

# A Promising Start and Not a Panacea: ChatGPT's Early Impact and Potential in Medical Science and Biomedical Engineering Research

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## Short Report

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# Abstract

The advent of artificial intelligence (AI) has catalyzed a revolutionary transformation across various industries, including healthcare. Medical applications of ChatGPT, a powerful language model based on the generative pre-trained transformer (GPT) architecture, encompass the creation of conversational agents capable of accessing and generating medical information from multiple sources and formats. This study investigates the research trends of large language models such as ChatGPT, GPT 4, and Google Bard, comparing their publication trends with early COVID-19 research. The findings underscore the current prominence of AI research and its potential implications in biomedical engineering. A search of the Scopus database on July 23, 2023, yielded 1,096 articles related to ChatGPT, with approximately 26% being medical science-related. Keywords related to artificial intelligence, natural language processing (NLP), LLM, and generative AI dominate ChatGPT research, while a focused representation of medical science research emerges, with emphasis on biomedical research and engineering. This analysis serves as a call to action for researchers, healthcare professionals, and policymakers to recognize and harness AI's potential in healthcare, particularly in the realm of biomedical research.

## Introduction

The emergence of artificial intelligence (AI) has sparked a profound revolution across various sectors, with healthcare being no exception. ChatGPT stands as a substantial language model capable of generating natural language responses by drawing from the generative pre-trained transformer (GPT) architecture [1]. Its versatility extends to various domains and tasks, including chatbots, poetry generation, and coding [2]. Medical science is one such domain where ChatGPT's potential is being explored extensively. The model's applications in the medical field encompass conversational agents that can access and generate medical information from diverse sources and formats. Medical professionals and students can benefit significantly, gaining access to the latest developments, updates, and relevant articles, alongside assistance in diagnosis, education, documentation, and communication [3]. Moreover, ChatGPT's potential to improve patient health and mental well-being has been evidenced through investigations into mental health-related issues [4] and vaccine uptake [5]. Personalized guidance, reminders, and feedback based on patient symptoms, history, and preferences are among the model's other possibilities in patient care [6].

The advent of large language models (LLMs) like ChatGPT, GPT 4, Google Bard, and Bing has piqued the interest of researchers across various domains, leading to a rapid surge in ChatGPT research and a substantial number of published articles. This growth in research activity bears a semblance to the research response observed during the COVID-19 outbreak in March 2020. The global research community responded vigorously, generating diverse studies that empowered daily life and addressed the pandemic's challenges [7–9]. In a similar vein, researchers have begun exploring ChatGPT's potential across various spheres of human life.

To that end, this study aims to identify the research trends of large language models, focusing on applications like ChatGPT, GPT 4, and Google Bard. It investigates the ongoing research direction, its applicability in medical science and biomedical engineering, and the potential for future implications. By employing artificial intelligence tools and mathematical models, the investigation endeavors to aid the medical fraternity and healthcare officials in optimizing the use of ChatGPT and similar AI tools, pinpointing areas that warrant further research.

## Findings

A Scopus search using the query "Chat GPT" OR "chat-GPT" OR "Chat GPT" OR "GPT 4" OR "GPT-4" OR "GPT4" "Google Bard" OR "Google-bard" returned a total of 1,096 documents. The publication trend was monitored from January 2023 to the present, and an exponential growth in ChatGPT research was observed, as depicted in Fig. 1.

This exponential growth can be obtained using the following equation (I).

$$Y = 33*(1.052)^X \text{ ————— (I)}$$

Based on this equation, it is projected that by the end of 2023, the total publication on Chat GPT would reach around 10,166 research papers, signifying an impressive volume of research output within a year. In comparison, a Scopus search for COVID-19-related research using queries such as "COVID 19" OR "COVID-19" OR "COVID19" OR "SARS-COV" OR "Corona Virus" retrieved a staggering 92,067 articles. This significant difference in the number of published articles highlights the varying research focus on COVID-19 and Chat GPT.

To examine the relevance of Chat GPT in the medical domain, a query for articles related to both Chat GPT and medical topics, such as "ChatGPT" OR "Chat-GPT" OR "chat GPT" OR "Google bard" OR "Google-bard" OR "GPT4" OR "GPT-4" AND "health" OR "disease," was conducted. The search yielded 286 articles, indicating that only approximately 26% of the total Chat GPT-related articles were specific to medical science and healthcare.

To delve deeper into the specific areas of medical science explored in Chat GPT research, VOSviewer [10], an AI based tool for complex network and bibliometric data analysis is used. Figures 2 and 3 illustrate the keyword occurrence analysis for total keywords of Chat GPT and medical science-specific keywords, respectively. Keywords with at least five occurrences are only considered.

It is notable that in Fig. 2, keywords related to medical science are not prevalent, rather artificial intelligence, natural language processing (NLP), LLM, and generative AI are dominantly occurred. However, contrary to this, a more focused and clear representation of chat GPT research in medical science is represented in Fig. 3. With the help of this illustration, we can observe that in addition to medical health related keywords, biomedical research and biomedical engineering have been extensively used in the recent reported research in the concerned field. These remarks are indicated with the help of

red arrows in the Fig. 3, as mentioned in its caption. This would be intriguing to see how these AI bots shall drive the future biomedical research.

## Conclusion

In this study, a quick summary on the recent development in chat GPT's research is presented. In addition, the publication trend of chat GPT and early COVID 19 research are compared. It is concluded that the chatGPT research is much less prevalent than COVID-19 research, as indicated by the lower number of articles and occurrences of keywords. Second, chatGPT research is more focused on natural language processing (NLP) and artificial intelligence (AI) aspects, such as language model, language processing, large language model, machine learning, deep learning, etc., while COVID-19 research was more focused on clinical and public health aspects, such as pandemic, health care delivery, health care personnel, patient care, patient education, clinical decision making, clinical decision support system, clinical practice, clinical research, diagnosis, diagnostic accuracy, etc. However, biomedical engineering, biomedical research, medical society, predominantly used keywords for chat GPT and medical science researches. These keywords suggest that chatGPT can be used to create conversational agents that can access and generate medical information from various sources and formats.

As we move forward, it is crucial to continue investing to leverage AI's potential to enhance healthcare and respond to global health crises effectively. Since COVID-19 research has been driven by the urgency of the pandemic, ChatGPT's integration into medical science research is a dynamic area that holds vast potential for transformative healthcare applications. As researchers continue to harness the power of ChatGPT, we anticipate significant advancements in medical communication, patient care, and healthcare decision-making. Nonetheless, ensuring the responsible and ethical use of this technology remains paramount to realize its full benefits in the medical domain.

## Declarations

### Conflict of interest.

There is no conflict of interest.

## References

1. Sohail, S. S., Farhat, F., Himeur, Y., Nadeem, M., Madsen, D. Ø., Singh, Y., ... & Mansoor, W. (2023). The future of gpt: A taxonomy of existing chatgpt research, current challenges, and possible future directions. *Current Challenges, and Possible Future Directions (April 8, 2023)*.
2. Farhat, F., Silva, E. S., Hassani, H., Madsen, D. Ø., Sohail, S. S., Himeur, Y., ... & Zafar, A. (2023). Analyzing the Scholarly Footprint of ChatGPT: Mapping the Progress and Identifying Future Trends.
3. Dave, T., Athaluri, S. A., & Singh, S. (2023). ChatGPT in medicine: an overview of its applications, advantages, limitations, future prospects, and ethical considerations. *Frontiers in Artificial*

*Intelligence*, 6, 1169595.

4. Farhat, F. ChatGPT as a Complementary Mental Health Resource: A Boon or a Bane. *Ann Biomed Eng* (2023). <https://doi.org/10.1007/s10439-023-03326-7>
5. Sohail, S. S., Madsen, D. Ø., Farhat, F., & Alam, M. A. (2023). ChatGPT and Vaccines: Can AI Chatbots Boost Awareness and Uptake?. *Annals of Biomedical Engineering*, 1-5.
6. Bahrini, A., Khamoshifar, M., Abbasimehr, H., Riggs, R. J., Esmaeili, M., Majdabadkohne, R. M., & Pasehvar, M. (2023, April). ChatGPT: Applications, opportunities, and threats. In *2023 Systems and Information Engineering Design Symposium (SIEDS)* (pp. 274-279). IEEE.
7. Ahamad, S., Branch, S., Harrelson, S., Hussain, M. K., Saquib, M., & Khan, S. (2021). Primed for global coronavirus pandemic: Emerging research and clinical outcome. *European journal of medicinal chemistry*, 209, 112862.
8. Zouch, W., Sagga, D., Ectiouei, A., Khemakhem, R., Ghorbel, M., Mhiri, C., & Hamida, A. B. (2022). Detection of COVID-19 from CT and chest X-ray images using deep learning models. *Annals of Biomedical Engineering*, 50(7), 825-835.
9. Bavel, J. J. V., Baicker, K., Boggio, P. S., Capraro, V., Cichocka, A., Cikara, M., ... & Willer, R. (2020). Using social and behavioural science to support COVID-19 pandemic response. *Nature human behaviour*, 4(5), 460-471.
10. Van Eck, N., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *scientometrics*, 84(2), 523-538.

## Figures

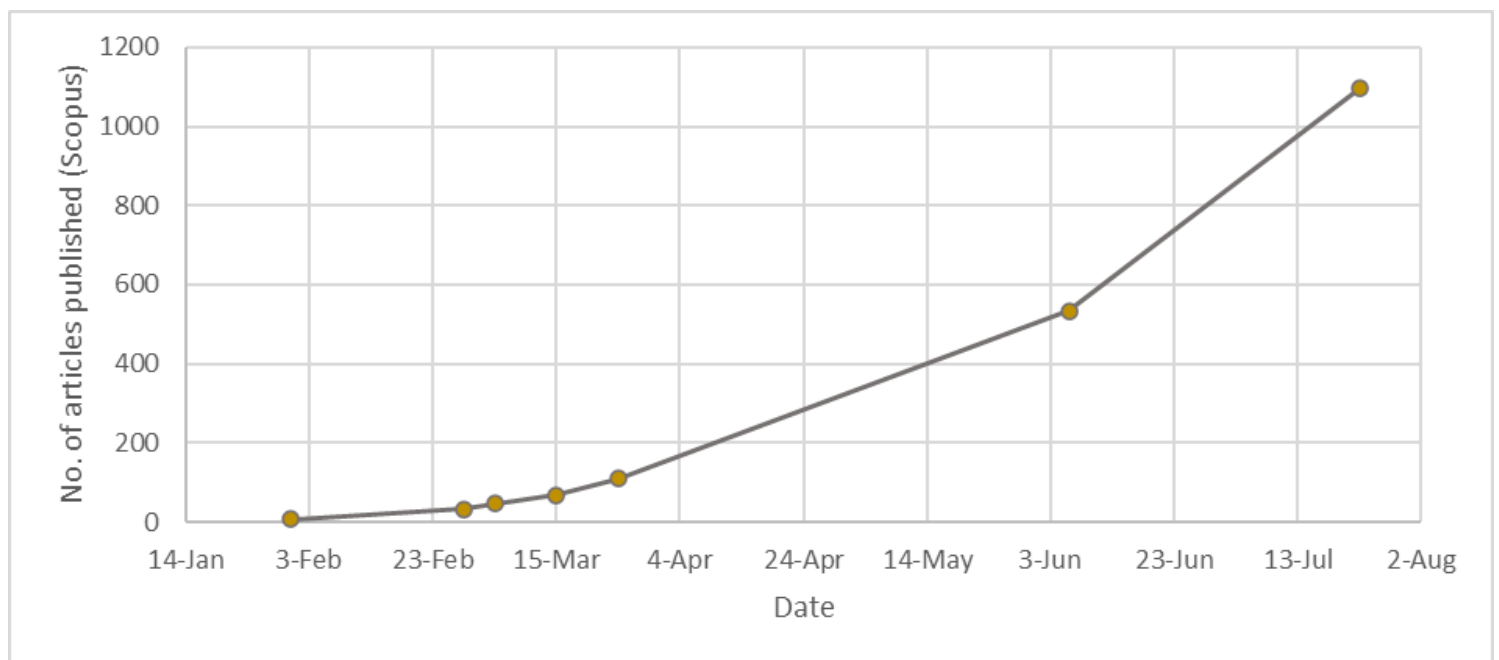


Figure 1

The rapid growth in research paper publication on “chat GPT” in 2023. The trend suggests an exponential growth in the publication.

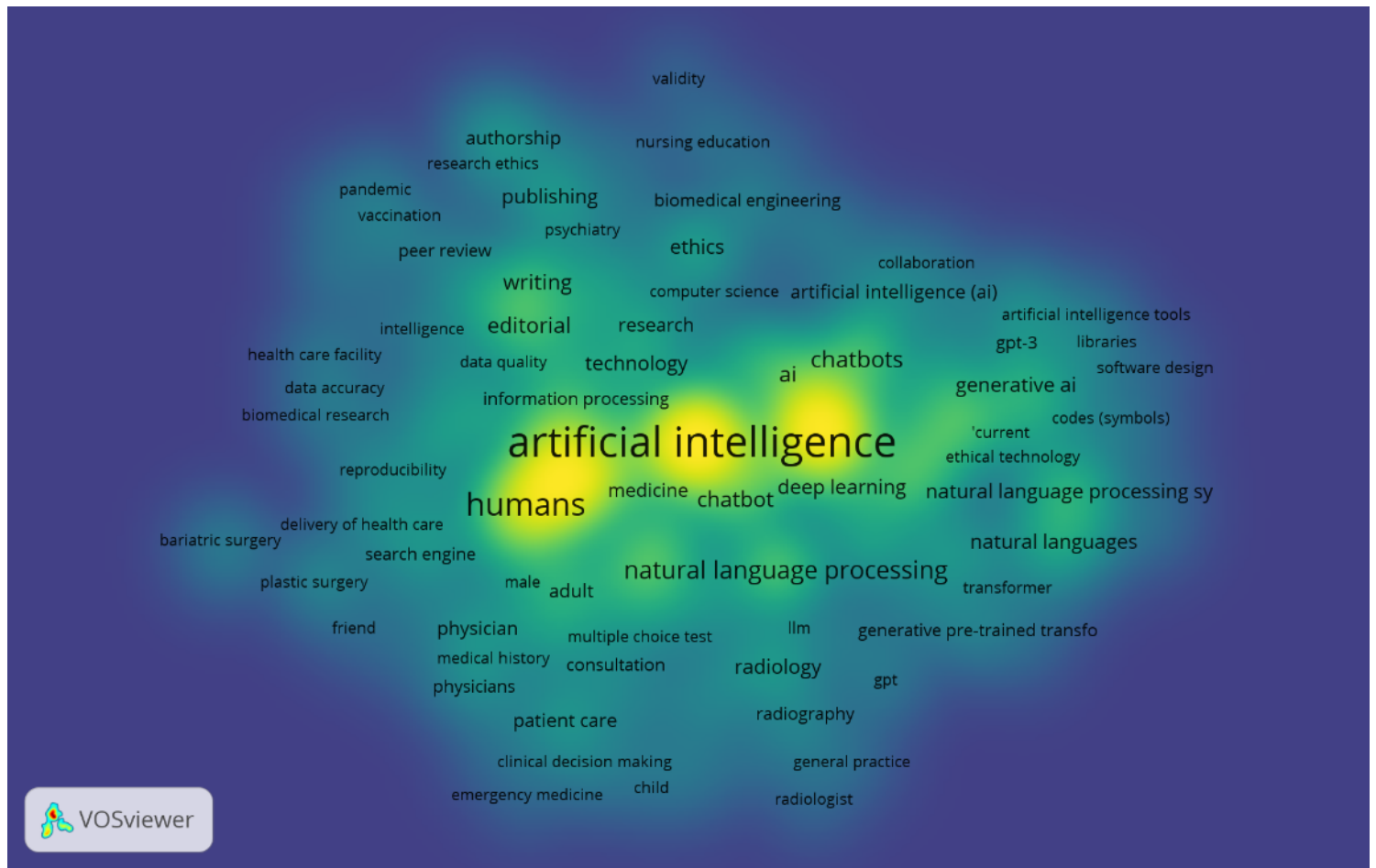


Figure 2

The density visualization for keyword occurrence on chat GPT research. The research duration is from January 2023 to July 23, 2023. The overall keyword occurrence contains very few keywords from medical science domain.

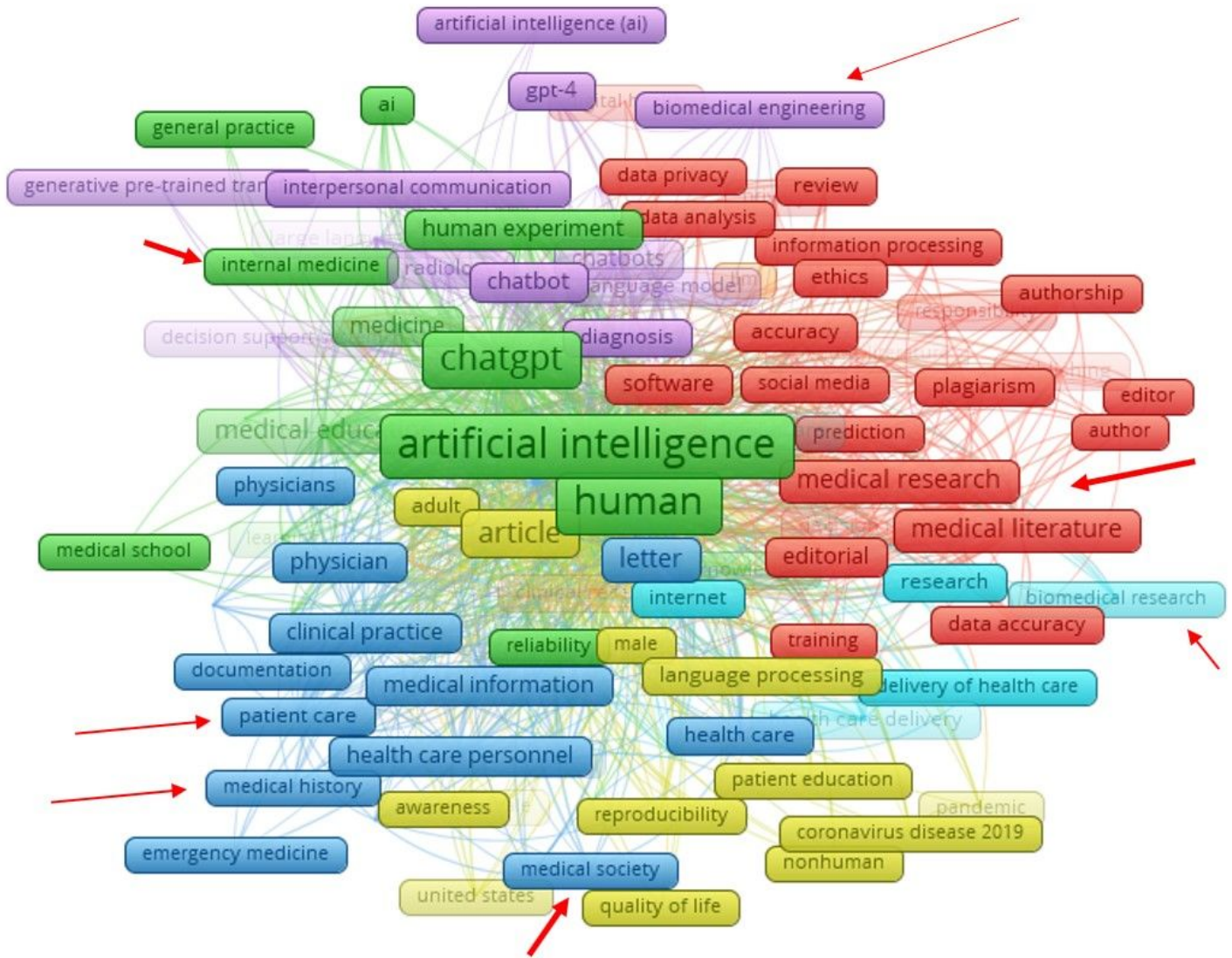


Figure 3

The network visualization for keyword occurrence on chat GPT research for medical science and healthcare. The research duration is from January 2023 to July 23, 2023. The keyword occurrence contains different domain of medical science in which medicine, medical care and biomedical are dominant, as indicated by 'red' arrows.