Archives of Academic Emergency Medicine. 2025; 13(1): e49

ORIGINAL RESEARCH

Effectiveness of ChatGPT for Clinical Scenario Generation: A Qualitative Study

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Received: March 2025; Accepted: April 2025; Published online: 24 May 2025

Abstract: **Introduction:** A growing area is the use of ChatGPT in simulation-based learning, a widely recognized methodology in medical education. This study aimed to evaluate ChatGPT's ability to generate realistic simulation scenarios to assist faculty as a significant challenge in medical education. **Methods:** This study employs a qualitative research design and thematic analysis to interpret expert opinions. The study was conducted in two phases. Scenario generation via ChatGPT and expert review for validation. We used ChatGPT (GPT-4) to create clinical scenarios on cardiovascular topics, including cardiogenic shock, postoperative cardiac tamponade after heart surgery, and heart failure. A panel of five experts, four nurses with expertise in emergency medicine and critical care and an anesthesia specialist, evaluated the scenarios. The experts' feedback, strengths and weaknesses, and proposed revisions from the expert discussions were analyzed via thematic analysis. Key themes and proposed revisions were identified, recorded, and compiled by the research team. **Results:** The clinical scenarios were produced by ChatGPT in less than 5 seconds per case. The thematic analysis identified six recurring themes in the experts' discussions: clinical accuracy, the clarity of learning objectives, the logical flow of patient cases, realism and feasibility, alignment with nursing competencies, and level of difficulty. All the experts agreed that the scenarios were realistic and followed clinical guidelines. However, they also identified several errors and areas that needed improvement. The experts identified and documented specific errors, incorrect recommendations, missing information, and inconsistencies with standard nursing practices. **Conclusion:** It seems that, ChatGPT can be a valuable tool for developing clinical scenarios, but expert review and refinement are necessary to ensure the accuracy and alignment of the generated scenarios with clinical and educational standards.

Keywords: Generative artificial intelligence; Artificial intelligence; Education, medical; Computer simulation

Cite this article as: Ghaffari F, Langarizadeh M, Nabovati E, Sabery M. Effectiveness of ChatGPT for Clinical Scenario Generation: A Qualitative Study. Arch Acad Emerg Med. 2025; 13(1): e49. https://doi.org/10.22037/aaemj.v13i1.2690.

1. Introduction

Artificial intelligence (AI) has emerged as a transformative tool across various sectors, including medical education. One of the most notable advancements in AI is the development of large language models (LLMs), such as OpenAI's ChatGPT (1, 2). ChatGPT is an advanced conversational AI that leverages natural language processing and deep learning techniques to generate human-like text. Its ability to understand context and produce coherent, structured responses has made it a valuable tool for various applications, including virtual assistants, automated tutoring, and interactive learning environments (3). In medical education, ChatGPT has demonstrated potential in simplifying complex concepts, generating mnemonics, and creating practice questions to support student learning (4). Additionally, educators can use ChatGPT to assist in designing learning activities, assessments, and curricula (5). A growing area of interest is the use of ChatGPT in simulation-based learning, a widely recognized methodology in medical education. Simulation-based learning provides students with a structured, risk-free environment to develop clinical reasoning and decision-making skills through interactive patient care scenarios (6, 7). However, designing high-quality simulation scenarios is a time-intensive and resource-demanding process, requiring an estimated 40-80 hours per scenario depending on complexity and learning objectives (8). The process involves extensive research, expert review, iterative revisions, and adherence to best-practice guidelines (9, 10). As a result, educators seek efficient solutions to streamline scenario development without compromising educational quality. While previous studies have explored the role of the ChatGPT in clinical training and medical education (6, 11, 12), its potential to automate or assist in the creation of structured, high-fidelity simulation scenarios remains underexplored. This study used a qualitative approach to evaluate ChatGPT's ability to generate realistic simulation scenarios efficiently to assist faculty, which is

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a significant challenge in medical education.

2. Methods

This study employs a qualitative research design and thematic analysis to interpret expert opinions. The study received approval from the Ethics Committee of Iran University of Medical Sciences (IR.IUMS.REC.1402.961) and was conducted in two phases: scenario generation via ChatGPT and expert review for validation.

2.1. Scenario generation

We used ChatGPT (GPT-4) to create clinical scenarios on cardiovascular topics, including cardiogenic shock, postoperative cardiac tamponade after heart surgery, and heart failure. The following prompt was used to generate a step-by-step scenario with assessment questions for students at each stage:

"Create a clinical simulation scenario for nursing students caring for [Topic]. The scenario should be step-by-step, with questions for student assessment at each step."

After ChatGPT generated the scenarios, they were reviewed for clarity and completeness. Any grammatical or formatting inconsistencies were addressed before the scenarios were forwarded to an expert panel for evaluation.

2.2. Expert review

2.2.1 Expert panel selection

A panel of five experts evaluated the scenarios. The experts included four nurses specializing in emergency and critical care and one anesthesiologist. The selection criterion for the experts was that they had at least 10 years of experience in nursing, emergency, and critical care education in clinical and academic settings. The experts were selected from faculty members specializing in emergency medicine, critical care, and anesthesia fields.

2.2.2 First session

The panel convened for an initial session to establish a shared understanding of clinical scenario evaluation, during which a medical informatics expert explained the standards of a simulated scenario on the basis of valid guidelines for the expert panel (13, 14). The guidelines included clinical accuracy, alignment with current medical guidelines and best practices, educational effectiveness, relevance to nursing competencies, learning outcomes, and scenario realism. After the session, each expert independently reviewed the scenarios.

2.2.3 Second session:

A second session was held to discuss the experts' feedback, highlight strengths and weaknesses, and propose revisions. The discussion was recorded and transcribed for further analysis.

The expert panel reviewed the AI-generated scenarios for their alignment with established clinical simulation design principles. The evaluation criteria were based on best practices outlined in the International Nursing Association for Clinical Simulation and Learning (INACSL) standards and other reputable sources (13, 14). The authors conducted a thematic analysis of expert feedback.

To ensure thorough familiarization with the data, the research team read all expert feedback multiple times. Feedback was transcribed verbatim, creating a comprehensive dataset for analysis. An open coding approach was employed, where meaningful and relevant text sections were identified based on the research questions and evaluation criteria. Each section was assigned an initial code representing a specific idea or concept. Similar codes were then grouped into broader categories. For instance, feedback on clinical details was categorized under "clinical accuracy," while feedback on patient care sequencing was grouped under "logical flow of patient cases." The emerging themes were systematically reviewed to ensure they accurately represented the dataset. The research team cross-checked the coherence of themes with the original data, ensuring that no critical insights were overlooked. To enhance the reliability of the thematic analysis, inter-rater agreement was assessed. Any discrepancies in coding were discussed in team meetings, and final coding decisions were reached through consensus.

2.3. Data analysis

Expert feedback gathered during the second session was transcribed verbatim, and the extracted codes were grouped together to become broader themes. After the codes were grouped, analysis was performed. This stage included meetings with the research team to review and evaluate the results. In these meetings, the data and analyses were reviewed again to confirm the accuracy and correctness of the analyses and to make necessary corrections on the basis of the feedback.

3. Results

3.1. Simulation scenario development

The clinical scenarios were produced by ChatGPT in less than 5 seconds per case. Each scenario followed a standardized structure, including patient details, nursing interventions, and assessment questions. Figure 1 shows a sample of the prompt provided and the response generated by ChatGPT. Each scenario contained embedded evaluation questions along with expected student responses to facilitate learning assessment. Since the same prompt was used for all three scenarios, their structures were highly similar. The full scenarios are provided in Supplementary table 1.

3.2. Scenario evaluation and revision

The thematic analysis identified six recurring themes in the experts' discussions. Table 1 shows the main themes and sub-themes.

Most of the experts agreed that the scenarios were realistic, followed clinical guidelines, had clear objectives, and were

appropriate in terms of Difficulty. However, all experts identified significant clinical errors requiring correction of signs, symptoms, clinical and laboratory data, and prescribed medications. The most frequent issues were incorrect medication dosages, incomplete patient histories, and inconsistencies in how the clinical conditions evolved. Examples of the experts' comments are shown in Table 2.

Additionally, each scenario was reviewed for scientific accuracy and educational effectiveness. The experts identified and documented specific errors, incorrect recommendations, missing information, and inconsistencies with standard nursing practices. These errors were categorized and addressed by the research team to increase the accuracy, coherence, and pedagogical value of the scenarios.

4. Discussion

The findings of this study, derived through thematic analysis, show that ChatGPT can significantly reduce the time required for clinical scenario development while maintaining high realism. However, AI-generated scenarios necessitate expert review and refinement to ensure accuracy and alignment with educational standards.

The study findings align with those of previous studies. For example, Reid demonstrated that ChatGPT could reduce the time needed to generate complex clinical scenarios (15), which aligns with our study. Similarly, Vaughn et al. reported that AI-generated scenarios are generally accurate but often require refinement (12), which is also evident in our study. Furthermore, Violato et al. noted that while subject matter experts preferred manually created simulations, ChatGPT significantly accelerated scenario production (16). Liu et al. emphasized that AI can potentially reduce educators' workload, a key benefit corroborated by our study (17).

Like previous studies, our study also revealed that human oversight is essential to ensure accuracy and relevance. While ChatGPT is excellent at generating detailed and realistic scenarios, it sometimes misses key details; thus, expert review remains necessary (12, 17, 18). The study by Wan et al. noted that since ChatGPT cannot independently validate scenarios, all scenarios should be validated against current medical guidelines to check for completeness and accuracy (1). Overall, all the studies emphasize the importance of understanding the limitations of the ChatGPT and the need for human oversight.

Similar studies have pointed out that differences in the backgrounds of experts and their level of mastery and familiarity with AI tools can affect how scenarios are evaluated. In particular, some experts may not be able to accurately evaluate scenarios due to being less familiar with the content produced by AI models (19-21). In this study, to prevent possible biases, an attempt was made to guide experts in evaluating scenarios generated by artificial intelligence based on educational and clinical content by providing clear evaluation criteria and emphasizing the clinical accuracy and educational effectiveness of the scenarios in the initial briefing session. However, limitations in AI-generated scenarios can also affect the evaluations.

Although our study focused on clinical cardiovascular scenarios, the findings may also be beneficial for other clinical domains. ChatGPT's capabilities in generating clinical scenarios are not limited to any medical specialty and the approach demonstrated in this study can be applied to other medical domains with necessary modifications based on each domain's requirements.

While AI-powered scenario generation has broad application in medical domains, it is important to note that some medical domains may require very specialized knowledge or patient interaction that AI is not able to simulate easily. Therefore, further research is needed to explore its use in different medical domains to ensure accuracy across disciplines.

Despite limitations such as content deficiencies, inaccuracy in clinical details, and limitations in accurately simulating human interactions, the evidence suggests that ChatGPT can be a practical and effective tool for educators to develop clinical scenarios across disciplines. With the review and correction of deficiencies, AI-generated scenarios can increase the efficiency of educational content development and expand the use of simulation-based learning in medical and nursing education. Future research should refine AI-assisted scenario generation to increase accuracy, minimize manual corrections, and explore its applicability across medical contexts. Integrating AI tools with clinical guidelines can increase the accuracy and reliability of generated scenarios. Addressing these improvements is crucial for enhancing AI's impact on medical education and ensuring its effective application in real-world training.

5. Limitations

This study has limitations that should be considered. First, the focus on scenarios related to cardiovascular conditions (cardiogenic shock, postoperative hemorrhage, cardiac tamponade, and heart failure) limits the generalizability of the results to other medical fields. However, while the findings are particularly relevant to cardiovascular scenarios in nursing education, the core principles of simulation design, clinical accuracy, and learning objectives may have broader applicability to other clinical areas. Another limitation was that the scenarios generated in this study were based on a prompt defined by the research team, and the results might vary if the prompt was modified.

Additionally, the limited number of expert panel members (five) may have reduced the diversity of perspectives. Additionally, the evaluation of the scenarios was partly dependent on the experts' subjective attitudes, and the evaluation results may change as the experts change. Future research could reduce these limitations by expanding the scope of topics and diversifying the expert panel.

Future studies may explore whether these findings can be generalized to other medical disciplines or if domain-specific adaptations are needed. We acknowledge that the transfer-

ability of the findings to other areas of clinical education requires further investigation, and we suggest that further research be conducted to explore the extent to which these results can be applied to non-cardiovascular clinical fields.

6. Conclusions

It seems that, ChatGPT can be a valuable tool for developing clinical scenarios, but expert review and refinement are necessary to ensure the accuracy and alignment of the generated scenarios with clinical and educational standards. Future research should focus on improving the quality of AI-generated scenarios, reducing the need for manual revisions, and evaluating the impact of integrating AI with clinical guidelines.

7. Declarations

7.1. Acknowledgments

The authors would like to thank Iran University of Medical Sciences. This research was conducted as part of a PhD thesis supported by Iran University of Medical Sciences (NO: 1402-4-37-27932).

7.2. Funding

There is no fund.

7.3. Data Availability Statement

Not applicable.

7.4. Author contributions

The first author was responsible for writing the main text of the article, developing the scenarios via artificial intelligence, taking notes during the expert panel discussions, analyzing the data, and editing the final manuscript. The second author, as the supervising faculty member, managed the project, oversaw the data collection process, conducted data analysis, and reviewed and revised the manuscript throughout the stages of preparation. The third and fourth authors supervised the data collection, facilitated the expert panel sessions, and reviewed and contributed to revisions of the final manuscript. All authors read and approved the final version of manuscript.

7.5. Conflict of interest

The authors have no competing interests.

7.6. Using artificial intelligence chatbots

The scenarios used in this study were generated via artificial intelligence.

7.7. Ethical considerations

This research was conducted as part of a PhD thesis supported by Iran University of Medical Sciences (NO: 1402-4-37-27932). The study received approval from the Ethics Committee of Iran University of Medical Sciences (IR.IUMS.REC.1402.961).

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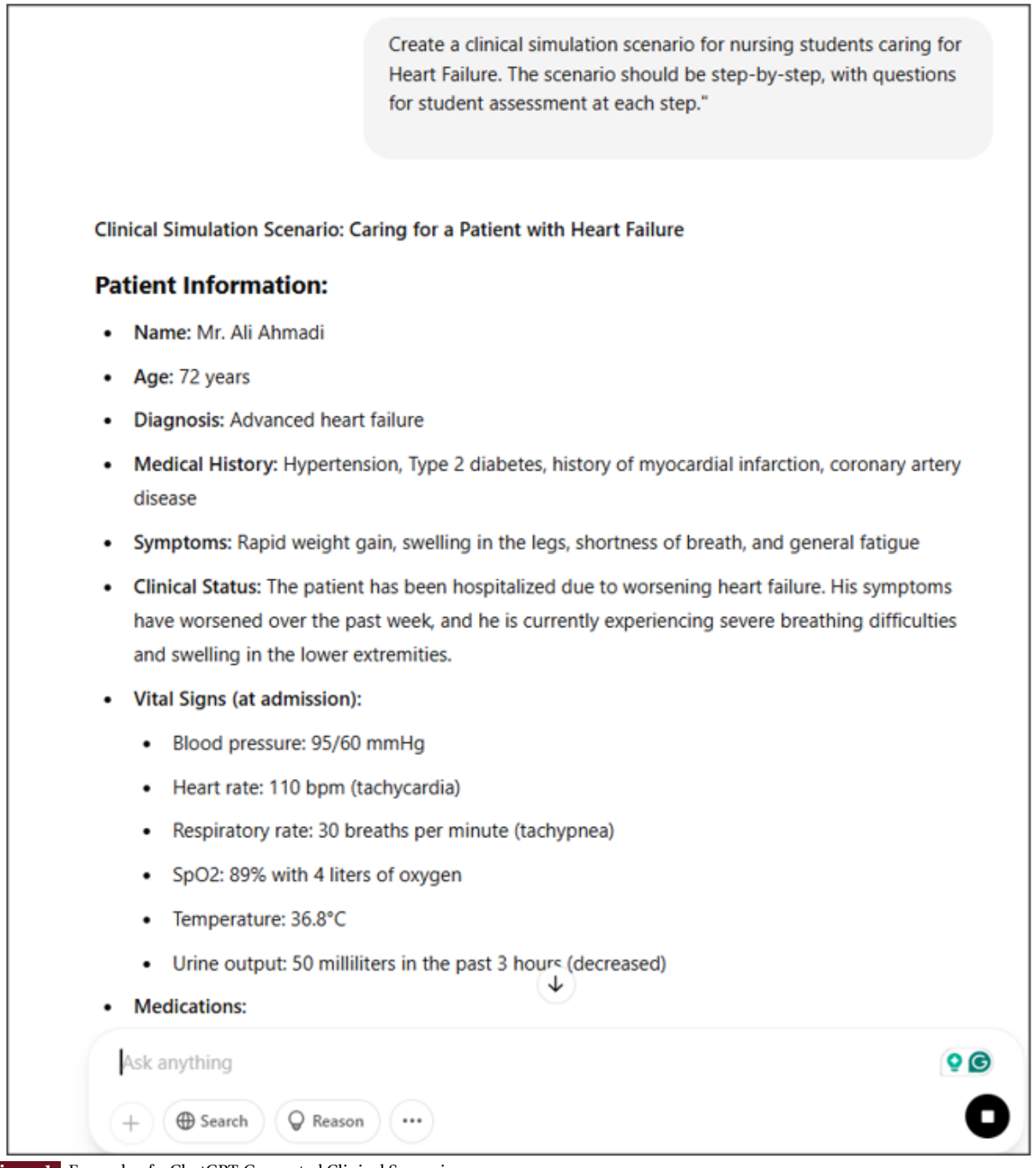

Figure 1: Example of a ChatGPT-Generated Clinical Scenario.

Table 1: Results of thematic analysis of expert feedback

Main Theme	Subthemes	Description
Clinical accuracy	Signs and symptoms	Matching the patient's symptoms, laboratory and clinical data, and signs with the disease
	Diagnosis and treatment consistency	Alignment with standard clinical protocols and evidence-based practices
Logical flow of patient cases	sequential symptom progression	Ensuring that the progression of symptoms, diagnostic findings, and interventions follows a realistic sequence
	Intervention response	Consistency in how patient conditions change following medical interventions.
Realism and feasibility	Clinical scenario realism	Ensuring the scenarios reflect real patient care situations
	Practical feasibility	Ensuring scenarios are implementable in training settings
Clarity of learning objectives	Explicit educational goals	Clearly stated and measurable learning outcomes
	Alignment with educational content	Ensuring that scenarios support curriculum objectives
Alignment with students' competencies	Skill and knowledge development	Evaluating whether the cases reinforce critical nursing skills and knowledge and decision-making processes
Level of difficulty	Appropriate challenge level	Ensuring the complexity of cases is appropriate for the intended level of nursing students
	Progressive complexity	Gradual increase in case difficulty to match learners' development

Table 2: Examples of expert feedback

Scenario	Comments
Cardiogenic shock	During the initial evaluation phase, in the first question, symptoms such as shortness of breath and loss of consciousness should be included. In the initial management and monitoring phase, in the first question, the term "nasal cannula" should replace "nasal catheter." The scenario should not expect students to prescribe medication, as prescribing is not within the nurse's scope of practice. In the feedback and post-scenario review phase, in the first question, oxygen therapy should be initiated. In the feedback and post-scenario review phase, in the second question, psychological support and controlled fluid administration should be included. In the initial patient information, the dosage of prescribed medications should be specified.
Heart failure	In the medications section, digoxin should be added. In the initial evaluation phase, in the second question, electrocardiography (ECG), echocardiography, blood tests, and chest X-ray should be included. In the symptom management phase, in the first question, the oxygen therapy level should be specified. In the third question, skin color changes, restlessness, anxiety, and fatigue should be included. In the signs and symptoms section, the onset time of symptoms should be specified.
Postoperative cardiac tamponade due to hemorrhage after cardiac surgery	In the signs and symptoms section, only numerical values should be presented, and any interpretations should be removed. The text in the initial evaluation section should be revised for clarity. In the initial evaluation section, the symptoms shortness of breath, chest pain, dizziness, and restlessness should be added. In Question 2 of the initial evaluation section, the following assessments should be included: vital signs monitoring, intake/output (I/O) monitoring, heart sound assessment, echocardiography, and chest X-ray.

Supplementary table 1: Details of generated and evaluated scenarios (continue)

• Simulation Scenario: Management of Cardiogenic Shock in an Adult Inpatient Patient Information: • Name: Mr. John Doe • Age: 56 years • Diagnosis: Acute Myocardial Infarction with Cardiogenic Shock • Medical History: Hypertension, Type 2 Diabetes, Hyperlipidemia • Current Status: Recently transferred to the ICU following an ST-Elevation Myocardial Infarction (STEMI). • Vital Signs (at the start of simulation): o Blood Pressure: 80/50 mmHg o Heart Rate: 130 bpm (Tachycardia) o Respiratory Rate: 24 breaths per minute (Tachypnea) o Oxygen Saturation (SpO2): 92% on 2 liters of oxygen o Temperature: 36.5°C o Urine Output: 10 mL in the last hour • Medications: o IV Fluids (Normal Saline at 100 mL per hour) o Nitroglycerin (IV) o Dobutamine (IV) o Aspirin (oral) o Heparin (IV bolus) Step 1: Initial Assessment and Identification of Cardiogenic Shock Scenario: You have received Mr. John Doe from the emergency department. His vital signs are unstable, and you must immediately assess his condition. After reviewing the ECG, you notice ST elevation in the anterior leads, indicating a recent myocardial infarction. Assessment Questions: 1. What key clinical signs should you assess in a patient to suspect cardiogenic shock? o Expected Answer: Hypotension, tachycardia, decreased urine output, cold extremities, altered mental status, weak pulses. 2. How do you interpret the patient's ECG findings, especially the ST elevation? What do these findings suggest? o Expected Answer: ST elevation indicates an acute myocardial infarction (STEMI), a common cause of cardiogenic shock. 3. Based on the vital signs, how do you diagnose that the patient is in shock? What criteria do you use for diagnosing cardiogenic shock? o Expected Answer: Shock is diagnosed with low blood pressure (80/50 mmHg), high heart rate (130 bpm), and signs of poor perfusion (cold extremities, altered mental status). Step 2: Initial Management and Monitoring At this stage, students should initiate oxygen therapy, administer IV fluids, and be prepared to manage the patient's hemodynamic status. They should decide on appropriate medications like dobutamine and nitroglycerin. Scenario: You have started oxygen therapy and need to assess the patient's fluid needs. The physician has prescribed dobutamine for cardiac support and nitroglycerin to reduce afterload. The patient is on 2 liters of oxygen, but SpO2 remains at 92%. Assessment Questions: 1. What is the initial oxygen therapy for a patient with cardiogenic shock, and how do you determine the appropriate flow rate? o Expected Answer: Initial oxygen therapy is usually via nasal cannula or face mask to maintain an oxygen saturation above 92%. The flow rate should be adjusted to achieve the target SpO2 (e.g., 2-4 L/min via nasal cannula or 5-10 L/min via face mask). 2. Why is fluid therapy important in the initial management of cardiogenic shock? How do you determine the amount and rate of fluid administration? o Expected Answer: Fluid therapy is essential for improving perfusion. The rate should be carefully adjusted to avoid fluid overload, especially in cardiogenic shock, where the heart cannot pump efficiently. Start with a 250-500 mL bolus and monitor closely for signs of fluid overload. 3. How do you adjust the dobutamine dose to improve cardiac output, and what signs do you monitor to assess its effectiveness? o Expected Answer: Dobutamine should start at a low dose and gradually increase to achieve a heart rate of 80-110 bpm and optimize cardiac output. Effectiveness should be monitored through blood pressure, urine output, and mental status. 4. What is the role of nitroglycerin (e.g., IV nitroglycerin) in managing cardiogenic shock? How does it help the patient's condition, and what side effects should be monitored? o Expected Answer: Nitroglycerin reduces afterload and decreases the heart's workload. It also improves myocardial oxygen delivery by dilating coronary vessels. Side effects such as hypotension and tachycardia should be monitored. Step 3: Managing Complications and Responding to Them Scenario: After one hour, the patient's urine output has significantly decreased, and his blood pressure remains low despite continued fluid therapy. You observe ventricular tachycardia on the ECG. Assessment Questions: 1. What does decreased urine output in this patient mean, and how do you assess renal perfusion? o Expected Answer: Decreased urine output indicates possible renal perfusion impairment. To assess renal perfusion, monitor urine output, check for signs of fluid overload (e.g., edema or crackles in the lungs), and monitor central venous pressure (CVP) and blood pressure. 2. If the patient develops ventricular arrhythmias (e.g., VT or VF), what is your first treatment step, and why? o Expected Answer: In case of ventricular tachycardia or fibrillation, immediate defibrillation (for VF) or synchronized cardioversion (for VT) is necessary. Rapid intervention is required to prevent worsening of the patient's condition. 3. How do you manage low blood pressure despite administering vasopressor medications? What changes would you consider in the current treatment plan? o Expected Answer: If low blood pressure persists, increase the vasopressor dose, add additional medications like norepinephrine, and consider consultation for advanced treatments such as intra-aortic balloon pump (IABP) or ECMO.

Supplementary table 1: The characteristics of the included studies (continue)

4. Given the patient's deteriorating condition, what additional interventions would you consider to improve perfusion or oxygenation?
o Expected Answer: Additional interventions may include adjusting the fluid balance, optimizing respiratory support, increasing the dose of inotropic and vasopressor medications, and considering advanced cardiac options such as IABP or ECMO.
Step 4: Team Collaboration and Communication Scenario: The patient's condition worsens. You need to communicate with the attending physician and other members of the care team to discuss further interventions.
Assessment Questions:
1. How do you report your findings regarding the patient's vital signs and lab results to the physician?
o Expected Answer: Clearly and concisely report key findings such as vital sign trends, lab results (e.g., elevated lactate or BNP), and any changes in the patient's clinical status (e.g., hypotension or arrhythmias).
2. What information should be included in the handoff report to the night shift nurse? How do you prioritize key issues for ongoing monitoring?
o Expected Answer: Include vital signs, medication regimen, any changes in patient status, lab results, and ongoing interventions. Prioritize issues like low blood pressure, urine output, and arrhythmia monitoring.
3. How do you ensure that all members of the care team are aligned on the patient's status and treatment plan?
o Expected Answer: Use clear, direct communication, conduct team status checks, and ensure roles and responsibilities are well defined.
4. If the physician requests that an IABP or ECMO be initiated, what is your role in managing this equipment, and what complications should be monitored?
o Expected Answer: The nurse's role includes ensuring proper setup of the devices and monitoring for complications such as bleeding, infection, or mechanical failure.
Step 5: Feedback and Post-Simulation Review Scenario: Now that the scenario is complete, you will participate in a feedback session to discuss actions, decisions, and potential improvements.
Assessment Questions:
1. Looking back at the management of this patient, what decisions do you identify as most critical, and how did they impact the patient's outcome?
o Expected Answer: Critical decisions include initiating early inotropic support, careful fluid management, and addressing arrhythmias to stabilize the patient's condition.
2. If you had more time, what additional assessments or interventions could you have considered to improve the patient's status?
o Expected Answer: Additional interventions could include administering more fluids, adjusting inotropic drugs, and early consultation for ECMO.
3. What communication strategies did you use to coordinate care with other team members, and what improvements could you make in the future?
o Expected Answer: Clear and concise reporting, team check-ins, and ensuring proper information transfer. Future improvements could involve structured methods like the SBAR technique.
4. Did you identify any weaknesses in your clinical decision-making or technical skills during this simulation?
o Expected Answer: Areas of improvement might include managing complex arrhythmias, optimizing fluid balance, or improving team communication.
• Scenario: Heart Failure in an Inpatient
Patient Information:
• Name: Mr. Ali Ahmadi
• Age: 72 years
• Diagnosis: Advanced heart failure
• Medical History: Hypertension, Type 2 diabetes, history of myocardial infarction, coronary artery disease
• Symptoms: Rapid weight gain, swelling in the legs, shortness of breath, and general fatigue
• Clinical Status: The patient has been hospitalized due to worsening heart failure. His symptoms have worsened over the past week, and he is currently experiencing severe breathing difficulties and swelling in the lower extremities.
• Vital Signs (at admission):
o Blood pressure: 95/60 mmHg
o Heart rate: 110 beats per minute (tachycardia)
o Respiration rate: 30 breaths per minute (tachypnea)
o SpO2: 89% with 4 liters of oxygen
o Temperature: 36.8°C
o Urine output: 50 milliliters in the past 3 hours (decreased)
• Medications:
o ACE inhibitors (e.g., Enalapril)
o Diuretics (e.g., Furosemide)
o Beta-blockers (e.g., Metoprolol)
o Antibiotics (prophylactic)
o Aspirin (for blood clot prevention)
Stage 1: Assessment and Identification of Acute Heart Failure Symptoms
Scenario: Mr. Ali Ahmadi has been admitted to the hospital due to worsening heart failure. He complains of severe shortness of breath, swelling in the legs, and decreased urine output. His symptoms have worsened over the past week. His blood pressure is low, and his heart rate is high. The patient requires thorough assessment to determine the severity of his heart failure and immediate therapeutic interventions.

Supplementary table 1: Sensitivity analysis after excluding outliers and influential studies (continue)

Assessment Questions: 1. What signs and symptoms indicate acute heart failure that should be identified in this patient?
o Expected response: Symptoms of acute heart failure include shortness of breath (especially at rest or while lying down), swelling in the lower extremities, rapid weight gain, decreased urine output, tachycardia, low blood pressure, and low blood oxygen levels.
2. How would you assess the severity of heart failure in this patient?
o Expected response: The severity of heart failure can be assessed through clinical symptoms (e.g., degree of shortness of breath and swelling) and hemodynamic evaluation (such as blood pressure and heart rate). Laboratory tests such as BNP (Brain Natriuretic Peptide) and echocardiography can also help determine the severity of the condition.
3. What immediate interventions are necessary to stabilize the patient with acute heart failure?
o Expected response: Immediate interventions include administering oxygen to improve oxygen saturation, using diuretics to reduce fluid retention and swelling, closely monitoring vital signs, and preparing for further pharmacological treatment such as ACE inhibitors and beta-blockers.
Stage 2: Fluid and Medication Management
Scenario: Given the patient's clinical status, the physician decides to administer diuretics immediately to reduce fluid retention. The patient requires urgent intervention due to decreased urine output and severe swelling in the limbs. Additionally, the patient's fluid status must be carefully monitored and managed.
Assessment Questions:
1. How should the patient's fluids be managed in acute heart failure?
o Expected response: Fluid management in acute heart failure should include the use of diuretics to reduce fluid retention. Urine output, swelling, and vital signs should be closely monitored. Fluids must be carefully controlled to avoid fluid overload.
2. What medications are effective in the treatment of acute heart failure, and when should they be administered?
o Expected response: Main medications for acute heart failure include diuretics (to reduce excess fluids), ACE inhibitors (to reduce cardiac load and blood pressure), beta-blockers (to reduce cardiac workload and heart rate), and sometimes inotropic agents (such as digoxin).
Administration of these drugs depends on the severity of the disease and the patient's hemodynamic status.
3. How can the effects of diuretic medications on the patient be evaluated?
o Expected response: The effects of diuretics should be evaluated by monitoring reduction in swelling, increased urine output, and improved breathing. Electrolytes (especially potassium and sodium) and kidney function should also be monitored.
Stage 3: Management of Respiratory Symptoms and Oxygenation
Scenario: Mr. Ahmadi requires oxygen therapy due to decreased oxygen saturation and severe shortness of breath. The healthcare team decides to optimize his blood oxygen levels and facilitate his breathing.
Assessment Questions:
1. How should oxygen therapy be managed for a patient with acute heart failure?
o Expected response: Oxygen therapy should be continuously evaluated in patients with acute heart failure. Oxygen should be administered to maintain oxygen saturation levels above 92%. Use of an oxygen mask or mechanical ventilation (if necessary) may be required.
2. How can you assess the patient's respiratory improvement after oxygen administration?
o Expected response: Respiratory improvement should be evaluated by increased blood oxygen saturation, reduced shortness of breath, and improved breathing comfort. The patient should also be monitored for signs of hypoxia and aspiration.
3. What signs indicate progression of the patient's respiratory status and the need for further interventions?
o Expected response: Warning signs include severe shortness of breath, use of accessory respiratory muscles, altered breathing patterns, and significant drops in oxygen saturation. In such cases, further interventions such as mechanical ventilation (CPAP or BIPAP) or tracheostomy may be needed.
Stage 4: Follow-up and Evaluation of Patient Status
Scenario: After initial interventions, Mr. Ahmadi shows slight improvement in his respiratory status and hemodynamic signs, but his overall condition still requires close monitoring.
Assessment Questions:
1. How would you assess the clinical status of the patient after the initial interventions?
o Expected response: The patient's status should be assessed by checking vital signs, oxygen levels, respiratory status, limb swelling, and urine output. Electrolyte levels and kidney function should also be monitored.
2. What indicators should be assessed to evaluate the improvement of heart failure in the patient?
o Expected response: Indicators include improvement in respiratory symptoms, reduced swelling, improved oxygen levels, increased urine output, and stabilized blood pressure.
3. What actions should be considered for ongoing long-term management of the patient with acute heart failure?
o Expected response: For long-term management, patient education on medication adherence, reducing salt intake, regular medical follow-ups, and continuous evaluation of cardiac and respiratory status are essential. Preventive interventions like controlling blood pressure and diabetes are also critical.
Stage 5: Feedback and Reflection
Scenario: After the scenario ends, your instructor asks you to review the decisions made, your communications with the healthcare team, and the treatment outcomes.
Assessment Questions:
1. What were your most important decisions during this scenario, and how did they affect the patient's outcome?
o Expected response: Key decisions included administering diuretic and ACE inhibitor medications, managing oxygen levels, and monitoring vital signs, which led to the improvement of the patient's condition.
2. What aspects of communication with the healthcare team were important for managing this situation?
o Expected response: Clear and continuous communication with the medical and nursing teams was essential for making decisions about medications, immediate interventions, and adjusting treatments.

Supplementary table 1: Sensitivity analysis after excluding outliers and influential studies (continue)

3. How can you improve your approach to treating heart failure in the future?
o Expected response: Improvements can include early identification of heart failure symptoms, prompt interventions, better team communication, and optimal fluid and medication management to prevent further complications.
• Scenario: Post-Surgery Bleeding and Cardiac Tamponade in a Patient Following Cardiac Surgery
Patient Information:
• Name: Ms. Sarah Martin
• Age: 60 years
• Diagnosis: First day post-coronary artery bypass graft (CABG) surgery
• Medical History: Hypertension, hyperlipidemia, type 2 diabetes, previous myocardial infarction
• Surgery: CABG, 3-vessel bypass
• Post-surgery Condition: The patient was stable immediately after surgery but is now showing signs of bleeding and cardiac tamponade.
• Vital Signs (Day 1 Post-Surgery):
o Blood Pressure: 85/55 mmHg
o Heart Rate: 120 beats per minute (tachycardia)
o Respiratory Rate: 22 breaths per minute (tachypnea)
o SpO2: 93% with 3 liters of oxygen
o Body Temperature: 37.1°C
o Urine Output: 25 mL in the last 2 hours (reduced)
• Medications:
o Heparin (IV)
o Morphine (IV for pain control)
o Antibiotics (prophylactic)
o ACE inhibitors (for blood pressure management)
o Antiplatelet medications (aspirin)
Step 1: Initial Assessment and Identification of Post-Surgical Complications
Scenario:
The nurse receives a report that Ms. Sarah Martin's blood pressure is gradually dropping despite adequate fluid intake. She is showing signs of tachycardia, tachypnea, and decreased urine output. There are also concerns about bleeding from the surgical site, as chest tube output has increased. The clinical team is suspicious of cardiac tamponade due to the patient's hemodynamic instability.
Assessment Questions:
1. What signs and symptoms of post-surgical bleeding and cardiac tamponade should be identified in this patient?
o Expected Answer: Post-surgical bleeding symptoms include low blood pressure, tachycardia, increased chest tube output, and decreased urine output. For cardiac tamponade, symptoms include low blood pressure, jugular vein distention (JVD), muffled heart sounds, and pulsus paradoxus.
2. How would you assess for signs of cardiac tamponade in this patient?
o Expected Answer: Signs of tamponade can be assessed by monitoring blood pressure, checking for JVD, performing a cardiac examination for muffled heart sounds, and observing for pulsus paradoxus. Echocardiography is the gold standard for confirming tamponade.
3. What immediate interventions would you initiate for this patient considering the possibility of post-surgical bleeding and cardiac tamponade?
o Expected Answer: Immediate interventions include notifying the surgical team, preparing for potential pericardiocentesis (if tamponade is confirmed), ensuring blood products are available for potential bleeding, and closely monitoring vital signs.
Step 2: Hemodynamic and Fluid Management
Scenario:
Despite adequate fluids, the patient's blood pressure remains low. Chest tube output has increased, and bleeding persists. The surgical team has been notified, and a repeat echocardiogram is planned to confirm tamponade. The nurse must continue monitoring the patient's status and provide supportive care as directed by the team.
Assessment Questions:
1. What are the key considerations for fluid management in a patient with post-surgical bleeding and the risk of tamponade?
o Expected Answer: Fluid management should focus on stabilizing blood pressure while avoiding fluid overload, as this could exacerbate tamponade. Administering balanced crystalloid solutions and potentially blood products to replace lost volume is important, while avoiding excessive fluids that could increase pressure on the heart if tamponade is present.
2. How would you assess the patient's response to fluids and adjust your interventions?
o Expected Answer: The response to fluids can be assessed by monitoring blood pressure, heart rate, urine output, and clinical signs of perfusion (such as capillary refill time and skin temperature). If the patient's condition does not improve with fluids, blood products may be considered, or if tamponade is confirmed, further interventions such as pericardiocentesis may be required.
3. What role do blood products (such as packed red blood cells and platelets) play in managing post-surgical bleeding, and when should they be considered?
o Expected Answer: Blood products should be considered if the patient shows signs of significant blood loss, such as a drop in hemoglobin, increased chest tube output, and hemodynamic instability. Transfusion should be based on clinical judgment and laboratory results (such as hemoglobin levels and coagulation profile).
Step 3: Diagnosis and Treatment of Cardiac Tamponade
Scenario:
An emergency echocardiogram confirms that Ms. Martin has significant pericardial effusion with signs of tamponade. The surgical team is ready to perform pericardiocentesis, and the nurse is responsible for preparing the patient and the necessary equipment. The patient remains hypotensive, and the team must act quickly to drain the tamponade and stabilize her condition.

Supplementary table 1: Sensitivity analysis after excluding outliers and influential studies (continue)

Assessment Questions:
1. What immediate interventions should you prepare for after diagnosing cardiac tamponade?
o Expected Answer: Immediate interventions include preparing the patient for pericardiocentesis, closely monitoring vital signs, ensuring blood products are available for potential use, and preparing equipment for invasive monitoring (such as central venous pressure monitoring).
2. What risks and complications may arise during pericardiocentesis, and how can they be minimized?
o Expected Answer: Risks include bleeding, puncturing the heart or lungs, arrhythmias, and infection. Risk reduction strategies include performing the procedure correctly under sterile conditions, using ultrasound guidance, and closely monitoring the patient before, during, and after the procedure.
3. How would you monitor the patient's status after pericardiocentesis and prevent or manage complications?
o Expected Answer: After the procedure, the patient should be monitored for blood pressure stabilization, improved heart rate, and increased urine output. Ongoing assessment of heart sounds (to check for muffled sounds), blood pressure, and JVD is essential to determine the success of tamponade relief. Complications to watch for include recurrence of effusion or infection.
Step 4: Post-Intervention Care and Monitoring
Scenario:
Ms. Martin's condition improves after a successful pericardiocentesis, and the cardiac tamponade has been relieved. The surgical team continues to monitor the patient for signs of recurrence of pericardial effusion and bleeding. The nurse is responsible for ongoing assessments and ensuring the patient's condition remains stable.
Assessment Questions:
1. How would you assess the patient after pericardiocentesis to identify potential complications in the post-operative period?
o Expected Answer: Potential complications to assess for include recurrence of pericardial effusion, bleeding from the puncture site, infection, and arrhythmias. Monitoring should include vital signs, heart sound examination to check for signs of recurrent tamponade, and checking for changes in chest tube output or deterioration in the patient's clinical condition.
2. What nursing interventions are important for the post-operative care of a patient who has undergone pericardiocentesis?
o Expected Answer: Key interventions include monitoring vital signs, especially blood pressure and heart rate, assessing for signs of bleeding or infection, managing pain, and providing emotional support for the patient. Ongoing fluid balance and urine output monitoring are also critical. 3. If the patient's condition worsens after the procedure, what would be your initial actions to manage the situation?
o Expected Answer: Initial actions include reassessing vital signs and the clinical status of the patient, including performing a heart sound examination to detect the return of tamponade. If tamponade is suspected, urgent assessment by the surgical team and possibly a repeat pericardiocentesis would be required.
Step 5: Feedback and Reflection
Scenario:
You have completed the scenario. In the feedback session, your instructor will guide you through reflecting on the decisions made, your communication strategies, and how to improve your response to critical situations in the future.
Assessment Questions:
1. What were the most important decisions you made throughout this scenario, and how did they impact the patient's outcome?
o Expected Answer: Key decisions included early identification of bleeding and tamponade, timely requests for interventions, and effective fluid management to stabilize the patient's condition.
2. What aspects of communication with the interdisciplinary team were essential to ensuring optimal care for this patient?
o Expected Answer: Clear and concise communication with the surgical team, as well as appropriate documentation and handoff of information during shift changes, were essential for ensuring the patient received continuous, effective care.
3. Based on this experience, what improvements would you make to your clinical practice or decision-making process?
o Expected Answer: Areas for improvement include quicker recognition of tamponade in post-surgical patients and earlier intervention when complications arise. Additionally, enhancing communication during critical moments to ensure better team coordination is important.