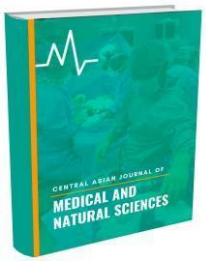

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Article

The Role of ChatGPT in Predicting, Diagnosing, and Managing Infectious

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Abstract: ChatGPT, a large language model developed by OpenAI, leverages advanced natural language processing to generate human-like responses and interpret complex medical information. It demonstrates significant potential in healthcare by supporting clinical decision-making, assisting in differential diagnosis, predicting disease outcomes, and enhancing epidemiological surveillance. Furthermore, ChatGPT can facilitate early-stage drug and vaccine development through literature synthesis, streamline clinical workflows via automated documentation and data retrieval, and inform public health policy and resource allocation. In medical education, it enhances learning by creating interactive experiences, generating educational materials, and improving training efficiency. Despite these advantages, its use raises ethical and privacy concerns, risks of misinformation, and requires ongoing professional and regulatory oversight to ensure safe and effective integration. Overall, ChatGPT represents a valuable complement to human expertise in advancing healthcare and medical education.

Keywords: ChatGPT, Artificial Intelligence, Healthcare, Medical Education, Clinical Decision Support

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1. Introduction

ChatGPT (Chat Generative Pre-trained Transformer) is an artificial intelligence (AI) tool developed by OpenAI that utilizes natural language processing (NLP) to simulate human-like conversations. As a chatbot, ChatGPT can respond to follow-up questions, recognize errors, debunk misinformation, and decline inappropriate requests. It is based on large language models (LLMs), which are complex deep-learning systems capable of understanding, generating, summarizing, translating, and predicting text in a manner similar to humans. By leveraging massive datasets, LLMs can process and generate knowledge across diverse domains [1], [2], [3], [4].

In medicine, ChatGPT shows great potential in supporting clinical and laboratory diagnosis, aiding research planning, and assisting in manuscript preparation [5], [6], [7]. Its application, however, raises ethical and legal considerations, including copyright concerns and transparency in AI-generated content [8], [9], [10], [11], [12]. Recent advancements in AI and machine learning (ML) have revolutionized healthcare, enabling improved disease diagnosis, prognosis, and treatment optimization [13]. In the context of dengue, AI models have been developed for outbreak prediction and disease severity assessment [14], [15], but using AI to formulate real-time assessment scales at diagnosis remains unexplored. Reliable AI tools could offer rapid, objective, and consistent

evaluations to support clinical decision-making, particularly for less experienced providers or high-demand settings.

Large language models like ChatGPT can also enhance patient care by analyzing medical data and formulating outcome prediction tools through prompt engineering [16]. Strategies such as OpenMedLM have demonstrated effectiveness in generating clinically relevant prompts [17].

2. Medical Education

Knowledge of microbiology and infectious diseases is essential for all medical graduates, particularly in the context of recent outbreaks such as COVID-19, Monkeypox, Nipah, and Zika viruses. Understanding these diseases equips students to manage and mitigate outbreaks effectively. AI, which simulates and extends human cognitive processes, has increasingly been applied to medical education, including microbial identification using machine learning and neural networks [18], [19]. AI tools can also generate questions, evaluate case solutions, and provide accurate feedback, improving medical training efficiency [20].

OpenAI, a research organization based in San Francisco, has developed platforms such as GPT-3.5 and GPT-4, large language models that can transform medical education [21]. Google AI's Gemini (formerly Bard) offers similar capabilities [22]. These LLMs can generate responses to educational queries, support curriculum development, and enhance learning strategies for medical students.

3. ChatGPT: Concept, Technology, and the Future of Communication

Generative Pre-trained Transformers (GPT) are systems designed to understand and generate complex text sequences. ChatGPT, based on GPT architecture, uses unsupervised learning to produce text resembling human writing. It gathers information from multiple sources, maps interconnections, and predicts contextually appropriate responses [23], [24]. Such technologies can be adapted for organizational training, content creation, knowledge management, and improved user interaction [25], [26].

ChatGPT represents a transformative tool for human-machine communication, with potential applications ranging from event planning to virtual assistance. While its impact can be significant, it is crucial to ensure ethical and responsible use. ChatGPT's responses depend on its training data and machine learning algorithms, enabling applications in content creation, translation, summarization, and healthcare communication [27], [28], [29], see Figure 1.

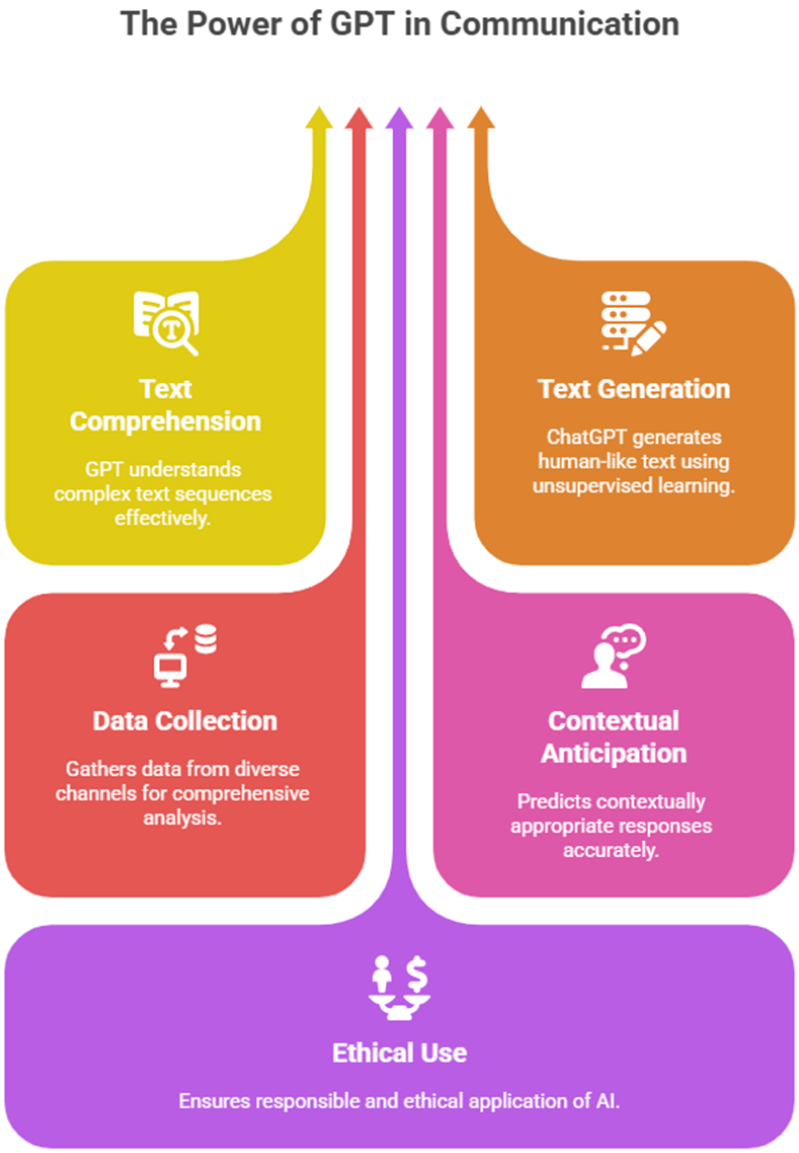

Figure 1. The power of GPT in communication.

ChatGPT in Healthcare

While many aspects of healthcare require direct patient interaction, not all tasks demand constant human involvement. ChatGPT has the potential to complement healthcare delivery by enhancing treatment adherence, providing practical and accessible guidance, and improving overall patient outcomes [30], [31]. However, its predictive capabilities in healthcare must be carefully constrained. Transformer models, such as ChatGPT, detect patterns in training data and generate predictions based on these patterns. This can sometimes lead to "hallucinations" or inaccurate outputs in medical contexts, highlighting the need for careful validation [32], [33].

ChatGPT can be particularly valuable for patients in underserved or rural areas who may have limited access to certified healthcare professionals. It can provide reliable guidance and information, easing patient anxiety and confusion, for instance, during the adjustment period after a new diagnosis such as diabetes. For patients requiring more frequent support, ChatGPT can offer additional education and assistance, promoting self-management, improving adherence, and reducing the demand for human intervention. By responding to patient inquiries and generating contextually relevant content, ChatGPT also facilitates communication among patients, healthcare providers, and insurance companies, ensuring timely access to essential health information [34], [35], [36].

4. Workflow Dimensions of ChatGPT in Healthcare

ChatGPT's workflow in healthcare can be understood across several key dimensions, including patient-centric criteria, services, data management, and workflow stages (Fig. 1) [37], [38], [39]. Its effective deployment depends on the seamless flow of information through structured databases, cloud-based updates, and reward model optimization. Notable applications include clinical decision support systems, where ChatGPT can analyze patient data such as medical history and vital signs to provide treatment suggestions, including optimal anesthesia dosing or pain management strategies. It can also deliver personalized, evidence-based pre-operative education to patients about surgical procedures and support post-operative care by offering symptom management advice tailored to a patient's medical background and tolerance levels. Beyond direct patient care, ChatGPT's advanced AI capabilities can enhance healthcare workflows in eLearning, educational content creation, and patient communication [40], [41], [42], [43], [44], [45], [46], [47], [48]. Nevertheless, it is crucial to use ChatGPT as a supportive tool rather than a replacement for human expertise.

5. Typical Applications of ChatGPT in Healthcare

ChatGPT can enhance healthcare efficiency and patient satisfaction by handling patient inquiries about insurance, billing, and appointments, supporting healthcare professionals in clinical decision-making, and automating routine tasks, allowing providers to focus on more complex care, counselling, and interdisciplinary collaboration [49], [50], [51], [52]. While ChatGPT's fluency and creativity make it a promising tool, human oversight remains critical to ensure accuracy and contextual appropriateness.

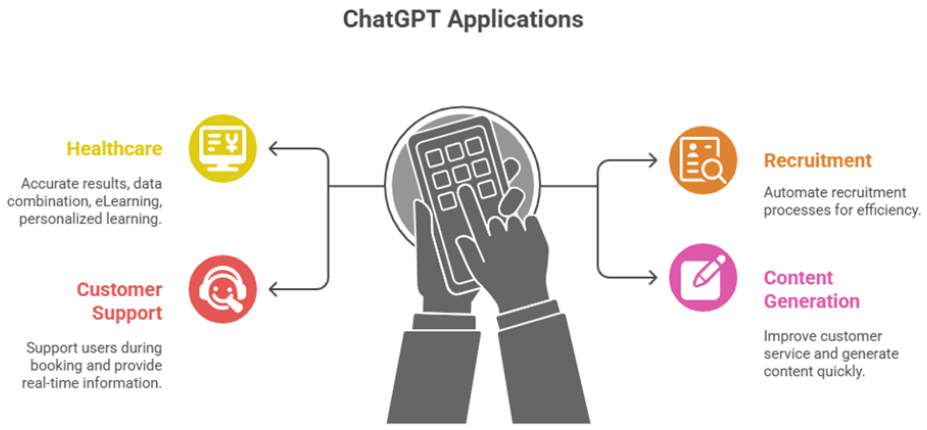

Figure 2. ChatGPT Applications.

6. Limitations of ChatGPT in Healthcare

While promising, ChatGPT has notable limitations. It may provide inaccurate or biased information and cannot access patient records or offer personalized medical advice. Ethical and legal concerns, including privacy, consent, and liability, remain significant. Human oversight is essential due to its lack of critical thinking, and automation could impact certain healthcare roles by shifting tasks to higher-value activities [53].

7. Future Scope

ChatGPT technology continues to evolve, with each new GPT version offering improved speed, accuracy, and features. In healthcare, it has the potential to provide precise outcomes, integrate real-world data, support eLearning, and offer personalized learning experiences [53]. Beyond healthcare, ChatGPT can streamline recruitment, assist

travelers with bookings and real-time information, and enhance customer support and content creation. Its human-like text generation makes it adaptable for diverse applications, and ongoing advancements in deep learning are expected further to expand its capabilities and impact across multiple sectors [53].

8. Conclusion

ChatGPT, as a large language model, shows significant potential in addressing challenges posed by infectious diseases by enhancing healthcare efficiency and effectiveness. It can improve epidemiological surveillance through analysis of large datasets, support clinicians in differential diagnosis, and assist in delivering targeted treatment recommendations while combating misinformation. Additionally, ChatGPT can inform public health policy and optimize resource allocation by modeling intervention scenarios, accelerate early-stage drug and vaccine research by synthesizing scientific literature, and streamline clinical workflows through automated documentation and information retrieval. However, it should be used as a complementary tool rather than a replacement for human expertise, with all outputs verified by professionals. Safe and effective integration requires investment in robust ethical and regulatory frameworks.

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