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ChatGPT's Role in Improving Education Among Patients Seeking Emergency Medical Treatment

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Providing appropriate patient education during a medical encounter remains an important area for improvement across healthcare settings. Personalized resources can offer an impactful way to improve patient understanding and satisfaction during or after a healthcare visit. ChatGPT is a novel chatbot— computer program designed to simulate conversation with humans— that has the potential to assist with care-related questions, clarify discharge instructions, help triage medical problem urgency, and could potentially be used to improve patient-clinician communication. However, due to its training methodology, ChatGPT has inherent limitations, including technical restrictions, risk of misinformation, lack of input standardization, and privacy concerns. Medicolegal liability also remains an open question for physicians interacting with this technology. Nonetheless, careful utilization of ChatGPT in clinical medicine has the potential to supplement patient education in important ways. [West J Emerg Med. 2024;25(5)845–855.]

INTRODUCTION

Effective communication and counseling between clinicians and patients is crucial for high-quality healthcare, particularly in the emergency department (ED) where time constraints and evolving diagnostics can complicate discussions about current and post-hospital care. This makes patient education an important gap to address. The urgency and complexity of emergency cases often hinder comprehensive information delivery, leaving patients' questions unanswered. Inquiries about their condition, treatment options, and prognosis are vital for patient understanding and engagement in decision-making. A systematic review examining the factors that influence the patient experience in the ED highlighted physician-patient communication as the most common factor affecting patient satisfaction.[1] Addressing these concerns not only boosts satisfaction but also empowers patients, improving health outcomes.

Effective discharge instructions are essential for a patient's post-emergency care, as ambiguity or inadequate explanation can result in confusion, noncompliance, and subsequent readmission.[2,3] A recent study revealed that 24% of patients do not fully understand their follow-up plan, 64% struggle to comprehend their return-to-ED instructions, and 42% do not receive complete discharge instructions.[3] Improving discharge communication can enhance transition to follow-up care, thereby improving patient care outcomes and reducing avoidable readmission. In addition to communication challenges, patients may struggle to identify the most appropriate type of care for their conditions. The ED often sees cases that could be more effectively managed in primary care or urgent care settings. About 13–27% of all ED visits are considered non-urgent in nature, resulting in approximately $4.4 billion annual cost.[4] Identifying factors that contribute to unnecessary emergency care utilization can aid the development of targeted interventions and educational initiatives aimed at redirecting patients to more appropriate avenues of treatment.

Furthermore, increasingly diverse patient populations bring language barriers to the forefront of care in the ED. Patients with limited English proficiency often face obstacles in understanding their diagnoses and treatment plans. One

studied showed only 52% of non-English speakers were satisfied with their ED visit, compared to 71% of English speakers.[5] Strategies to reduce the inequitable impact of language barriers has obvious benefits for patient safety and outcomes in the ED.

One method to address these limitations could be clinical application of a machine learning (ML) large language model (LLM), such as ChatGPT (OpenAI, LP, San Francisco, CA). An ML-based chatbot can learn from a vast array of training data and user interactions to improve performance and efficacy of its delivered communication. In recent performance evaluations, ChatGPT scored above the national average on publicly available renditions of Step 1, Step 2-Clinical Knowledge, and Step 3 of the United States Medical Licensing Exam (USMLE).[6] The model's USMLE performance continues to improve with new updates, such as GPT-4, which additionally offers image-analysis capabilities.[7] Models are also being used to train medical students and prepare them for clerkships.[8–10] These benchmarks demonstrate ChatGPT's fluency with basic medical information at the knowledge level of a medical school graduate.

Patients often undertake an internet search of medical topics before or after speaking with a physician. However, with a vast array of information and misinformation available on the internet, physicians and other healthcare professionals remain an important interface to source reliable medical knowledge. Here, we evaluate the potential role that LLMs like ChatGPT could have as a personalized educational resource for patients seeking emergency medical treatment.

CHATGPT: HOW IT WORKS

ChatGPT is a text-based chatbot that facilitates user interaction through natural language. The ML model for the publicly available versions, GPT-3.5 and GPT-4, were trained on written text drawn from a vast spectrum of online databases. Pretraining enables the models to construct a robust linguistic framework. Further conditioning includes assignment-specific adjustments, human feedback that can bolster its conversational abilities, and rigorous testing to ensure resilience against challenging user queries. This process is critical for aligning the model's output with nuanced human dialogue, enhancing its capacity to provide precise and contextually appropriate responses.[10]

GPT-4 is the latest iteration of this LLM, with an enhanced architecture that not only understands and generates textual content but also interprets and responds to visual input.[11] Furthermore, while experimental features in GPT-4 include the potential for current internet data, such capabilities have not been broadly released to users. The broader implications of this limitation, including the balance between model autonomy and the necessity for human oversight, are examined further in the section on technical

restrictions. Nevertheless, the current capabilities of ChatGPT are an important leap toward a collaborative role that humans and AI systems will share in navigating complex real-world applications.[12]

PATIENT EDUCATION BENEFITS

The ED is a setting with a particularly high demand for efficient and clear patient education at discharge given the potential reappearance or sequelae of conditions requiring emergent evaluation. However, the ED also often imposes a high degree of constraint on patient-clinician interaction time. Even in the setting of low-acuity conditions, an observational study showed the combined amount of time physicians, nurses, and technicians spent with patients once they are assigned to a bed was about 25% of total patient length of stay.[13] The factors underlying limited interaction time are multifactorial, but often-cited contributing reasons include patient volume and high load of documentation requirements. Offering a resource that is adaptive and responsive to patient concerns relevant to their specific situation is an important gap in the ED. ChatGPT can provide an interactive modality that is personalized to meet this gap for the healthcare education needs of patients and their clinicians.

Care-Related Questions

ChatGPT may offer multiple benefits for patients in the ED. It can quickly give personalized responses to queries on a wide range of healthcare topics. For example, the software

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Population Health Research Capsule

What do we already know about this issue?
Current patient education in the ED is inadequate, often leading to misunderstanding and noncompliance with post-care instructions.

What was the research question?
How can the chatbot ChatGPT improve patient education in the ED setting?

What was the major finding of the study?
ChatGPT helps triage, clarify discharge, and provide care instructions.

How does this improve population health?
ChatGPT can enhance patient education, improving comprehension and adherence to follow-up care, reducing unnecessary ED visits and enhancing overall outcomes.

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can provide purpose- and risk-based information about procedures a patient or their family member may undergo during an ED encounter (Figure 1A). ChatGPT offers background information about the procedure and refers to the care team for further encounter-based questions and concerns. The information provided about a procedure, such

Figure 1A: General Medical Care Questions	
Input	
I am currently in the emergency department and my doctor says my husband needs a CT-angiogram. What is that and why does he need it? Is it risky?	
GPT-3.5 Response	**GPT-4 Response**
A CT angiogram, also known as a computed tomography angiogram, is a medical imaging test that uses X-rays and a special dye to create detailed images of the blood vessels in the body, including those in the heart and lungs. This test is often used to help diagnose or evaluate conditions that affect blood flow, such as blood clots, aneurysms, or pulmonary embolism. Your doctor may have recommended a CT angiogram for your husband if he suspects that your husband may have a condition that affects the blood vessels, or if he needs further evaluation to confirm a diagnosis. The test may also be used to monitor the progress of treatment for certain conditions, such as aneurysms. A CT angiogram is generally considered safe, but like any medical procedure, there are some risks involved, including exposure to radiation and an allergic reaction to the contrast dye. However, the benefits of the test usually outweigh the risks, especially when used to diagnose or treat serious medical conditions. Your doctor will provide you with more information about the procedure and what to expect, including any risks or potential complications. If you have any questions or concerns, be sure to discuss them with your doctor or the medical staff before the test.	I'm sorry to hear that your husband is in the emergency department, and I hope he receives the best possible care. A CT angiogram is a medical imaging test that combines a CT scan with an injection of a contrast material to produce detailed images of blood vessels and tissues in a part of your body. "CT" stands for computed tomography, which is an advanced form of X-ray that takes multiple images from different angles and then uses a computer to create cross-sectional views of the inside of the body. When these images are focused on the body's blood vessels, it's known as an angiogram. Doctors may order a CT angiogram for a variety of reasons, including but not limited to: 1. **Diagnosing aneurysms** (outpouchings of a blood vessel wall that can be at risk of rupture) 2. **Identifying blockages or other abnormalities in blood vessels** that could be responsible for conditions like stroke, ischemia, or other forms of vascular disease. 3. **Evaluating blood vessels after surgery** to ensure they are functioning as intended. 4. **Detecting tumors** in certain parts of the body, since they often have a distinct blood supply. 5. **Evaluating the condition of blood vessels in patients with trauma**, to detect injury or bleeding. Regarding risks, CT angiograms are generally safe, but as with any procedure, there are some risks and considerations: 1. **Allergic Reaction to Contrast Dye**: Some people may have an allergic reaction to the iodine-based contrast dye used in the procedure. It's important to tell your doctor if your husband has had a prior reaction to contrast material or has severe allergies in general. 2. **Kidney Function**: The contrast dye can sometimes cause kidney damage, particularly in people who already have kidney problems. Your husband's doctors will likely check his kidney function before proceeding with the test. 3. **Radiation Exposure**: CT scans involve exposure to radiation, which is a concern, especially if someone has had multiple scans over time. However, the diagnostic benefits often outweigh the risks, especially in emergency situations. 4. **Pregnancy**: CT angiography is usually not recommended for pregnant women due to potential risk to the unborn baby from radiation exposure. The decision to proceed with a CT angiogram is based on a careful consideration of risks versus benefits. In an emergency setting, if a doctor recommends a CT angiogram, it is often because they believe that the immediate benefits of diagnosing a potentially serious or life-threatening condition outweigh the risks associated with the procedure. I hope this explanation helps you understand why this test might be necessary. Please do ask the medical team any questions you have; they are there to help and support you both through this. If you have any concerns about your husband's health condition or the procedures being recommended, don't hesitate to discuss them with the medical staff.

Figure 1B: General Medical Care Questions	
Follow Up Question	
The doctor said my wife has heart failure and needs to start a medicine called milrinone, what does that mean?	
GPT-3.5 Response	**GPT-4 Response**
Milrinone is a medication used to treat heart failure. Heart failure occurs when the heart cannot pump enough blood to meet the body's needs, and milrinone works by improving the heart's ability to contract and pump blood. Milrinone is typically given through an intravenous (IV) Infusion in a hospital setting, it can improve the symptoms of heart failure, such as shortness of breath, and increase the amount of blood pumped by the heart. It's important to follow your doctor's instructions for taking milrinone and to attend all scheduled appointments to monitor your wife's condition and adjust the treatment plan if necessary. It's also important to be aware of potential side effects of the medication, such as low blood pressure or an irregular heartbeat, and to notify your doctor if any occur.	I'm not a doctor, but I can provide you with some general information about heart failure and the medication milrinone. It's important to consult with your wife's healthcare provider for specific guidance and information tailored to her condition. Heart failure is a medical condition where the heart is unable to pump blood effectively to meet the body's needs. This can lead to symptoms such as shortness of breath, fatigue, fluid retention, and difficulty with physical activities. Heart failure can have various causes, and it's typically classified into different types, including systolic and diastolic heart failure. Milrinone is a medication that falls into a class of drugs called "phosphodiesterase inhibitors." It is used in the treatment of heart failure, particularly in cases of acute decompensated heart failure or when other treatments may not be sufficient. Milrinone works by increasing the strength of the heart's contractions and relaxing blood vessels to improve blood flow. Here are some key points to understand about milrinone: 1. **Inotropic Medication**: Milrinone is known as an inotropic medication because it enhances the heart's contractility. This can help the heart pump blood more effectively in cases of heart failure. 2. **Vasodilator**: Milrinone also acts as a vasodilator, which means it widens the blood vessels. This helps reduce the workload on the heart and improves blood flow. 3. **Short-term Use**: Milrinone is typically used for short-term treatment in a hospital setting, especially for patients with acute heart failure. It's often administered intravenously (through an IV) and monitored closely by healthcare professionals. 4. **Side Effects**: Like any medication, milrinone can have side effects. Common side effects may include low blood pressure, irregular heartbeats, and changes in potassium levels. Your wife's healthcare provider will monitor her for these side effects. 5. **Individualized Treatment**: The use of milrinone and the specific dosing will depend on your wife's condition, medical history, and the judgment of her healthcare provider. It's crucial for her to follow her healthcare provider's guidance and take the medication as prescribed. 6. **Regular Follow-up**: Managing heart failure often involves ongoing medical care and lifestyle changes. Regular follow-up with her healthcare provider is important to adjust her treatment plan as needed. It's essential for you and your wife to have a detailed discussion with her healthcare provider about her diagnosis, the reasons for starting milrinone, how to take the medication, and what to expect in terms of managing her heart failure. They will provide you with the most accurate and personalized information to ensure her well-being.

Figure 1. (A–B) Selected Q&A relating to medical care. Inputs are human questions and outputs were generated by ChatGPT.

as computed tomography angiography in this example, describes an initial depth of response that is likely adequate for a layperson's introduction. In contrast to conducting a general internet search for the purposes and risks of this procedure, ChatGPT summarizes the pertinent information in a conversational format that is easily accessible to the user.

Another example demonstrates ChatGPT's sensitivity to slight alterations of meaning when asked about medical conditions and medications. The user first asks a question about the purpose of the medication milrinone for a stated condition of heart failure (Figure 1B). The software's response explains a short summary for both the condition and the medication.

Given the same set of prompts, there are several differences between GPT-3.5 and GPT-4 outputs. GPT-4 outputs are lengthier, with clearer structure to the answer approach. In these examples, there appears to be a tendency toward itemizing lists. There is also an observed empathetic bent with apparent self-anthropomorphization by starting sentences with "I." While further study on the end-user impact of this model iteration is warranted, GPT-4 appears to offer more comprehensive information than GPT-3.5 for select healthcare-associated queries (Figure 1).

Discharge Instructions

Discharge instructions for patients leaving the ED are important for patient safety and satisfaction. However, studies show that patients often do not fully understand the after-care instructions provided to them.[2,14,15] Poor adherence to medical advice or follow-up may be attributable in part to a gap in medical understanding. Personalized efforts to increase patient adherence to discharge instructions have focused on staff follow-up via phone call or SMS messaging, but these interventions bear relatively high time and monetary requirements, and do not always provide positive results.[16–18] ChatGPT can be used to improve patient understanding of instructions given by a clinician. Its natural-language interface allows patients to ask questions as if they were conversing with a human (Figure 2A, 2B). Similar tendencies are observed comparing the GPT-4 model to GPT-3.5, with longer answers, increased list creation, and greater use of first- or second-person writing style.

Seeking Care

Navigating the US healthcare system to determine the appropriate entity from which to seek care is often a significant challenge for patients. The ED remains one of the only settings in which relatively timely evaluation and care is available and is often used as a safety net for patients with no health insurance. However, even patients with insurance and a designated primary care physician sometimes opt for an ED visit due to barriers accessing their physician. Benefits of comprehensive evaluation and services, with imaging, labs,

and pharmacy provided in one location is a competitive convenience for patients.[19,20] Due in part to these factors, annual ED utilization rates continue to rise disproportionate to demographic factors, increasing burden on ED resources for conditions that are better addressed in preventive-care settings.[21]

ChatGPT can provide guidance in seeking urgent vs emergent care. In one example, a patient with symptoms typical of a urinary tract infection asks if a visit to the emergency room is advisable (Figure 3A). The response indicates that care should be sought but suggests urgent care or primary care settings for first-line evaluation, given the stated symptoms. The response also provides examples of more serious symptoms that indicate need for emergent evaluation. Guiding a patient's decision matrix in a personalized, interactive manner may be an impactful way to encourage them to seek an appropriate level of care. Reducing instances of ED utilization for low-acuity health concerns assists efforts to reduce ED crowding, which can have wide-ranging benefits for healthcare systems by improving patient outcomes.[22] Future study could examine the usefulness of ChatGPT in triage scenarios, compared to current modalities such as nurse advice phone lines.

ChatGPT can also offer guidance during prehospital emergencies, detailing step-by-step instructions to responders and advising how to seek an appropriate level of care. For example, ChatGPT describes recommended actions upon encountering a syncopal patient (Figure 3B). Prehospital-intervention education geared toward laypersons has been a key focus in public health, particularly for conditions such as cardiac arrest, stroke, and major hemorrhage. While certain practices are best taught in a hands-on demonstration setting, ChatGPT may be a valuable reference resource for laypersons acting in the capacity of an emergency responder.[23]

Patient Communication

ChatGPT can offer real-time translation for languages including English, Spanish, French, German, Italian, Portuguese, Chinese, Japanese, Korean, Arabic, Dutch, Polish, Russian, and more. While real-time translation is of crucial importance for ED history-taking, translator services are becoming ubiquitous due to the growing popularity of tele-health consultation devices. The benefits of using software with translation capability to address patient questions is apparent in prehospital and post-disposition settings. For example, ChatGPT offers the same response for a question asked first in English, and then in Spanish (Figure 4). Compared to GPT-3.5, GPT-4's English response takes a more cautious approach to providing medical guidance. However, GPT-4's Spanish response appears more like GPT-3.5 in the unhedged encouragement for further medical care. This difference may be due to a variety of

Figure 2A: Discharge Instructions	
Input	
Why do I need to take antibiotics for my lung infection?	
GPT-3.5 Response	**GPT-4 Response**
Antibiotics are prescribed for lung infections when they are caused by bacteria. Bacterial lung infections, such as pneumonia, are treated with antibiotics because they can help to kill the bacteria causing the infection and prevent it from spreading further. Antibiotics work by targeting and killing the specific bacteria causing the infection. They are often effective in treating bacterial infections, but they do not work for viral infections, such as the common cold or the flu. In fact, taking antibiotics for viral infections can actually be harmful, as it can lead to antibiotic resistance and increase the risk of side effects. It's important to note that not all lung infections require antibiotics. Some may be caused by viruses or other organisms that cannot be treated with antibiotics, and in those cases, other treatments such as rest, hydration, and over-the-counter medications may be recommended. If you are experiencing symptoms of a lung infection, such as cough, fever, chest pain, or difficulty breathing, it's important to see a healthcare provider for proper diagnosis and treatment.	Taking antibiotics for a lung infection is a common and essential medical treatment, but the specific reasons for using antibiotics in your case depend on the type of infection you have. Antibiotics are prescribed to treat lung infections when the cause is suspected to be bacteria. Here are some common reasons why antibiotics may be necessary for a lung infection: 1. Bacterial Infection: If your healthcare provider suspects that your lung infection is caused by bacteria, antibiotics are prescribed to target and kill the bacteria responsible for the infection. Common bacterial lung infections include bronchitis, pneumonia, and certain types of chronic obstructive pulmonary disease (COPD) exacerbations. 2. Preventing Complications: Bacterial lung infections, if left untreated, can lead to severe complications. For example, untreated pneumonia can progress and lead to respiratory failure, sepsis, or other life-threatening conditions. 3. Shortening the Duration of Illness: Antibiotics can help reduce the duration and severity of symptoms associated with a bacterial lung infection. They work by inhibiting the growth and reproduction of the bacteria, allowing your immune system to more effectively fight the infection. 4. Preventing Spread: Taking antibiotics as prescribed can help prevent the spread of bacterial lung infections to others. Many respiratory infections are contagious, and treating them promptly can reduce the risk of transmission. 5. Preventing Antibiotic Resistance: It's important to take antibiotics exactly as prescribed and for the full duration of the treatment course. This helps prevent antibiotic resistance, which occurs when bacteria become resistant to the drugs. Incomplete or inappropriate use of antibiotics can contribute to the development of antibiotic-resistant bacteria. 6. Specific Antibiotic Selection: The choice of antibiotic depends on the suspected or identified type of bacteria causing the infection. Different antibiotics are effective against different types of bacteria. Your healthcare provider will select the most appropriate antibiotic for your specific infection. It's crucial to follow your healthcare provider's instructions regarding the antibiotic treatment. This includes taking the medication as directed, even if you start feeling better before the full course is completed. Stopping antibiotics prematurely can lead to the survival of bacteria that are more resistant and potentially more difficult to treat in the future. If you have concerns or questions about your antibiotic treatment, it's important to discuss them with your healthcare provider. They can provide you with specific information about your condition, the prescribed antibiotic, potential side effects, and any other relevant details related to your lung infection and its treatment.

Figure 2B: Discharge Instructions	
Follow Up Question	
What would happen if I don't take the antibiotics?	
GPT-3.5 Response	**GPT-4 Response**
If you have a bacterial lung infection and do not take the prescribed antibiotics, the infection may continue to worsen and lead to potentially serious complications. The bacteria causing the infection could spread to other parts of the body, leading to conditions such as sepsis, which can be life-threatening. In addition, not completing a full course of antibiotics as prescribed can also contribute to antibiotic resistance. This means that the bacteria causing the infection may become resistant to the antibiotic, making it more difficult to treat future infections. It's important to follow your healthcare provider's instructions for taking antibiotics, including taking them for the full course of treatment, even if you start to feel better before the medication is finished. If you have concerns about taking antibiotics or experience side effects, speak with your healthcare provider before making any changes to your treatment plan.	If you have a bacterial lung infection and you don't take the prescribed antibiotics, several potential consequences can occur: 1. Worsening of Infection: Bacterial lung infections can progress and become more severe if left untreated. Symptoms such as cough, fever, and difficulty breathing may worsen, and the infection can spread to other parts of the lung or body. 2. Complications: Untreated bacterial lung infections can lead to complications, which can vary depending on the type and severity of the infection. Complications may include pneumonia, abscess formation (pus-filled cavities in the lung), pleurisy (inflammation of the lining around the lung), or even lung abscesses. 3. Respiratory Distress: As the infection progresses, it can cause increasing inflammation and damage to lung tissue, making it more difficult for your lungs to function properly. This can lead to respiratory distress, making it harder for you to breathe. 4. Systemic Illness: Bacterial lung infections can sometimes lead to systemic illnesses, including sepsis, which is a life-threatening condition where the infection spreads throughout the body and can affect multiple organs. 5. Transmission: Some bacterial lung infections are contagious, and not taking antibiotics can increase the risk of spreading the infection to others, especially if you are in close contact with family members, friends, or coworkers. 6. Prolonged Illness: Without treatment, your body's immune system may struggle to clear the infection, leading to a more prolonged illness. This can result in persistent symptoms, discomfort, and a longer recovery time. 7. Antibiotic Resistance: Failing to complete a prescribed course of antibiotics can contribute to the development of antibiotic resistance. This means that the bacteria causing the infection may become more resistant to antibiotics in the future, making them more challenging to treat. It's essential to take prescribed antibiotics as directed by your healthcare provider to effectively treat the bacterial lung infection, prevent complications, and reduce the risk of antibiotic resistance. If you have concerns about the medication or experience side effects, discuss them with your healthcare provider rather than stopping the treatment on your own. They can provide guidance and potentially adjust the treatment plan if necessary. Your healthcare provider's goal is to help you recover from the infection safely and efficiently while minimizing potential risks.

Figure 2. (A–B). Selected questions relating to discharge instructions and ChatGPT output.

factors: model language training; translation filters; or underlying differences in training data itself. Further discussion of technical limitations is discussed in the section on technical restrictions. Future studies should investigate the accuracy of ChatGPT translations and compare the results to alternative modalities like certified medical translators, or other text-only modalities like Google Translate, in a clinical healthcare environment.[24,25]

Figure 3A: Triage Recommendations	
Input	
I just started having burning when I pee, and peeing frequently and feeling a strong and sudden urge. Should I go to the emergency room?	
GPT-3.5 Response	**GPT-4 Response**
It is recommended that you seek medical attention as soon as possible for these symptoms, but it may not necessarily require a trip to the emergency room. You could start by contacting your primary care physician or an urgent care center. They can evaluate your symptoms and recommend the appropriate course of action. In some cases, they may refer you to an emergency room if they believe it is necessary. If you experience severe pain or bleeding, have trouble urinating, or have a fever, these could be signs of a more serious condition, and you should seek immediate medical attention at an emergency room.	I'm not a doctor, but I can offer some general guidance on your symptoms. It sounds like you may be experiencing symptoms of a urinary tract infection (UTI) or another urinary condition. While I can't provide a definitive diagnosis, I can offer some suggestions: 1. UTI: The symptoms you described, including burning during urination, frequent urination, and a strong and sudden urge, are common signs of a UTI. UTIs can be uncomfortable and, if left untreated, may lead to more severe infections. 2. Other Possible Causes: Your symptoms could also be related to other conditions, such as a urinary tract or bladder infection, kidney stones, or interstitial cystitis. It's important to consult a healthcare professional to determine the underlying cause. 3. Seek Medical Advice: It's a good idea to seek medical advice and evaluation. While it might not necessarily require a visit to the emergency room, you should contact your primary care doctor or visit an urgent care facility for an initial assessment. 4. When to Go to the ER: In some cases, you may need to go to the emergency room if you experience severe pain, blood in your urine, high fever, or if your symptoms rapidly worsen. These could be signs of a more serious condition or complications. 5. Stay Hydrated: While waiting for a medical evaluation, make sure to stay hydrated by drinking water. Adequate hydration can help flush out bacteria and potentially ease some of the discomfort associated with a UTI. It's crucial to seek timely medical attention to receive an accurate diagnosis and appropriate treatment. Your healthcare provider can perform tests, such as a urine culture, to confirm the presence of an infection and prescribe antibiotics or other medications as necessary. Untreated urinary issues can lead to more severe health problems, so it's important to address your symptoms promptly.

Figure 3B: Triage Recommendations	
Input	
My wife passed out, what should I do?	
GPT-3.5 Response	**GPT-4 Response**
If your wife has passed out, there are several steps you should take to ensure her safety and wellbeing: 1. Call for emergency medical assistance: The first thing you should do is call your local emergency services or go to the nearest emergency room. This is especially important if your wife is unconscious for more than a few seconds or if she has any other symptoms such as chest pain, difficulty breathing, or seizures. 2. Check her breathing and pulse: If your wife is unconscious, check to see if she is breathing and has a pulse. If she is not breathing or does not have a pulse, start performing CPR immediately and continue until medical professionals arrive. 3. Make her comfortable: If your wife is breathing and has a pulse, try to make her as comfortable as possible. Place her in a safe and comfortable position, such as on her side with her head supported. Loosen any tight clothing or jewelry that may be restricting her breathing or circulation. 4. Stay with her. Stay with your wife until medical professionals arrive. If possible, have someone else call for emergency assistance while you attend to your wife. Remember, passing out can be a sign of a serious medical condition, and it's important to seek medical attention right away. Stay calm and take the necessary steps to ensure your wife's safety and wellbeing.	I'm not a medical professional, but I can offer some general guidance on what to do if someone passes out. If your wife has lost consciousness, it's important to take the following steps: 1. Check for Safety: Ensure that both you and your wife are safe. Make sure there are no immediate dangers, such as a fall hazard or ongoing medical emergency. 2. Assess Responsiveness: Gently try to wake your wife by calling her name and tapping her shoulder. Check if she responds to verbal or tactile stimuli. If she doesn't respond, she is unconscious. 3. Call for Help: If your wife is unconscious or if she regains consciousness but seems confused or disoriented, call 911 (or the emergency number in your country) immediately to request emergency medical assistance. It's important to have professional medical help on the way. 4. Monitor Breathing: Check if your wife is breathing. If she's not breathing or if her breathing is irregular, you may need to start CPR if you are trained to do so. If you are not trained in CPR, the emergency dispatcher can guide you through it. 5. Positioning: If your wife is breathing normally, place her in a safe and comfortable position, lying on her back with her legs elevated slightly if possible. This can help improve blood flow to the brain. 6. Recovery Position: If your wife is breathing but you're concerned about vomiting, you can gently roll her onto her side in a recovery position to help prevent choking. Keep her head supported and her airway clear. 7. Stay Calm: Try to remain as calm as possible during the situation. Stress and panic can make the situation more challenging. 8. Provide Information: When medical professionals arrive, be prepared to provide them with information about your wife's medical history, any medications she's taking, and any recent events or symptoms leading up to her passing out. It's crucial to let healthcare professionals assess your wife's condition, as there could be various causes for loss of consciousness, including but not limited to dehydration, low blood sugar, heart issues, seizures, or neurological problems. Timely medical evaluation is essential to determine the underlying cause and provide appropriate treatment. Please remember that this advice is not a substitute for professional medical guidance. Always follow the instructions of trained medical personnel during an emergency.

Figure 3. (A–B). ChatGPT input and output. Top output demonstrates ChatGPT triage recommendations and bottom output signifies urgent response instructions.

Costs

ChatGPT is currently easily accessible and offers a no-cost user account for the public. A subscription-based upgrade is also offered, which provides quicker response times and early access to new features.[7] Utilization of ChatGPT to assist patient education for various aspects of care, including understanding health conditions, discharge instructions, and when to seek emergency medical care may save hospital time, money, and resources. Emergency departmemt spending is a growing financial concern on a national level but may be

Figure 4: Multiple Languages
Input
I am having pain in my chest, back, and neck. I have a history of diabetes. Should I go to the emergency room?

GPT-3.5 Response	GPT-4 Response
Yes, chest, back, and neck pain can be symptoms of a serious medical condition, such as a heart attack, especially if you have a history of diabetes. It's always better to err on the side of caution when it comes to chest pain, as delaying treatment can lead to serious complications. Therefore, it is recommended that you go to the emergency room or call your local emergency services immediately for further evaluation and treatment.	I'm not a doctor, but I can provide some general guidance based on your description. If you are experiencing chest pain and have a history of diabetes, you should take your symptoms seriously, as they could potentially be related to a cardiac issue or other medical concerns. Chest pain can have various causes, some of which may be life-threatening. It's essential to err on the side of caution and seek immediate medical attention if you're unsure about the cause of your symptoms. Here are some factors to consider: 1. Chest Pain: Chest pain can be a symptom of a heart attack or other cardiac problems. While chest pain can also be caused by other conditions, it's important not to dismiss it, especially if it's accompanied by other symptoms. 2. Diabetes: Having a history of diabetes can increase your risk of cardiovascular issues, so any chest pain should be taken seriously. 3. Other Symptoms: Pay attention to any additional symptoms you may be experiencing, such as shortness of breath, dizziness, nausea, sweating, or pain radiating down your arm. These symptoms could indicate a cardiac event. 4. Medical Evaluation: Given your symptoms and medical history, it is advisable to seek medical evaluation promptly. It's generally safer to go to the emergency room for chest pain, as they can perform necessary tests and diagnostics to rule out serious conditions. 5. Do Not Drive Yourself: If you don't have someone to drive you, consider calling an ambulance or emergency services for transportation to the hospital. It's safer than attempting to drive yourself. It's crucial not to delay seeking medical attention when you experience chest pain, especially if you have a history of diabetes or other risk factors for heart disease. While the symptoms could be due to a non-cardiac issue, it's important to rule out any serious conditions and receive appropriate care. Please consult with a healthcare professional or call 911 for immediate assistance.

Input
Tengo dolor en el pecho, la espalda y el cuelo. Tengo antecedentes de diabetes. ¿Debo ir a la sala de emergencias?

GPT-3.5 Response	GPT-4 Response
Sí, el dolor en el pecho, la espalda y el cuello puede ser un síntoma de una afección médica grave, como un ataque cardíaco, especialmente si tiene antecedentes de diabetes. Si experimenta este tipo de dolor, es mejor ser precavido y buscar atención médica inmediata en la sala de emergencias o llamar a los servicios de emergencia locales para una evaluación y tratamiento adecuados. Es importante no ignorar los síntomas y recibir atención médica lo antes posible.	Lamento escuchar que estás experimentando dolor en el pecho, la espalda y el cuello, y entiendo que tienes antecedentes de diabetes. Es importante tomar estos síntomas en serio, ya que podrían estar relacionados con problemas cardíacos u otras condiciones médicas. El dolor en el pecho puede tener varias causas, algunas de las cuales podrían ser potencialmente graves. Aquí hay algunos factores a considerar: 1. Dolor en el Pecho: El dolor en el pecho puede ser un síntoma de un ataque al corazón u otros problemas cardíacos. Debido a tus antecedentes de diabetes, debes prestar especial atención a este síntoma. 2. Antecedentes de Diabetes: La diabetes puede aumentar el riesgo de problemas cardiovasculares, por lo que es importante tomar en serio cualquier dolor en el pecho. 3. Otros Síntomas: Observa si tienes otros síntomas adicionales, como dificultad para respirar, mareos, náuseas, sudoración o dolor que se irradia hacia el brazo. Estos síntomas podrían indicar un evento cardíaco. 4. Evaluación Médica: Dados tus síntomas y antecedentes médicos, es aconsejable buscar evaluación médica de inmediato. Por lo general, es más seguro acudir a la sala de emergencias en caso de dolor en el pecho, ya que allí pueden realizarse pruebas y diagnósticos necesarios para descartar condiciones graves. 5. No Te Conduzcas a Ti Mismo: Si no tienes a alguien que pueda llevarte, considera llamar a una ambulancia o a servicios de emergencia para que te transporten al hospital. Es más seguro que intentar conducir por ti mismo. No debes demorar la búsqueda de atención médica cuando experimentas dolor en el pecho, especialmente si tienes antecedentes de diabetes u otros factores de riesgo para enfermedades cardíacas. Aunque los síntomas podrían deberse a una afección no cardíaca, es importante descartar cualquier condición grave y recibir la atención adecuada. Consulta a un profesional de la salud o llama al 911 para recibir asistencia inmediata.

Figure 4. ChatGPT responses in English (top) and Spanish (bottom).

alleviated by reducing the frequency of presentations for preventable causes and avoidable visits.[26] By providing personal guidance on when to seek emergency care, ChatGPT has the potential to make important contributions to lowering hospital burden.

RISKS AND LIMITATIONS OF CHATGPT
Technical Restrictions

Using ChatGPT in emergency medicine carries certain risks. One major concern is that the model can provide different responses to the same or similar questions, which affects its reliability and usefulness. Because ChatGPT is based on a ML algorithm, it may generate different responses to similar questions depending on a variety of factors, such as the order or context of words used as input. In a recent study on ChatGPT's responses, identical questions regarding cirrhosis and hepatocellular carcinoma were submitted twice and independently graded. ChatGPT was able to produce two similar responses 90.48% of the time. Although this number may be regarded as high reproducibility, it raises

concerns over the potential consistency of offering medical advice to laypersons. Although most instances will provide the user with the same information, ChatGPT's responses are based on probability.[27] Future studies should analyze this variability to determine the impact on response appropriateness for the user.

In addition to output variability, there is also a potential for differences in user comprehension. This underscores another risk: the potential for differences in comprehension and interpretation of the information provided to laypersons. Although this limitation is common among many different technologies, these differences in comprehension can lead to potentially adverse outcomes for patients. Given these considerations, it is crucial to exercise caution and apply critical thinking when using ChatGPT as a source of information in healthcare interactions. It is essential to be aware of the potential for developing overconfidence in ChatGPT's recommendations, and the risk for anchoring on a specific diagnosis or impression for both patients and clinicians.

Response variability and interpretation of responses can impact the consistency and reliability of this model. It is important for clinicians and patients to be aware of these risks, and to use ChatGPT as a supplementary tool rather than a primary source of information. Therefore, ongoing improvements in the technology and continued training of the algorithm should be pursued. Efforts to incorporate current medical literature into the training data could enhance the reliability and relevance of ChatGPT's responses. However, it remains essential to recognize the dynamic nature of clinical practice and the importance of relying on evidence-based guidelines to ensure patient safety and well-being.

Misinformation

Ensuring accurate and truthful information is crucial when using ChatGPT, as misinformation can have serious consequences for patient care. ChatGPT's training data is limited to information available before 2021. Medical knowledge and practices have evolved since this knowledge cutoff point, and ChatGPT may reference information that is outdated or no longer applicable to current medical practices. According to the ChatGPT study for cirrhosis and hepatocellular carcinoma, ChatGPT's answers contained a mix of correct and incorrect information. The percentage of responses that were classified as having both correct and incorrect or outdated answers was 22% in basic knowledge, 33% in diagnosis, 25% in treatment, 18% in lifestyle, and 50% in preventive medicine.[28] However, while this study highlights potential limitations of ChatGPT's accuracy in responding to questions about hepatocellular carcinoma, it is important to recognize that further research is needed to comprehensively evaluate the accuracy of ChatGPT's responses across all medical domains. Physicians and

patients must remain cautious when using ChatGPT and seek confirmation from other reliable sources before making decisions based on the information provided.

Another concern is the model's opaque algorithm, which can generate plausible sounding but inaccurate or nonsensical answers, a phenomenon known as "hallucinations".[29] Evidence of this can be seen in fabricated sources when ChatGPT is asked to provide references for a given response.[30] ChatGPT's training may have included scientific literature citation datasets, but its generative algorithm does not allow for one-to-one data source matching, resulting in a response that provides completely fabricated sources. Patients may be less likely to question the accuracy of ChatGPT's responses if they are presented with a source and simply assume that the information has been verified. This can ultimately lead to patients making decisions that are not in their best interest and may even result in harm.

There is currently unavoidable risk of misinformation when using ChatGPT for patient education in emergency medicine. To mitigate this risk, it is important to manage expectations and risk thresholds. Physicians and patients should be advised of the risks and benefits of this technology. Additionally, regular evaluation and improvement of the model will help minimize the risk of inaccuracies and misunderstandings.

Privacy and Security

Ensuring patient privacy and security is another concern when using ChatGPT for patient encounters. Unauthorized access to protected health information (PHI) can lead to identity theft, insurance fraud, and other types of harm to the patient. For physicians, unauthorized disclosures violate the Health Insurance Portability and Accountability Act (HIPAA) and can lead to disciplinary action, loss of licensure, and legal liability. OpenAI, the creators of ChatGPT, have stated that data used with ChatGPT will remain secured by default, with an opt-out option to share data for research and quality improvement. Nevertheless, major corporations such as Verizon and JPMorgan & Co. have restricted employees from accessing ChatGPT due to concerns over possible data breaches.[31] Sensitive healthcare information could be at a similar risk.

While the public availability of the ChatGPT application programming interface makes it easy to integrate into websites and applications, it also raises concerns about the security and privacy of patient information. As the use of artificial intelligence (AI) chatbots become more widespread, it is increasingly important to ensure that these technologies are used in a way that protects patient privacy and complies with regulations such as HIPAA. Integrating ChatGPT into a HIPAA-compliant framework may help address these concerns. Healthcare technology leaders must take necessary measures to protect PHI.

Medicolegal and Other Ethical Consideration

Integration of ChatGPT into emergency medicine presents a complex landscape of medicolegal and ethical implications.[32] We have previously discussed limitations with the software: potential for misdiagnosis and delayed treatment is a significant concern. Artificial intelligence systems, while advanced, may not always accurately interpret patient symptoms, which is dependent upon the quality of user input and the software's understanding. This has potential to influence patient outcomes, and there are numerous situations that could do the same.

Consider the following hypothetical, ethical scenarios:

- ChatGPT recommends against seeking care, which results in a harmful or life-threatening patient outcome.
- ChatGPT provides false information to a patient.
- Patients inadequately advised on the risks/benefits of ChatGPT misinterpret its analysis.
- Patient PHI is accessed during a data breach or during the performance improvement process.
- ChatGPT provides information that is not up to date or conflicts with current guidelines.

In the unfortunate circumstance where one or more of these events occur and legal action is taken, who should be held responsible—OpenAI, clinicians, or both? This is a current challenge that necessitates further interdisciplinary discussion between stakeholders.[33] Nonetheless, there are steps that must be taken to help minimize risk for all parties involved. For example, there should be restrictions placed on LLMs prior to official implementation in the field. Whether through legislation or an independent body, ChatGPT must adhere to regulatory standards that ensure HIPAA-compliance and informed consent.[34] Physicians and OpenAI must also work toward education on potential risks of the software. Physicians and other healthcare professionals should also implement legal forms and liability waivers into the care process to ensure protection in instances where these regulations fail.

TRANSITIONING INTO CLINICAL STUDIES

The next major step that must be taken is to validate ChatGPT's efficacy and safety in clinical settings.[32] One of the major barriers that researchers may face is the ever-changing updates to the software, which is also a limitation of this paper. Not only is ChatGPT continually being updated, but the protocols by which fine-tuning, updates, and further training occur are confidential.[10] This inherently makes ChatGPT difficult to study. However, potential future studies with ChatGPT are many and should assess the accuracy, safety, readability, and semantic analysis of the software. One such future study could consider the efficacy of patient triage for ChatGPT and triage nurse phone calls. Future studies should also investigate the cost benefit of implementing such a system into ED workflow, either for triage, discharge instructions, or

both. This should be corroborated by examining potential algorithm bias in the real world.[32,34,35]

THE PHYSICIAN'S ROLE IN CHATGPT

As stated previously, ChatGPT cannot replace a physician. Although OpenAI has made significant strides in developing a software that communicates in a more human-like, empathetic manner compared to previous chatbots, current technology still lacks the oversight and nuance offered by a human. This technology cannot replace an in-depth history, physical exam, or clinical reasoning. However, given the current rate of progress on these technologies, it would be naive to consider a future independent of technology-assisted patient encounters. For this reason, physicians and healthcare professionals must be involved in research and development oversight to ensure accurate data is available on these platforms, and that these technologies are being developed with the right intentions. Physicians should also continue to be informed on AI developments, so that they can play a proactive role in educating patients on the benefits, limitations, and liability of the software. Further studies must also examine the legal implications for physicians, patients, and OpenAI, as ChatGPT and healthcare continue to intersect.

CONCLUSION

This paper describes the use of ChatGPT as an educational resource for patients seeking emergency medical treatment. Although limitations such as technical issues, misinformation risk, lack of input standardization, and privacy concerns exist, this software offers compelling benefits for patient education. The software can answer questions specific to patients and their presentations, allowing for a personalized educational resource. ChatGPT can also clarify discharge instructions, help triage urgent vs emergent conditions, and it can respond in multiple languages. Physicians must understand these benefits and limitations to best guide patients and conduct further research in new AI technologies.

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