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Chasing Fevers: An Interactive Exercise for Pediatrics Residents on Triaging and Assessing Inpatients With Fever

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Abstract

Introduction: Pediatrics residents are frequently tasked with triaging fevers in pediatric inpatients. The variety of clinical scenarios in the inpatient setting—patients with a multitude of diseases and a spectrum of risk for invasive infection—makes this task challenging. To enhance our residents' training on this topic, we developed an activity providing explicit instruction on how to approach these patient scenarios. Methods: The 45-minute activity began with an interactive discussion on approaching pediatric inpatient fevers, followed by a case-based exercise where small groups were assigned one of six clinical scenarios involving inpatients with fever. Learners discovered new information about their patient by drawing paper slips out of a container. Each slip could take their patient's story in a different direction. Small groups discussed decision-making options for their assigned case at each step. Among the potential events were rapid response calls—acute issues requiring immediate assessment—in which learners competed for limited seats to determine who would respond to the call. The activity concluded with a discussion about treatment of inpatient fevers. Results: Respondents to the postevent evaluation rated the activity as highly engaging, effective in helping them achieve its learning objectives, highly relevant to their career, and effective in simulating real-life clinical decision-making situations. Discussion: This instructional technique offers a unique, engaging, case-based approach to teaching about inpatient fever management in which instructors facilitate and support learners' articulation of clinical reasoning. Future directions include using this technique for other common clinical problems and with other learner groups.

Keywords

Clinical Reasoning, Fever, Pediatrics, Hospital Medicine, Pediatric Critical Care Medicine, Pediatric Infectious Diseases, Pediatric Rheumatology, Case-Based Learning, Games, Editor's Choice

Educational Objectives

By the end of this activity, learners will be able to:

- List important screening questions to triage high- versus low-risk patients when contacted by staff about a pediatric inpatient with fever.
- Describe a systematic approach to evaluating the clinical features of pediatric inpatients with fever (symptoms, physical exam findings, vital sign trends, and other clinical data).
- 3. Identify clinical scenarios in which further testing and/or empiric treatment are indicated.

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4. Apply the above strategies to triage common clinical scenarios of febrile patients in the pediatric inpatient setting.

Introduction

Fever is one of the most commonly encountered complaints among pediatric patients, including those admitted to inpatient settings.^{1,2} Pediatrics residents are frequently tasked with triaging nursing calls about fevers occurring in the inpatient setting. The number and types of clinical scenarios in which residents are faced with making decisions about this symptom in the pediatric inpatient setting are myriad, and so the task of learning how to safely triage these calls can be particularly challenging for house staff. One must first determine the clinical significance of fever in each patient—which varies widely depending upon the age of the patient and the presence or absence of many additional risk factors—and then determine if additional diagnostic and/or management steps are indicated. Much of what pediatrics residents learn about how to approach clinical decision-making for nurse calls about fever typically occurs longitudinally over time through cumulative inpatient encounters and is largely derived from implicit sources (i.e., modeling from more experienced residents and faculty).

In order to advance their clinical decision-making skills, learners require feedback on their thought process from more experienced clinicians who, as Bowen suggests in her review of educational strategies to support clinical reasoning, "should point out diagnostically meaningful information in the data on the case, identify redundant or irrelevant findings, and highlight the discriminating features, including their relative weight or importance for drawing conclusions as to the correct diagnosis."³ Such feedback on one's performance is a critical element of deliberate practice (a conceptual framework described by Ericsson⁴) toward development of expert performance of clinical reasoning skills. The use of case-based instruction in training sessions on clinical decision-making is particularly important. Cases help to situate the learning content into authentic clinical contexts that link theoretical concepts to clinical practice, which enhances the relevance of the learning content for learners.⁵

Several *MedEdPORTAL* publications provide case-based instruction on how to approach pediatric fever.⁶⁻⁹ In contrast to our learning activity, these publications focus on initial approaches to fever (particularly in young infants in the emergency department setting), cover more fundamental knowledge about fever in pediatric patients, and emphasize medical knowledge rather than development of clinical decision-making skills. Other publications emphasize clinical decision-making for common pediatric problems, but they do not include approaches to fever, and other skills such as patient handovers are more heavily emphasized.¹⁰⁻¹³

Methods

This learning activity was a 45-minute segment of an academic half-day for our pediatrics residents focusing on the topic of fever (the other segments of the half-day training session included a primer on fever physiology, measurement, and common misconceptions; evaluating fever in young children; common fever scenarios in the outpatient pediatric setting; and fever in immunocompromised patients). This session was scheduled early in the academic year and included a mixture of residents at all training levels (first through third years). Prerequisite knowledge for learners included some prior experience working in the inpatient pediatrics setting—ideally, at least 2 or more weeks on a pediatric inpatient rotation (participation in the other academic half-day activities was not required for participation in this activity). Prerequisite knowledge and experience for instructors include at least 1 or more years beyond one's intern year in residency caring for pediatric patients of all ages in an inpatient setting.

Activity Preparation

Learning materials: Prior to conducting this learning session, the following materials were prepared (the preparation activities took approximately 30 minutes to complete):

- The following documents were printed out: introductory case slips (Appendix A), nurse assessment slips (Appendix C), physical exam slips (Appendix D), and rapid response call slips (Appendix E). Each set was cut into separate slips, and slips were folded so that the case information on them was hidden. Slip sets were kept organized by exercise step (steps 1-4) and placed into separate, labeled envelopes until the exercise was ready to begin.
- The folded introductory case slips were placed into a large hat from which learners could easily draw them out.
- The case details documents (Appendix B) were printed out.

Room setup: We used the room setup shown in the Figure for this learning activity. The total number of chairs placed in the center of the room was two to four less than the total number of learners available to participate in the rapid response call portion of this exercise (Appendix G).

Activity Description

The activity lasted approximately 45 minutes and consisted of three main parts, with the following time allotment:

- Introductory discussion: approaching calls about pediatric inpatients with fever (5-10 minutes).
- Chasing Fevers case-based exercise (25 minutes).
- Concluding discussion: treating inpatients with fever; take-home points (5-10 minutes).

Learners were instructed to distribute themselves among the small-group tables (three to six people per table, at least one of whom was an upper-level resident), leaving the central circle of chairs empty.

Introductory discussion: During this interactive, facilitated discussion, the instructor discussed with the whole learner group general notions about approaching fever in pediatric inpatients. Learners were asked to share their thoughts about how they approached fevers in inpatient pediatric patients (discussion prompts for this portion of the activity are provided in the facilitator guide, Appendix G).



Figure. Room setup. Several small-group tables with chairs (large enough to seat three to six people each) were arranged around the periphery of the room, with enough tables to accommodate the full learner group. Additional chairs, arranged in a circle, were set up in the center of the room, facing outward. The total number of chairs in the central circle was two to four less than the total number of participating learners. Space was left between tables to allow learners to easily stand up and move quickly to and from the central circle of chairs. The podium was off to one side of the projection screen, out of the way of the small-group tables.

Next, a clinical decision-making diagram for approaching inpatient fevers (Appendix F) was displayed on a projection screen viewable by the whole learner group. The instructor briefly described each decision-making step of this diagram (see instructor notes in the PowerPoint file of Appendix F for suggested teaching points).

Small-group Chasing Fevers exercise: The instructor then facilitated an exercise simulating the decision-making points of common pediatric inpatient case scenarios in which a nurse call about a fever required the physician to make decisions about pursuing further evaluation and/or interventions:

- Step 1: First, the instructor assigned a unique case scenario to each small group by having each group select a slip of paper out of a hat. The facilitator prompted learners to provide their initial thoughts for approaching their assigned patient's fever.
- Step 2: The facilitator then gave each small group additional details for its assigned case and again prompted learners for their thoughts for approaching their patient's fever.
- For each subsequent decision-making point for the patient's fever, small groups discovered new clinical information about their patient by drawing additional slips of paper out of a hat; each slip had on it a different description of the patient, which could take the patient's story in a different direction. With the new clinical data, the facilitator prompted learners from each group to revise their

assessment of the patient and their subsequent clinical decision-making:

- Step 3: Small groups drew a slip representing the bedside nurse's description of the patient.
- Step 4: Small groups drew a slip representing the physical exam findings from their own exam.
- For activity steps 3 and 4, rapid response call slips were mixed in with the other case slips. Learners were instructed that if one of these slips was drawn at any point in the exercise, they must compete for an open chair in the central circle (much like the game musical chairs). The two to four learners who did not get seats during these rapid response calls were designated the rapid response team and were given a new case scenario for which they were asked to state their approach to assessing the patient. The instructor then facilitated a brief discussion with the rapid response team about the case, including salient teaching points related to that case. Rapid response team participants were next instructed to return to their small-group tables, and the Chasing Fevers small-group exercise resumed, as above.

Concluding discussion: During this interactive, facilitated discussion, the instructor discussed with the whole learner group how to approach decisions to treat pediatric inpatients' fevers with antipyretics. Learners were given an opportunity to ask questions related to any portion of the activity. Finally, the instructor concluded the activity with important take-home points.

In the activity's second iteration in 2019, we also printed and distributed pocket cards for residents to keep for future reference on this topic (Appendix I; this file permits printing of four cards per front-and-back page—for durability, we recommend printing on card-stock paper).

Evaluation

Given that this learning activity primarily focused on enhancing learners' clinical reasoning skills (rather than knowledge acquisition) and that the feasibility of directly assessing residents' performance on nursing phone calls for fever in real inpatients would be challenging, we instead chose to survey participating residents about their perception of the effectiveness of the session for helping them to learn about the content listed in the Educational Objectives, above. In addition, a major goal of the design of this new activity was to develop a learning experience that would be more interactive and engaging than traditional didactics; therefore, a learner evaluation survey was felt to be most appropriate for assessing this (i.e., Kirkpatrick's pyramid level 1: learner reaction). In addition to the survey we distributed about this specific learning activity, we also received learner feedback data from our residency program leadership's standard survey for academic half-day sessions.

The learner evaluation survey (Appendix H) asked residents to rate on 5-point Likert-type scales the relevance of the learning content to their roles as pediatricians; the appropriateness of the activity's small-group format, pace, and duration; the effectiveness of the Chasing Fevers exercise in helping them to achieve the Educational Objectives; and the overall effectiveness of the activity for learning about how to approach pediatric inpatients with fever. Respondents were asked to provide narrative comments about the activity's format, strengths of the activity, and areas needing improvement. Finally, they were asked to state whether they would like to participate in other activities structured like this one.

Results

Setting and Participants

This activity was implemented in early August of 2018 and again in early September of 2019 and was led by one of the authors (Jennifer M. Jackson), an experienced academic pediatric hospitalist. Twenty-two residents attended the academic half-day educational session in which this activity was conducted in 2018, and 24 residents attended the session in 2019. Thirteen (59%) and 16 (67%) of the session attendees were upper-level (secondor third-year) categorical pediatrics residents, and nine (41%) and six (25%) were categorical pediatrics interns in 2018 and 2019, respectively; two (8%) of the attendees in 2019 were pediatric neurology interns. The lesson plan was successfully deployed within the allotted 45-minute time frame.

Outcomes

Participants were sent a link to an online survey (Appendix H) eliciting their assessment of the learning activity within a few days of the learning activity. In 2018, 11 of 22 resident attendees (50%) responded to the learner evaluation survey following the event; in 2019, 11 of 24 resident attendees (46%) responded to the postevent survey.

Regarding the activity's relevance to their role as pediatricians, all (100%) respondents rated the content of the activity as extremely or quite relevant in both 2018 and 2019. Regarding the activity's instructional design, 91% of respondents in both 2018 and 2019 agreed or strongly agreed that the interactive small-group format was appropriate for this learning content, and 91% in both 2018 and 2019 agreed that the pace and duration of the activity were appropriate for this learning content. Respondents indicated the activity was effective in helping them to achieve each of the learning objectives (see the Table). Ninety-one percent (2018) and 82% (2019) of respondents indicated they would like to participate in additional learning activities structured like this one.

Residents' narrative comments indicated that they found the learning activity to be highly engaging and felt it effectively simulated real-life clinical decision-making situations. They liked having the opportunity to discuss the cases in small groups and the fact that small groups included a mixture of residents at different training levels. They also liked being mobile during the activity. Resident quotes included the following:

- "LOVED this scheme for learning. It kept me entertained but also challenged me to think."
- "I liked interacting in a smaller group with various levels of training and having our own case to think through while getting to hear the other cases as well! It was a really interesting setup because it mimicked what would happen on nights if a rapid were called (you heard check out about the patient but don't know them all that well, have never seen them, etc.)."
- "Very engaging and interesting! Simulated real life situations and made us think like we would on the floors, but in a safer situation with more time for discussion."
- "Receiving updates on the patient's condition as we were going instead of being given all of the information at once was nice because it made us think carefully about our next steps and mimicked the way that we receive information about patients when working nights."

Table. Learner Evaluation Results for Inpatient Fever Game, August 2018 (11 Respondents, 50% Response Rate) and September 2019 (11 Respondents, 46% Response Rate)

ltem	Very Effective (%)		Effective (%)		Somewhat Effective (%)	
	2018	2019	2018	2019	2018	2019
Describe a systematic approach to evaluating the clinical features (symptoms, physical exam findings, vital sign trends, other clinical data) of inpatients with fever.	45	55	18	27	36	9
List important screening questions to identify high- versus low-risk patients when contacted by staff about an inpatient with fever.	55	64	36	18	9	0
Identify clinical scenarios in which further testing and/or empiric treatment are indicated.	45	55	45	27	9	0
Apply the above strategies to triage common clinical scenarios of febrile patients in the inpatient setting	45	55	45	27	9	9

- "Kept everyone engaged since we didn't know what was coming next and how the patient narrative would be changing."
- "Having the possibility of a rapid response made the upper levels key in more and kept everyone's attention."
- "Overall, this was a very fun, creative, and unique activity, and I really enjoyed it. There was good variation in the types of cases used, and I think [this activity] created a more realistic situation rather than just a didactic format."

Discussion

To enhance training for our pediatrics house staff on the topic of pediatric inpatient fevers, we developed a learning activity that provided more explicit instruction on the clinical reasoning and decision-making required for approaching inpatient fever scenarios. In particular, we crafted specific examples highlighting how to make distinctions between patient scenarios that were lower risk versus those that were higher risk, which required more aggressive investigation and management. We used the cognitive apprenticeship model (a conceptual framework described by Collins and colleagues^{14,15}) in our instructional approach for this activity, so that the cognitive and metacognitive processes involved in expert thinking in these clinical scenarios would be made visible to learners (modeling), learners would be observed performing these cognitive tasks and be given feedback (coaching), and learners would be supported by the instructor to their current level of clinical reasoning skills, after which support would gradually decrease as the learners progressed (scaffolding).

In designing the learning activity described in this resource, we sought to develop an instructional design that would support high levels of learner engagement. Learner engagement with the learning content is important because it enhances learners' assimilation of new knowledge and skill development. As such, learner engagement has been shown to be a strong predictor of learning outcomes—higher levels of engagement result in higher levels of performance.^{16,17} Learner-learner interaction during learning activities is also important for optimizing learning outcomes; several studies have demonstrated that learners working collaboratively in teams achieve higher performance outcomes compared to learners working independently, even for the highest-performing individuals.¹⁸ Therefore, we developed a new learning activity that would be highly engaging and provide learners with an opportunity to work in teams to solve clinical problems. Based on both learners' feedback and our experiences during our implementation of this activity, we noted that the possibility of rapid responses was particularly effective at engaging learners, as it motivated the residents to maintain focus throughout the activity. The fact that even the instructor did not know where each case story would go made the activity very stimulating from the educator's perspective as well.

To our knowledge, this resource is the first to provide instruction on clinical decision-making for fevers in pediatric inpatient scenarios. Our approach to this learning activity includes providing learners with both a general approach to triaging such calls that can be adapted to various clinical situations and prototypical case scenarios through which residents can practice and receive feedback on their clinical reasoning skills. The structure of the activity offers flexibility in terms of the case scenarios and event steps selected, which can be tailored according to an instructor's learning objectives. The activity requires minimal instructor preparation, a relatively small amount of learners' time, and low resource utilization for implementation.

Maintaining a fun, engaging, and safe learning environment during this type of activity is particularly important to encourage learner participation and to minimize learner anxiety about being put on the spot to address clinical decisions throughout the exercise. Instructors can achieve a safe learning environment by providing supportive responses to learners' suggestions and by routinely soliciting additional suggestions from other learners at each decision step, in case redirection is needed for incorrect responses. It is also helpful to take quick polls from the learner audience for some steps (e.g., "Who has encountered this challenge before?"), which serves both to engage the learner group and to make learners' recognition of the relevance of the learning content explicit.

It is important for instructors and learners to recognize that this activity is not intended to provide learners with a comprehensive resource about how to manage every potential type of fever scenario they might encounter in pediatric inpatients; the clinical significance and management of fever vary too widely among patients for this to be a feasible learning goal. Rather, the activity is designed to help learners develop a basic decisionmaking framework upon which they can subsequently build their clinical reasoning skills through ongoing knowledge acquisition, cumulative clinical experiences, and additional feedback over time. The fact that the presence of fever often presents ambiguity for the clinician is leveraged intentionally in this exercise to stimulate learner discussion and metacognition.

This type of case-based exercise presents a temptation to instructors to venture into mini-lectures on various clinical topics (e.g., pneumonia, urinary tract infections, viral syndromes) throughout the case discussions, during which such opportunities are numerous. While pointing out clinical pearls is certainly encouraged, we recommend instructors try to be selective about such sidebars; otherwise, the length of the activity will increase, and learners' attention spans and engagement could decrease accordingly. By presenting limited discussions on multiple clinical scenarios, the activity encourages learners to recognize individual knowledge gaps, which in turn can motivate them to seek to learn more after the activity has concluded.

Participating learners offered helpful suggestions for improvement, including ensuring that all participants speak loudly enough so that the whole group can hear them; from a preparation standpoint, this means selecting a learning setting conducive to good acoustics and ensuring a microphone is available, if needed. Another learner suggested having oneliners for each case displayed in some way (e.g., projected on a screen, written on a dry-erase board or chalkboard, or written on a standing notepad), so that learner groups could more easily recall the case details of other groups' patients during the exercise; without this, these details may be difficult for them to remember. One learner observed that the upper-level residents in his/her group were more active participants than the interns and recommended a mechanism to encourage interns to take a more active role. This observation was not surprising, as more experienced residents are expected to have higher levels of confidence in addressing these clinical decisions. It is important, however, for the instructor, when facilitating this learning activity, to ensure that learners at all levels of training are encouraged to actively participate in the exercise.

Limitations

This learning activity was piloted at a single institution, with a relatively small learner group size; this inherently limits the generalizability of our evaluation results. However, our residents' training experience is felt to be reasonably representative of that of many other categorical pediatrics residency programs that are based in a similar training setting (i.e., based at a tertiary care pediatrics hospital located within a medical center).

A limitation of the evaluation approach we used is that we did not directly assess learners' actual performance of clinical decisionmaking skills following this session. Such an assessment, if performed, could have provided stronger evidence of effectiveness of this learning activity in supporting residents' clinical reasoning development for approaching inpatients with fever. In addition, our learner evaluation survey response rate for this learning activity was relatively low; therefore, our outcomes data are limited to learners who chose to respond and may therefore represent sampling bias.

Future Directions

The instructional strategy used in this activity can be applied to other common inpatient problems encountered by clinicians caring for patients of any age (e.g., respiratory distress, chest pain). This exercise and/or its methods can be implemented with other learner groups besides pediatrics residents, including those in other specialties, trainees who are more novice or more advanced, and other health professions trainee types. Further investigation is needed to assess whether this instructional technique results in improved trainee performance in the workplace.

Appendices

- A. Introductory Case Slips.docx
- B. Case Details.docx
- C. Nurse Assessment Slips.docx
- D. Physical Exam Slips.docx
- E. Rapid Response Call Slips.docx
- F. Inpatient Fever Activity Slides.pptx
- G. Facilitator Guide.pdf

- H. Postevent Learner Survey.docx
- I. Pocket Card.pdf

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

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Disclosures

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Ethical Approval

The Wake Forest School of Medicine Institutional Review Board approved this study.

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