Infant and Toddler Examination Workshop for Preclerkship Medical Students

Miriam Schechter, MD*, Hai Jung Rhim, MD, MPH, Mimi McEvoy, RN

*Corresponding author: mschecht@montefiore.org

Abstract

Introduction: Teaching the pediatric physical exam (PE) is commonly reserved for pediatric clerkships. However, with the trend toward aligning basic science curricula with clinical skills development, teaching the pediatric PE as a variation of the adult PE supports integrated learning. Methods: This 2-hour infant and toddler examination workshop teaches the pediatric PE to 12-14 preclerkship medical students within a physical diagnosis course. Differences between the adult and the infant and toddler PE are made explicit, particularly regarding approach, sequence, and variations of the PE unique to infants and toddlers. Infants and toddlers are recruited from within the medical school community and serve as real subjects. Faculty examine one infant and one toddler in an interactive format, providing students the opportunity to learn the unique aspects of the pediatric PE and compare differences in growth and development. Results: A retrospective pre-/postsurvey conducted after the workshop revealed that students’ perception of their skill levels increased, specifically their approach to the pediatric PE, use of observation as an important examination modality, identification of unique pediatric PE components, performance of a developmental assessment, and interpretation of growth charts on all items. Discussion: Our workshop’s focus on teaching the pediatric PE to preclerkship students, ability to accommodate an entire class in a half-day session in a small-group interactive manner, and presence of actual infants and toddlers make it a distinctive contribution to the literature.

Keywords
Clinical Skills, Physical Examination, Toddlers, Infants, Preclerkship Medical Students

Educational Objectives

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

1. Describe the different approaches to the pediatric physical exam based on the child’s developmental level.
2. Recognize the importance of observation in making general assessments of an infant and toddler.
3. Identify unique components of the infant and toddler physical exams.
4. Perform basic developmental assessments of infants and toddlers.
5. Interpret growth charts.

Introduction

Learning the skills of physical examination (PE) is a key part of medical training. In 2005, the Association of American Medical Colleges’ Task Force on the Clinical Skills Education of Medical Students came out with recommendations for clinical skills curricula for undergraduate medical education; however, they did not provide specifics on how early before clerkship training these curricula needed to be introduced. Whipple, Barlow, Smith, and Goldstein found that early introduction of clinical skills improves medical student comfort at the beginning of clerkships. Another motivation for introducing the pediatric exam prior to clerkships involves integration of foundational knowledge and clinical practice, specifically cited by the Carnegie Foundation for the Advancement of Teaching report to medical schools on curriculum
Many medical schools include information about human growth and development during the first and second years without sufficient opportunity for integrating that knowledge with clinical practice. Thus, aligning the pediatric exam with an adult physical diagnosis course might provide an opportunity for students to see the connections between the science of growth and development and infant and toddler assessment.

Generally, PE courses focus on the adult exam, so one challenge is when and how to introduce the pediatric PE as a variation of the adult exam. The Council on Medical Student Education in Pediatrics delineates PE skills specific to pediatrics in its curriculum competencies and objectives. Yet a survey of clerkship directors showed that there was tremendous variability as to when medical students were taught pediatric history and PE skills. Methods also varied and involved didactic lectures, preceptor shadowing, and simulation with manikins, although Pinnock, Jones, and Trenholme found that some students had difficulty transferring skills acquired on manikins to real children. When looking at several methods for teaching PE skills to medical students, the highest-ranked methods are demonstrations and practice with standardized patients (SPs) and practice on real patients. However, the literature supports the idea that real patient encounters are more instructive and authentic than SP encounters.

This half-day infant and toddler examination workshop is designed to introduce preclerkship medical students to the PE of the infant and toddler. Pediatric faculty facilitators lead an interactive demonstration of the infant and toddler PE, including growth and developmental assessments, with small groups of students. Infants and toddlers serve as real models to be examined during the workshop and are recruited from the medical and graduate student community of the medical school, the pediatric housestaff, and faculty of major affiliates. The workshop is contextualized for pediatric preceptors as a significant variation of the adult head-to-toe PE when applied to young children. Differences in the PE between an adult and an infant or toddler are made explicit in the workshop and include elements such as approach to the exam, variations in sequence, unique components of the exam, and special techniques. We use real infants and toddlers for demonstration and practice to highlight these distinctions.

The main unique contribution of this workshop is its focus on pediatric physical assessment for preclerkship students using live children. A vast majority of resources in the literature are focused on the adult PE, and those initiatives intended to teach pediatric PE are pitched for medical students in pediatric clerkships. In addition, a major challenge to educators teaching the pediatric PE is the difficulty in securing willing children and parents to learn from, especially outside the newborn period. Our use of actual infants and toddlers not only is unique in this respect but also enables us to emphasize the difference between the pediatric and adult physical assessments. The workshop placement within a physical diagnosis course helps students make this distinction.

A MedEdPORTAL publication entitled "Pediatrics Training Modules for Preclinical Medical Students" describes an interactive workshop for students prior to starting their clerkships. It supplies a series of training modules that students view ahead of time and later review and apply during an interactive workshop. The publication has many useful resources, but what makes our workshop unique is that we have recruited actual infants and toddlers with their parents for the session, giving students the opportunity to observe a full physical assessment of the infants and toddlers, participate in some aspects of the exam, and ask parents questions to learn about developmental milestones as well as PE techniques. Also, our workshop provides students with the chance to see and interact with both an infant and a toddler, so students are also able to see the impressive differences between an infant and toddler with regard to growth and development.

The journal article "Teaching Pediatric Communication Skills to Medical Students" uses a case-based discussion format that is relevant to preclinical medical students, but its initiative focuses on communication skills, not skills for physical assessment.

A preclinical curriculum for an elective rotation in pediatrics entitled “Pediatric Clinical Rounds Teaching Guide: A Preclinical Curriculum to Improve Medical Student Comfort With Pediatric Patients,” available on MedEdPORTAL, does include modules on PE skills. These sessions demonstrate portions of the exam on
a student volunteer, followed by demonstration on previously chosen inpatient children of different ages. However, these sessions are done in small groups and are elective; thus, the entire class cannot easily get this pediatric PE training. Our workshop introduces an entire preclinical medical school class at once to the pediatric exam.

Thus, the focus of our workshop on all preclerkship students, physical assessment, and the presence of actual infants and toddlers in an interactive setting makes the description of this workshop a distinctive contribution to the literature.

**Methods**

The introduction to clinical medicine course teaches preclerkship medical students the techniques of PE of an adult using a head-to-toe, system-based approach. As an element of this course, the infant and toddler examination workshop is contextualized for pediatric preceptors as a significant variation of the adult head-to-toe PE when applied to an infant and toddler. Differences in the PE between an adult and an infant and toddler are made explicit in this workshop.

Within the approach to the PE, building a verbal rapport with the adult is customary before the PE. However, building a rapport with the parent or caretaker is important for the infant and toddler examination. In addition, the adult PE traditionally takes place on the examination table; the PE of the infant and toddler might take place on the examination table but is often performed on the parent’s or caretaker’s lap. The sequence of the adult PE follows the traditional head-to-toe approach. The PE of an infant or toddler generally begins with the least invasive portions and then proceeds to the most invasive. It therefore starts with examination of the chest and ends with the head, eyes, ears, nose, and throat. There are several PE components that are unique to infants and toddlers, such as vital signs (different parameters for heart rate, respiration, and blood pressure), palpation of the anterior fontanelle, measurement of head circumference, evaluation of the red reflex during the eye exam, examination of the ear and tympanic membrane, and rotation of the hips.

The workshop takes place on a single afternoon for the entire medical school class. The class is divided into groups of 12 to 14 students. Faculty, fellows, and chief resident facilitators are recruited from pediatric clerkship sites from the departments of pediatrics and medicine-pediatrics. One facilitator is assigned to each student group.

Recruitment of infants, toddlers, and faculty is done at least 6 to 8 weeks in advance. There should be one infant (0 to 12 months) and one toddler (13 to 24 months) with a parent assigned to each group. Children are recruited from within the medical school community (medical students, residents, and attendings) for the workshop through e-mail (Appendix A). Parents are asked to bring the child’s most recent weight and length measurements to the workshop. Providing transportation to parents and even a small monetary gift (or gift card) facilitates the recruitment of volunteers. Providing a light lunch to the faculty also encourages participation from clinicians with busy schedules.

A limiting factor to the success of the workshop is the number of children and faculty available. Ideally, the more faculty and patients (and thus the smaller the student groups), the more hands-on and interactive the session can be. If this is challenging, there are other strategies to aid with recruitment. Half the number of infants and toddlers can be recruited and each examined twice on the same day by switching between two groups halfway through the session, thereby ensuring one infant exam and one toddler exam are demonstrated to each student group. Alternatively, the class can be split in half and the workshop run on different days, bringing the volunteers and faculty back twice. Finally, a single exam of an infant or toddler could be demonstrated. While larger student groups would reduce the need for as many young children, they provide less opportunity for making the workshop interactive for all participants.

Our workshop takes place in our clinical skills center, a simulation space with multiple examination rooms. If a similar space is not available, the workshop could be conducted in any outpatient clinical venue with multiple exam rooms, perhaps after hours. An exam room with enough space for an exam table and chairs for all students, the parent, and the faculty member is needed for each group. Students bring their own
stethoscopes. There should be a sink or hand sanitizer in the room. The entire workshop occurs during a
half-day (approximately 3 hours 15 minutes total for faculty; 2 hours for students, parents, and children).

Resources are used to provide background and framework for students in preparation for this session.
These materials are distributed to students electronically a week before the session. Students are
expected to review these ahead of time. In addition, resources on instruction of the pediatric PE to
medical students are made available to interested faculty (Appendix B).

The following necessary materials for the workshop should be compiled into folders for each participating
faculty member:

1. Room and student assignments.
2. Infant and toddler assignments (names of children and parent, ages of children).
4. Growth charts (one for every student in the group).
5. Denver Developmental Screening Test sheets (one for every student in the group).
6. Measuring tapes to measure head circumference (two per group).
7. Workshop and faculty evaluation forms, if not online (one for every student in the group).

Half-Day Session Overview

Table 1 depicts the time line of the half-day session, including faculty orientation before the session and
faculty debriefing after it.

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 hour</td>
<td>Faculty orientation (food—Program directors review workshop background, objectives, schedule, expectations, roles of students and facilitator, and strategies for session. —Prior participants share best practices. —Directors provide faculty with the names of the parents and children to be examined, ages of the infant and toddler, and names of the students in the group.</td>
<td></td>
</tr>
<tr>
<td>2 hours</td>
<td>Student workshop</td>
<td>—Facilitator leads discussion on the pediatric physical exam and assessment of growth and development (15 minutes). —Facilitator runs interactive demonstration of the physical exam of one infant and one toddler, with the opportunity for students to perform some components of the physical exam (85 minutes).</td>
</tr>
<tr>
<td>15 minutes</td>
<td>Faculty debriefing</td>
<td>—Group discussion of how sessions went. —Postexamination discussion with students and wrap-up (20 minutes). —Feedback to program director.</td>
</tr>
</tbody>
</table>

Facilitators have 2 hours with the students. The first 15 minutes are used to set up the session with them.
Faculty introduce themselves and discuss their role as a pediatrician. They then discuss the following
important items:

1. Differences in the approach to the pediatric PE in infancy and toddlerhood.
2. How pediatricians gather important information from observation alone.
3. Need to be flexible in the sequence of the exam.
4. Distinctive portions of the exam or typical physical findings in infancy and childhood (fontanelles, red reflex, rapid heart rate, ear exam, hip exam).
5. Use of growth charts.
6. Use of developmental screening and surveillance tools (parents are often sensitive and sometimes naturally defensive about their baby’s growth and development, so students need to be discreet).

The next 85 minutes are devoted to the examination of one infant and one toddler. Forty minutes are
allotted for the examination of each child, with a 5-minute transition period for the parents to switch to a
different room. When a parent and child enter the room, they are introduced to the group without
revealing the age of the child.
Facilitators ask students to observe the child's behaviors and demonstration of developmental milestones. Students can use the Denver Developmental Screening Test to identify milestones observed or reported by the parent when asked. However, it should be explained that this is not the typical use of this developmental screening tool. At the end of the sessions, students will try to estimate the age of the child. The facilitator then examines the patient while discussing and describing the unique approach, techniques, and findings. Students may participate (feel a fontanelle, measure a heart rate) at the discretion of the facilitator and parent. The exam may be done on the exam table or the parent's lap. Students may ask parents questions about the child. Facilitators ask the parent to report the child's most recent weight and length.

After both the infant and the toddler have been examined and left the room, 20 minutes are used for a postexamination discussion and wrap-up with the students. Facilitators are encouraged to elicit student observations and questions about the encounter. Facilitators reinforce the unique approach to infants and toddlers that students should have noticed, including the need for flexibility, the use of observation, the different order of the exam from the adult PE, and the use of the parent as an aid to facilitate the exam. The pediatric-specific portions of the PE are reviewed. Based on their developmental assessments, students can review milestones and try to guess the age of the children. Once the age is confirmed, they can plot the reported measurements on the growth charts and determine the percentiles. Workshop and faculty evaluations can be administered on paper or online.

In the final 15 minutes, after the students leave, faculty reconvene in a conference room for a debriefing session. They discuss how the sessions went, successes and challenges, and suggestions for future sessions.

Results

We measured the effectiveness of this workshop by creating a survey gleaned from our workshop objectives (Appendix D). We administered the survey with paper and pencil immediately at the conclusion of the workshop and then entered the data into SurveyMonkey for analysis. This survey was employed as a retrospective pre-post instrument, which is an acceptable means of measuring skills acquisition.

For the 2014-2015 academic year, 173 out of 183 students attending the workshop answered the survey questions, which corresponds to a response rate of 95%. Survey items included approach to the pediatric PE relative to the child’s developmental level, appreciation of observation as an important examination modality, identification of unique PE components, performance of a developmental assessment, and interpretation of growth charts. Our survey results showed significant findings (p < .0001) in that students rated themselves as having acquired increased skill levels after the workshop compared to their perceptions of their skills before the workshop on all survey items. The research study aspect of our educational initiative was deemed exempt by our institutional review board.

### Table 2. Results of Paired t Tests and Mean Score Differences With Standard Deviations of Pre-Post Ratings

<table>
<thead>
<tr>
<th>Question</th>
<th>M</th>
<th>SD</th>
<th>M</th>
<th>SD</th>
<th>M</th>
<th>SD</th>
<th>N</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appreciation of the specific differences between an adult and pediatric physical assessment</td>
<td>4.48</td>
<td>0.64</td>
<td>3.30</td>
<td>1.05</td>
<td>1.18</td>
<td>1.06</td>
<td>171</td>
<td>.0001</td>
</tr>
<tr>
<td>Familiarity with different approaches to the pediatric PE based on child's developmental level</td>
<td>4.23</td>
<td>0.68</td>
<td>2.71</td>
<td>1.12</td>
<td>1.52</td>
<td>1.06</td>
<td>172</td>
<td>.0001</td>
</tr>
<tr>
<td>Knowledge about the importance of observation in making general assessments of an infant or toddler</td>
<td>4.55</td>
<td>0.57</td>
<td>3.25</td>
<td>1.15</td>
<td>1.30</td>
<td>1.13</td>
<td>173</td>
<td>.0001</td>
</tr>
<tr>
<td>Ability to identify unique components of the infant and toddler PE</td>
<td>4.33</td>
<td>0.64</td>
<td>2.82</td>
<td>1.05</td>
<td>1.51</td>
<td>1.05</td>
<td>171</td>
<td>.0001</td>
</tr>
<tr>
<td>Ability to do a basic developmental assessment of an infant or toddler</td>
<td>3.99</td>
<td>0.69</td>
<td>2.35</td>
<td>1.13</td>
<td>1.65</td>
<td>1.06</td>
<td>168</td>
<td>.0001</td>
</tr>
<tr>
<td>Ability to interpret growth charts</td>
<td>4.33</td>
<td>0.69</td>
<td>3.14</td>
<td>1.21</td>
<td>1.19</td>
<td>1.10</td>
<td>167</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Abbreviations: M, mean; PE, physical examination; SD, standard deviation.

Each paired t test was based on a difference score, which was calculated by subtracting a person's pretest score from his or her posttest score on the same question. For example, the mean
difference of 1.18 for the first question indicates that the rating increased by an average of 1.18 points (based on the 5-point scale used, in which 1 = low, 3 = medium, and 5 = high). The null hypothesis for a paired t test is that there is no difference, meaning the expected value is zero, so the farther away the actual difference is from zero, the more significant the finding. The mean change from pretest to posttest ranged from 1.18 to 1.65, and the paired t tests for all six questions were highly significant at \( p < .0001 \).

In the same academic year, to measure students’ knowledge, we also included two multiple-choice items on the course’s written final examination, which was timed about 1 month after the workshop. Analysis of these two items on the examination showed that 96% of students knew the normal developmental expectations of a 9-month-old infant and 86% of students knew the best approach for conducting a PE of an older infant.

**Discussion**

Feedback solicited from our facilitators was instructive and has helped to improve this workshop over the years. Informal focus-based discussions with faculty facilitators immediately following the workshop yielded not only positive comments but also specific ideas for improvement, which are framed as lessons learned from experience.

Originally, we recruited only infants for the workshop. However, feedback from the pediatricians suggested that we recruit both infants and toddlers so that students could appreciate the vast changes in development that occur between early infancy and toddlerhood. Additionally, we would be able to compare and contrast the different strategies for conducting a PE and assessing the growth and developmental parameters between the two groups.

Facilitators also suggested several logistical adjustments regarding time, in particular, building in 15 to 20 minutes at the beginning, before the infants and toddlers arrive, to discuss the workshop objectives, strategies, and review materials (i.e., growth charts, developmental screening charts, and approaches to the PE for an infant and toddler). Another suggestion was to prepare a miniature developmental kit for each group to demonstrate different developmental tasks such as reaching out for a colorful object, ball, pencil, or crayon.

Lastly, the opportunity for some hands-on practice is what makes this workshop effective given the large numbers of students. This same opportunity would not be possible if we had to identify real clinical settings to achieve the same objectives.

While not a specific educational objective, our experience of inviting medical students, residents, and attendings to volunteer their children and have other students enjoy and learn from them during the workshop has many benefits. It allows the invitees to share aspects of their personal lives (their children) with the greater medical school community. This helps students see their fellow students or faculty members in a parenting role, which models for students how a healthy work-home life balance is possible in medicine.

There is a limitation regarding the results of our educational initiative. This workshop has only been conducted at our own institution, thus rendering our results nongeneralizable.

Future plans include partnering with other medical schools to assess the broader application of this educational initiative. In addition, we plan to incorporate various online teaching modules into the sessions, including videos of common pediatric pathologies, simulation models to practice more challenging pediatric PE techniques (i.e., viewing the tympanic membrane), and interactive modules using case presentations.

Nevertheless, this workshop successfully allows for early introduction of the different approaches to infant and toddler PEs through integration of these pediatric components into a general PE skills course. The workshop also uses real children in order to make this first pediatric encounter as instructive and
authentic for preclerkship students as possible. Using a small-group format, students can get close up and experience hands-on training to enhance their appreciation and knowledge of what makes the approach to a pediatric patient different from that to an adult.

Miriam Schechter, MD: Assistant Professor, Department of Pediatrics, Albert Einstein College of Medicine
Hai Jung Rhim, MD, MPH: Assistant Professor, Department of Pediatrics, Albert Einstein College of Medicine
Mimi McEvoy, RN: Associate Professor, Department of Family and Social Medicine and Assistant Professor, Department of Pediatrics, Albert Einstein College Of Medicine

Disclosures
None to report.

Funding/Support
None to report.

Ethical Approval
This publication contains data obtained from human subjects and received ethical approval.

References