

**How to Cite:**

Jacob, J., D'souza, R. S., Deshpande, S. ., Yamjala, H., Chandrakeerthy, D. M., Hanumesh, H. V., Jain, R., & Vhora, S. (2023). Evaluating the efficacy of chatGPT in near-peer simulation for resident doctors in the emergency department. *International Journal of Health Sciences*, 7(S1), 1780–1789. <https://doi.org/10.53730/ijhs.v7nS1.14367>

# Evaluating the efficacy of chatGPT in near-peer simulation for resident doctors in the emergency department

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**Abstract**--Introduction: Near-peer teaching is gaining popularity as a newer teaching tool, as it improves the learner's comprehension, targets the right audience and promotes familiarity with the clinical situation and enhances critical thinking.(1) This study was initiated to evaluate the efficacy of chatGPT in near-peer simulation using AI-enabled scenarios in the residency training programme of an emergency department. (2) Methods: ChatGPT an LLM was asked to generate clinical scenarios as per prompts given to evaluate its efficacy in generating real-time and realistic scenarios with information on stepwise approach and critical treatment decisions for the patient. Results: In our study, ChatGPT was able to successfully generate real-time and realistic scenarios based on the prompts given with detailed treatment approaches and critical decisions for all patients/scenarios given, serving as a successful tool to consider in near-peer education using simulation enabled by AI. CONCLUSION: Near-peer simulation training was found to be a valuable method of teaching residents for increasing hands-on experience, skill assessment, confidence in diagnosis and practical thinking. Integration of AI into near-peer simulations aids in creating a wider range of scenarios with prompt treatment decisions. It also helps in keeping the knowledge up to date and not forgetting essential steps in patient management which would be standardised across centres.

**Keywords**---medical education, ChatGPT, AI, near-peer simulation.

**Introduction**

Near-peer simulation is an effective educational strategy that provides learners with an opportunity to practice clinical skills and decision-making in a safe and controlled environment. (3,4) Traditionally, near-peer simulations involve experienced human instructors or standardized patients. (4) However, recent advancements in artificial intelligence have introduced virtual near-peer simulation partners, such as ChatGPT and Google Bard, which can simulate the role of an experienced clinician. (5,6)

This study aims to evaluate the efficacy of ChatGPT as a virtual near-peer simulation partner for resident doctors in the emergency department. (6,7) By utilizing ChatGPT, resident doctors can engage in realistic patient encounters and receive feedback and guidance during the simulation process. The objective is to determine whether ChatGPT can effectively enhance the learning experience and improve clinical skills acquisition in emergency medicine. (8,9)

It is crucial to incorporate a module that combines effective and efficient methods of knowledge delivery.(9,10,11) We hypothesised that a learning module that combines AI-enabled simulation and near-peer simulation to teach emergency management would enhance the student's knowledge, application of emergency algorithms and critical treatment decisions. (11)

## Methods

This was a prospective study conducted in the emergency medicine department of a tertiary care centre in South India. ChatGPT was used to simulate patients for near-peer simulation training and was found to be prompt and precise in simulating realistic patients when given a command prompt. The patients simulated by chatGPT are shown with the prompts given in table 1 below:

<b>Prompt</b>	<b>Patient Details</b>
<p>1. Simulate a patient of acute gastrointestinal bleeding</p>	<p><b>Patient Information:</b>  Name: Emily Wilson  Age: 55  Sex: Female  Medical History: Hypertension, peptic ulcer disease</p> <p><b>Scenario:</b></p> <p>Emily Wilson, a 55-year-old female with a history of hypertension and peptic ulcer disease, presents to the emergency department with symptoms of acute gastrointestinal bleeding. She complains of severe abdominal pain, dizziness, and passing black, tarry stools.</p> <p><b>Emergency Department Assessment and Treatment:</b></p> <p>Initial Evaluation:  The medical team quickly triages Emily and assesses her vital signs, including heart rate, blood pressure, and oxygen saturation.  They note her pale appearance and signs of active bleeding, such as tachycardia and hypotension.</p> <p>Stabilization and Monitoring:  Emily is placed on a cardiac monitor to continuously monitor her heart rhythm.  A large-bore intravenous line is established to administer fluids and medications.</p> <p>Airway Management:  The medical team ensures Emily's airway is clear and assesses her ability to maintain adequate oxygenation.  If necessary, supplemental oxygen is administered to improve her oxygen levels.</p> <p>Intravenous Access and Blood Transfusion:  Blood samples are drawn for laboratory testing, including a complete blood count (CBC), coagulation profile, and blood type</p>

	<p>and crossmatch.</p> <p>Based on the severity of bleeding and Emily's vital signs, she may receive an immediate blood transfusion to replace lost blood volume and improve oxygen-carrying capacity.</p> <p><b>Fluid Resuscitation:</b> Emily receives intravenous fluids, such as crystalloids (e.g., normal saline), to restore her blood pressure and maintain adequate organ perfusion.</p> <p><b>Medications:</b> Emily may receive proton pump inhibitors (PPIs) intravenously to reduce gastric acid secretion and minimize further damage to the gastrointestinal tract. If necessary, medications such as vasopressors or inotropic agents may be administered to support blood pressure and cardiac function.</p> <p><b>Diagnostic Tests:</b> Emily undergoes diagnostic tests to identify the source and severity of the gastrointestinal bleeding. Tests may include upper endoscopy, colonoscopy, or imaging studies (such as CT angiography) to locate the bleeding site.</p> <p><b>Hemostasis and Intervention:</b> Depending on the source of bleeding identified, the medical team may perform endoscopic interventions, such as thermal coagulation, sclerotherapy, or band ligation, to stop the bleeding. In some cases, interventional radiology procedures or surgery may be necessary to control the bleeding.</p> <p><b>Ongoing Monitoring and Treatment:</b> Emily is closely monitored for signs of ongoing bleeding, hemodynamic stability, and response to treatment. Additional blood transfusions, interventions, or surgical procedures may be required based on her condition.</p> <p><b>Referral and Follow-up:</b> Once the acute bleeding is controlled, the medical team may consult with gastroenterologists or other specialists to address the underlying cause of the bleeding and provide appropriate long-term management. Emily is provided with instructions for follow-up appointments, medication regimens, dietary modifications, and lifestyle changes to prevent future episodes of gastrointestinal bleeding.</p>
2. Simulate a case with unstable atrial fibrillation with acute pulmonary oedema	<p><b>Simulation Scenario:</b> Unstable Atrial Fibrillation with Acute Pulmonary Edema</p> <p><b>Patient Information:</b> Name: John Smith Age: 65 Medical History: Hypertension, Coronary Artery Disease</p>

**Scenario:**

You are working as a healthcare provider in the emergency department of a hospital. John Smith, a 65-year-old male, is brought in by an ambulance. He is conscious but appears extremely anxious and has severe shortness of breath. The paramedics inform you that John has a history of hypertension and coronary artery disease. According to the paramedics, John developed sudden-onset palpitations, followed by worsening shortness of breath at home.

**Vital Signs:**

Blood Pressure: 180/100 mmHg  
Heart Rate: Irregularly irregular, 150 bpm  
Respiratory Rate: 30 breaths per minute  
Oxygen Saturation: 88% on room air

**Primary Survey:**

Assess the patient's airway, breathing, and circulation. Ensure that the patient has an adequate airway, and if necessary, provide supplemental oxygen.  
Establish intravenous access and obtain blood samples for laboratory tests, including a complete blood count, electrolytes, renal function, and cardiac enzymes.  
Attach the patient to a cardiac monitor to assess heart rhythm and monitor oxygen saturation continuously.

**Immediate Actions:**

Administer supplemental oxygen via a non-rebreather mask at 15 liters per minute.  
Initiate continuous cardiac monitoring to assess the rhythm and monitor for any changes.  
Assist the patient into an upright position to optimize respiratory mechanics.  
Administer sublingual nitroglycerin to help alleviate chest pain and reduce preload.

**Interventions:**

Initiate synchronized cardioversion for the unstable atrial fibrillation. Consider sedation with a short-acting agent such as midazolam or propofol if necessary.  
Start an intravenous infusion of loop diuretics (e.g., furosemide) to reduce fluid overload and alleviate pulmonary edema.  
Administer intravenous morphine to relieve anxiety, reduce preload, and help with pain management.  
Consider initiating non-invasive positive pressure ventilation

	<p>(NIPPV) with continuous positive airway pressure (CPAP) or bilevel positive airway pressure (BiPAP) to support oxygenation and ventilation. Administer intravenous antiarrhythmic agents (e.g., amiodarone or procainamide) as per institutional protocols, to stabilize the patient's heart rhythm.</p> <p><b>Monitoring and Follow-up:</b></p> <p>Continuously monitor the patient's vital signs, including blood pressure, heart rate, respiratory rate, and oxygen saturation. Assess the patient's response to treatment, including improvement in symptoms, oxygen saturation, and heart rate. Repeat an electrocardiogram (ECG) after cardioversion to assess for successful restoration of sinus rhythm. Repeat chest X-ray to evaluate the resolution of pulmonary edema. Arrange for cardiology consultation to assess the underlying cause of atrial fibrillation and develop a long-term management plan.</p> <p><b>Debriefing:</b></p> <p>After the simulation, conduct a debriefing session to discuss the actions taken during the scenario, review the decision-making process, and address any questions or concerns. Identify areas of improvement and discuss strategies to enhance patient care and management in similar situations.</p>
3. Simulate a case of pancreatitis	<p><b>Patient Information:</b> Name: John Davis Age: 50 Sex: Male Medical History: None reported</p> <p><b>Scenario:</b></p> <p>John Davis, a 50-year-old male, presents to the emergency department with symptoms suggestive of pancreatitis.</p> <p><b>Initial Assessment and Vitals:</b></p> <p>Patient Complaint: John complains of severe abdominal pain that radiates to his back. He describes it as a constant, sharp pain that worsens after eating.</p> <p><b>Vital Signs Assessment:</b> Blood Pressure: 140/90 mmHg Heart Rate: 110 beats per minute Respiratory Rate: 20 breaths per minute Oxygen Saturation: 98% on room air</p>

	<p>Temperature: 38.5°C (101.3°F)</p> <p><b>Pain Assessment:</b> The medical team assesses John's pain level using a standardized pain scale (e.g., numeric rating scale or visual analog scale).</p> <p><b>Physical Examination:</b> The medical team performs a thorough physical examination, focusing on the abdomen. They assess for signs of abdominal tenderness, distension, and rigidity. They also examine for other possible causes of abdominal pain.</p> <p><b>Intravenous Access:</b> The medical team establishes intravenous access to administer fluids and medications.</p> <p><b>Treatment and Monitoring:</b></p> <p><b>NPO Status:</b> John is instructed to remain nil per oral (NPO), refraining from eating or drinking anything, to allow the pancreas to rest.</p> <p><b>Fluid Resuscitation:</b> John receives intravenous fluids, typically isotonic crystalloids (e.g., normal saline or lactated Ringer's solution), to maintain hydration and restore fluid balance.</p> <p><b>Pain Management:</b> John is given analgesic medications, such as intravenous opioids (e.g., morphine or fentanyl), to alleviate his severe abdominal pain.</p> <p><b>Laboratory Tests:</b> Blood samples are collected for laboratory testing, including pancreatic enzymes (e.g., amylase, lipase), liver function tests, complete blood count, and electrolyte levels. These tests help confirm the diagnosis of pancreatitis and assess the severity of the condition.</p> <p><b>Imaging Studies:</b> Depending on the severity of symptoms and clinical judgment, imaging studies such as abdominal ultrasound, computed tomography (CT) scan, or magnetic resonance imaging (MRI) may be ordered to evaluate the pancreas and surrounding structures.</p> <p><b>Monitoring:</b> Vital signs, including blood pressure, heart rate, respiratory</p>
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	<p>rate, and oxygen saturation, are closely monitored. Pain level and response to treatment are assessed regularly. Electrolyte imbalances, especially calcium and potassium, are monitored and corrected as necessary.</p> <p><b>Antiemetic Medications:</b> If John experiences nausea or vomiting, antiemetic medications, such as ondansetron, may be administered to alleviate these symptoms.</p> <p><b>Nutrition Support:</b> In severe cases or if John's condition does not improve, he may require nutritional support through a nasogastric tube or total parenteral nutrition (TPN) to maintain adequate nutrition.</p> <p><b>Consultation and Specialist Involvement:</b> The medical team may consult with a gastroenterologist or intensivist for further evaluation and management of John's pancreatitis. If complications arise, such as pancreatic pseudocysts or infected necrosis, additional interventions or procedures may be necessary.</p>
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## Results

As seen above chatGPT was able to simulate real-time scenarios when given prompts for near-peer simulation training for residents in the emergency department. In doing so wholesomely it showed great value in being an addition to simulation training and enabling AI to improve critical thinking, team dynamics and timely treatment decisions in patient care. Multiple studies including the study by Xiayan Shen et al in Singapore Medical Journal already exhibited the utility and usefulness of near-peer training in improving patient care. The incorporation of AI-based LLM softwares not only helps save time but also serves as a real-time model for patient care scenarios.

## Discussion

Simulation is a technique used to replicate or enhance real experiences by creating interactive scenarios that closely resemble real-world situations. (12) Numerous studies have compared simulation-based medical education to non-simulation-based teaching methods and have found modest to moderate positive effects associated with simulation.(13,14) These findings are particularly relevant given the increasing emphasis on patient safety and work-hour restrictions for residents, which limit opportunities for direct patient encounters and highlight the value of simulation-based training. (14)

The use of near-peer teaching in simulations allows residents to feel comfortable asking questions and perceive the facilitators as understanding their needs and addressing their concerns. Near-peer facilitators, drawing from their own

experiences, can explain hospital treatment protocols and provide valuable insights to newly qualified doctors participating in the simulation program. (15)

A similar program was conducted in a North American internal medicine residency program at Massachusetts General Hospital, demonstrating the feasibility of resident-led simulation training. (16)

In conclusion, our experience shows that it may be beneficial for residency programmes to conduct a simulation-based medical education programme for first-year residents using the near-peer simulation with AI models, specifically to aid residents in preparing to face real-life emergency scenarios.

### **Scope for Further Studies**

AI-based near-peer simulation training can be used for training of first year residents and pre and post-training knowledge can be assessed by way of questionnaires and confidence to identify and treat patients based on protocols can be measured by way of Likert scales and quantified enhancing the utility of AI-based near-peer simulation.

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