The Development, Implementation, and Evaluation of an Acute Otitis Media Education Website

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ABSTRACT

OBJECTIVE: To develop, implement, and evaluate an acute otitis media (AOM) education website for clinician-educators.
METHODS: We developed an education website following Kern's curriculum model.
RESULTS: The website contained peer-reviewed content, educational objectives, library search pages to identify evidence-based resources, and a faculty toolbox with instructional and evaluation instruments. Pediatric clinician-educators were purposefully sampled from different clinic sites to evaluate the website. Semi-structured interviews explored key website components for content and usability in clinical teaching. In grounded theory tradition, investigators used the constant comparative method with qualitative analysis software to identify themes and representative quotations. Eleven faculty members (9 females and 2 males with teaching experience from 6 to 26 years) participated in the study. Identified themes were: 1) value of visual impact for learning specific topics, 2) promotion of efficiency in teaching clinical topics, 3) varying approaches for using website, and 4) faculty's self-report of knowledge and self-efficacy needs.
CONCLUSIONS: An education website may enhance the teaching of AOM, accommodate different teaching preferences, promote efficiency in teaching, and advance clinician-educator knowledge and skills. Next steps include evaluation of learners' perspectives, generalizability in varied teaching settings, and assessment of higher learning outcomes including impact on knowledge, skills, and patient outcomes.

KEYWORDS: acute otitis media; clinical educator; education websites; faculty development; pediatric otoscopy; pediatric resident education

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WHAT'S NEW

Acute otitis media (AOM) is the most common childhood condition for which antimicrobials are prescribed. We developed an AOM education website, following Kern's curriculum model, which facilitates efficient instruction, promotes learner evaluation, and advances faculty skills.

PROBLEM

PEDIATRIC OTOSCOPY SKILLS are critical to the accurate diagnosis of acute otitis media (AOM), which is the most frequent indication for antibiotic treatment of children in the United States.[1−3] Pediatric otoscopy instruction begins in medical school and continues throughout postgraduate training.[3] While the main learning of AOM occurs primarily during direct patient care,[4] learning opportunities for AOM may be seasonal and site-specific. Clinically based standardized curricula for residents and students have only recently emerged, and their use is faculty dependent.[4−7] The clinician-educator is the principal source of experience and specialized materials to facilitate learning about AOM.[8]

Despite the clinician-educator's significant role in direct patient care settings, little is known regarding suitable resources and teaching strategies for the development of their knowledge and skills in teaching topics such as AOM in busy and varied settings. Educators report use of the American Academy of Pediatrics' guidelines, but their own practices may vary from the guidelines.[8,9] Such variances and the possible lack of effective teaching resources suggest that more innovative teaching approaches, centering on standardized content, may be useful for the clinician-educator.

The internet has become an important resource in medical education, and its influence is likely to become more significant given the changed education landscape due to the COVID-19 pandemic. Appropriately developed websites hold the potential to provide valuable standardized content. Web-based modalities in varied specialties such

as in radiology and ophthalmology have been developed and described from the perspectives of learners.[10−12] However, no websites on AOM have been developed to meet the educational needs of faculty and of learners in pediatric graduate medical education.

APPROACH

An AOM website was created in 2002 at the University of Texas-Medical Branch, with financial support from the Macy Foundation and University of Texas-Medical Branch. The site was moved to the University of Wisconsin in 2017. A group convened to revise and update the website's curriculum in a process which reflected Kern's approach to curriculum development.[13] This institutional-supported development team consisted of the lead authors, an undergraduate research intern, a pediatric residency program director, experienced pediatric clinician-educators, and experts in web development, digital health, educational design, and pediatric otoscopy.

STEPS 1 AND 2: PROBLEM IDENTIFICATION AND NEEDS ASSESSMENT

AOM has traditionally been taught by the clinician-educator in an apprentice-style format. An empirical literature search failed to identify teaching resources specifically developed for clinician-educators. Our review also found that while some educators had developed peer-review curricula, there was no evidence anecdotally or in the literature that such standardized curricula were being utilized.[4,6,7] An earlier needs assessment demonstrated that medical students expected to learn the pediatric ear exam during their pediatric clerkship.[4] A national survey found that pediatric clinician-educators desired standardized curriculum and described a discrepancy between awareness of best-practices and the educators' own teaching and clinical practices.[8]

STEP 3: DEVELOPING GOALS AND OBJECTIVES

Our aim was to develop a website that educators could use to enhance their teaching of AOM. The goal of this curriculum was that learners would be able to diagnose and manage pediatric patients with suspected AOM. Objectives were developed for residents and medical students based on peer-reviewed curricula[4,6,7] augmented with expert consensus. Eleven objectives were formulated for residents, including the following examples: 1) describe the difference between AOM and otitis media with effusion and differentiate between the 2 conditions with the use of valid images and 2) demonstrate the proper technique in evaluating the presence or absence of a middle ear effusion.

STEP 4: EDUCATIONAL STRATEGIES

TARGETED LEARNER AND USER GROUPS

Targeted learners included medical students, residents, and faculty.

CURRICULUM CONTENT

Website content ranged from the general ear exam to management of AOM, including how to conduct an age-based and development-appropriate exam using appropriate holding and distraction techniques. The site used peer-reviewed videos and a previously published checklist to facilitate the teaching of pneumatic otoscopy and cerumen removal.[7] Diagnostic criteria relied on standardized sources.[1] Content was based on the peer-reviewed AOM literature.[3,4,6,7,14−16]

Initiating a curation process and building on a common approach used by health sciences information specialists, our medical librarian developed a page where users could conduct rapid online PubMed searches for the most recently published literature on curricula, diagnosis, and management. For the curricula section, highly cited articles from high-impact journals were presented. For management, trusted clinical databases were listed, including guidelines from relevant organizations. Furthermore, a PubMed literature search query using a combination of Medical Subject Headings and free text terms was developed.

INSTRUCTIONAL STRATEGIES

The website included a faculty toolbox to aid in instruction and evaluation. Sample tools included peer-reviewed curricula, a downloadable presentation that could be adapted for different types of learners and settings, and, high-quality images of the normal ear, otitis media with effusion, and AOM.[3,4,6,7,11,14-16] The toolbox also contained a tutorial on understanding and interpreting tympanometry and brief clinical cases focusing on diagnosis and treatment. The clinical cases aimed to promote discussions during "micro-teaching" moments between patient encounters in clinic, where faculty could select a case to highlight a particular teaching point. Finally, the toolbox also linked directly into PubMed search pages.[4,6,7]

EVALUATION INSTRUMENTS

The website provided evaluation instruments for both formative and summative evaluation and links to online citations. These instruments included peer-reviewed pre- and post-tests and a checklist for evaluation of otoscopy exams in simulated and live settings.[6,7]

VALIDITY EVIDENCE

Given the potential reach of the website, it was ensured that all curricular elements originated from peer-reviewed sources. The website relied on several previously developed AOM education tools with demonstrated validity evidence[3,4,6,7,15,16] and learning strategies that were shown to be reliable and generalizable.[4,6,7] Standardized images showing normal, mild, moderate, and severe changes in the tympanic membrane during AOM were previously validated.[14−16]

STEP 5: IMPLEMENTATION

The website, https://www.pediatrics.wisc.edu/education/acute-otitis-media/[17] was pilot-tested by a learning

specialist, faculty, and 2 outside members of our research team. Reviews assessed standardized content, process, and navigability, and ensured that content was suitable for the general pediatrics learner. Formal beta testing by students and residents was not undertaken. The website was launched in April 2019. It was reviewed quarterly.

STEP 6: EVALUATION AND FEEDBACK

The perspectives of general pediatrics faculty regarding the website's utility were examined using a qualitative research design.[18] The evaluation component was certified as program evaluation by the University of Wisconsin Institutional Review Board.

SETTING AND PARTICIPANTS

In the fall of 2019, faculty in an academic health system with active roles in ambulatory primary care were purposefully sampled and recruited by e-mail to participate in semistructured interviews. Interviews of faculty from different clinic sites were conducted in person.

INTERVIEWS

Participating faculty reviewed the website prior to interviews. An interview guide was developed to facilitate a conversation about faculty perspectives. Questions focused on key components of the website including content, usability, applicability, and limitations in clinical teaching. A trained researcher completed the interviews, which were audio-recorded and transcribed. Recordings and transcripts were stored on a secured, encrypted server.

INTERVIEW ANALYSIS

In the grounded theory tradition, 4 investigators with previous experience in qualitative analysis used the constant comparative method via the software Dedoose to identify themes and representative quotations.[19] Multiple investigators with varying knowledge about AOM and the website participated in the study design process, fostering a reflexive design.[20] The investigators reviewed transcripts throughout data collection to assess responses and potential themes. After 11 interviews were conducted, similarities in responses indicated that theoretical saturation had been reached.

Investigators applied a qualitative codebook to all transcripts. The first step in this process was the collaborative development of the codebook. The investigators each reviewed the transcripts and developed an initial codebook independently. They then met and used a consensus-seeking approach to create a codebook reflecting all investigators' perspectives. Second, the investigators affirmed the reliability of the codebook. To this end, 2 investigators applied the codebook to the same 4 transcripts. Afterward, they discussed discrepancies and revised the codebook. Third, the 2 investigators independently applied the codebook to the remaining transcripts.

After all transcripts were coded, the 4 investigators focused on synthesizing and integrating codes in order to develop themes. They independently collapsed codes into superordinate codes. They then met and used a consensus-

seeking approach to create a final list of themes. The investigators identified illustrative quotations for each theme.

RESULTS: THEME IDENTIFICATION

Participants in the study included 9 female and 2 male faculty with 6 to 26 years of teaching experience. The analysis identified 4 themes which are summarized in the Table.

THEME 1: VALUE OF VISUAL IMPACT FOR LEARNING SPECIFIC TOPICS

Participants explained how the website was useful for understanding a topic like otoscopy, which requires a visual exam. One participant said, "I think this kind of thing lends itself very well to a very visual topic that's difficult to see otherwise." Another participant explained, "It's really helpful to have the learner to point at the [image of tympanic membrane] like 'what do you think you're seeing?' or 'what of these [images]... what did it look like [with live patient]?'"

THEME 2: PROMOTION OF EFFICIENCY IN TEACHING CLINICAL TOPICS

Participants described ways that the website could serve as an efficient and useful resource in clinical teaching. One participant described the website as, "a one-stop-shop kind of place where you can look at all information." Another participant said, "For teaching, I think there hasn't been a tool like this before, and so I find that very useful."

THEME 3: VARYING APPROACHES FOR USING WEBSITE

Participants described differing assumptions about ways they might use the website. While one participant commented, "I would want to see the pictures right away," another participant explained, "I like the cases cause the cases would be something that would be easy for me to use, particularly in my general clinic if I'm just sitting there and a student's like, 'Well, I don't understand what you were seeing,' or 'why did you do that with this patient?'"

THEME 4: FACULTY'S SELF-REPORT OF KNOWLEDGE AND SELF-EFFICACY NEEDS

Participants described the content of the website in relation to their knowledge and self-efficacy levels with regard to otoscopy. One participant said, "That was actually helpful for me, even, to learn from." Another commented, "I've been doing this for 20 years, but I still think it's actually interesting." On the other hand, one participant said, "I kind of knew the material in terms of what we are going to treat and not treat."

OUTCOME SUMMARY

Our findings highlight several advantages of our educational website. First, faculty perceived that the website may facilitate learning, especially when specific skills are needed, such as in pediatric otoscopy, where diagnosis depends on careful visual inspection and interpretation of

Table. Themes From Interviews With Pediatric Primary Care Faculty Regarding Acute Otitis Media Training on Website

Themes	Example Quotes
Value of visual impact for learning specific topics	"The graphics were excellent, . . .in terms of the pictures." "I liked the picture and I liked how it was broken down a lot. . . I just liked the whole layout underneath the patient evaluation." "I think this kind of thing lends itself very well to a very visual topic that's difficult to see otherwise. So, you know this is very well done for that, but there are many other common pediatric conditions [that] could be more visual like rashes and things like that." "I'm trying to think about other areas that would lend themselves to something visual, because that's the power of this media."
Promotion of efficiency in teaching clinical topics	"It's not something that we've seen before where everything is all together in one place. . .not only for our own resources. . ..to have you know the guidelines and things like that all together." "[It] offers a comprehensive way to understand what are the diagnostic criteria of this? How do you evaluate a patient? How do you treat a patient?" "I'm trying to think of other discreet things [like] strep throat. You could use it for growth patterns. That would be really nice because I think those things are a little bit harder to take, take some intensive [thinking], you have to sit and think about those things a little bit so it could be useful." "It gave us a lot of good resources."
Varying approaches to using the website	"We can jump to a case and be like, 'Here's a case that's similar. . .Here's a 15 month old that we saw that had otitis last week and we saw one again today. . .' To be able to use [the website] in those cases I think was helpful." "It could be useful for, for giving to a medical student one day at three p.m., you know, at the end of a clinic session or when there's like an hour, hour and a half left and say, 'Work through this in its entirety,' because the medical student isn't integral to clinical care so that could be a really good thing for them to work through in its entirety." "I'm probably going to start using some of this stuff. . .you know, clinical teaching. Probably we have students and residents there [the website] all the time."
Faculty's self-report of knowledge and self-efficacy needs	"Especially the graph of the normal tympanogram, like I learned a lot because some of these things were like, 'Oh man I didn't even know that!'" "I liked the tympanometry page. I think that was actually helpful for me, to even to learn from so I like those ones." "[Useful for all] so medical students, residents, NP but even honestly, as a continuing medical educational tool for staffed physicians." "This is a really great.. you know it is a program that you could look at to help you buff up your skills right."

structures with altered appearance and anatomy. Second, faculty felt that the websites may promote efficiency and flexibility in clinical teaching. A "one-stop-shop" educational website, as one participant described it, may allow learners and faculty to return to images, the literature, and cases in an iterative yet efficient manner. Third, faculty described varying uses of the website, such as utilizing the website to view specific images or proceeding through the content sequentially. This suggests that websites may be developed to accommodate different faculty teaching preferences. However, it may be that individual faculty expectations about the intended use of education websites may cause confusion. Thus, faculty development on how to utilize education websites may optimize this teaching tool. Finally, faculty described the usefulness of the website's content in relation to their prior knowledge and skills. Some even shared that they had learned from the website. Thus, the use of websites which contain peer-reviewed, frequently updated, expert content may have utility as "stealth curriculum," that is, instructional content that indirectly addresses faculty's own knowledge gaps and ensures faculty expertise in teaching a particular topic.[21]

NEXT STEPS

Future studies should examine learners' perspectives, website utility in varied educational settings, and residents' use of the website especially in the unique context of the resident-educator role.[22] More innovative methodologies to assess digital impact such as website hits and incorporation into digital health strategies are needed to expand our knowledge of internet-based education. Finally, studies should assess the impact of this teaching innovation on educators' and learners' knowledge and skills and on the ultimate outcome, bedside patient care.

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