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Case Report

ChatGPT for healthcare services: An emerging stage for an innovative perspective

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ABSTRACT

Generative Pretrained Transformer, often known as GPT, is an innovative kind of Artificial Intelligence (AI) which can produce writing that seems to have been written by a person. OpenAI created this AI language model called ChatGPT. It is built using the GPT architecture and is trained on a large corpus of text data to respond to natural language inquiries that resemble a person's requirements. This technology has lots of applications in healthcare. The need for accurate and current data is one of the major obstacles to adopting ChatGPT in healthcare. GPT must have access to precise and up-to-date medical data to provide trustworthy suggestions and treatment options. It might be accomplished by ensuring that the data used by GPT is received from reliable sources and that the data is updated regularly. Since sensitive medical information would be involved, it will also be crucial to consider privacy and security issues while utilising GPT in the healthcare industry. This paper briefs about ChatGPT and its need for healthcare, its significant Work Flow Dimensions and typical features of ChatGPT for the Healthcare domain. Finally, it identified and discussed significant applications of ChatGPT for healthcare. ChatGPT can comprehend the conversational context and provide contextually appropriate replies. Its effectiveness as a conversational AI tool makes it useful for chatbots, virtual assistants, and other applications. However, we see many limitations in medical ethics, data interpretation, accountability and other issues related to the privacy. Regarding specialised tasks like text creation, language translation, text categorisation, text summarisation, and creating conversation systems, ChatGPT has been pre-trained on a large corpus of text data, and somewhat satisfactory results can be expected. Moreover, it can also be utilised for various Natural Language Processing (NLP) activities, including sentiment analysis, part-of-speech tagging, and named entity identification.

1. Introduction

Using the chatbot Artificial Intelligence (AI) language paradigm, Open AI creates the ChatGPT communication tool. Generative Pre-trained Transformer (GPT) human-like alerts are available for various duties, including responding to inquiries, troubleshooting ChatGPT network issues, and producing original content. They can also translate between different languages. ChatGPT can learn from prior discussions and apply that learning to deliver appropriate answers to future questions, becoming a more effective chatbot over time [1–3]. ChatGPT recognises the general context of a query or conversation and creates detailed replies relevant to the subject. ChatGPT may be utilised in healthcare for various goals, from bettering patient experiences and assisting medical personnel in optimising healthcare procedures and revealing valuable information. It can provide a better healthcare solution which is helpful for medical care providers and patients' communication [4,5].

ChatGPT comprehends and reacts to various conversational inputs, such as queries, claims, and directives in healthcare. It can converse with patients naturally and human-likely, which is advantageous for chatbots, customer service agents, and digital assistants. By using Machine Learning (ML) algorithms and natural language processing (NLP) approaches, ChatGPT develops conversational proficiency. The model can analyse and forecast word sequences through word embedding and recurrent neural networks. ML is essential to effective AI, and Data must be continuously fed into chatbot neural networks [6,7]. When identifiable patient data is entered into ChatGPT, it becomes a part of the database that the chatbot will eventually utilise. Generative Transformers can build conversational AI apps like chatbots that can have genuine discussions with consumers and other stakeholders after being educated. ChatGPT can accurately respond to customer inquiries and frequently asked questions by analysing various written materials, including textual and spoken language [8,9].

When there are feeds in the training data, they may also be reflected in response to the appropriate question. ChatGPT is a learning model

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that can only react based on feed data. Due to ChatGPT's excellent scalability and efficiency, businesses of various sizes may use it for a reasonable price. It can provide more thorough dialogue than other technologies because of its capacity to evaluate both written and spoken language. It is accurate, with a low percentage of false positives and negatives. Chatbots, used in various businesses to offer customer support, answer questions, and carry out other duties, are the most effective use of ChatGPT [10–12]. ChatGPT must be adjusted and tested for tasks particular to mental health for applications to be developed successfully. Models may be better prepared to handle behavioural traits with the correct blend of unique data, hyperparameters, architecture, and algorithms. This process of fine-tuning is essential to ensuring that models are used morally and adequately [13,14].

ChatGPT assists in analysing customer data and segmenting customers according to their preferences, needs, and behaviours, enabling the marketing team to conduct more successful targeted marketing campaigns. With the help of its sophisticated machine-learning algorithms, it can overcome language barriers, significantly improving consumer experiences and expanding our worldwide reach. It may help companies strengthen their online presence by being accessible around the clock on websites and social media platforms to respond quickly to consumers' frequently asked questions [15–17]. With the help of its sophisticated algorithms, ChatGPT may increase sales and marketing efforts, automate repetitive processes, and boost customer service while also increasing productivity. Observing how ChatGPT affects the salesforce platform and spurs industry innovation as technology develops further will be fascinating. In healthcare, this is helpful in various applications because they can comprehend natural language inputs and provide human-like answers [18,19]. The main aim of this paper is to discuss the significant applications of ChatGPT in healthcare.

2. ChatGPT

Generative Pretrained Transformers (GPT) refer to systems that can comprehend and generate long strings of complicated concepts. ChatGPT is a natural language processing (NLP) model created by OpenAI that enables real-time discussions with an AI chatbot similar to a person's. It is built on the GPT architecture, a language model that uses unsupervised learning to produce writing that resembles a human's. ChatGPT gathers data from every source it can find, feeds it into a transformer model, maps the connections between the various pieces of data, and makes educated estimates about what text should be used in which circumstances [20,21]. ChatGPT and comparable technologies may be trained on organisational data to alter the industry as technology develops. They also provide excellent starting points for producing software and content, managing knowledge, enhancing consumer interactions, and improving employee experiences. Event planners, tutors, and virtual personal assistants are all potential future developments [22,23].

ChatGPT has the potential to be a game-changing innovation that would significantly enhance the way humans communicate with machines. It remains to be seen whether it will be utilised for good or harm, but one thing is for sure: it will probably significantly influence our lives in the years to come. It is crucial to consider the technology's potential advantages and threats as it continues to advance and develop and to guarantee that it is utilised morally and responsibly. The replies produced by Chat GPT are based on the data it was trained on. ChatGPT is one of the chatbot applications, a very potent language model that uses ML algorithms to simulate human–machine interface. The ChatGPT has various uses, including content creation, translation, and summarisation. It can produce human-like text in healthcare for better treatment and patient disease awareness [24–26].

3. Need for ChatGPT in healthcare

Although many elements of healthcare need connection with patients, it is only sometimes necessary for optimal treatment. By enhancing adherence to treatment regimens and offering more practical and accessible care, ChatGPT may enhance the care given by a human healthcare provider and improve patient outcomes [27,28]. ChatGPT would need to have its prediction powers restricted for use in healthcare. A transformer model will detect patterns in the training data and apply that knowledge during inference. Transformer models may hallucinate predictions in a medical summary because they are rewarded by identifying patterns and generating predictions based on them. Patients who reside in underserved or rural regions could struggle to meet a certified diabetes educator or other healthcare experts physically. These patients may be able to use ChatGPT to get help and knowledge from a dependable source, even if they cannot physically visit a healthcare centre [29,30].

Patients may experience anxiety and confusion as they adjust to their new diabetes diagnosis. Some patients could find ChatGPT a handy and approachable method to get information and assistance while figuring out how to manage their disease. For certain people to adequately manage their diabetes, more frequent or intensive assistance may be needed. These patients could access extra information and assistance via ChatGPT, which would help them better manage their conditions. It answers patient questions, enhancing happiness and lowering the need for human care. ChatGPT can generate interesting and relevant content using natural language processing, depending on the input and user preferences. It facilitates communication between patients, insurance providers, and healthcare professionals. ChatGPT may help provide timely access to pertinent healthcare information to the appropriate parties [31–33].

4. Research objectives

ChatGPT assists healthcare personnel with routine chores like report generation and transcription of medical records. Healthcare providers might save time and concentrate on other crucial duties, including patient care, by automating these procedures using ChatGPT. For instance, a GPT system may be taught to reliably and quickly transcribe patient medical records, freeing up medical staff to spend more time dealing with patients and delivering treatment. It may lessen the possibility of medical record inaccuracies, which might harm patients. To make medical reports and other documents like clinical trials more understandable for patients and healthcare professionals, ChatGPT may be used to summarise them. ChatGPT may translate medical texts from one language to another, facilitating communication and aiding in comprehending crucial information between patients and healthcare providers [34–36]. The primary research objectives of this review-based article are as under:

RO1: - To brief about ChatGPT and its need for healthcare;

RO2: - to study the significant Work Flow dimensions of ChatGPT for the healthcare sector;

RO3: - to brief the typical features of ChatGPT towards the Healthcare domain;

RO4: - to identify significant applications and limitations of ChatGPT for healthcare.

5. Significant work flow dimensions of ChatGPT for the medical sector

The several distinguished dimensions related to chatGPT structure towards the solicitations in the medical domain are highlighted in Fig. 1. It further reflects the patient-related criteria, services and facts, database traits, workflow progress stages, etc. To process the ChatGPT working structure, a streamlined flow of information and knowledge is a must. Fig. 1 exemplifies the different working and progressive steps of the ChatGPT system for supporting the routine needs of the social structure. Further, the database gets sampled, and the process gets concluded by determining the reward model and updating dates the

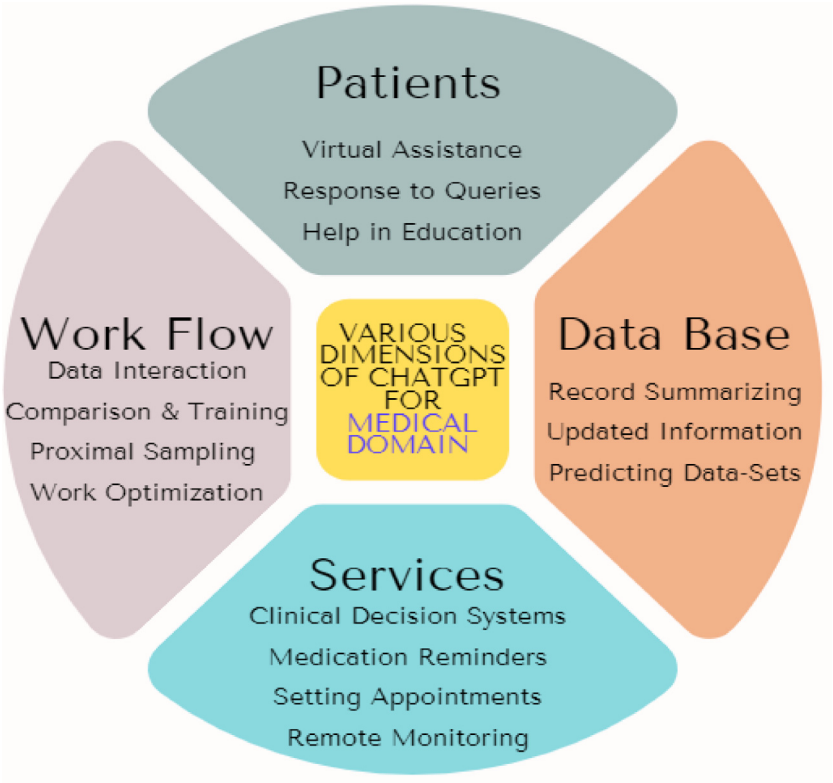

Fig. 1. Associated dimensions of ChatGPT framework for medical domain.

same in the cloud data set [37–39]. Various four associated dimensions are highlighted and discussed with the help of Fig. 1.

Making use of ChatGPT for the creation of clinical decision support systems is one possible use for healthcare. These programmes may review patient information and provide suggestions for treating pain and other ailments. For instance, ChatGPT could examine a patient's medical background, vital signs, and other information to recommend the best anaesthesia or dose. Ensuring they get the best treatment may enhance patient safety and results. Delivering pre-operative instruction is another possible use of ChatGPT in anaesthesia. ChatGPT may be used to provide individualised, evidence-based information to patients who may have questions or concerns regarding their scheduled operation. The treatment of post-operative pain and other symptoms may also be aided with ChatGPT. Personalised pain management advice, for instance, might be given via ChatGPT based on a patient's medical background, level of pain tolerance, and other variables. This could ensure that patients get the best treatment for their unique needs [40–42].

Medical education is another area that is anticipated to see a substantial influence. ChatGPT is a potent tool for promoting learning since it is an AI language model that can comprehend and react to spoken language. Students may get a more profound comprehension of challenging ideas using ChatGPT's interactive learning environment. Students may get immediate feedback, ask questions, and conduct more exciting and individualised subject exploration utilising conversational AI. ChatGPT's advancement in AI has been intriguing and has the potential to change how we interact with technology [43,44] entirely. ChatGPT is a highly accurate AI-powered chatbot that can precisely comprehend natural language and respond to user questions. One of its main advantages is that this technology can provide replies to cues it has yet to be exceptionally trained on. It makes a helpful tool for building chatbots that can have natural conversations with people since it can handle a variety of subjects and circumstances [45,46].

Chatbots for customer support are one possible use for ChatGPT. A ChatGPT-powered chatbot might respond to ranging consumer questions thoroughly and accurately, freeing human customer care professionals to address more complex problems. A chatbot built to deliver information about a specific medical condition or treatment might utilise ChatGPT to create replies in addition to its text creation capabilities. It might also provide replies for a computer programme that aids patients in managing their treatment, such as a virtual assistant who reminds them to take their prescription or gives them details about their health state. In essence, we advise users to utilise the tool as a source of creative inspiration, to generate ideas, and to act as a springboard for later-on, mostly human works. In other words, ChatGPT may provide many suggestions that combine existing concepts and may lead us to a place we would never have considered on our own [47,48].

ChatGPT is a valuable tool for connecting with persons who may not speak the same language or have the same communication preferences since it employs Natural Language Processing, which is taught to interpret and comprehend natural language. ChatGPT has certain clear benefits over conventional customer service methods, including the ability to provide real-time assistance around-the-clock, allowing users to get assistance more quickly. It can provide clients with a more personalised experience by promptly replying to queries, processing several conversations simultaneously, and saving time by understanding linguistic complexity. ChatGPT delivers the precise answers to their questions in detail so that they may know everything about their query, and it is affordable and presents correct answers to our inquiries [49,50]. By employing ChatGPT to gather user input, Open AI aims to make AI systems more natural and safer to engage with Students, professors, and scientists may utilise ChatGPT for writing since it can respond to inquiries and create a document on a subject based on the compilation of material accessible online.

The purpose of ChatGPT is to make our life simpler. ChatGPT has been a ground-breaking innovation that supports these conversations. With this AI chatbot's robust model and research-based learning capabilities provided by the ChatGPT, people can even converse with a bot and get a humanised response back. ChatGPT can completely change how we produce, distribute, and use instructional information in the context of eLearning. Every topic may be researched and learned about by lone learners using ChatGPT. Self-directed learning of this kind may

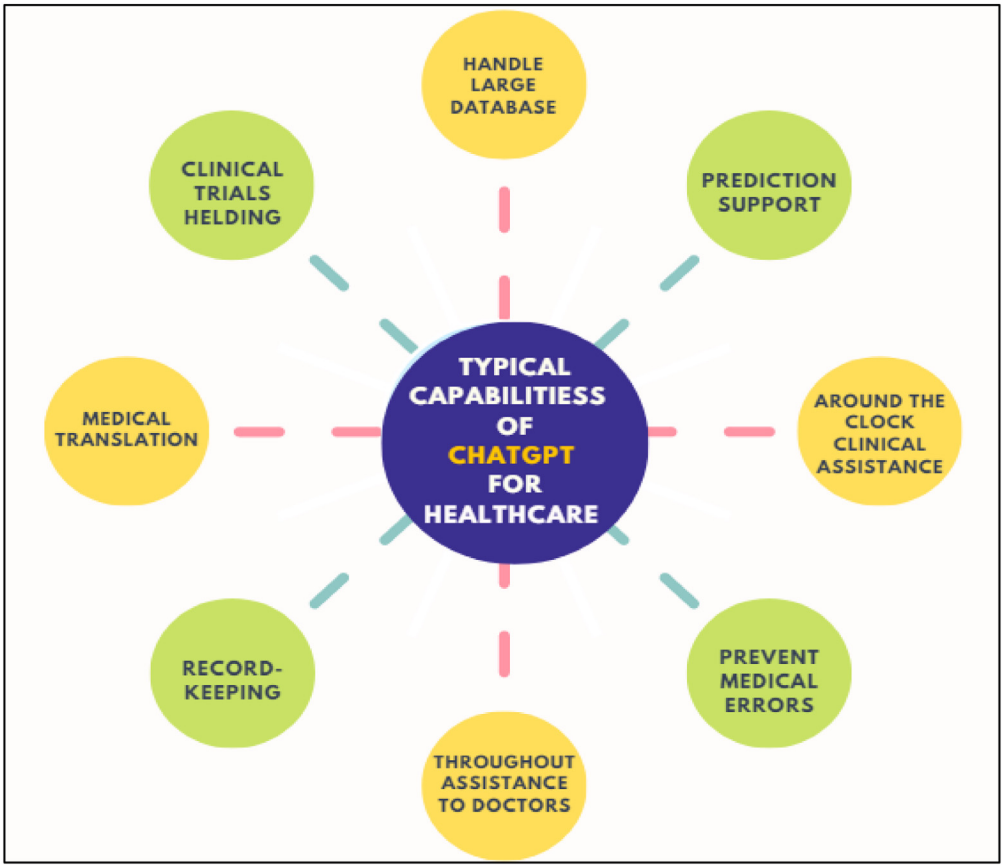

Fig. 2. Typical capabilities of ChatGPT for the healthcare sector.

be very beneficial for enhancing one's knowledge and abilities. Using ChatGPT, medical students may ask questions, get rapid feedback, and get solutions suited to their requirements. The use of ChatGPT may aid students in understanding and remembering what they are learning [51–53].

ChatGPT technology can completely transform eLearning and the process of developing educational materials. It allows training companies to create, evaluate, and change material to ensure it is instructional valid and satisfies business and learning goals. It also enables learners to interact directly with the model to improve their knowledge and abilities. It may help treat post-operative pain and other symptoms and create clinical decision support systems and pre-operative education. While ChatGPT can potentially enhance patient care, it is crucial to consider its limits and utilise it as an addition to, rather than a substitute for, human knowledge and discretion [54,55].

6. Typical features of ChatGPT towards healthcare domain

Fig. 2 explores the various associated typical capabilities, features, and applications of ChatGPT support for the healthcare sector. It includes the features like remembering aspects, prediction support, medical translations, etc. Apart from these different features and capabilities, various limitations have been observed, such as; the sometimes generation of incorrect information that may arise with biased content, etc. [56,57]. In addition to this, several associated other characteristics and classical perspectives of ChatGPT are further represented and elaborated in Fig. 2.

The development of virtual assistants for patients is one instance of how ChatGPT might be used in medicine. These assistants may provide individualised suggestions and counsel based on the patient's medical history, present symptoms, and other pertinent information. For instance, a virtual assistant may advise on managing a chronic ailment like diabetes or advise over-the-counter drugs or home cures for a patient suffering from the flu or cold. Many platforms, including websites, smartphone applications, and voice assistants, may be used to access these virtual assistants. As people may get individualised suggestions and guidance without seeing a healthcare practitioner physically, this can be constructive for patients residing in remote regions or needing help obtaining healthcare. In order to find novel drug targets and develop fresh ideas, ChatGPT may be used to evaluate a lot of scientific material, including research articles and patents. For drug development, this technology is used to train the model on a large body of scientific literature before using the model to provide fresh hypotheses or recommendations for more studies [58,59].

In specific ways, ChatGPT as a language model is a ground-breaking innovation in healthcare, especially in terms of its capacity to comprehend and produce text on various subjects with excellent accuracy. ChatGPT has the potential to be used in a variety of healthcare applications, including automating time-consuming tasks like report generation summaries and note taking, which can save time and improve efficiency; helping patients with symptom-checking, medication management, and appointment scheduling; and supporting patient education, compliance, and self-management of chronic conditions. ChatGPT can be employed in the healthcare industry for several activities, including patient contacts, clinical trial analysis, medication research, and medical recordkeeping. In some ways, ChatGPT's evolution is similar to that of the web browser [60,61]. While the internet existed long before the web browser, it was made more widely accessible by the latter. Similarly, ChatGPT makes AI more approachable by offering a straightforward and user-friendly conversational interface.

The ability to be linked to a variety of platforms, including websites, chatbots, and mobile applications, is another benefit of ChatGPT. This enables a user-friendly user experience and a more seamless technology integration into current systems. For instance, a chatbot coupled

with ChatGPT may respond to customer inquiries, suggest products, or help customers complete transactions. In addition to customer service, ChatGPT has the potential to be employed in several other sectors, such as education and finance. For instance, ChatGPT might be used in the healthcare industry to provide people with individualised information and assistance, such as responding to inquiries about their symptoms or helping them locate a doctor. ChatGPT might be used in the classroom to provide students with individualised coaching and assistance, enabling them to study more interestingly and dynamically. ChatGPT's potential to take the role of human workers in various fields, including journalism and customer service, contributes to its current popularity. Humans can teach the model to carry out previously performed jobs by humans, and they can do so much more quickly and accurately [62–64].

ChatGPT is profoundly influencing the writing sector, as many authors and content producers use the tool to either spark new ideas or enhance their existing works. It is more likely to be used to support and supplement human authors' writing and content-creating efforts. It may give employees more time to concentrate on higher-value jobs that require greater creativity and problem-solving if accepted and utilised correctly. Practical usage of ChatGPT requires unique expertise. Instead of being concerned about how it will affect our work, we must comprehend it and educate ourselves fully. The applications for ChatGPT are many and diverse, ranging from language translation software to chatbots for customer support [65,66]. ChatGPT may also help with content sourcing and curation from various sources, aiding businesses in creating a unified and successful content marketing strategy.

ChatGPT is a natural language processing technology with AI that enables conversational chatbots. Asking the language model for assistance with tasks like composing emails, articles, and code is possible. The basis for medical guidance and treatment is high-quality evidence. In the age of democratic healthcare, patients and clinicians utilise a variety of channels to obtain data that influences their choices. However, at this stage of its development, ChatGPT may need to be sufficiently resourced or set up to provide accurate and objective information. Developers may work on chatbots and voice-based apps using ChatGPT. Developers may evaluate the responsiveness and correctness of their apps in real-time by simulating user interactions. Companies might use ChatGPT to propose products or to provide details about impending deals or promotions. Sales may be boosted, and consumer involvement increased in this way. The ChatGPT programme may also be a personal assistant to assist users with various chores. For instance, a chatbot may generate emails, schedule appointments, alert users about impending deadlines or key events, or even assist with housework [67,68].

7. Typical ChatGPT applications for healthcare

ChatGPT offers support for healthcare providers, which can help reduce wait times and improve patient satisfaction. This can include patient inquiries regarding insurance, billing, and appointments to provide them with the necessary information. Healthcare practitioners needing help in making informed patient care choices might utilise ChatGPT as a clinical decision-support tool [69,70], but with caution. Healthcare workers may use this technology to learn about treatments, drugs, and diagnostic techniques and get help on what to do next. This technology can automate specific processes, increase efficiency in the healthcare industry, and even replace some jobs. Remembering that AI may improve human skills in the healthcare industry and open up new career prospects is also crucial. By using AI in healthcare, professionals may spend less time on routine chores and more on more challenging and valuable duties like patient care, counselling, and cooperation with other healthcare practitioners. ChatGPT may help raise patient safety, lower mistakes, and enhance treatment quality. ChatGPT can be a game-changer because of its extraordinary fluency and inventiveness [71–74]. The significant applications of ChatGPT for the healthcare sector are identified and briefly presented in Table 1.

ChatGPT is anticipated to provide support in many ways to improve healthcare services' sustainability and error-free nature. AI can completely transform healthcare management by simplifying interactions, automating time-consuming chores, and creating more precise and effective procedures for patients and doctors. This helps carry out operations that require human intellect, such as comprehending and interpreting linguistic signals, forming judgements, or learning from data. An AI system with a language model is created primarily to process and comprehend natural language. Language models may create text or reply to user input in a manner that sounds natural and human-like because they are trained on massive datasets of text and utilise ML techniques to understand the patterns and structures of language. ChatGPT can write creative sonnets and tales in their distinctive style, narrate historical events in a famous person's voice, and correct computer programming instructions [75–77].

8. Discussion

ChatGPT can reply to various themes and discussions since it was trained on various text materials, including books, papers, and web pages. ChatGPT may be used as a language model for various things, such as chatbots, question-and-answer platforms, and language translation. The capacity of Chat GPT to produce superior, human-like replies to text prompts garnered it great recognition and appeal, even though it is simply one of several AI technologies created by OpenAI. It has been used in several settings, such as social networking, educational applications, and customer service. Several physicians have tested ChatGPT to determine whether the AI-based chatbot can assist with doctors' routine chores. ChatGPT may provide patients with round-the-clock assistance with lesser human involvement. This technology can carry out many challenging activities for managing complex medical and clinical data. It might aid in describing and quantifying human–AI interactions and standardising experimental techniques.

ChatGPT may soon be widely used in clinical practice, with various applications in almost all medical specialities, such as patient communication and clinical decision assistance. Clinicians began experimenting with ChatGPT as a result of its outstanding success. Customer support, marketing, education, and entertainment are used for ChatGPT. They may be used to provide individualised customer service, such as making product suggestions specific to the consumer's needs or replying to their enquiries. Moreover, they might be used for marketing activities like producing material on social media or offering automated customer service. ChatGPTs may be used in the classroom to support student learning by giving them individualised feedback or direction. Compared to conventional rule-based chatbots, it has been trained on a vast corpus of text data, enabling it to provide more correct and coherent responses.

Several enquiries may be handled simultaneously, and rapid and effective solutions can increase user experience and patient satisfaction. ChatGPT might be a cheaper alternative to employing human customer support agents for businesses trying to enhance customer service. It has access to a wealth of knowledge and information on various subjects since it has been trained on a significant quantity of text data. It can create content, such as summaries, articles, and product descriptions, which increases productivity by obviating the requirement for human content generation. It is a helpful tool for corporations and organisations with a worldwide presence since it can translate text across languages. ChatGPT may be used to deliver information and answers on various subjects. It may be used to assess and classify the sentiment of text data, giving companies and organisations valuable insights [78].

The development and use of Chat GPT are still in their early phases, and over the following years, it is anticipated to continue to advance quickly. Adoption will rise as more people learn about its possibilities and use it, resulting in more remarkable advancements and inventions. ChatGPT and other technologies promise to boost productivity, communication, and efficiency at work and elsewhere. By delivering prompt

Table 1
ChatGPT applications for the healthcare domain.

S. No	Applications	Description
1.	Educate patients	• Patients may utilise ChatGPT to educate themselves on their health and problems, giving them the knowledge, they need to decide on their treatment. • This may respond to patients' queries and provide them with details on procedures, drugs, and dietary adjustments; rule-based expert systems and knowledge graphs are utilised for activities including diagnosis, therapy, planning, and drug development. • In specialities, including radiology, pathology, and ophthalmology, AI-powered medical imaging systems are employed for tasks like picture categorisation, segmentation, and diagnosis. • AI-powered robots are employed for procedures, including surgery, physical therapy, and patient monitoring. • ChatGPT in healthcare can increase the efficacy and efficiency of medical treatment. • One of the possible issues with using AI in healthcare is that it can dehumanise it, putting more emphasis on data and algorithms than the needs and values of patients and healthcare professionals. • The tool's capacity to produce lines of code is another characteristic that software professionals will undoubtedly value greatly. • If the users accurately articulate the issue statement, ChatGPT can produce a code snippet. • ChatGPT's bot can convert complex technical topics into clear and understandable words for everyone.
2.	Clinical studies	• ChatGPT may be utilised in clinical studies to assist with data gathering • The chatbot can help people to provide information about clinical trials. • A team of specialists, comprising data scientists, engineers, healthcare workers, and ethicists, are needed to develop and deploy AI models in the healthcare industry, which might create new jobs. • It is crucial to remember that any possible job displacement brought on by medical AI should be minimised by offering chances for healthcare employees to get new training and skills and establishing new jobs in fields like data science and AI research and implementation. • By offering several methods of articulating the exact words, ChatGPT may aid in interpreting patients' open remarks. • In order to establish a conversational mechanism for patients to communicate their symptoms in English, we could utilise the public version of ChatGPT to learn terms that potentially map to symptoms.
3.	Monitor patients remotely	• Medical personnel may remotely monitor patients using ChatGPT to maintain tabs on their health. • Patients may be reminded to check their vital signs by the chatbot, and they can alert medical personnel if anything changes or causes them to worry. • Those searching for help with routine business chores like composing emails, producing reports, and establishing other communications find ChatGPT increasingly popular. • In order to provide appropriate output, it uses AI to learn from prior encounters and sample texts. Because of this, creating material can be done quickly and easily. • The creation of conversational and interactive chatbot experiences is also possible with ChatGPT. • Anyone may build chatbots with an understandable conversation flow that responds to natural language questions by utilising ChatGPT. • This is accomplished by combining domain-specific training with OpenAI's GPT language model.
4.	Accessing information regarding health	• In order to obtain instant access to information about their health and problems, patients may utilise ChatGPT as a virtual assistant. • The chatbot will provide accurate and up-to-date replies to queries from patients about their symptoms, medical procedures, and prescription medications in different languages. • Text in various forms, including articles, tales, and social media postings, may be generated using ChatGPT. • ChatGPT may be used to summarise content in many languages and translate text from one language to another. • ChatGPT can classify and categorise text by determining the tone of a social network post. • It may pull the most critical details from a lengthy text and show them abbreviated. • Thus, to create chatbots that can comprehend and react to natural language input from patients and carers, ChatGPT may be utilised. • These chatbots can provide symptom checking, triage, scheduling, and other fundamental healthcare information. • ChatGPT is also for quizzes, language translation, paragraph production, etc.
5.	Medical suggestions and counselling	• ChatGPT can provide patients with medical suggestions and counselling based on their symptoms and medical background. • The chatbot can help patients make educated choices regarding their health and provide them with peace of mind. • A chatbot that employs ChatGPT to summarise patient medical data for healthcare professionals, including information on diagnosis, treatment, and progress. • For healthcare workers, patients, and researchers, a chatbot that employs ChatGPT for medical language translation may translate medical terminology and phrases from one language to another. • A chatbot that leverages ChatGPT to help people and medical professionals by reporting adverse events associated with medications and other items. • The chatbot may help users complete required forms and documents, walk them through the reporting process, answer questions regarding the event and the reporting requirements, and provide general information about it. • Using ChatGPT, the clinical safety chatbot can help medical practitioners to report adverse events connected to clinical trials, such as adverse responses, significant adverse events, and unforeseen issues.
6.	Schedule appointments	• ChatGPT allows patients to schedule appointments with doctors, making getting the treatment they need at a convenient time easier. • Patients may ask the chatbot for a list of available appointment slots, which might help them choose a time that works for them. • The ChatGPT model must be trained and tuned by professionals knowledgeable in ML methods and methodologies. • For the chatbot to utilise an extensive collection of medical data and queries to answer user input, data scientists or analysts with expertise in data analysis methods, including data cleansing, data visualisation, and statistical analysis, are required. • The chatbot must be implemented, integrated with other systems, and optimised for performance by software developers familiar with programming languages. • For the chatbot to have a user-friendly interface, such as a website or mobile app, that enables users to engage with the chatbot effortlessly, user interface designers with expertise in user interface design concepts are required.

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Table 1 (*continued*).

S. No	Applications	Description
7.	Help to identify patient symptoms	• ChatGPT helps patients identify their symptoms and decide on the best action by acting as a symptom checker. • The chatbot may ask patients about their symptoms and provide them with a list of possible diagnoses and instructions on what to do next. • ChatGPT is a significant advancement in AI technology and has the potential to enhance how humans communicate with machines. • It will be crucial for academics and industry leaders to work together as the technology develops and matures to ensure it is used for the betterment of society. • ChatGPT undergoes rigorous training on vast volumes of data to understand linguistic patterns. • The procedure guarantees accuracy while speculating the following words in a string of words, where supervised and reinforcement learning techniques are used to train and improve ChatGPT. • Human specialists train the computer to make judgements that benefit people by providing plausible and moral replies. • The conversation capabilities of ChatGPT can be developed to answer follow-up inquiries, confess its errors, dispute faulty premises, and reject unsuitable requests.
8.	Medication reminders	• Patients may use ChatGPT to get medication reminders, encouraging them to take their prescriptions as directed. • Patients may get reminders on when to take their drugs and information about side effects and possible drug interactions from the chatbot. • It is possible to produce content rapidly and effectively using ChatGPT. Also, it may be utilised to provide distinctive, captivating content customised to specific audiences. • ChatGPT may improve personalisation; thus, examining user data may provide tailored suggestions for goods, services, and information. • Moreover, it may be utilised to develop virtual assistants that are catered to user requirements. ChatGPT's rapid access to knowledge and insights may revolutionise how organisations run. • Real-time analytics and suggestions may be provided with this technology and used in conjunction with business apps to assist organisations in making better choices and remaining competitive.
9.	Developing patient-specific treatment programmes	• Developing patient-specific treatment programmes is another possible use for GPT in the medical field. • A GPT-powered system may provide a personalised treatment plan by looking into a patient's medical history, present symptoms, and other characteristics, as well as the patient's particular wants and preferences. • Patients with unusual or complicated diseases that need specialist treatment may find this extremely helpful. • For instance, depending on a patient's medical history and other criteria, a GPT system may suggest a particular mix of drugs or treatments most likely successful for that patient. • This might lower the possibility of adverse responses or other issues and guarantee that patients get the best treatment possible for their circumstances. • It opens up new avenues for creativity and artistic expression by making it possible to produce creative material like music, poetry, and visual art. • It has several potential uses in fields including customer service, virtual assistants, and more because of its massive size and human-like replies. • Deep learning, reinforcement learning, natural language processing, and computer vision are just a few of the cutting-edge research specialities of OpenAI.
10.	Medical terminology and ideas	• To increase ChatGPT's comprehension of medical terminology and ideas, which may be used to extract structured data from unstructured materials like electronic health records (EHRs) and clinical notes, ChatGPT can be fine-tuned on medical texts. • A vast corpus of text data is used to train the Chat GPT using an unsupervised learning approach. • Pre-training involves teaching the model to recognise correlations and patterns in text data by foretelling the next word in a string of words. • When pre-training is finished, the model may be fine-tuned to perform a particular job, such as producing text or responding to inquiries. • In order to fine-tune a model, a smaller dataset relevant to the current job must be used. • Based on its training data, Chat GPT predicts the most probable set of words that will come after a prompt to produce a response. • Longer paragraphs of text and shorter replies may be produced using the approach. • Chat GPT combines attention techniques and language modelling to produce replies. • The attention mechanisms allow the model to concentrate on various sections of the input sequence while creating its answer.
11.	Digital assistant for doctors	• ChatGPT might be trained to serve as a digital assistant for doctors by using AI and ML. The system would collect crucial data from patient records, classifying information including test findings, family history, symptoms, and current medications. • Physicians can evaluate patient requirements more quickly now that this information is easily accessible by using AI. This feature enables a sharper focus on the crucial components of patient care. • Training ChatGPT to function as a virtual assistant for doctors is possible. • From patient records, it may extract essential data that can be used to populate reports with information such as family history, symptoms, present medicines, allergies, test results, etc. • By succinctly putting the information at their fingertips, doctors would have more time to visit patients and concentrate more on patient care. • Chat GPT might be tailored for specific sectors or use cases to serve those customers' requirements better. • The ability to handle other languages would increase Chat GPT's usability for users all across the globe. • Chat GPT might be improved better to comprehend a conversation's or task's context, resulting in more detailed and pertinent replies. • For the demands of organisations of various sizes, from tiny companies to massive corporations, Chat GPT may be scaled up or down. • There are several chances for innovation and cooperation in the future for ChatGPT.

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Table 1 (*continued*).

S. No	Applications	Description
12.	Enhance communication	• The capacity of ChatGPT to enhance communication, where the natural language processing tool can comprehend and react to patient enquiries and concerns, is one of the key advantages of utilising ChatGPT in healthcare. • This lessens the burden on healthcare personnel. • As healthcare organisations ramp up their digitalisation, ChatGPT will be a resource for everything from patient communication to automating back-office tasks. • The business uses ChatGPT to create and analyse customer surveys to learn more about consumer requirements and preferences. • The extensive survey data could be analysed using ChatGPT, which provided insightful information on consumer behaviour and industry trends. • Businesses are employing ChatGPT to examine competitor data and provide insights into their market positioning and business plans, as a result, they could keep one step ahead of the competition and confidently decide on their marketing tactics. • To manage client enquiries and provide real-time information on the shipment status, delivery dates, and other relevant factors, ChatGPT may be coupled with chatbots or messaging services.
13.	Assistance to diabetic patients	• ChatGPT may be used to provide rapid and individualised assistance to diabetic patients. • A trained diabetes educator is often the ideal person to answer these concerns or questions since many persons with diabetes may have them. • It might be challenging for educators to be accessible at all times to respond to these queries. By giving patients a chance to get assistance and knowledge even when their educator is not physically there, ChatGPT may help close this gap. • Moreover, ChatGPT may create individualised meal plans and locate recipe suggestions based on a patient's unique health requirements and preferences. • It may be used to assist in the resolution of specific issues or to motivate patients to adopt a healthy diet and lifestyle. • AI-powered chatbots can provide round-the-clock customer service and quickly respond to client enquiries. • Chatbots may help compile insightful data about prospective diabetic patients and provide data-driven insights to help patients, thereby allowing them to customise doctors' strategies.
14.	Rapid access to medical information	• ChatGPT's rapid access to medical information has the potential to enhance healthcare. • Also, physicians and nurses can access the most recent findings and treatment suggestions by incorporating the language model into healthcare apps. • With ChatGPT, developers may create code more quickly and effectively using code snippets generated based on specific programming languages and paradigms. • It is crucial to remember that this technology cannot replace physical work, soft skills, or the development and maintenance of relationships. • ChatGPT can respond to follow-up queries, acknowledge errors, refute false assumptions, and reject unsuitable requests, but the final word has to be from the doctor.
15.	Help doctors reply to insurance claims.	• ChatGPT might help doctors reply to insurance claims much more quickly. • A doctor may utilise an AI tool to create a response and rapidly update it before submitting it, saving them time and effort. • Early adopters have been utilising ChatGPT to help with tedious activities, including drafting sick notes, patient letters, and letters requesting payment from medical insurance for specific pricey patient prescriptions. • Chat GPT is developed using a vast amount of online content. • It tries to mimic human writing and may serve several functions in medical care and scientific study. • This necessitates that data be continuously fed back into chatbot neural networks. • When identifiable patient data is entered into ChatGPT, it becomes a part of the database that the chatbot will eventually utilise. • Doctors and their employees may spend less time negotiating insurance approvals, creating recommendation letters, and dealing with claim rejections. • By providing a template and a set of instructions, ChatGPT can produce code rapidly and precisely.
16.	Individualised health advice and suggestions for patient care	• AI-powered chatbots may provide individualised health advice and assistance in identifying medical issues. • Moreover, AI-driven chatbots may help patients have a better healthcare experience by automating administrative activities like appointment scheduling and medication refills. • ChatGPT's sophisticated language processing capabilities make it the best tool for automating routine operations. • With data from tests, laboratories, vital signs, and symptoms available, this technology may be taught to match the information and provide doctors with suggestions for patient care and treatment options.
17.	Keep patients informed	• Doctors may keep patients informed throughout therapy by transmitting information to patients and utilising the ChatGPT bot to translate complicated medical records into understandable English. • Due to their hectic schedules, physicians are sometimes difficult to reach throughout the workday. • Answers to commonly asked questions about diagnosis and disease management are available on ChatGPT. • AI development has revolutionised computer science and changed how people interact with technology. • The ChatGPT, which can communicate with people in a nearly human-like way, is one of the most extraordinary instances of AI. • ChatGPT can produce human-like text in response to instructions given to a web browser in seconds, and this writing may be in various formats.
18.	Mental health-related contexts	• ChatGPT may be used in several mental health-related contexts, such as diagnosing mental diseases or supporting treatment sessions. • Without the need for expert therapists, ChatGPT may provide individualised replies catered to people seeking therapy. • Also, physicians and counsellors might diagnose their patients' illnesses more accurately by recognising a person's conversational patterns and constructing specialised therapies over time. • By using ChatGPT to its total capacity, we may reimagine how we connect with our interior thoughts and discover sympathetic paths to recovery. • ChatGPT has the potential to be a powerful tool for improving mental health and well-being. • When utilised properly, it may improve communication, help individuals comprehend their ideas and feelings, and teach them coping mechanisms for challenging circumstances.

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Table 1 (*continued*).

S. No	Applications	Description
19.	Revolutionise the digital health sector	• ChatGPT has the power to revolutionise the digital health sector and lessen physician burnout. • By automating time-consuming activities, freeing up time to perform essential responsibilities, and boosting patient communication, ChatGPT may enhance the entire experience for both doctors and patients. • The use of ChatGPT in healthcare is only the start of a new age of AI-assisted medicine, but for now, it is imperative to maintain a human eye on the results it produces. • AI is used in a plethora of different ways. Hence, its applications appear limitless and full of potential in many fields, widening the range of options and indicating a promising future. • ChatGPT will continue to improve its capacity to discern human language and provide more sensible and appropriate responses. • The model may get even "smarter" and better at responding to a broader variety of questions and requests by applying more current ML methods and training on brand-new datasets. • ChatGPT has a wide range of possible future developments, and it is fascinating to see the app's continuous evolution and improvement. • In reality, ChatGPT elaborates its responses using sentences that are likely to be recognised as such by a person.

and correct answers to frequent questions and actions, including making plans or gathering information, Chat GPT may help individuals save time and effort. It may increase client happiness and loyalty by giving prompt, individualised solutions to client concerns. Internet search is one of ChatGPT's most often cited benefits. A straightforward question using ChatGPT often yields a straightforward and unambiguous response, which Google, despite all of its algorithms, seldom matches. ChatGPT was trained on a large corpus of conversational text and used the GPT paradigm of operation. As a result, it can answer questions and deliver information in a way that is practically identical to a human discussion.

Doctors may use this technology to instruct medical students and provide answers to their inquiries excitingly. The production of tests or quizzes is one possible educational use for ChatGPT. This network is built from several transformer blocks that analyse the input text and provide predictions. The network has self-attention mechanisms that allow one to evaluate the significance of various words and phrases about one another and the conversation as a whole. ChatGPT is an excellent tool for developers who want to create a new feature or enhance an existing one since it can comprehend and evaluate complicated technological ideas. A novice programmer may learn general programming concepts and computer science concepts with the aid of ChatGPT. It may provide knowledge of the advantages and disadvantages of different coding languages, the most efficient ways to deal with coding issues, and the best practices for software development. ChatGPT's advantages for companies are a game-changer that will help them better their minor operations and continually remain one step ahead of the competition.

In order to help with medical coding and billing, ChatGPT may provide recommendations for the better treatment of the patients as per the patient's symptoms and medical history. It automates clinical encounter reports and discharge summaries, saving patient care time. This is helpful for real-time, evidence-based clinical decision assistance for healthcare practitioners.

9. Limitations of ChatGPT in healthcare

With technological development, there is potential to influence society and the economy significantly. Thus, this AI tool has to be well thought out before any application. It could need help comprehending complicated or abstract ideas, which might result in errors or misinterpretations. The large quantity of data that ChatGPT has access to poses ethical and privacy issues. Examples include the risk of misuse or illegal access to private data. Some of the significant limitations we foresee are as follows.

- One of the significant limitations is that it may be used to propagate false healthcare information or fake news since the model might need to be able to tell which sources are trustworthy and which are not.
- This might promote the spread of inaccurate information and inflict damage on certain people or groups, which could have detrimental effects on society.
- ChatGPT could automate employment by providing chatbots and customer support personnel, which lead to healthcare job losses and a decline in the need for human involvement.
- A large number of ethical issues exist with using this smart chatbot in patient care and medical research.
- There are various issues, such as, predominantly medical ethics, privacy, consent, medical care standards, dependability, and equality.
- The implementation of ChatGPT in healthcare and research has ethical ramifications, although they still need to be better understood.
- ChatGPT puts users in danger of violating their privacy. The foundation of the doctor–patient relationship's trust is the confidentiality of patient information. This privacy is in danger from ChatGPT, a concern that weaker patients cannot fully comprehend.
- Patients may need to comprehend the implications of their agreement fully. Some people may still need to be asked for permission. As a result, medical professionals and organisations risk facing legal action.
- ChatGPT cannot even provide personalised advice to diabetic patients based on their blood sugar and medication data.
- As a language model, ChatGPT cannot prescribe treatments to patients or access their medical records.
- Responses from the ChatGPT are created automatically and can only sometimes match the subtlety or tone of a human answer, which might make the user experience less individualised.
- ChatGPT could not comprehend the context of a job or discussion as effectively as a person, which might result in less accurate or pertinent replies. Like with any automated system, there is a chance that ChatGPT replies may include mistakes or inaccuracies, which may cause confusion or annoyance for the user. If sensitive data is exchanged or kept inside the system, using Chat GPT may give rise to worries about data privacy and security.
- ChatGPT may provide inaccurate information or biased replies that can have a detrimental effect on the overall calibre of the code created is one of the main drawbacks for developers. The code may need to be fixed, usable, or unnecessarily complicated.
- The critical thinking and problem-solving skills humans are absent in ChatGPT. This might cause issues in several applications where ChatGPT could respond incorrectly because it needs help to grasp the subtleties of a query. The inability of ChatGPT to develop code that needs many contexts is another one of its drawbacks. To reach the intended outcome, developers would have to provide the code with every piece of information possible, which could be more practical.

- ChatGPT can produce straightforward code in various programming languages when given instructions, but it cannot handle complex issues. ChatGPT has yet to be widely used by companies to create programmes. Since the technology is still in its infancy, handling sophisticated coding jobs will take much work.
- ChatGPT must improve its capacity to process sophisticated questions or provide information tailored to a given environment. Additionally, since it cannot comprehend emotions or provide emotional support, the software may be unable to cope with emotional reactions or understand users. This may be a drawback when consumers seek emotional support, such as in mental health or counselling services.
- ChatGPT can provide human-like replies and has access to much information, but it needs a higher level of common sense. This technology could provide meaningful or correct answers to specific queries or circumstances for health-related issues, but not to all.
- ChatGPT can access much information, but it can only access some of the knowledge that doctors possess. It may not be able to respond to inquiries regarding very specialised or narrow subjects, and it might not be up to date on current advancements or changes in particular disciplines.

10. Future scope

The technology behind ChatGPT is still being developed and improved, and OpenAI has already published multiple versions of GPT with progressively better speed and features. In the upcoming days, this technology will be one of the most important in future healthcare development. It will be used in healthcare to get precise outcomes. The ChatGPT AI system does not yet compare its findings to real-world data, but real-world data integration is something anticipate in the future. Recruiters will use ChatGPT to automate several steps in the hiring process, improving efficiency and reducing time and costs. ChatGPT will help travellers quickly and conveniently book flights, hotels, and other forms of transportation. It may provide real-time information on weather, local events, and flight status, making it more straightforward for passengers to plan their travels and remain informed. Unlike any other technology, it can comprehend and produce text resembling human speech, making it adaptable and helpful for many healthcare purposes. ChatGPT is sure to impress and please, whether we use it for customer support, content production, or pleasure. It is thus a highly beneficial and effective tool for everyone. ChatGPT can be the future of healthcare eLearning, from creating text-based information to offering individualised learning experiences. Training companies must collaborate with a solution provider that provides integrated learning platform solutions driven by generative AI and GPT to fully realise these technologies' potential. ChatGPT is improving the state of all AI technologies. Deep learning's capabilities are being pushed to their limits to pave the path for future developments in AI technology.

11. Conclusion

ChatGPT is an effective tool for producing human-like text replies to questions. Its capacity to produce well-organised and educational text responses has made it a popular option for various applications. ChatGPT was developed using a vast amount of online content. ChatGPT offers several applications in the healthcare industry and benefits both patients and medical personnel. It tries to mimic human writing and may serve several functions in healthcare. The healthcare industry, which is constantly evolving to meet patients' increasing requirements, is one of the industries with the quickest rate of development globally. Because of technology improvements, ChatGPT is becoming a crucial tool for healthcare providers, offering a range of benefits to patients and healthcare professionals. The healthcare sector can use ChatGPT as it is considered cutting-edge conversational AI due to its tremendous training experience and exceptional natural language comprehension. The basis for medical guidance and treatment is high-quality evidence. In healthcare, patients and clinicians utilise a variety of channels to obtain data that influences their choices. However, at this stage of its development, ChatGPT may need to be sufficiently resourced or set up to provide accurate and objective information. Based on input data, ChatGPT may automatically produce medical reports, including radiology reports, pathology reports, and discharge summaries. Medical research articles may be analysed using ChatGPT to spot significant ideas and patterns and aid in the hunt for novel approaches. The data from adverse event reporting may be fine-tuned in ChatGPT to find patterns and trends that can be utilised to improve patient safety. Using the dataset, the ChatGPT model may be trained to comprehend user input naturally and accurately for healthcare. However, this AI tool cannot replace a doctor. There are several limitations pertaining to responsibility, medical ethics, legal framework, interpretation of data and variations in the human anatomy and responses.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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