

Clinical Reasoning in the Ward Setting: A Rapid Response Scenario for Residents and Attendings

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Abstract

Introduction: There is a need for educational resources supporting the practice and assessment of the complex processes of clinical reasoning in the inpatient setting along a continuum of physician experience levels. **Methods:** Using participatory design, we created a scenario-based simulation integrating diagnostic ambiguity, contextual factors, and rising patient acuity to increase complexity. Resources include an open-ended written exercise and think-aloud reflection protocol to elicit diagnostic and management reasoning and reflection on that reasoning. Descriptive statistics were used to analyze the initial implementation evaluation results. **Results:** Twenty physicians from multiple training stages and specialties (interns, residents, attendings, family physicians, internists, surgeons) underwent the simulated scenario. Participants engaged in clinical reasoning processes consistent with the design, considering a total of 19 differential diagnoses. Ten participants provided the correct leading diagnosis, tension pneumothorax, with an additional eight providing pneumothorax and all participants offering relevant supporting evidence. There was also good evidence of management reasoning, with all participants either performing an intervention or calling for assistance and reflecting on management plans in the think-aloud. The scenario was a reasonable approximation of clinical practice, with a mean authenticity rating of 4.15 out of 5. Finally, the scenario presented adequate challenge, with interns and residents rating it as only slightly more challenging (means of 7.83 and 7.17, respectively) than attendings (mean of 6.63 out of 10). **Discussion:** Despite the challenges of scenario complexity, evaluation results indicate that this resource supports the observation and analysis of diagnostic and management reasoning of diverse specialties from interns through attendings.

Keywords

Clinical Reasoning, Simulation, Standardized Patient, Scenario-Based Simulation, Think-Aloud, Medical/Surgical Ward, Rapid Response, Tension Pneumothorax, Critical Care Medicine, Surgery, Qualitative Research, Quantitative Research

Educational Objectives

By the end of this scenario, participants will be able to:

1. Develop a problem-focused history.
2. Prioritize and perform a problem-focused physical examination.
3. Appraise clinically relevant information (e.g., interview findings, physical findings, laboratory results).
4. Formulate a differential and leading diagnosis with supporting evidence.
5. Prioritize and provide resuscitative care for a patient with a tension pneumothorax.

Citation:

Ohmer M, Durning SJ, Kucera W, et al. Clinical reasoning in the ward setting: a rapid response scenario for residents and attendings. *MedEdPORTAL*. 2019;15:10834.
https://doi.org/10.15766/mep_2374-8265.10834

Introduction

Clinical reasoning is a central activity in making accurate diagnoses and includes the activities of gathering and synthesizing information, interpreting data, generating differential diagnoses, refining those initial hypotheses to arrive at a leading diagnosis, and developing management plans.¹⁻⁵ Errors in clinical reasoning are viewed as a primary contributing factor to diagnostic error: instances in which the correct diagnosis is missed, delayed, or wrong.⁶ In primary care, diagnostic errors may occur in up to 10% to 15% of patient visits,⁶ and research suggests that diagnostic error may result in up to 40,000 patient deaths and 150,000 patient harms annually.⁷⁻⁹ Furthermore, a retrospective analysis indicates that the second most common source of errors in the inpatient setting was diagnostic errors, at a rate of 21%.¹⁰

Factors believed to influence a physician's clinical reasoning processes include deficits in cognitive processes¹¹ (e.g.,

nonanalytic and analytic reasoning errors), deficits in medical knowledge,^{12,13} inappropriate selectivity¹⁴ (i.e., not being selective in the information one gathers or follows up on), physician affect,¹⁵ and contextual factors^{16,17} (i.e., aspects of the clinical encounter beyond the patient's signs and symptoms that can affect clinical reasoning). Recent research indicates that physicians along a continuum of practice (i.e., interns through attendings) could benefit from continuous practice in clinical reasoning processes.¹⁸ Thus, there is a need for educational resources that can support the practice and assessment of the complex processes of clinical reasoning along the fuller continuum of practice in the inpatient setting.

Audience and Contribution

Building on prior instructional design and research efforts examining clinical reasoning in the outpatient setting,¹⁹ we created a suite of resources to assist medical education stakeholders' efforts examining clinical reasoning processes (e.g., synthesizing information, interpreting data) in the inpatient setting. The target audience is internal medicine, family medicine, and general surgery interns, residents, and attendings. *MedEdPORTAL* provides numerous resources focusing on improving or remediating clinical reasoning, including debiasing strategies²⁰⁻²⁴ and scenarios that individuals can engage in to practice specific diagnoses.²⁵⁻²⁸ This resource adds to these resources and *MedEdPORTAL* by (a) providing a scenario that addresses clinical reasoning in the inpatient ward context (as opposed to the emergency department or outpatient setting), (b) coupling the scenario with a reflection protocol to elucidate clinical reasoning processes, (c) being adaptable to both medical and surgical specialties, and (d) being applicable to physicians ranging from intern through attending (vs. a singular focus on medical students).

The purpose of this report is twofold. First, we describe the development and logistical requirements of this suite of resources for those considering employing it in their settings. We then describe the design and results of the implementation evaluation, a useful tool for developing new educational activities.²⁹ The purpose of the evaluation was to determine if the scenario could be consistently delivered as specified and to examine how well the resources supported our goal of eliciting physicians' clinical reasoning processes.

The evaluation questions were:

1. Does the suite of resources enable participants to engage in clinical reasoning processes consistent with design specifications (e.g., gathering and synthesizing

information, interpreting data, generating differential diagnoses)?

2. Are participants satisfied with the scenario-based simulation as a reasonable approximation of clinical practice?
3. Does the scenario present participants of diverse years of experience with an adequate challenge?

Methods

Drawing on previous efforts to examine and assess clinical reasoning processes,¹⁹ we developed a scenario-based simulation to elicit clinical reasoning in an inpatient experience. We coupled the scenario with written and verbal reflection tools to evaluate physicians' reasoning. Given that our prior resources emphasized patients with low to moderate levels of acuity, we sought to develop a resource to examine clinical reasoning in a higher-acuity situation.

Resource Design Rationale

We used a live scenario-based simulation employing a narrative and requiring participants to identify and resolve a problem while interacting with the tools (e.g., stethoscope, examination table), clinical roles (e.g., patient, other health care professionals), social interactions, and clinical procedures found in actual clinical practice.³⁰⁻³³ This type of simulation is useful in studying diverse individual- or team-level behaviors,^{1,34} decision making,³⁵ and clinical reasoning.¹⁹

Design procedures for the scenario: We used participatory instructional design processes (see Battista and colleagues¹⁹ and Könings and colleagues^{36,37} for information), which encouraged the inclusion and integration of the perspectives of diverse stakeholders.³⁶ The process included three stages: initial design (e.g., determining scenario goals, identifying stakeholders), preliminary testing (e.g., read-throughs, rehearsals), and implementation with evaluation (e.g., analysis of implementation processes and participants' performance).

Design features used to support diverse specialties and levels of experience: We selected an admission diagnosis (cellulitis with an abscess drained in the emergency department; see Appendix I) that, according to interviews with physician and nursing subject matter experts, could plausibly be admitted to either a medical or surgical team (see Appendix D for a full standardized patient [SP] case). To accommodate differences in experience (i.e., level of comfort with needle or tube thoracostomy), we included more than one branching option in which participants could proceed (see Appendix J).

We also used three strategies to increase scenario complexity for a continuum of practice, namely, diagnostic ambiguity, contextual factors, and increased patient acuity. In terms of diagnostic ambiguity, defined as a series of symptoms and findings that could suggest more than one diagnosis, we drew from Tschan and colleagues.³⁴ We developed a history of present illness—pain and trauma associated with a fall—that could have been caused by more than one source, such as simply tripping and falling or a fall caused by syncope. In terms of contextual factors, defined as aspects of the clinical situation unrelated to the patient's signs and symptoms, such as physician fatigue, logistical problems, or a language barrier between physician and patient,¹⁶ participants were asked to report to the bedside of a patient unknown to them to further introduce uncertainty. Research has suggested that contextual factors influence clinical reasoning performance, potentially introducing significant unwanted variance (error) in patient care, affecting both residents and attending physicians.^{16,38} Preliminary findings from our prior research in the outpatient setting suggested that increased patient acuity resulted in perceptions of increased scenario complexity,¹⁹ so we designed the scenario so that the patient's condition would deteriorate as the scenario progressed and the tension pneumothorax worsened.

Rationale for multiple modality simulation: We designed a multiple modality simulation, using both an SP and a surgical simulator.³⁹ The SP was able to accurately portray a patient in distress (e.g., speaking through clenched teeth, withdrawing from palpation at the site of injury, displaying changes in level of consciousness). Meanwhile, the TraumaMan (commercially available from Simulab, Seattle, Washington) surgical simulator (stored out of view of participants outside the patient room and introduced only if participants indicated a desire to do a procedure) supported thoracostomy performance.

Scenario Procedures and Logistics

Scheduling logistics: For each scheduled study date, we requested two simulation rooms. The first room (no special setup required) was used to allow participants to complete the think-aloud warm-up privately prior to participating in the scenario and to complete the postencounter form (PEF) and rewatch their performance while thinking aloud afterward. The second room mimicked an inpatient ward hospital room, including a hospital bed, an IV pole, a chair, a sink, and a headwall with oxygen hookup and call bells (a full supply list is shown in Appendix G). We asked the SP to arrive approximately 30 to 45 minutes early for moulage application (see Appendix H for moulage images and instructions). One to four participants were scheduled on

each study day; we suggested that participants plan for a 2-hour session to allow for technical issues.

Simulated stethoscope: Participants used an AURiS simulation stethoscope (commercially available from iSimulate, Albany, New York), which mimicked abnormal breath sounds in the SP. Our orientation procedures for participants included verbal instructions, followed by practice on themselves prior to starting the scenario. If participants struggled with the stethoscope during the scenario, the simulated nurse provided support so as not to disrupt the scenario flow.

TraumaMan: Participants were not oriented to the TraumaMan model prior to the scenario so as not to prime them to the diagnosis. Participants were informed prior to the scenario that they might encounter task trainers (see Appendix B), and the simulated nurse provided support so as not to disrupt the scenario flow.

Staffing requirements: We scheduled three team members, in addition to the SP portraying the patient, for each session:

1. The first team member greeted and oriented each participant to the simulation laboratory and all session activities and portrayed the patient care technician, assisting in the simulation.
2. The second team member, who possessed clinical experience, portrayed the primary nurse and remained in the room for the duration of the simulation to assist the participant as a typical medical/surgical nurse would.
3. The third team member portrayed the first rapid response team (RRT) member to arrive, elicited information from the participant, and determined when to end the scenario.

Video recording and video playback during think-alouds: To support the replaying of participant videos during their think-alouds, we video recorded each scenario using three portable video cameras with removable SD cards. Following each scenario, while the participant completed the PEF, a team member removed the SD card and connected it to a computer so that participants could rewatch their video.

Think-alouds: The think-aloud protocol was conducted by a team member who was trained in the think-aloud procedure (see Appendix C for think-aloud instructions¹⁹). A written script was used for consistency. This team member remained with participants (in a closed room for privacy from others) while they viewed their performance and thought aloud. Think-alouds were audio recorded using two digital voice recorders.

Participant procedures: On the scheduled day, participants were oriented to the session workflow (Appendix A), prebriefed (Appendix B), and oriented to the think-aloud (Appendix C). Because we recruited participants of varying experience and clinical specialty, we instructed participants to practice within the limitations of their comfort level (Appendix B). Because participants in this sample were participating as part of a research study, issues related to confidentiality and privacy were addressed in the consent process. We refer the reader to the International Nursing Association for Clinical Simulation and Learning's standards of best practice for simulation design and prebriefing.⁴⁰

During the scenario, participants received a phone call (using a team member's cell phone) from the primary nurse calling to report the patient's fall (see Appendix F, page 1, for the primary nurse scripted opening); were directed to the patient's room, where they had up to 20 minutes to complete their assessment and any necessary interventions (there was no penalty for finishing early or being stopped before completion); and had the scenario stopped after giving a brief report to the RRT member.

Observation and management of strugglers or delays in care: We anticipated that some participants might struggle or delay escalating care or seeking help. Thus, participants were observed by the primary nurse and one of the team members not present in the room (e.g., the RRT member) for extended delays. Delays usually manifested as instances where participants remained focused on their assessment, failing to call for help or express concern for or consideration of the patient's deterioration. In these cases, the primary nurse verbally indicated concern about the patient's condition and was going to call a rapid response.

Following the scenario, participants completed the PEF (see Appendix K), were reread the instructions for thinking aloud (Appendix C), and watched their video-recorded performance while thinking aloud (Appendix C).

Optional feedback: These scenarios and reflection protocols were initially intended to support research; however, we recognized that participants could benefit from feedback from a dedicated study team physician with expertise in treating patients with similar conditions. Following each session, we notified participants verbally and by follow-up email that individual feedback was available if desired.

SP Casting and Training

We sought an SP similar to our designed role in age and body habitus (a middle-age male of average weight and stature).

For simulated participants portraying health care professionals (e.g., primary nurse), we sought individuals who possessed prior clinical experience.

To prepare, all simulated participants were first provided with the SP case (Appendix D) and the SP rehearsal guide (Appendix E) to review.⁴¹ We then scheduled two training sessions, each approximately 2 hours. During the first training session, we walked through the scenario and possible hypothesized pathways that participants might take. During the second training session, one of our team members portrayed the participant, and we practiced the scenario up to three times (see Appendix J).

SPs were not required to adhere verbatim to any specific utterances; instead, we asked them to commit to memory the time line of the scenario and the patient's past medical history, family history, and social history so that they could provide spontaneous answers while keeping within the facts of the case we had developed. SPs were instructed to provide information when prompted and minimize volunteering. Our goal in developing the rehearsal guide (Appendix E) was to enhance implementation fidelity of the scenario, which took place over several months, rather than to mandate specific utterances.

Clinical Reasoning Assessment

Postencounter form: The PEF (see Appendix K, Part 1) was a computerized free-text measure that asks participants to provide (a) additional history questions, (b) additional examination actions, (c) a problem list, (d) a differential diagnosis, (e) a leading diagnosis, (f) supporting evidence for that diagnosis, and (g) a management plan. The PEF was originally developed and validated for evaluating clinical reasoning in medical students after completing an SP encounter.⁴² It has since been utilized to support studies examining clinical reasoning processes in resident physicians and attendings using both video- and live scenario-based simulations.^{16,19,43,44}

Think-aloud protocol: The retrospective think-aloud protocol was a strategy that could be used to elicit insight into individuals' cognition and experience while also strengthening their learning⁴⁵⁻⁴⁷ (Appendix C). This process involved asking participants to watch a video recording of their performance and provide a stream-of-consciousness reflection on what they were thinking while partaking in the scenario.

Implementation Evaluation Design, Measures, and Analysis

We conducted an implementation evaluation²⁹ using the think-aloud reflections and the PEF to examine whether the

suite of resources supported participants' engagement in clinical reasoning processes and to determine if the scenario-based simulation was appropriate for diverse participants. We sought a sample of participants representing internal medicine, family medicine, and general surgery specialties with a range of training levels. To determine if participants gathered clinically relevant information, we evaluated the think-aloud transcripts for the presence of four key pieces of information relevant to the diagnosis: the mechanism of injury (mechanical fall hitting the side of the chest); tenderness and ecchymosis over the right lower ribs; decreased lung sounds and hyperresonance to percussion of the right lower lung fields; and progression to shock, with decreased level of consciousness, hypotension, and tachycardia. To further analyze participants' gathering and interpretation of data, we conducted a descriptive analysis of the PEF responses related to differential diagnoses, leading diagnosis, supporting evidence, and management plans.⁴²

To explore participants' perceptions of authenticity, a measure to examine approximation to clinical practice, we developed a single-item question asking participants to rate the authenticity of the scenario on a scale from 1 (*not at all authentic*) to 5 (*very authentic*) (Appendix K, Part 2). Descriptive statistics were used to analyze these findings.

To examine whether the scenario was sufficiently complex for a diverse range of participants, we used a single-item self-reported cognitive load question adapted from Plass and colleagues⁴⁸ asking participants to rate their invested mental effort after completing the PEF on a scale from 1 (*very low mental effort*) to 10 (*very high mental effort*) (Appendix K, Part 3).

Results

Participants were 20 internal medicine, family medicine, and general surgery physicians (six female and 14 male). Twelve were resident physicians (six from PGY 1 and six from PGY 2-4), one participant was a fellow (hereafter grouped with attendings), and seven were attendings (Table 1).

Table 1. Participant Demographics

Demographics	Intern	Resident (PGY 2-4)	Attending
Gender			
Male	5	3	6
Female	1	3	2
Specialty			
Internal medicine	5	6	5
Family medicine	0	0	1
General surgery	1	0	2

Participants' total time to complete the scenario, the PEF, the think-aloud, and other informational questionnaires (collected for research purposes and not included with this resource) ranged between 75 and 90 minutes. Completion of the PEF accounted for the majority of the variability in total time, ranging from 15 to 30 minutes. All participants performed a history and physical examination based on the patient's acute complaint.

Evaluation Question 1: Participants' Engagement in Clinical Reasoning Processes

Gathering and synthesizing clinically relevant information: Content analysis of the think-alouds revealed that 90% of participants considered the mechanism of injury, 80% discussed the tenderness and ecchymosis of the right lower chest, 85% considered the decreased lung sounds and/or hyperresonance to percussion, and 100% discussed the patient's development of shock. Thus, across the levels of experience, participants were engaged in and verbalized appraisal of evidence.

Generating differential diagnoses: Participants considered a total of 19 independent differential diagnoses (Table 2). The most common included tension pneumothorax, pulmonary embolism, pneumothorax, hemothorax, rib fracture, and sepsis. These varied by PGY: Interns considered nine independent differential diagnoses, residents considered 10, and attendings considered 15. The number of differential diagnoses listed by each participant ranged from three to seven ($M = 4.20$). Interns (PGY 1) listed between three and five differentials ($M = 3.50$), residents (PGY 2 and 3) listed between three and six differentials ($M = 4.16$), and attendings listed between three and seven differentials ($M = 4.63$).

Table 2. Most Common Differential Diagnoses Considered

Differential Diagnosis	Frequency of Listed Differential Diagnoses ^a		
	Interns (n = 6)	Residents (n = 6)	Attendings (n = 8)
Tension pneumothorax	5	2	6
Pneumothorax	1	5	3
Hemothorax	0	4	5
Rib fracture/flail chest	1	3	5
Sepsis	3	4	2
Cardiac tamponade	2	1	3
Pulmonary embolism	4	3	4
Angina/acute coronary syndrome/ myocardial infarction	3	1	3

^aTotal frequency count exceeds 20 because participants were not limited in the number of differential diagnoses they could list. Additional diagnoses listed that received two or fewer mentions included pulmonary contusion, anaphylaxis, hyperosmolar hyperglycemic syndrome/diabetic ketoacidosis, underlying lung disease (leading to pneumothorax), malignancy (leading to pneumothorax), stroke, obstructive shock, pneumonia, liver injury, diaphragm injury, and cardiogenic syncope.

Refining hypotheses—leading diagnosis and supporting evidence: Participants listed a total of four different leading diagnoses: tension pneumothorax, pneumothorax, hemothorax, and septic shock (Table 3).

The most common supporting evidence listed by participants included hypotension ($n = 17$), recent chest trauma ($n = 15$), absent or decreased breath sounds in the right lung fields ($n = 14$), tachycardia ($n = 13$), and hypoxia ($n = 10$). Participants who performed a needle or tube thoracostomy also noted the improvement in the patient’s vital signs and mental status ($n = 6$ for each) after the procedure. Interns listed between four and six items of supporting data ($M = 4.67$), residents listed between four and seven ($M = 5.00$), and attendings listed between one and eight ($M = 4.75$).

Developing and carrying out management plans: As participants had the opportunity both to perform interventions during the scenario and to list management considerations on the PEF, we examined the video recordings and the PEFs for management reasoning, per Advanced Trauma Life Support guidelines⁴⁹ and input from our subject matter experts. Ten participants either performed a needle thoracostomy followed by a tube thoracostomy in the scenario or indicated that those interventions were necessary on their PEF (Table 4). Participants who did not perform a needle or tube thoracostomy ($n = 4$) did call for help or activate the RRT and provide supportive care in the interim, including supplemental oxygen and IV fluids.

Additional future management considerations included placing a chest tube ($n = 13$), performing a needle decompression ($n = 9$), administering supplemental oxygen ($n = 8$), continuing antibiotic treatment ($n = 7$), transferring the patient to the intensive care unit ($n = 7$), administering pain medication ($n = 6$) or intravenous fluids ($n = 5$), and performing more invasive airway management ($n = 4$). Other management tasks mentioned were placing the patient on continuous cardiac monitoring, pulmonary toilet and incentive spirometry use, thoracic surgery consult, and obtaining laboratory values (complete blood count, coagulation studies, troponins, lactate, arterial blood gas, and blood cultures).

Table 3. Most Common Leading Diagnoses

Leading Diagnosis	Frequency of Listed Leading Diagnoses		
	Interns ($n = 6$)	Residents ($n = 6$)	Attendings ($n = 8$)
Tension pneumothorax	4	1	5
Pneumothorax	1	5	2
Hemothorax	0	0	1
Sepsis/septic shock	1	0	0

In addition to performing therapeutic interventions (e.g., needle thoracostomy), participants also requested additional diagnostic testing, including a chest X-ray ($n = 16$) or an electrocardiogram ($n = 3$), and four stated that they would consider chest computed tomography when the patient was more stable.

Evaluation Question 2: Authentic Approximation of Clinical Practice

Participants generally rated the case as being authentic ($M = 4.13$ on a 5-point scale). Although there was not enough power to test statistically, we noted that residents ($M = 4.50$) rated the authenticity slightly higher than interns ($M = 4.00$) or attendings ($M = 3.94$). Analysis of the think-alouds indicated that all participants commented on the authenticity of the scenario at least once. The most common themes related to authenticity were the use of the simulated stethoscope and responding to the bedside of an unknown patient.

Evaluation Question 3: Adequate Challenge for Diverse Years of Experience

Participants’ self-reported cognitive load for this scenario ranged from 4 to 10 on a 10-point scale ($M = 7.15$), suggesting moderate to high challenge. The sample was too small for significance testing; however, findings supported expectations, and we noted that interns found this scenario to require more mental effort ($M = 7.83$) than residents ($M = 7.17$) or attendings ($M = 6.63$).

Discussion

The findings from the implementation evaluation indicate that participants engaged in a variety of clinical reasoning processes: They interpreted data to generate numerous differential diagnoses, suggesting that we introduced adequate complexity for diagnostic ambiguity. The evaluation also showed good evidence for refining hypotheses: Most participants achieved the desired outcome of identifying the leading diagnosis of tension pneumothorax, whereas the remaining participants indicated that the patient suffered from a pneumothorax. Based on participant actions during the scenario, we suspect that many of the participants who listed pneumothorax (without the specifier tension) may have done so because at the time the participants completed the form, the tension aspect of the pneumothorax had been resolved. Evidence of clinical reasoning was also seen in the relevant supporting evidence (e.g., hypotension, chest trauma) that participants offered for the diagnosis. Finally, the scenario enabled participants to engage in management actions (i.e., needle decompression, chest tube, or a call for help) and management reasoning (e.g., transfer to the ICU, continuing antibiotic treatment).

Table 4. Participant Activities and PEF Responses Related to Treatment^a

Participants	Called for Help/Rapid Response Only	Both Needle and Tube Thoracostomies	Needle Thoracostomy Only	Tube Thoracostomy Only
Interns				
During scenario	2	1	2	1
Noted on PEF	1	2	1	2
Residents				
During scenario	1	0	4	1
Noted on PEF	0	2	3	1
Attendings				
During scenario	1	2	4	1
Noted on PEF	0	6	1	1

Abbreviation: PEF, postencounter form.

^aTotal frequency count exceeds 20 because some participants both performed the intervention during the scenario and noted it on their PEF.

Participants appeared satisfied with the scenario’s approximation of clinical practice, with all participants finding it at least moderately authentic and interns and residents rating the authenticity slightly higher than attendings.

Finally, the scenario provided sufficient challenge (measured by cognitive load): All participants found it at least moderately challenging, with interns and residents reported a slightly greater cognitive load than attendings.

Strengths

This suite of resources presents a scenario-based simulation and supporting materials to support the observation and analysis of the diagnostic and management reasoning processes of internists, family physicians, and general surgeons in the inpatient context. Examining physicians’ reasoning processes may be particularly useful for eliciting strengths and weaknesses of clinical reasoning. The use of a scenario-based simulation coupled with a think-aloud protocol could also potentially support remediation efforts, although we have not utilized these resources in this way. The scenario and supporting resources could also be employed to support the training of RRTs in the clinical context, potentially supporting interprofessional learning if, for example, the primary nurse role is assigned to a nurse on the designated unit. Furthermore, the think-aloud resource could be integrated with other scenarios in addition to the one we present here.

Weaknesses

Weaknesses of the evaluation of this scenario include our use of a small sample from a single institution, making it difficult to make generalizations beyond this group. Furthermore, we report the cognitive load and scenario authenticity using a single-item question, which may provide limited information about actual cognitive load or nuances in perceived scenario authenticity. Finally, the implementation evaluation does not assess what

participants learned (e.g., through self-report or reflection); however, it suggests that this suite of resources did support our goal of eliciting a situation that enables clinical reasoning practice via the scenario and supports analysis of clinical reasoning through the PEF and think-aloud process.

Challenges

Scenario complexity made it challenging to anticipate and prepare for the actions of participants, but participatory design methods helped minimize instances in which the simulation team was uncertain about how to respond to a participant’s actions. This resulted in greater consistency in implementation, which was especially desirable because our use of this scenario was intended for research.

Differences in participants’ experience and medical specialty were also a challenge, so we intentionally designed a scenario with more than one possible outcome option so that the scenario, especially during patient management, could support this diversity (e.g., calling a rapid response, performing a needle thoracostomy). The findings from the evaluation suggest that this strategy was successful, but it required all members of our team to be knowledgeable about the differing branches and to exercise judgment about how to support the scenario as it unfolded (especially the primary nurse and the rapid response nurse). The SP case (Appendix C), the storyboard (Appendix F), and the branching diagram (Appendix J) supported these decisions. Subsequently, in remaining flexible, we learned that there was a fair amount of variation in how participants approached a patient of this nature.

Last, one strategy to introduce complexity, responding to the bedside of an unknown patient, resulted in three participants noting that they felt this was unrealistic. Although we discussed this challenge during the design stage and depicted the patient as having just arrived on the floor at scenario start, this could have also contributed to some participants’ lower ratings of

authenticity. The findings from the think-aloud indicated that at least six participants commented on this aspect of authenticity. Depending on the context of other organizations employing this scenario, users could consider building in a mock sign-out prior to implementing the call from the primary nurse to mitigate this issue.

Future Directions

This scenario represents the third in a series of four scenarios designed explicitly for examining clinical reasoning in differing clinical contexts that also introduce contextual factors (e.g., physician, patient, or environmental). Our previous publication includes two outpatient scenarios (i.e., new-onset diabetes, coronary artery disease) coupled with a think-aloud reflection,¹⁹ and we are presently developing and testing a fourth scenario depicting gallstone pancreatitis in the emergency department. Additional future efforts may include video-based scenarios to support instances where live scenarios may not be feasible and telehealth-related scenarios to support this growing trend in the delivery of health care.

Appendices

- A. Workflow Diagram.pdf
- B. Participant Prebriefing Instructions.docx
- C. Think-Aloud Instructions and Warm-Up.docx
- D. SP Case.docx
- E. SP Rehearsal Guide.docx
- F. Storyboard.docx
- G. Supply List.docx
- H. Moulage Images and Instructions.docx
- I. ED Medical Record.docx
- J. Branching Diagram.pdf
- K. Questionnaires.docx

All appendices are peer reviewed as integral parts of the Original Publication.

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Acknowledgments

We gratefully acknowledge the support and guidance from Drs. Paul Hemmer and Jeff LaRochelle while refining these scenarios prior to their implementation. We also want to thank our standardized participant, Michael Betteridge, and the Walter Reed Simulation Center operations team for their advice and feedback throughout development and implementation.

Disclosures

None to report.

Funding/Support

None to report.

Ethical Approval

Uniformed Services University Office of Human Subject Protection Institutional Review Board approved this study.

Disclaimer

The opinions and assertions expressed herein are those of the authors and do not necessarily reflect the official policy or position of the Uniformed Services University or the Department of Defense.

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Received: November 30, 2018

Accepted: May 21, 2019

Published: September 27, 2019