program, written by ChatGPT, which performs the automated PubMed queries relative to the question and saves all abstracts and references. It then performs term-frequency and correlation analysis on the texts. Lastly, the text corpus is used as input for ChatGPT's interpretation of the original question to return a response based on the referenced summaries. The result intuitively demonstrates, to the human reader, what the text-based information consisted of before being interpreted by ChatGPT's model.

The final result consists of **Figure 1 (A-D)** illustrating the summarized content from PubMed, **(E)** a balanced text report based on those summaries, and **(F)** the list of publications used in the analysis.

The supporting data was automatically sourced for the first twenty PubMed results, the URLs and PMIDs printed and automatically imported into a citation manager. We limited the method to the default of twenty publication abstracts so that it is easy to replicate, however using ChatGPT API the system could be automated, with relative ease, to run on far larger datasets.

Our findings show that AI can provide valuable information for problem solving. We believe our colleagues' concerns are justified since most users initially assume that responses to queries are supposed to be fact-based. By adjusting the approach, we can use AI tools to improve how we find and analyse information.

However, we must highlight that the process, as it stands, is time-intensive - our session required two hours. It would be unrealistic to expect every user to dedicate such effort. We anticipate the advent of more user-friendly tools and interfaces, making data retrieval and analysis accessible and efficient.

Sincerely,

Dylan Lawless, PhD

Department of Intensive Care and Neonatology, University Children's Hospital Zurich, University of Zurich, and Global Health Institute, School of Life Sciences, Ecole Polytechnique Fédérale de Lausanne, Switzerland.

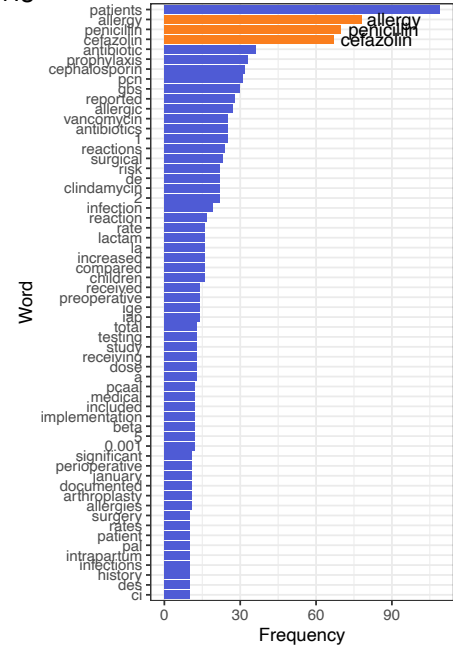
Dylan.Lawless@epfl.ch

Figure 1. Term frequency in automated PubMed queries and final interpretation. **[A]** Most common words in abstracts related to cefazolin and penicillin allergy (quantile 0.95 shown). **[B]** TF-IDF for terms of interest in abstracts related to “cefazolin” and “penicillin” “allergy” (text labels highlight matches to the three terms). **[C]** Network plot of edge weights based on the frequency of co-occurrence in abstracts related to cefazolin and penicillin allergy (quantile 0.98 shown). **[D]** Heatmap of term co-occurrence in abstracts (co-occurrence threshold >9 shown). This same dataset throughout was used for subsequent interpretation by ChatGPT. **[E]** Final response by ChatGPT based on summaries from abstracts. **[F]** References used for ChatGPT's final response. TF-IDF, term frequency-inverse document frequency.

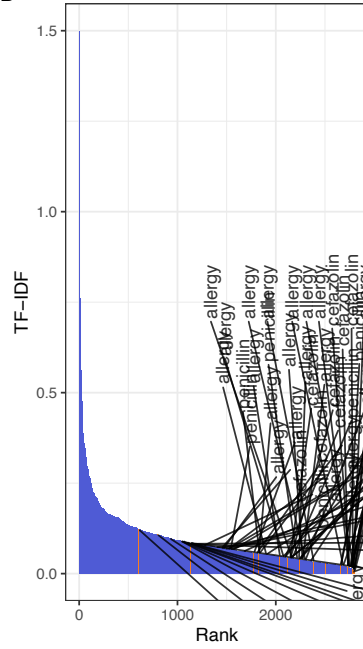
References

1. Dages, K.N., Ender, E.C., Park, M.A. and Li, J.T., 2023. It Ain't perfect: Artificial intelligence errors in allergy. Journal of Allergy and Clinical Immunology. <https://doi.org/10.1016/j.jaci.2023.06.009>

Figure No. 1



B



E

3_file3_final_answer ChatGPT v4.

“Based on the provided text, it seems that the issue of administering cefazolin to patients with a history of penicillin allergy is approached carefully in clinical settings. The collected data suggests the following:

1. The use of cefazolin among patients with reported allergies to penicillin tends to result in a low rate of cross-reactivity. This means that most patients with penicillin allergies don't experience allergic reactions when given cefazolin. However, a small percentage of patients may still have reactions due to cross-reactivity between penicillin and cefazolin.

2. Some studies indicate that de-labeling of patients with a penicillin allergy may not be necessary before administering cefazolin, suggesting a growing confidence in its safety profile among patients with a history of penicillin allergy.

3. Hospitals and pharmacies have successfully increased the use of cefazolin among penicillin-allergic patients, often without a corresponding increase in adverse reactions. This increase is made possible through initiatives that improve the understanding and documentation of the penicillin allergy, allowing healthcare professionals to make informed decisions.

4. Other texts suggest that underuse of cefazolin in certain situations is considered undertreatment, which implies a strong confidence in its effectiveness and safety profile. Other antibiotics may present additional risks compared to cefazolin, emphasizing its relative safety.

In summary, the provided texts suggest that with careful risk stratification, allergy clarification, and careful monitoring, cefazolin can be safely administered to patients with a history of penicillin allergy. However, the risk of cross-reactivity, though small, is still present and should always be taken into account. Therefore, the decision to use cefazolin should always be taken by a healthcare professional who has thoroughly evaluated the individual patient's allergy history and the benefits versus potential risks of the treatment.”

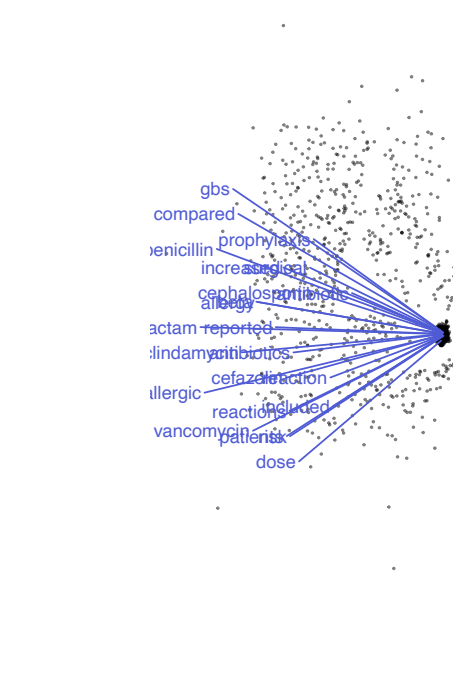
F

[Click here to access/download;Figure No.;figure_1.pdf](#)

References

1. Hong, Z. et al. A cohort study of intrapartum group B streptococcus prophylaxis on atopic dermatitis in 2-year-old children. BMC Pediatr 22, 693 (2022).
2. Snider, J. B., Mithal, L. B., Kwah, J. H., Rhodes, N. J. & Son, M. Antibiotic choice for Group B Streptococcus prophylaxis in mothers with reported penicillin allergy and associated newborn outcomes. BMC Pregnancy Childbirth 23, 400 (2023).
3. Hanson, S. et al. Antibiotic Prescribing Practices in Group B Streptococcus Positive Obstetric Patients with Penicillin Allergy. S D Med 75, 462–468 (2022).
4. Pineles, B. L., Goodman, K. E., Pineles, L. & Harris, A. D. Appropriate Antibiotic Use for Group B Streptococcus Prophylaxis Among Penicillin-Allergic Patients in Academic and Nonacademic Hospitals. Open Forum Infect Dis 9, ofac514 (2022).
5. Norvell, M. R. et al. Cefazolin vs Second-line Antibiotics for Surgical Site Infection Prevention After Total Joint Arthroplasty Among Patients With a Beta-lactam Allergy. Open Forum Infect Dis 10, ofad224 (2023).
6. Kurcz, B. P. et al. Documented Penicillin Allergies Should Not Preclude Use of Preoperative Cefazolin in Hip and Knee Arthroplasty. J Am Acad Orthop Surg 31, e107–e117 (2023).
7. Otani, I. M. et al. Impact of an Inpatient Allergy Guideline on β -Lactam and Alternative Antibiotic Use. J Allergy Clin Immunol Pract S2213-2198(23)00536–6 (2023) doi:10.1016/j.jaip.2023.04.051.
8. VanderVelde, K. A. et al. Increasing cefazolin use for surgical prophylaxis in penicillin-allergy-labeled patients. Antimicrob Steward Healthc Epidemiol 3, e11 (2023).
9. Said, S. A. et al. Long term assessment of antibiotic prophylaxis and biliary microbiome in pancreaticoduodenectomy. HPB (Oxford) 24, 1861–1868 (2022).
10. Genis, H. et al. Optimizing Cefazolin Prophylaxis in Obstetrical Patients with Reported Beta-Lactam Allergy Undergoing Cesarean Delivery. J Obstet Gynaecol Can S1701-2163(23)00406–1 (2023) doi:10.1016/j.jogc.2023.05.026.
11. Michaud, L., Yen, H. H., Engen, D. A. & Yen, D. Outcome of preoperative cefazolin use for infection prophylaxis in patients with self-reported penicillin allergy. BMC Surg 23, 32 (2023).
12. Nakhla, M. N. et al. Perioperative Antibiotic Use in Endoscopic Endonasal Skull Base Surgery. J Neurol Surg B Skull Base 83, 390–396 (2022).
13. Lessard, S. et al. Pharmacist adjustment of preoperative antibiotic orders to the preferred preoperative antibiotic cefazolin for patients with penicillin allergy labeling. Am J Health Syst Pharm 80, 532–536 (2023).
14. Stonerock, D. et al. Pharmacist-led improvement in perioperative antibiotic selection for patients with a penicillin allergy label. Am J Health Syst Pharm 80, e111–e118 (2023).
15. Bragg, J. T. et al. Preoperative allergy testing for patients reporting penicillin and cephalosporin allergies is economically justified in preventing infection after total shoulder arthroplasty. J Shoulder Elbow Surg 32, 186–191 (2023).
16. Legg, A. et al. Risk Factors for Nephrotoxicity in Methicillin-Resistant Staphylococcus aureus Bacteraemia: A Post Hoc Analysis of the CAMERA2 Trial. Clin Drug Investig 43, 23–33 (2023).
17. Sarrazin, J.-F. et al. Safety of Cefazolin Test Dose in Patients With Penicillin Allergy Just Prior to Cardiac Device Implantation: A Single-Centre Experience. CJC Open 4, 695–700 (2022).
18. Zhang, H. et al. Study on the relationship between intrapartum group B streptococcus prophylaxis and food allergy in children. Front Pediatr 10, 1039900 (2022).
19. Panther, E. J. et al. Techniques for Decreasing Bacterial Load for Open Shoulder Surgery. JBJS Rev 10, (2022).
20. Maisat, W., Bermudez, M. & Yuki, K. Use of clindamycin as an alternative antibiotic prophylaxis. Perioper Care Oper Room Manag 28, 100278 (2022).

C



D

