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# A Flipped Classroom and Case-Based Curriculum to Prepare Medical Students for Vaccine-Related Conversations with Parents

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## Abstract

**Introduction:** Immunizations, one of the most significant public health successes in the last century, have recently been met with a resistance that has resulted in populations with falling immunity and outbreaks of vaccine-preventable diseases. In response to this, we conducted a needs assessment of medical students at the University of California, Los Angeles David Geffen School of Medicine to assess attitudes towards vaccines, knowledge of vaccines and vaccine-preventable diseases, and confidence in discussing vaccines. The results informed the development of this interactive, flipped-classroom and case-based curriculum for third-year pediatric clerkship students. **Methods:** In our two-part curriculum, students independently view a short podcast with an overview of vaccines and vaccine-preventable diseases, then participate in a case-based workshop. For the workshop, students divide into small groups and are presented with a case-based scenario surrounding a child with a parent who has concerns about recommended vaccines. Students discuss the case in small groups, find answers to directed questions, and present the case and findings to the larger group, with specific focus on their approach to the vaccine hesitant parent. **Results:** Anonymous student evaluations revealed that 93% of students enjoyed learning from this flipped classroom and case-based format. Likewise, 98% of students felt more confident in their approach to vaccine discussions. **Discussion:** Vaccine hesitancy is becoming an increasingly common and worrisome problem. Our curriculum provides students with knowledge about the importance of childhood immunizations as well as an opportunity to practice addressing common concerns and misconceptions they will encounter in clinical settings.

## Keywords

Communication, Vaccination, Pediatrics, Vaccine Hesitancy

## Appendices

- A. Needs Assessment Survey .docx
- B. Podcast.mp4
- C. Podcast Slides.pptx
- D. Case Scenarios and Questions for Students .docx
- E. List of Helpful Resources .docx
- F. CDC Immunization Schedule.pdf
- G. Facilitator's Guide to Case Scenarios and Questions .docx
- H. Curriculum Evaluation.docx

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

## Educational Objectives

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

1. Recommend vaccines for a child based on age and vaccination history.
2. Understand, justify, and explain the importance of vaccines and the consequences of vaccine-preventable diseases.
3. Find and use reliable online sources to gather information about vaccine efficacy and safety.
4. Become confident discussing vaccines with patients and their families.

## Introduction

Recent resistance to vaccinations has resulted in clusters of falling immunity, leading to outbreaks of vaccine-preventable diseases (VPDs).<sup>1</sup> Health care providers play a critical role in educating patients and their families about vaccines. Parents cite their child's health care provider as their most trusted resource for vaccine information. Among parents who consider delaying vaccinations for their children but ultimately accept them, provider recommendation is the most commonly cited reason for acceptance.<sup>2</sup>

Additionally, patients can miss opportunities for vaccinations if their providers do not recommend vaccines appropriately.<sup>3,4</sup>

As medical students enter their clinical training, they are expected to provide reliable information to patients about vaccines. However, we at the University of California, Los Angeles David Geffen School of Medicine conducted a needs-assessment survey demonstrating that medical students at our institution did not all feel prepared for these conversations and that some had misconceptions about vaccine safety and efficacy.

Because both attitudes and knowledge about vaccines can be influenced by the medical school curriculum, medical students are a crucial population to target with effective vaccine education. Although there is a lack of consensus in the literature demonstrating truly effective interventions to increase vaccine uptake among vaccine-hesitant populations,<sup>5</sup> at the very least medical students should be familiar with common misconceptions surrounding vaccines and should gain experience with how to address them. Because the reasons for vaccine refusal change over time, students should know how to find and recognize reliable, up-to-date information about vaccines and VPDs.

Our resource used the results of a needs assessment to both develop a curriculum for medical students during their pediatric clerkship. This curriculum employs a flipped-classroom and case-based model, and encourages students to work collaboratively to practice addressing misconceptions and concerns about vaccines. Case scenarios encourage students to use reliable online resources to find answers to specific questions about vaccines and VPDs, and to address common parental concerns. It builds upon previously published work that targets trainees at different levels of training<sup>6,7</sup> as we believe it is important to provide students with a guided experience during their clinical training so that they can provide patients with effective vaccine counseling.

## Methods

Similar to previously published curricula, which used a combination of lecture-based teaching and small-group case-based discussion,<sup>6,7</sup> we also used case-based discussion as the foundation of the learning in this curriculum. In addition, we employed a flipped classroom model to allow students to prepare before class at their own pace and maximize class time for interactive learning. This took the format of a video podcast, followed by interactive small-group discussions in class.

Before administering our curriculum, we performed a needs assessment to measure baseline knowledge, attitudes, and confidence in counseling families about vaccines. We sent a voluntary online survey to all students before they began their core clinical clerkships in their third year of medical school (Appendix A). We performed a descriptive analysis with the findings regarding student knowledge and then used the results to identify knowledge gaps to inform our curriculum. We further used an inferential analysis to assess if there was any correlation between favorable attitudes towards vaccines and correct answers on knowledge-based questions. All third-year medical students typically participate in the pediatric clerkship as part of their core clerkship education, and all students at three of our four pediatric clerkship sites participated in our curriculum as part of required didactics. The fourth site was located a significant distance from the other three and students at that site participate in separate didactics. As a result the students based there did not participate in this curriculum. The combination of students from three clinical sites equated to approximately 12 to 20 students participating in the curriculum during each rotation. As with all of our required core third-year clerkships, there are no prerequisites for participation in the clerkship or in didactics, other than successful completion of the first 2 years of medical school.

At least a week ahead of the classroom-based session, students are given access to a recorded podcast that includes a brief overview of VPDs, the impact of vaccines on reducing disease burden, the safety of vaccines, the recommended vaccine schedule, and commonly expressed concerns about vaccines (Appendix B). They are asked to watch this video prior to the scheduled class time for this topic. Students also receive access to a PowerPoint file version of the slides used for the podcast so that they can take notes and review the information later (Appendix C).

During the 90-minute in-class workshop, students are divided into four small groups, with four or five students per group. Each group is assigned a case with a scenario involving a vaccine-hesitant parent, along with specific questions to answer. We distribute copies of the cases and questions (Appendix D) along with a handout containing descriptions of helpful online vaccine resources (Appendix E) to all students. Each small group is also given a copy of the current vaccine schedule as recommended by the Centers for Disease Control and Prevention (Appendix F).<sup>8</sup> Students spend 15 to 20 minutes working in their groups to find answers to each of the questions posed in their case and are encouraged to use the recommended online resources to address the parental concerns in the clinical scenario. A faculty member (typically one of the authors) is present throughout the entire class time to answer questions and encourage group work.

Each small group is then given 10 to 15 minutes to present their case to the rest of the class. They review the case, provide answers to the questions that are posed, and report on the resources used. All students participate in this discussion and share experiences from their own clinical encounters. The faculty member addresses any gaps or questions that have not been answered by the students assigned to each case. A facilitator's guide for the faculty member details the answers for the questions raised by each case along with references (Appendix G). In person, and immediately after finishing the session, students complete an anonymous evaluation of both the in-class portion of the curriculum and the podcast (Appendix H). They also indicate if they had experienced vaccine hesitancy either in their clinical work or outside of medical school.

## Results

There was a 46% response rate to the voluntary needs assessment survey. The distribution of answers to questions related to the knowledge base regarding vaccination and vaccine preventable diseases are shown in the Table. Inferential analysis of the needs assessment results revealed that there was no significant correlation between favorable attitudes towards vaccines and correct answers on knowledge-based questions ( $R = .08, p = .45$ ).

**Table.** Student Responses to Knowledge-Based Questions

| Question   | Answer | Student Response Rate |        |           |
|--|--------|-----------------------|--------|-----------|
|  |        | Correct               | Unsure | Incorrect |
| An 18-month-old with upper respiratory tract infection symptoms and low-grade fever should have vaccines postponed until symptoms resolve.   | FALSE  | 19%                   | 30%    | 51%       |
| Some vaccines are contraindicated in an infant with a seizure disorder.  | FALSE  | 38%                   | 46%    | 16%       |
| A 4.5-year-old child on immunosuppressive medication should not receive some immunizations.  | TRUE   | 78%                   | 14%    | 8%        |
| A child should not receive measles, mumps, and rubella (MMR) and varicella zoster virus (VZV) vaccines if a household contact is receiving chemotherapy (and therefore is immunosuppressed). | FALSE  | 52%                   | 25%    | 23%       |
| A vaccine series needs to be restarted if more than the recommended interval of time has elapsed between doses in the series.  | FALSE  | 38%                   | 37%    | 25%       |
| A 12-year-old boy who is not yet sexually active should receive the human papillomavirus (HPV) vaccine.  | TRUE   | 92%                   | 3%     | 5%        |
| Before the introduction of the vaccine, haemophilus influenzae type b (Hib) was the leading cause of meningitis affecting children under 5 years of age.                                     | TRUE   | 90%                   | 7%     | 3%        |
| Pertussis is more likely to cause serious complications in an adult rather than an infant.   | FALSE  | 42%                   | 29%    | 28%       |
| There are no long-term effects if an unvaccinated child contracts measles and recovers uneventfully.   | FALSE  | 82%                   | 16%    | 2%        |
| A newborn only needs a hepatitis B vaccine at birth if the mother is hepatitis B surface antigen positive.   | FALSE  | 66%                   | 25%    | 9%        |
| Women should not receive influenza and pertussis vaccines while pregnant.  | FALSE  | 60%                   | 35%    | 5%        |
| Immunity to covered HPV strains remains high for at least 10 years after receiving the HPV vaccine series.   | TRUE   | 68%                   | 27%    | 5%        |

This curriculum was successfully implemented in three of our four pediatric clerkship sites during the 2015-2016 academic year. All students at these sites participated in the in-class portion of the curriculum during the eight rotations throughout the year (approximately 120 students per year).

The anonymous evaluations completed after participation in the curriculum indicated that 87% of students reported having experienced vaccine hesitancy in their clinical work during the third year and 76% reported experiencing vaccine hesitancy outside of school in conversations with friends or family

members. In terms of learning experience, 93% of students indicated that they enjoyed learning from our flipped-classroom and case-based formats, and 89% would recommend this approach in other clerkship didactics. Additionally, 98% of students reported an increase in their confidence in discussing vaccines with patients after participation in the case-based discussion. This compares to only 61% of students who indicated that they felt confident discussing vaccines with patients when they were surveyed at the beginning of their third year prior to their clerkship and the intervention. Finally, 68% of students indicated that they had watched the podcast ahead of class time.

### Discussion

The goal of our curriculum was to increase knowledge about vaccines and VPDs so students could feel more comfortable discussing vaccines with patients. We felt it was especially important to expose students to some of the common concerns about vaccines and require them to use reliable resources to practice providing answers to specific questions. That way, when they are faced with these concerns and misconceptions in the clinical setting, they can have informed conversations about the value of vaccines. We require students to not just remember and understand which vaccines are given as part of the vaccine schedule, but also to justify the importance of vaccines and create their own arguments about the importance of vaccines, all while explaining the risks of not vaccinating. Immediately after participating in our curriculum, nearly all students indicated that they felt more confident in their discussions about vaccines. Although self-reported confidence may not necessarily indicate true competence or effectiveness in advocating for the use of vaccines, when students feel more confident, they may be more likely to strongly recommend vaccines for patients and engage hesitant families in conversations about vaccines. Both these factors are important variables that have been associated with acceptance of vaccines.<sup>2,4,9,10</sup>

A major advantage of our curriculum is its ease of implementation, as it requires only 90 minutes of in-class time with one faculty member for 12 to 20 students. Most of the learning is active and self-directed in small groups, with faculty guidance needed only for the larger discussion.

Another advantage is the flexibility of this curriculum. There are currently no published comprehensive data regarding medical student knowledge or attitudes about vaccines, so we designed our cases based on common concerns that our faculty have encountered in practice, gaps identified in knowledge among our own medical students, and commonly cited concerns in the literature.<sup>2</sup> However, our curriculum could be adjusted for implementation at other institutions based on a needs assessment among students or common questions that faculty members address in clinical practice. We included the survey we used (Appendix A) so that educators at other institutions can use this to conduct needs assessment of their own medical students. They can also use their own clinical experience of vaccine-related concerns in practice to adjust or add to the cases that we have created.

This curriculum could also be easily expanded to pediatric or family medicine residents or to medical students in their preclinical years. We modified the curriculum to create a workshop for first and second-year medical students, which was received very well. Case scenario and question difficulty could be adjusted to meet the needs of various types of learners, and the level of faculty support can be altered based on the familiarity of the learners with the subject.

This curriculum could also be shortened or expanded, based on time restrictions, number of learners, and number of faculty available. It could be shortened by using only a few of the cases or by selecting only a few questions to answer from each case. The curriculum could be expanded by creating more cases, by having more extensive case discussions, or by taking time to discuss experiences that learners have had with vaccine hesitancy and how they have seen questions addressed in practice. The experience could also be expanded by having students role play the scenarios.

This curriculum has several limitations. The most significant limitation is that a large portion of the material covered is time sensitive and will need to be reviewed and updated prior to use. For example, the vaccine

schedule referenced in our PowerPoint file and podcast will need to be updated with the most recent schedule released by the CDC. In order to allow for this, we have included the link to the CDC website directly in our PowerPoint file. Additionally, new data surrounding the safety and efficacy of vaccines, as well as common concerns regarding vaccines, is constantly changing and will require some investigation by users prior to implementation of this resource in order for the content to remain current. In order to ensure that the video file is up to date, one option is for users to update the PowerPoint slides and record a new video for distribution to their learners. This PowerPoint file has the speaker notes listed at the bottom of each slide and could be used to create new, updated podcasts as information regarding vaccines and concerns about vaccines changes over time. Given the fact that information surrounding vaccines is constantly changing, and the fact that we try to focus on the principles of addressing concerns and looking up the answers to questions as opposed to focusing simply on disseminating knowledge to students in a unidirectional fashion, we see the ability to find answers to questions to be as valuable over time as knowing any specific set of facts.

Additionally, the response rate for our needs assessment was relatively low, at 46%, so we cannot necessarily draw robust conclusions from this data. Furthermore, we do not know that the results found in the descriptive analysis of the knowledge of our students at the University of California, Los Angeles, will necessarily generalize to medical students or other health professionals at other institutions. In order to address this limitation, we provided the needs assessment that we used so that users at other institutions can survey their own students to identify their specific gaps in knowledge or misconceptions.

Another limitation of our curriculum is that it requires 90 minute of in-class time, along with a faculty member to guide discussion. We also learned throughout the design and implementation of this curriculum that the in-class portion can easily last longer than 90 minutes if the discussion is not kept focused. Further, the curriculum may be difficult to coordinate if students are working in distant clinical sites, or if it is difficult to find faculty willing to spend 90 minutes teaching this curriculum. This limitation can partially be addressed by shortening the in-class time and reviewing fewer cases. Furthermore, much of the curriculum could be completed by students without participating in an in-class portion. The facilitator guide could be made available to residents to review with students when there is free time on clinical rotations. The facilitator guide could also be given to students at the end of the rotation to be used after they attempted to answer the questions on their own. Although this approach is not ideal because it eliminates the group learning and discussion component of the curriculum, it may be easier to implement in some settings.

Finally, we found that a significant minority of our students (32%) did not watch the podcast ahead of class time. Although this did not seem to preclude students from actively engaging in searching for information and discussing content with their peers, it may be necessary to give students several reminders about viewing the podcast ahead of class time. An individual readiness assurance test could be used prior to starting discussion if faculty want to ensure higher levels of completion of the podcast.

Going forward, we plan to continue to adapt this curriculum based on student feedback and current trends in vaccine-related concerns. In order to assess knowledge retention and practical application of this curriculum, we are also considering implementation of a simulated patient encounter, as has been described in a curriculum targeting pediatric residents.<sup>7</sup>

Our curriculum has been adopted as an integral part of our pediatric core curriculum education for third-year medical students. We recognize that the majority of medical students will not be entering pediatrics and may not receive future pediatric training that includes education about immunizations. Despite this, they will very likely encounter issues around vaccine safety and be asked their opinion about vaccines, whether it be in their professional or personal life. We feel that by providing this interactive educational platform for teaching the benefits of vaccines and the risks of vaccine preventable diseases, we are providing an educational experience that many students not pursuing pediatrics or family medicine will lack otherwise.

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Reported as not applicable.

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