

Otitis Media Module in the Pediatric Preclerkship Educational Exercises (PRECEDE) Curriculum

Stacy Cooper, MD, W. Christopher Golden, MD, Michael A. Barone, MD, MPH, Eric D. Balighian, MD, Robert A. Dudas, MD, Emily Frosch, MD, Justin Jeffers, MD, David W. Cooke, MD, Olivia Widger, MD, Rosalyn W. Stewart, MD, MS, MBA*

*Corresponding Author: rstewart@jhmi.edu

Abstract

Introduction: The Johns Hopkins Pediatrics Clerkship developed the PRECEDE (preclerkship educational exercises) curriculum with the primary goal of offering students formative instruction in essential pediatric clinical skills to prepare them for their clerkship. PRECEDE sessions occur at the beginning of each basic clerkship for new clinical clerkship students. The otitis media module is one in a series of modules presented in the curriculum and consists of a lecture and four short skills-development stations, each with a faculty facilitator.

Methods: This 2-hour module began with a 1-hour didactic overview of otitis media. Medical students were divided into three groups. One group learned about writing prescriptions via two otitis media clinical vignettes. Another group explored visualization and diagnosis of otitis media via video. The last student group was subdivided and learned proper techniques for positioning and restraining pediatric patients during otoscopic exams and the psychomotor skills for performing otoscopic examinations, including pneumatic otoscopy. Student groups rotated through all four activity stations. Students were guided through discussion to develop interpretation, diagnostic, and treatment skills for acute otitis media. **Results:** Between 2010 and 2012, 254 third- and fourth-year medical students participated in this module. When asked to evaluate overall quality, 86% of learners rated the module as excellent, and 14% rated it as good. **Discussion:** By establishing these important skills, students may be better equipped to develop appropriate otitis media assessments, diagnoses, and care plans for patients and to use otitis media as a platform for broad education in other essential pediatric skills.

Keywords

Acute Otitis Media, Examination, Guidelines, Family Medicine, Otolaryngology, Pediatrics

Educational Objectives

By the end of this session, pediatric clerkship students will be able to:

1. Describe the current American Academy of Pediatrics otitis media guidelines.
2. Compare and contrast the physical exam findings of acute otitis media and otitis media with effusion.
3. Demonstrate correct patient positioning for a pediatric ear examination, including proper restraint of an infant and a toddler.
4. Correctly perform an otoscopic examination, including pneumatic otoscopy.

5. Explain an algorithm for appropriate treatment of acute otitis media in pediatric populations.
6. Compose a prescription for a pediatric patient, including the necessary elements.

Introduction

The Johns Hopkins Pediatrics Clerkship team developed the PRECEDE (preclerkship educational exercises) curriculum with the primary goal of providing students with experiential and standardized instruction in essential pediatric clinical skills to better prepare them to incorporate these skills during their clerkship. This workshop and other previously published components of the PRECEDE curriculum¹⁻³ can be implemented in part or in their entirety, depending on the needs of the training program, and can be modified according to the availability of instructors and pediatric patient populations. The development of this session was prompted by a needs assessment that asked students, "What clinical skills or knowledge specific to this clerkship do you wish you had been explicitly taught, with

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opportunity for practice and feedback, before you started to see patients on the pediatric clerkship?” This local needs assessment was refined further by discussion with clerkship directors from other disciplines at our institution to avoid redundancies in the delivery of clinical skills instruction.

Otitis media is one of the most frequently diagnosed pediatric conditions for which antibiotics are prescribed,^{4,5} and invariably, pediatric clerkship students will encounter this condition during their clinical experiences. This module aims to provide students with the necessary psychomotor skills to perform an otoscopic exam (including restraining the child, if needed), distinguish acute otitis media from otitis media with effusion, determine when antibiotics are indicated for acute otitis media, and appropriately generate a prescription. This last aim is a unique skill needed for pediatrics, as dosing is usually determined by the weight of the patient (rather than using a flat amount) and medications are frequently dispensed in a concentrated liquid form.

Additionally, this workshop was designed to incorporate the Council on Medical Student Education in Pediatrics’ curricular objectives,⁶ which state that students should be able to do the following:

1. Observe the tympanic membrane using an otoscope and an insufflator.
2. List the age-appropriate differential diagnosis for pediatric patients presenting with otalgia.
3. Describe the appropriate use of antibiotics in the outpatient setting, including when it is not appropriate to treat with antibiotics.
4. Write a prescription for a common medication such as an antibiotic.

This module builds upon previously published educational curricula in the literature on otitis media by addressing several unmet needs. PedsCases, a web-based educational tool aimed at medical students, offers a podcast on pediatric acute otitis media⁷ that uses a passive didactic format instead of an interactive module addressing several learning styles. Children’s Hospital of Colorado has an otitis media module⁸ in its residency primary care curriculum; however, this module may be too advanced for clerkship students who have not had any previous pediatric exposure. The Colorado curriculum also utilizes actual pediatric patients, does not employ videos of otoscopy demonstrating actual pathology, and relies on findings of patients in clinic on the day of instruction. The Stanford University pediatric residency program also has a curriculum available on the use of acute otitis media clinical practice

guidelines.⁹ However, this flipped classroom module is aimed at more advanced learners and does not address many other aspects of otitis media, such as distinguishing acute otitis media from otitis media with effusion, the practical needs of prescription writing, the psychomotor skills of performing otoscopy, and the basics of restraining a child. Finally, the University of Michigan has created a curriculum on appropriate email communication¹⁰ that features a parent expecting antibiotics for otitis media as one example. While the curriculum offers excellent instruction on specifics of this communication strategy, its focus is not on otitis media or on the specifics of watchful waiting strategies and communication with caretakers.

As one of the most common diagnoses encountered in pediatrics, otitis media serves as the ideal platform for applied education in a preclerkship exercise. In addition to learning specifically about the diagnosis and management of otitis media, students also learn about broad topics that pertain to other common aspects of their clerkship. These include general topics such as interpreting consensus group clinical guidelines, levels of evidence in evidence-based medicine, how to generate a prescription, health care literacy, approach to selection of empiric antibiotics, and minimizing antibiotic resistance. Our module also highlights pediatric-specific issues such as Food and Drug Administration drug approvals in pediatric populations, the use of weight-based dosing, the principles of liquid dosing, and effective methods of restraining pediatric patients.

Medical education has increasingly called for integration of curricula in a supportive environment that promotes professional identity development¹¹ and scientific inquiry. Thus, we designed the otitis media module with the need for multimodal teaching in mind. The module combines a wide variety of learning styles, including demonstration as well as visual, auditory, and kinesthetic learning,¹² to meet various student-learning needs. A brief didactic lecture helps learners who prefer an auditory learning style. The small-group sessions focus on different learning styles and augment the information presented in the lecture. This design aims to deliver instruction in a way that encourages a higher level of interaction and engagement than afforded by traditional modes of teaching:

1. Visual: Learners and instructor walk through video cases in order to confirm appropriate diagnosis and care recommendations.
2. Kinesthetic: Learners and instructors practice the otitis media exam, including proper use of insufflation.
3. Demonstrative: Learners and instructors walk through and practice prescribing an antibiotic for a pediatric

patient using weight-based dosing and a solution of a particular strength.

Methods

Overview

This module consisted of a 1-hour didactic session, followed by four sequential stations for the next hour. Two groups of four to eight students participated in two sessions (video visualization and prescription writing), while a third group was subdivided and practiced otoscopy (including pneumatic otoscopy) and holding/positioning. At least one faculty facilitator attended each of the four stations. The ideal location for this module would have four separate classrooms (one for each station), with one room having the capacity for the entire class. The session, however, could be held in any setting able to accommodate these separate components.

The module began with all students participating in a 1-hour overview of otitis media led by a faculty facilitator. The PowerPoint slides and the facilitator's guide for this session are provided in Appendices A and B, respectively.

At the conclusion of the didactic session, the students were divided into three groups. Group 1 started at Station A, Group 2 started at Station B, and Group 3 was split into two smaller

groups to complete Stations C and D. After 20 minutes, students at Stations C and D reassembled into Group 3 and moved to Station A. Group 1 students moved to Station B, and Group 2 students divided and completed Stations C and D over the next 20 minutes. For the final 20 minutes, students at Stations C and D reassembled into Group 2 and moved to Station A. Group 3 students moved to Station B, and Group 1 students divided to complete Stations C and D (Figures 1 and 2).

Station A

At Station A, students in the assigned group viewed a video of otoscopic findings (Appendix C),¹³ with a faculty leader facilitating a discussion for 20 minutes on the relevant aspects of visualization of the tympanic membrane and its normal and abnormal exam findings using the slide lecture book.¹⁴ The faculty guide for this is included as Appendix D.

Station B

At Station B, students in the assigned group spent 20 minutes reviewing two clinical vignettes of cases of pediatric acute otitis media. The faculty preceptor used the cases to lead a discussion on the necessary elements of a prescription, and the students practiced writing two prescriptions. The PowerPoint slides a faculty guide for this session are provided in Appendices E and F, respectively.

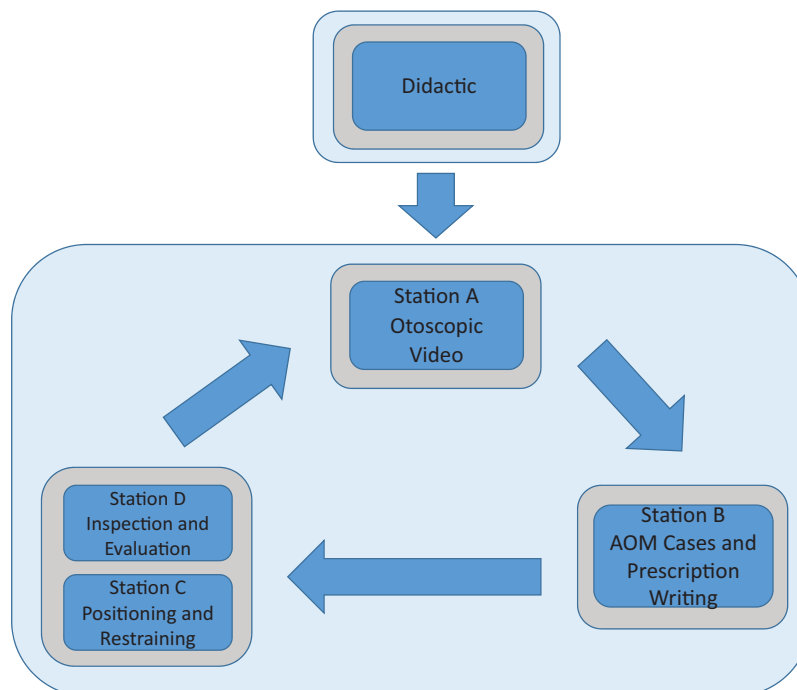


Figure 1. Small-group rotations. Abbreviation: AOM, acute otitis media.

	Activity		
Session minutes	Group 1	Group 2	Group 3
0-60	Didactic		
61-70	Station A	Station B	Station C
71-80			Station D
81-90	Station B	Station C	Station A
91-100		Station D	
101-110	Station C	Station A	Station B
111-120	Station D		

Figure 2. Skill stations’ rotational flow. During each 20-minute session, students at Stations C and D switch at the 10-minute mark. Groups 2 and 3 move to Station A after Stations C and D; Group 1 ends the skill sessions at Stations C and D.

Stations C and D

For Stations C and D, the assigned student group was split into two groups of two to four persons, who spent 10 minutes at each of these two stations. Station C reviewed the proper technique for restraining an infant and a toddler during an otoscopic exam. Points for preceptors to emphasize were included in the faculty guide (Appendix G). Station D reviewed the proper technique for holding an otoscope and performing an otoscopic exam, including the use of pneumatic otoscopy (with student volunteers) as well as an otoscope training simulation model. The preceptor’s guide is included here as Appendix H. After 10 minutes, the groups at Stations C and D switched so that the entire group completed both stations within the 20 minutes.

Appendices A (PowerPoint Slides), B (Lead Facilitator’s Guide), and C (OM Video)—Otitis Media Overview Session

The opening PowerPoint was designed to provide an overview of otitis media for the learners. The slides included definitions of acute otitis media and otitis media with effusion. The presentation also highlighted the 2013 American Academy of Pediatrics (AAP) guidelines for evaluation and management of otitis media, with a discussion of levels of recommendation for generation of such guidelines. The slide show also discussed epidemiology, anatomy, pathogenesis, and complications of otitis media. The video entitled “A View Through the Otolaryngoscope: Distinguishing Acute Otitis Media From Otitis Media With Effusion” was created by the AAP and used with permission.¹³ It highlighted several

otoscopic images of acute otitis media and otitis media with effusion, along with brief clinical vignettes, tympanometry, and reflexometry for each image.

Appendix D (Faculty Guide)—Station A: Otitis Media Video Session
Facilitators could use this guide to review as many or as few cases as necessary to emphasize the method of diagnosing otitis media.

Appendices E (PowerPoint Slides) and F (Faculty Guide)—Station B: Clinical Vignettes and Prescription-Writing Session
This PowerPoint-led session allowed the students to practice the knowledge gained from the didactic session on clinical management of otitis media. The prescription-writing tasks reinforced the use of mass/weight-based dosing of medications in pediatrics, a new concept for some learners. Several clinical pearls were included for facilitators to impart to the trainees, including dangers of over-the-counter otic drops for ear pain/discomfort.

Appendix G (Faculty Guide)—Station C: Instruction on Neonatal and Infant Restraining During a Middle Ear Exam

This guide provided facilitator information for teaching learners the proper restraining of neonates, infants, and children, with particular emphasis on the utility of holding in achieving a successful view of the middle ear. This station was best performed with low-fidelity mannequins (one infant-sized, one toddler-sized).

Appendix H (Faculty Guide)—Station D: Proper Use of an Otoscope and Performance of an Otoscopic Exam

This guide provided facilitator information for teaching learners the proper holding and utilization of an otoscope, with particular emphasis on the nuances of the ear exam in neonates, infants, and children. This station was best performed with ear trainer mannequins and learners willing to practice otoscopy on each other.

Results

From 2010 to 2012, this module was run 10 times, once every 10 weeks at the start of each clerkship session. A total of 254 students participated, ranging from 18 to 27 students in each session. A total of 10 faculty facilitators participated, with each in attendance for this module in at least six of the sessions and most attending eight. This otitis media module was assessed via an online evaluation platform, EValue, used by the students to evaluate all of their courses in medical school.

In order to measure the impact of the new curriculum, students completed questionnaires that were analyzed for the purposes of curriculum improvement. Each question had four options the student could choose: strongly disagree, disagree, agree, and strongly agree. From 2010 to 2012, 239 of the 254 students participating in PRECEDE (94%) completed the questionnaire at the end of the workshop. All students agreed that the session was educationally valuable and met the stated learning objectives (Table). In particular, the students felt the session provided opportunities to develop skills and critical thinking about otitis media in a supportive environment. When rating the overall quality of the session, students had four choices: poor, fair, good or excellent; 86% of the students rated it as excellent, and 14% rated it as good.

Table. Results of the Student Surveys

Item	Percentage (No.)	
	Agree	Strongly Agree
This session met the stated objectives.	19.3% (46)	80.7% (192)
This session increased my SKILLS related to this topic.	21.0% (50)	79.0% (188)
Having had this session will improve my ability to function as a clinical clerk on the wards.	15.7% (37)	84.3% (199)
This session was educationally valuable.	14.4% (34)	85.6% (202)
The instructors provided a supportive learning environment.	15.2% (36)	84.8% (201)
Active student participation was encouraged.	12.3% (29)	87.7% (206)
The instructors enabled me to accomplish the learning objectives for the session.	12.7% (30)	87.3% (206)
The instructors' teaching methods stimulated my own critical thinking.	15.7% (37)	84.3% (198)

Discussion

This session, focused on the skills and knowledge required to perform a pediatric otoscopic exam and properly diagnose and manage otitis media, is a component of the PRECEDE curriculum. The curriculum was designed to provide students with core instruction in the essential pediatric skills needed for optimal performance in their clerkship. The objectives of this session reflect a focus on practical components, while also stimulating students' critical thinking. Evaluation by the students who completed this session demonstrated that they believed the module was successful in achieving these objectives.

Students on the pediatric clerkship need a solid foundation in the diagnosis and practical management of otitis media, as this condition is seen commonly in pediatrics and represents the most common indication for childhood prescriptions. Distinguishing between acute otitis media and otitis media with effusion requires a nuanced understanding of physical exam findings and clinical preparation to facilitate antibiotic stewardship. However, training for this skill set has been identified as suboptimal.¹⁵ Education dedicated to this essential aspect of pediatrics early in the pediatrics clerkship allows for additional opportunities to practice during the rotation with the appropriate physical exam foundation.

Additionally, students should recognize the differences in therapy based on age and clinical presentation. This module highlights the appropriate use of antibiotics in children, in terms of not treating otitis media with effusion with antibiotics as well as treating acute otitis media (vs. watchful waiting). This important distinction is essential to minimize the inappropriateness of antibiotics, which could lead to antibiotic resistance. Additionally, this module exposes students to national clinical standards (e.g., the AAP Clinical Guideline on Otitis Media),¹² which we address by discussing the levels of evidence and categories of support for each recommendation.

In addition to providing concrete skills for otitis media, this module introduces important concepts needed for all areas of medicine. For many students, the discussion of appropriate antibiotic use may be their first exposure to this concept. Our module posits a generalizable framework of identifying the most likely pathogens for otitis media and determining the narrowest coverage of those targeted microbes. Furthermore, the general framework for formulating prescriptions can be applied to any medication on any clerkship, depending on which rotations students have completed previously. Our module is often a student's first dedicated introduction to, and application of, the granular aspects of a prescription format (e.g., proper

nomenclature for the drug prescribed, weight-based dosing, amount of drug per unit volume, etc.). The prescription-writing session also allows for a discussion on health care literacy, best practices for compliance with medication, and communication strategies with caregivers insistent on use of antibiotics.

Moreover, this module encompasses lessons that are generalizable to other crucial aspects of pediatric care. For example, skills of restraining and swaddling infants and toddlers are useful for the performance of other physical exam maneuvers (e.g., suturing lacerations). The section on prescription writing includes an introduction to weight-based dosing in pediatrics, as well as the nuances of prescribing liquid medications, featuring details of concentration choices to obtain reasonable volumes. The module also includes the principle of medication safety, discussing the maximum sizes of certain pediatric medications to avoid overdose from accidental ingestion. Finally, the module allows an opportunity to discuss the role of the federal Food and Drug Administration in pediatrics.

One challenge faced in this curriculum is that the students come to the module with very different backgrounds and experience with pediatric topics and physical exam maneuvers. At our medical school, the clerkship may contain students ranging from those on their first clinical rotation (at the end of second year) to fourth-year students who have already applied for residency. Additionally, while our preclinical students have a longitudinal ambulatory experience for a year prior to starting their clerkships, the majority of these sessions are in adult clinics,¹⁶ and some students do not receive formalized training in otoscopy in their preclinical years. While initially we thought of this variety as a limitation, we have since embraced the diversity and learned to capitalize on the different experiences each student brings to the module. For example, some students have had repeated ear infections as children and can speak to the experience of frequent ear exams and the importance of establishing trust with the medical provider. Additionally, there are often fourth-year students applying for otolaryngology residencies who provide a unique perspective from their electives in this field. Although presented to our clinical clerks in toto, this module could be broken into individual sessions and implemented at various points in a medical school's curriculum, engaging and educating preclinical students, new clinical clerks, and more seasoned learners.

An additional challenge is the instructors' limitation in demonstrating the multiple correct ways to restrain children of varying ages while holding and properly stabilizing an otoscope. This issue is important since students will work in

the ambulatory pediatric setting with many preceptors who perform the otoscopic exam correctly, albeit in a manner they have developed over years of practice. We discuss this issue with students and ultimately see it as an opportunity to expose students to diversity of practice, rather than as something that will lead to student confusion.

A final limitation of our module is that students do not get the opportunity to examine the ear of an actual child during this session. This module breaks down the components of the ear exam (positioning the child and the otoscope, using insufflation, and reviewing findings using dynamic video clips). However, students do not have the opportunity to integrate and apply these skills until starting their clinical assignments. Although simulation can prepare students for these individual components of the exam, we rely on our clinical preceptors to teach the live exam, as adequate visualization and insufflation of the tympanic membrane of a fussy infant or toddler remain a difficult task.

The next steps for this module will involve the addition of an electronic medical record (EMR) component to compare and contrast styles of prescription writing (including the benefits and frustrations of an EMR system). Because the pediatric clerkship has many different sites at our institution, we can demonstrate many different examples of EMR systems, as well as how orders and prescriptions are written in each. Additionally, in order to achieve higher-order objectives, we will develop an otitis media case for the annual comprehensive clinical skills exam performed at our institution by fourth-year medical students. We can then analyze student scores to assess whether those who complete this module during PRECEDE can accomplish learning objectives 2, 3, and 4 and make the appropriate diagnosis. Components of this module also could be used in transitional courses for senior medical students to assess psychomotor skills (in use of the otoscope), prescription writing, and clinical reasoning in management of otitis media.

Appendices

- A. OM PRECEDE Ped Clerkship.pptx
- B. PPT Guide for Lead Facilitator.docx
- C. OM Video.m4v
- D. OM Video Faculty Guide.docx
- E. Prescription Writing in AOM.pptx
- F. AOM Cases & Prescription Writing Faculty Guide.docx
- G. Restraining Children for Middle Ear Exam Faculty Guide.docx

H. Visual Inspection of Middle Ear Faculty Guide.doc

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

Stacy Cooper, MD: Assistant Professor, Department of Oncology, Johns Hopkins University School of Medicine; Assistant Professor, Department of Pediatrics, Johns Hopkins University School of Medicine

W. Christopher Golden, MD: Assistant Professor, Department of Pediatrics, Johns Hopkins University School of Medicine

Michael A. Barone, MD, MPH: Associate Professor, Department of Pediatrics, Johns Hopkins University School of Medicine

Eric D. Balighian, MD: Assistant Professor, Department of Pediatrics, Johns Hopkins University School of Medicine

Robert A. Dudas, MD: Associate Professor, Department of Pediatrics, Johns Hopkins University School of Medicine

Emily Frosch, MD: Associate Professor, Department of Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine

Justin Jeffers, MD: Assistant Professor, Department of Pediatrics, Johns Hopkins University School of Medicine

David W. Cooke, MD: Associate Professor, Department of Pediatrics, Johns Hopkins University School of Medicine

Olivia Widger, MD: Clinical Associate, Department of Pediatrics, Johns Hopkins University School of Medicine

Rosalyn W. Stewart, MD, MS, MBA: Associate Professor, Department of Medicine, Johns Hopkins University School of Medicine; Associate Professor, Department of Pediatrics, Johns Hopkins University School of Medicine

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Ethical Approval

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