

Pediatric Boot Camp Series: Longitudinal Care for a Child With Asthma—From the Emergency Department to Outpatient Clinic

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Abstract

Introduction: Childhood asthma is a major source of worldwide morbidity and mortality. Successful management requires a broad spectrum of skills. Given the prevalence, medical students should be proficient in evaluating and managing asthma, including the acute treatment of an exacerbation through the maintenance phase. **Methods:** We used a high-fidelity simulation case of a 2-year-old boy presenting to the emergency room in respiratory distress to let medical students practice the assessment and management of a patient in status asthmaticus. Small-group, case-based discussions combined with provider/parent role-playing facilitated building a framework for addressing the medical management and social aspects of asthma control. Large-group discussions and review of national asthma guidelines helped solidify the material. **Results:** Forty-one fourth-year medical students participated in this curriculum over a 5-year period. All participants strongly agreed with the statement “I took away ideas that I plan to apply to internship.” Using a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*), the mean agreement with the statement “This simulation session and debrief was useful” was 5 and with “The small-group role-play and discussions were useful” was 4.5. Students reported that they had a better framework for the treatment and management of asthma. **Discussion:** This curriculum is unique in that it uses one unifying case through different phases of care to allow participants to demonstrate comprehensive management of childhood asthma in various practice settings. The curriculum can be used independently or in conjunction with other learning activities as part of a pediatric boot camp.

Keywords

Pediatrics, Boot Camp, Asthma, Simulation, Role-Play, Case-Based Learning

Educational Objectives

After participation in this activity, participants will be able to:

1. Perform medical stabilization of a child in status asthmaticus.
2. Develop an asthma action plan.
3. Classify asthma severity using the National Heart, Lung, and Blood Institute’s guidelines.
4. Discuss different treatment options and management strategies for chronic asthma.
5. Develop skills for effective communication with patients, families, and health care providers on asthma care and management.

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Introduction

Asthma is a common pediatric problem that leads to significant childhood morbidity and mortality. The estimated prevalence of asthma among children less than 18 years of age in the US is 6.2 million, with an estimated 20% of children with asthma requiring emergency department visits annually.^{1,2} The overall rate of emergency department visits for children 2-17 years of age is estimated to be 9.29 visits per 1,000 US children.³ Children with asthma present to medical care in both the acute care and outpatient clinic settings. In 2012, there were 10.5 million ambulatory visits for asthma.⁴ Care in each of these settings poses unique challenges to the medical provider. In the acute care setting, timely diagnosis of wheezing and respiratory distress is critical. Providers must be familiar with the management of status asthmaticus and decide on the appropriate disposition from the emergency department. Equally important are outpatient follow-up and management of patients with a chronic illness like asthma. The challenges of outpatient management of asthma include medication management, discussions surrounding long-term medication use,

development of mitigation strategies for environmental triggers, and active participation of parents and children in early symptom recognition.

This curriculum was developed to teach graduating medical students about the complexity of both acute and chronic asthma management. The components of the curriculum reflect the different aspects of care of a child with asthma, including acute airway and breathing management, team communication, providing instructions to parents and patients on proper use of medications, engaging in sometimes difficult discussions surrounding long-term steroid use, staging a child's asthma severity, and developing an asthma action plan. In small groups, students work through a case longitudinally from the emergency department to the inpatient hospitalization and subsequent outpatient follow-up. The curriculum utilizes high-fidelity simulation, role-playing, and small-group discussions complemented by self-reflection and peer/facilitator feedback to address the learning objectives. These educational strategies were selected so that students could apply their knowledge and practice both management and communication skills in a safe environment with direct, timely feedback while having the opportunity to immediately incorporate suggestions. This curriculum can be used in a stand-alone fashion or be incorporated into a longer course focusing on pediatric principles and/or communication and clinical skills to prepare graduating medical students for residency.⁵⁻⁷ While other simulation curricula on management of status asthmaticus exist,^{8,9} this curriculum encompasses a broader scope including emergent, inpatient, and outpatient asthma management.

The target audience for this curriculum was originally defined as graduating medical students who were entering into residencies where they would care for pediatric patients in both the acute care and outpatient settings (pediatrics, family medicine, emergency medicine). Junior residents (including new interns at the beginning of residency), nurses, and respiratory therapists may also benefit from this curriculum.

Methods

Development

This curriculum was developed as part of a 2-week pediatric boot camp experience for graduating fourth-year medical students who had matched into pediatrics and family medicine. Students entering into emergency medicine, dermatology, and psychiatry have also participated. Participants had basic prerequisite knowledge through prior coursework on the assessment and stabilization of the airway, breathing, and circulation in pediatric

patients.¹⁰ Students had been observed providing oxygenation and ventilation support during previous simulation and had been given formative feedback at that time. Baseline knowledge of the medical management of acute asthma exacerbations as well as chronic management of symptoms and prevention strategies was also useful. Preparticipation review of assessment skills and asthma management could be helpful for some learners.¹¹⁻¹³ These sessions occurred during one of the last 2 days of the annual boot camp, so students had recent experience with simulation, airway management, and role-playing.

When designing the curriculum, we considered adult learning principles, including discussion of schema development, reflection on action, and active learning through participation. We ran this session over the course of 1 day since each activity built on previous ones. The curriculum presented was unique because it incorporated several learning modalities and followed a single virtual patient through several stages of the disease. The content of the case was selected based on the clinical experiences of the authors as a pediatric emergency medicine physician and pediatric hospitalist.

This workshop was divided into four sections: emergency department simulation (scenario 1), inpatient management (scenario 2), outpatient acute care management (scenario 3), and outpatient chronic asthma management case (scenario 4), plus wrap-up/evaluation. See [Table 1](#) for the schedule and required resources for each section.

Equipment/Environment

We conducted high-fidelity simulations in situ within a patient care room in the pediatric emergency department. They could also occur in a simulation center, if available. We used a high-fidelity pediatric mannequin. Students had access to actual equipment and simulated medications found within our clinical environment. Appendix A was used to prepare for the simulation (scenario 1). The role-play cases and discussions were held in a conference room with adequate space to divide into groups of three to four students per facilitator. No equipment was required for these sessions.

Personnel

A simulation technician managed the monitors and simulator. Facilitators played the roles of nurses and parents. The role of nursing staff and respiratory therapists could also be filled with actual providers, if available. We found it difficult to have medical students play the parts of these professionals because the students lacked understanding of the professionals' capabilities and roles.

Table 1. Time, Personnel, Equipment, and Resources for Workshop Parts

Activity	Time (Minutes)	Personnel (Ideal No.)	Equipment	Resource Files
Emergency management of status asthmaticus, emergency department simulation (scenario 1)	90	<ul style="list-style-type: none"> • Simulation technician (1) • Facilitators (1 per 4-5 students) 	<ul style="list-style-type: none"> • Mannequin • See Appendix A 	Appendices A-E
Break	15			
Acute inpatient management of asthma exacerbation (scenario 2) and acute care follow-up in outpatient clinic (Scenario 3)	90	<ul style="list-style-type: none"> • Presenter (1) • Small-group facilitators (1 per 3-4 students) 	<ul style="list-style-type: none"> • Computer (1) • Projector (1) • Asthma action plan 	Appendices F-H
Break	15			
Chronic asthma management, outpatient management (Scenario 4)	90	<ul style="list-style-type: none"> • Presenter (1) • Small-group facilitators (1 per 4 students) 	<ul style="list-style-type: none"> • Computer (1) • Projector (1) • Asthma action plan • Prescription pads 	Appendices H-I
Wrap-up and evaluation	30	<ul style="list-style-type: none"> • Facilitator (1) 	<ul style="list-style-type: none"> • Pens 	Appendix J

Adaptation for low-fidelity simulation: Scenario 1 could be conducted with a low-fidelity mannequin, with physical exam findings verbally reported by the facilitators and vital signs displayed on a tablet or smartphone device.

Implementation

Scenario 1—simulation: The workshop began with a simulation using the scenario of a 2-year-old boy, Eli, with a history of eczema and reactive airway disease, presenting to the emergency department in respiratory distress (Appendix B). The toddler required continuous albuterol treatment with additional therapies including magnesium sulfate before showing some clinical improvement. Appendix C was used to provide chest radiograph results, if the team requested these images. The simulation ended when a diagnosis of status asthmaticus (or asthma exacerbation/attack) had been made and the patient had shown enough improvement to be safely transferred to an inpatient medical unit. We chose improvement to occur after administration of continuous albuterol, steroids (oral or IV), and IV magnesium, although the end point could be changed depending on local practices and resources. The focus of the simulation included team communication, timely diagnosis of status asthmaticus, initial management of status asthmaticus, and safe transfer to inpatient care.

Scenario 1—debriefing for the high-fidelity simulation: The initial debriefing focused on discussing teamwork and communication; the assessment and stabilization of airway, breathing, and circulation; and the initial management of asthma. We used Appendix D to guide the debriefing and selected specific areas to focus on depending on team performance or questions or concerns raised by the learners during the debrief. Appendix E is a glossary of terms related to teamwork and communication that served as a reference when debriefing about team dynamics and performance.¹⁴ Alternatively, this glossary could be provided as an educational supplement to participants.

Small-group work (scenarios 2, 3, and 4): The case-based scenarios continued to build on the diagnosis and management of asthma introduced in the simulation in scenario 1. Eli, the 2-year-old who was admitted to the hospital for an asthma exacerbation in scenario 1, was then followed over time from his discharge from the hospital to a follow-up appointment with his primary care provider 3 days after discharge and then again 9 months after hospitalization.

Scenario 2: The second section began after the admission of the patient, Eli, from scenario 1 to the inpatient team. Learners formed small groups with three to four learners per facilitator depending on the class size and number of facilitators available. The students received the cases and prompts in Appendix F. Facilitators received the materials in Appendix G, which served as the facilitator guide for the small-group discussions. The small-group discussion started off with a review of the appropriate inpatient management of asthma. Learners were asked to determine important historical information they would review with the family as well as admission orders for the patient. They were also asked to identify discharge criteria and to anticipate any possible complications associated with the disease and treatment that could occur during the hospitalization. Learners worked in pairs to develop an asthma action plan for the patient (Appendix H). Learners then role-played with facilitators how they would best discuss the asthma action plan and counsel parents on recognition of respiratory distress. The section ended with the learners discussing medication side effects and writing prescriptions for the medications (albuterol and prednisolone) with which the patient was being discharged (Appendix I).

Scenario 3: After the patient was discharged from the hospital, the learners took on the role of primary care providers seeing the child back for an inpatient follow-up visit to the hospital stay. Facilitators or learners played the role of parents. Participants took a history of medication adherence and ongoing symptoms and were asked to identify possible triggers. The learners were

next introduced to the National Heart, Lung, and Blood Institute (NHLBI) guidelines for classifying asthma severity.⁹ Students then discussed how to classify the child’s asthma in the scenario and what medication recommendations should be made based on that classification.

Scenario 4: The fourth scenario of the curriculum focused on chronic management of asthma, including environmental mitigation and escalation of care to long-acting inhaled steroids.¹⁵ Facilitators or students again took on the role of Eli’s parents, and learners role-played eliciting a history including medication use, asthma triggers, and review of any recent asthma exacerbations. Learners again used the NHLBI guidelines to classify the patient’s asthma control. After gathering this information, in a large group, learners discussed the important points of the medical history, environmental triggers, parental concerns surrounding long-acting steroid use, and ways providers could address these concerns. Learners broke out into their previous small groups to role-play discussion of these topics and develop new asthma action plans (Appendix H), taking into account the addition of a long-acting inhaled steroid. The section ended with practice writing prescriptions for the medication (fluticasone inhaler) that the patient was being sent home with (Appendix I). The workshop closed with a wrap-up of the case and a verbal review of the learning objectives and key points.

Assessment

Learners were provided with formative feedback from the facilitators and their peers during each section of the workshop. In past iterations conducted as part of a 2-week-long boot camp, session evaluation data and free-text comments were obtained as part of an overall course feedback system that asked standard questions for each session (Appendix J). Students were asked to rate their agreement with four statements on a 5-point Likert scale (1 = *strongly disagree*, 3 = *neutral*, 5 = *strongly agree*). These statements were “The asthma simulation session was useful,” “The asthma cases were useful,” “There was a good balance between the didactic components and the small-group activity/interactive portion of the sessions,” and “I took away ideas that I plan to apply to internship.”

Results

This curriculum has been used with a total of 41 fourth-year medical students over 5 years. Seventy percent (*n* = 29) of the participants were future pediatric residents, and 12% (*n* = 5) were future family medicine residents, with the remainder of participants from other specialties, including emergency medicine, dermatology, internal medicine, and psychiatry

Table 2. Distribution of Participants by Specialty

Future Residency	No. of Participants
Pediatrics	29
Family medicine	5
Medicine/pediatrics	2
Dermatology	2
Emergency medicine	1
Internal medicine	1
Psychiatry	1

(see Table 2). Revisions to the small-group exercises and simulation were made after each annual iteration. While the simulations were conducted in groups of six to 10 based on facilitator availability, all small-group discussions occurred with one facilitator per three or four students. Students demonstrated a high level of agreement that the sessions were useful (simulation session = 5, case discussion = 4.5), that there was a good balance between didactics and active learning (4.9), and that they took away ideas they would apply in internship (5; see Table 3).

All 41 students completed evaluations immediately following the sessions. Students reported that they enjoyed using simulation to practice airway and breathing management. Examples of feedback when asked about the most useful aspects of the sessions included the following:

- “Learning how to talk to parents about steroids.”
- “Enjoyed the continuity of the case and then learning about asthma management. Really enjoyed the role playing.”
- “Reviewing medical asthma management for inpatient and outpatient settings was high yield.”
- “The simulation in the morning was really helpful to go through and get a handle on what we could face as interns in the ED. I’m glad we continued to review asthma.”
- “Loved following the same asthma patient from the ER to outpatient.”

Constructive feedback included suggestions to have facilitators model how they would discuss the management of acute and

Table 3. Participant Feedback on Course (*n* = 41)

Statement	Mean Score ^a	Range
The asthma simulation session was useful.	5	4-5
The asthma cases were useful.	4.5	3-5
There was a good balance between the didactic components and the small-group activity/interactive portion of the sessions.	4.9	4-5
I took away ideas that I plan to apply to internship.	5	4-5

^aRated on a 5-point Likert scale (1 = *strongly disagree*, 3 = *neutral*, 5 = *strongly agree*).

chronic symptoms and management of asthma as well as decreasing the amount of role-play, although other participants requested more opportunities to role-play. There was also variable enthusiasm around writing asthma action plans depending on how much experience the students had had during their other rotations.

Discussion

We created this educational resource to help teach graduating medical students about the evaluation and management of asthma within the pediatric patient. As this is a very common chronic illness in children, we incorporated this session into a larger pediatric boot camp course focusing on skills and knowledge crucial for the care of the pediatric patient. We chose a combination of high-fidelity simulation and case-based role-playing so that students could apply their knowledge in clinical scenarios and practice communication and management skills firsthand. While many curricula exist to teach medical students about the disease, this one is unique in that learners follow one patient through many aspects of care in order to understand the continuum of the disease and the priorities for care during different settings. The sessions have been well regarded by medical students over several iterations, and they continually express their satisfaction with the continuity aspect of the material.

During the 5 years we have used this curriculum, we have adapted the content and delivery methods based on student and instructor feedback. For example, we found that students were more engaged in the learning sessions when a single case was used throughout the day. In our first iteration of this curriculum, we used separate cases to discuss short-term and long-term asthma management. Students reported that they preferred continuity, which we had used in other teaching sessions.⁵ We therefore revised the case presentation without altering the learning objectives or overall style. Students did rate the high-fidelity portion of the simulation slightly higher than the case-based sessions, likely reflecting a slight preference for simulation compared to role-playing as a learning tool.

While using this curriculum, we have also learned that participants should have familiarity with different options for providing oxygenation and ventilation support to pediatric patients. During our 2-week pediatric boot camp course, we have used this curriculum several days after a course focused on skills such as airway support and intubation. During the first year, we found that students were eager to intubate the patient and attributed this to priming they may have received during the previous parts of the course. We therefore introduce the concept

of air trapping and the need to assist with bronchodilation during these earlier sessions so that participants would have a fresh understanding of the risks of positive pressure ventilation in a child with active asthma.

A limitation to this curriculum is the lack of a formal assessment of changes in student knowledge, skill, or behavior. While objective summative assessments were not performed, participants did receive formative feedback as guided by Appendices D and G throughout the day. Given the very small number of participants going into fields other than pediatrics, we did not compare results between groups. In the future, we plan on collecting data from participants measuring their self-perceived confidence and growth related to the learning objectives after participation in the session.

We feel that this curriculum provides the opportunity to discuss and explore many aspects of patient care. The ability to diagnosis and manage asthma, both in the acute setting and as a chronic illness, is a crucial skill for any physician who will be caring for children given the high prevalence of this disease. This curriculum addresses issues beyond medical knowledge. Through small-group activities and role-playing, participants are challenged to build therapeutic relationships and address parental concerns and hesitations. This allows learners to practice language and behaviors that will help facilitate patient care.

Appendices

- A. Asthma Simulation Environment Preparation.docx
- B. Asthma Simulation Case.docx
- C. Asthma Chest Radiograph.pptx
- D. Asthma Simulation Debriefing Materials.docx
- E. Asthma TeamSTEPPS Glossary.docx
- F. Asthma Cases.docx
- G. Asthma Cases Facilitator Guide.docx
- H. Asthma Action Plan.pdf
- I. Asthma Prescriptions.pptx
- J. Asthma Evaluation Form.doc

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

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