Contraceptive Pharmacology and Risk Communication: A Case-Based Flipped Classroom Exercise

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Abstract

Introduction: Oral contraceptives are widely used for both contraceptive and noncontraceptive purposes. Of women ages 15-44 who have ever had sexual intercourse, 88% have used at least one hormonal contraceptive method. Health care providers caring for reproductive-age women need a strong base of knowledge in hormonal contraception. Those who provide contraceptive counseling must apply this knowledge to shared decision making, including effective quantitative communication.

Methods: Students and faculty at Florida International University Herbert Wertheim College of Medicine created a prerecorded lecture and in-class interactive case on contraceptive pharmacology and risk communication. The 20-minute lecture focused on mechanisms of action, bioavailability, drug-drug interaction, effectiveness, and major vascular risks of combined hormonal and progestin-only contraceptives. The 55-minute in-class session integrated knowledge of risks and effectiveness of contraception with risk communication surrounding contraceptive decision making and counseling. For the 2018 academic year, 122 first-year medical students participated in the session. Students anonymously answered three questions related to the session on their end-of-course evaluation. Student learning was assessed with five multiple-choice questions on the pharmacology final exam.

Results: Students rated the session very positively. They highly rated the lecture’s utility and the session’s contribution to solidifying their basic science knowledge and understanding of its clinical applications. Class average performance on the relevant final exam questions was 88.4%. Discussion: The lecture and case discussion successfully addressed gaps in the curriculum and provided students the opportunity to integrate multiple domains of learning. Students’ perception of the materials was positive, and they demonstrated adequate learning.

Keywords

Counseling, Communication, Contraception, Pharmacology

Educational Objectives

Upon completing this exercise, learners will be able to:
1. Apply knowledge of drug-drug interactions involving hormonal contraception to contraceptive decision making.
2. Apply knowledge of major medical risks and relative effectiveness of progestin-only methods and combined hormonal methods to contraceptive decision making.
3. Apply evidence-based principles of quantitative communication to discussion of relative contraceptive effectiveness and failure.
4. Use evidence-based resources for guiding the provision of contraception.
5. Explain the mechanisms of action and pharmacokinetics of combined hormonal contraceptives and progestin-only methods.

Introduction

Oral contraceptives are widely used for both contraceptive and noncontraceptive purposes. As of 2013, 88% of women ages 15-44 who have ever had sexual intercourse have used at least one hormonal contraceptive method, with about four of every five sexually experienced women having used oral contraceptives. As of 2012, 35% of all women of reproductive age were currently using a hormonal
contraceptive method. All health care providers caring for reproductive-age women need a strong base of knowledge in hormonal contraception, including basic pharmacology, contraceptive effectiveness, and short- and long-term benefits and risks based on updated evidence. Those who provide contraceptive counseling need to apply this knowledge toward shared decision making that includes effective quantitative communication.

The 10th edition of the APGO Medical Student Educational Objectives includes three learning outcomes related to hormonal contraception: counseling, description of the mechanisms of action and effectiveness, and review of barriers to effective contraceptive use and to the reduction of unintended pregnancy. It does not include developmentally specific learning objectives supporting the ultimate achievement of these outcomes. The National Board of Medical Examiners content outline provides curricular direction in the form of topics. Under the female reproductive system, the content outline lists the topic of “contraception (eg, oral contraceptives, IUD, vaginal cap, cervical sponge, diaphragm, implant, morning-after pill, male and female condoms).”

The curriculum at Florida International University Herbert Wertheim College of Medicine includes a pharmacology course at the end of the first year, a reproductive organ systems module in the second year, and an obstetrics and gynecology clerkship in the third year. The reproductive systems module teaches all contraceptive methods in a single 1.5-hour session, thereby requiring coverage of the topic earlier in the curriculum to provide spaced learning of and multiple touches on the material, as well as sufficient time to create a sound preclinical knowledge base. For the pharmacology course to appropriately support the subsequent reproductive systems module, we decided to focus on the pharmacology of estrogen and progestins, including drug-drug interactions, overall contraceptive effectiveness, and serious vascular risks and contraindications.

We searched for existing materials in different databases: in PubMed using the terms undergraduate medical education and contraception, in Google Scholar advanced search using the terms contraception medical education or contraception medical students in the title, and in MedEdPORTAL using the terms contraception and then pharmacology. We were not able to locate any materials for interactive teaching or modules addressing contraceptive pharmacology or applying this knowledge to counseling.

Methods
To fill our first-year curricular gap and to maintain consistency with the instructional formats of the pharmacology course, we chose a flipped classroom approach for our session. To prepare students for the flipped classroom, we designed and recorded a lecture introducing the fundamentals of hormonal contraception (Appendix A). Prerecorded material was targeted towards medical students who had completed the first-year introductory courses in our discipline-based curriculum, specifically, biochemistry, anatomy, physiology, and pathology. The in-class portion focused on the application of the preparatory material and featured two cases written to unfold over the course of the session, with stops for questions to prompt small-group discussion. Test questions pertaining to this material were developed to align with session learning objectives and included in the final exam for the course.

Students were directed to watch the 20-minute prerecorded lecture prior to class. For the in-class PowerPoint presentation (Appendix B), only a projector was used. The session was given four times to groups of about 30 students, who sat at tables holding five to eight students each; this small-group seating helped to facilitate conversation. A total of 122 students participated in this activity. Students were given no additional materials and were asked to put their phones and tablets away before beginning the session. The instructor began by reviewing the format of the session, including the case role-play, the multiple discussion questions for the student groups, and the expectations for participation. Following this introduction, the in-class presentation, which included all relevant information for the case discussion, began. The presentation had multiple stops with prompts and questions for students to first discuss among themselves and to then address within the larger group. At the first stop, after only a brief summary
of the presenting patient’s information, the instructor prompted students to think about what information they needed to obtain from the patient to provide appropriate contraceptive counseling. The instructor then role-played the patient, with each group sending up one student to ask several questions of the patient. The answers to questions commonly asked by the students can be found in the faculty guide (Appendix C). A maximum of 5-6 minutes was allotted to this role-play interview. Using the domains listed on slide 5 of the in-class presentation, the instructor then facilitated a discussion about what pertinent questions were appropriately asked by the students and what relevant information was missed.

At subsequent stops in the case discussion, students were asked to identify the tests or exams necessary to prescribe the patient contraception, the contraceptive options they would recommend for the patient along with the rationale for each, and their intended approach to counseling the patient. The instructor then called on each group to share what it had discussed. The instructor had the opportunity to elicit responses from multiple students, thus exposing differences and inviting further discussion among students. The relevant PowerPoint slides were then used to reinforce the key points of each question. The in-class session lasted 55 minutes.

Throughout the entire session, the facilitator was essential in working to maintain the students’ focus on the most salient pharmacology-related points of this exercise, such as the effectiveness of various contraceptive methods and the difference between the risks of progesterone and estrogen. Additionally, the facilitator asked the questions highlighted throughout the PowerPoint slides and directed the discussion so that the key points articulated in the notes section of the in-class presentation were covered. Furthermore, the faculty member was provided with a faculty guide to review in preparation for the session.

Faculty facilitating the large-group session should have familiarity with the content of the prerecorded lecture, including interpretation and use of the U.S. Medical Eligibility Criteria for Contraceptive Use, 2016 (US MEC), as well as the US MEC summary chart and Effectiveness of Family Planning Methods chart. They should also have background in contraceptive counseling and the basic guidelines for quantitative communication. With this background, review of the prerecorded lecture, and review and use of the faculty guide, they should be well prepared to run the session.

On their end-of-course evaluation, students were asked three Likert-type questions about their experience with the session. On the course final examination, they answered five multiple-choice questions pertaining specifically to the session material.

**Results**

As discussed above, students voluntarily completed three questions related to this session on their anonymous end-of-course evaluation. Evaluations were completed by 103 of the 122 students (84.4% response rate) who participated in the session. Students were asked to rate their level of agreement with three statements on a 5-point Likert scale (1= *Strongly Disagree*, 2= *Disagree*, 3 = *Neutral*, 4 = *Agree*, 5 = *Strongly Agree*); results of these session evaluation data are found in Table 1.

| Statement                                                                 | M  | SD  |
|---------------------------------------------------------------------------|----|-----|
| The contraceptive pharmacology session facilitated my understanding of the basic science material presented in class. | 4.42 | 0.72 |
| The contraceptive pharmacology session helped me to appreciate clinical implications of the relevant basic science material. | 4.42 | 0.75 |
| Participation in the contraceptive pharmacology session was a valuable use of my time. | 4.31 | 0.95 |

*Rated on a 5-point Likert scale (1 = *Strongly Disagree*, 5 = *Strongly Agree*).

Additionally, five questions pertaining to the lecture material were written for the course final exam. The questions were a mixture of application and recognition types. The content of one question was covered
exclusively in the online module; all other questions were both covered in the online module and then reinforced during the in-class session. Results are shown in Table 2. The average class performance across these five questions was 88% for the class of 2021 and 78% for the class of 2020. We analyzed the discrimination index, which is a measurement of how the good students were doing versus the poor students on a particular question. The discrimination indices were acceptable to strong, with all but one in the range of .11 to .43. (One was .02, an expected value for a question with a correct response rate of .99.)

Table 2. Class Performance on Pharmacology Course Final Exam Questions Related to Contraceptive Pharmacology

| Question | Educational Objective Assessed | Description of Question | Coverage | Item Difficulty | Discrimination Index |
|----------|--------------------------------|--------------------------|----------|-----------------|----------------------|
| 1        | 3                              | Risk communication of contraceptive effectiveness | In-class session, online module | .63 | .99 |
| 2        | 2                              | Contraceptive options for a patient with thrombotic risk | In-class session, online module | .65 | .74 |
| 3        | 5                              | Mechanism of action of a contraceptive option | In-class session, online module | .81 | .93 |
| 4        | 5                              | Explanation for the differing doses of progestins needed to prevent pregnancy | Online module | .85 | .87 |
| 5        | 1                              | Identification of drug-drug interaction | In-class session, online module | .94 | .89 |

Discussion

The lecture in conjunction with the in-class case discussion not only filled the curricular gap in contraceptive pharmacology but also provided students a unique and developmentally appropriate opportunity to learn about risk-communication skills while furthering their foundational science knowledge. Student ratings confirmed their perception of the success of the exercise. Performance on the final exam questions demonstrated short-term learning in basic principles of pharmacology, risk communication, and shared decision making related to contraceptive methods.

After this session was run for the first time in the spring of the 2017, we used the data from student performance on the relevant final exam questions to inform minor modifications of the voice-over PowerPoint for the subsequent class year. In particular, more attention was paid to risk communication as this was a primary goal of the session. Additionally, more emphasis was placed on this objective in the face-to-face setting. From the class of 2020 to the class of 2021, there was significant improvement in student performance on the related final exam question (question 1 in Table 2).

Additionally, significant improvement was seen in student performance on a question about contraceptive management for patients with thrombophilic mutations (question 2 in Table 2). For the class of 2021, the voice-over PowerPoint and class discussion both emphasized that barrier methods and natural family planning are appropriate options only if other methods are not available.

The limitations of our session evaluations are twofold. First, we do not have baseline data regarding students’ contraceptive pharmacology knowledge; therefore, while students performed well on the related final exam questions, we do not know if this performance represented preexisting knowledge or reflected learning that directly resulted from our session. Additionally, the session evaluation revealed only students’ satisfaction with and perception of the session, without evaluating their learning. In the future, a more robust assessment of student learning may include a mixture of multiple-choice and short-answer questions, which could more adequately evaluate learning objectives related to risk communication.

The major challenge of this session was limited time. Approximately the first 15 minutes were spent on the initial case presentation and role-play. The next 35 minutes were spent talking about the clinical reasoning behind the optimal contraceptive choices for the patient and discussing contraceptive effectiveness communication. In two of four sessions, we did not have time to cover the brief final case, which looked at
drug-drug interactions between antiepileptics and contraceptives (slides 12-13). A 75-minute session would provide enough time to comprehensively cover the material in its entirety. When facilitating this in-class case discussion in the future, we recommend either allotting more time (if possible) or omitting the role-play (slide 4, question 1) and instead facilitating the case as a discussion focused on brainstorming the information important to contraceptive counseling and decision making without supplying the answers to the student-generated questions (slide 5). This approach would allow sufficient time for the second case.

In structuring the role-play, we had each class of 30 students break up into groups of five to eight students and first discuss amongst themselves what questions they would ask about a patient when considering contraceptive decision making. We then went from group to group and had each group ask several questions. To make this more interactive and to mimic the format used in many of our institution’s other case discussions, a faculty member role-played the patient and provided answers to the questions generated by the students. We ensured participation by calling on each group. While this enabled students to practice both their communication and clinical skills, it was time consuming, as noted above. Our session was facilitated in one of our school’s laboratories, where each student group sat at a different table. We feel that the session would run equally as well, if not better, with fewer small groups or a single small group.

We are not currently planning any revisions to this session for the upcoming academic year. However, the recorded lecture can easily be edited in Articulate Presenter to reflect changes in guidelines and updated data on effectiveness. The materials provided here are meant to be used, either in part or in their entirety, to support medical student learning regarding the foundations of contraceptive pharmacology and to introduce students to contraceptive counseling. As such, they could appropriately be integrated into a pharmacology or reproductive system course for preclinical medical students.

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Prior Presentations
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Ethical Approval
The Florida International University Health Sciences Institutional Review Board approved this study.

References
1. Daniels K, Mosher WD, Jones J. Contraceptive methods women have ever used: United States, 1982–2010. Nat Health Stat Report. 2013;62(1):1-15.
2. Jones J, Mosher W, Daniels K. Current contraceptive use in the United States, 2006–2010, and changes in patterns of use since 1995. Nat Health Stat Report. 2012;(60):1-25.
3. Han PKJ, Joekes K, Elwyn G, et al. Development and evaluation of a risk communication curriculum for medical students. Patient Educ Couns. 2014;94(1):43-49. https://doi.org/10.1016/j.pec.2013.09.009
4. APGO Medical Student Educational Objectives. 10th ed. Crofton, MD: Association of Professors of Gynecology and Obstetrics; 2014.
5. USMLE content outline. USMLE website. http://www.usmle.org/pdfs/usmlecontentoutline.pdf. Published 2017. Accessed June 10, 2018.
6. Curtis KM, Tepper NK, Jatlaoui TC, et al. U.S. Medical Eligibility Criteria for Contraceptive Use, 2016. MMWR Recomm Rep. 2016;65(3):1-104. https://doi.org/10.15585/mmwr.r6503a1