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Abstract

Introduction: During the preclinical curriculum, students are introduced to EBM principles, however structured application to clinical medicine varies throughout clinical experiences. Application of EBM in a clinical educational environment affords students opportunities to practice required skills.

Methods: Students selected a patient case and formulated a question related to diagnosis or

treatment using the PICO framework. Students selected research publications related to the patient case, critically appraised their validity and generalization, and developed a comprehensive presentation involving a case summary and related EBM topics, which were evaluated by a faculty member using a rubric developed for the project. To assess the effectiveness of the curriculum addition, students were administered a survey to rate their knowledge of EBM before and after completing the EBM project.

Results: One full academic year of clerkship cohorts (n=103) were surveyed. Regardless of EBM knowledge before the project, comparison of self-reported knowledge increased to above-average level of understanding as a result of the project (mean=4.0, SD=1.07, CI=3.75-4.19). Furthermore, student presentation percentage scores using the rubric showed an above average understanding of EBM (mean=96, SD=4.40).

Conclusion: It is important for students to integrate EBM into their practice early in their training. This curriculum addition was effective and could be utilized in other clerkships.

Keywords: undergraduate medical education; evidence-based medicine

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Introduction

The term Evidence-Based Medicine (EBM) was coined in 1991 by Gordan Guyatt and quickly became the standard for integrating new evidence into how physicians and medical professionals practice medicine. With the goal of improving healthcare quality, Guyatt provided a simple model to incorporate skills into everyday practice and clinical decision-making. This model involved the following steps: formulating a clinical question, searching the literature, critically appraising the literature, and applying evidence to patient care.[1]

In medical student education, preparing each new generation of physicians with the skills required for residency is of utmost importance. To set the standard for expected skills and behaviors for medical students transitioning to the next phase of training, the Association of American Medical Colleges (AAMC) identified 13 activities, called Core Entrustable Professional Activities (EPA). Core EPA 7 requires students be able to "form clinical questions and retrieve evidence to advance patient care".[2] Following Guyatt's model, the AAMC's four key competencies in this domain are simplified to ask, acquire, appraise, and advise with measurable, specific behaviors students are expected to have acquired before residency.

EBM is usually taught through didactic sessions, case-based learning, and journal clubs. While many schools have discrete blocks, some use a longitudinal approach, incorporating EBM skills over the course of the medical school curriculum. A 2020 study at Indiana University School of Medicine revealed that a scaffolded, integrated approach taught over the course of two years was more effective than a two month discrete block, increasing both assignment grades and Step 1 scores.[3] A separate systematic review determined that clinically integrated methods improved EBM knowledge, skills, attitudes, and behaviors, while stand-alone modules improved

knowledge only.[4] Using information from systematic reviews and pedagogical theory, a proposed hierarchy for methods of EBM instruction cited that interactive, clinically integrated teaching and learning activities may be the most effective.[5] Although it is known that these methods are most effective, many obstacles stand in the way. One study surveyed 120 educators from 11 countries to determine barriers to teaching in clinical practice and revealed that lack of time was the largest barrier, followed by lack of curricular requirements to teach EBM.[6]

As a result of this literature, we hypothesize the most effective method for EBM instruction is longitudinal and clinically integrated. To promote the incorporation of knowledge, skills, attitudes, and behaviors into the routine practice of our medical students, we proposed the incorporation of a novel EBM module into the Obstetrics and Gynecology clerkship. In our institution, didactic and case-based EBM instruction occurs prior to starting the clinical rotations; our goal was to build upon that knowledge by providing students an opportunity to apply skills learned in the classroom to actual patient encounters. The objectives were to ensure medical students met the AAMC's Core EPA 7 and could effectively formulate searchable questions, acquire evidence, critically assess the research for validity and generalization, and use the gathered evidence in their clinical decision-making. To assess effectiveness, our study goal was to determine whether self-reported student knowledge increased with completion of the newly incorporated EBM module.

Methods

This curriculum addition was designed to be implemented into the clerkship phase of medical school. For the best results, students should have a basic understanding of EBM principles,

preferably through instruction during the preclinical years. At our institution, students were exposed to biostatistics, case-based EBM coursework, and validity assessments during their preclinical years.

Curriculum addition overview:

During the Obstetrics and Gynecology clerkship, students were required to complete an EBM end-of-rotation project. During their clerkship, students were challenged to choose a patient encounter of interest. They were encouraged to formulate a clinical question regarding the diagnosis, treatment, or management of their chosen patient encounter. Students with interests in other specialties were encouraged to choose a topic related to their area of interest which allowed for student buy-in and enhanced participation. For example, a student interested in Radiology may choose a case from Gynecologic Oncology which utilized magnetic resonance imaging and discuss imaging modalities that aid in diagnostic efforts.

Students chose their topic, formulated a PICO (Population, Intervention, Control, and Outcomes) question, and performed a literature search in order to find a research study that answered their question before their midterm meeting with the clerkship director. During this meeting, their topic was discussed. Suggestions for improvement were offered. Once approval was granted for their selected patient topic, each student used the Critical Appraisal Skills Programme (CASP) to assess their chosen study for validity.

During the latter half of the clerkship, students prepared for their EBM capstone presentation. This formal oral presentation included discussion of their patient case (in SOAP format), the related PICO question, and a summary of their selected research study. During the research

portion, they were expected to highlight research methods and data analysis. Finally, this evidence was applied to their chosen patient case, highlighting opportunities to improve patient outcomes. Presentations were expected to include visual aids using a slide presentation application.

Capstone Presentation:

Students presented their EBM capstone presentation during the final week of the Ob-Gyn clerkship. In preparation for the presentations, a large room with multiple round tables was reserved during the regularly scheduled didactic time. Multiple faculty members were recruited to serve as evaluators for the capstone presentation. Presentations were conducted simultaneously in small groups, with 3-4 students and one faculty member seated at each table. This format was selected to ensure presentations could be conducted in the regularly scheduled didactic time and did not interfere with or detract from clinical experiences. As students presented, they were evaluated by their peers and faculty members according to a rubric (Appendix E) designed for the project. Project and presentation feedback was given immediately following each presentation. The small group setting also allowed for a short, topic discussion led by the faculty. Each student's final grade comprised an average of grades from their peers and faculty member. The goal was to complete the session withing 3 hours.

Student Learning Assessment:

A Qualtrics survey was created to assess student knowledge of EBM principles. Following Institutional Review Board exemption, students were recruited to participate in the survey after the completion of the module. The survey assessed the students' self-reported knowledge of EBM before and after the completion of the module using a 5-point Likert scale. Students were

also asked to provide narrative feedback on the EBM project in an open-ended response question. Descriptive statistics were calculated utilizing IBM SPSS Statistics, Version 29.0.

Results

After a full academic year of medical students completed the rotation with the EBM curriculum addition, we assessed the addition for effectiveness. The eight rotation cohorts were comprised of 116 medical students that completed the module; 103 students (89%) completed the survey. Self-reported knowledge of evidence-based medicine before the module was minimal to moderate (mean=2.30, SD=0.95, CI=2.11-2.49). Regardless of EBM knowledge before the project, comparison of self-reported knowledge increased to an above average level of understanding in EBM knowledge (mean=4.00, SD=1.07, CI=3.75-4.19). Using the student rated knowledge of EBM after completion of the module, we set the threshold for what we would believe to be adequate to maintain it as part of the curriculum. To continue with the module and deem it as a successful addition to the curriculum, we required that at least 70% of the cohort to report a 3 or better on the scale provided. Using a binomial test, we determined whether the students' self-reported knowledge met the threshold of 70% noted above. Of the 103 students that completed the survey, 89 (86.4%) reported a 3 or better.

Students were graded by a project-specific rubric (Appendix F). All students met minimum requirements and passed the presentation component of the clerkship. The minimum passing score was 80% and the average score was 96% (SD=4.40). All sessions were completed in under 3 hours.

Qualtrics narrative feedback:

Student comments on the EBM curriculum addition were extremely positive. The following positive themes were identified as :

- The project prepared students for formal presentations required during residency and fellowship
- Students were able to choose a topic related to their specialty interests
- It focused on mastering statistical analysis and interpretation of results
- The opportunity to learn about Ob-Gyn topics through peers' presentations was valuable
- Learning how and when studies are generalizable to our patient populations

Several weaknesses of the curriculum addition were identified as well:

- The time commitment required to complete the project was challenging while balancing clinical duties and other curricular commitments
- The evaluations varied based on different faculty graders
- There was a lack of resources for tutoring on research methods and statistical analysis

Discussion

Typically when third-year students begin their clinical clerkships, they have spent little time seeing patients and have not begun to adopt practice habits. We believe it is important to integrate these skills, attitudes, and behaviors into students' practice early, with the hope that they will continue to seek the most up-to-date, well-studied information to guide clinical decision-making in the future.

Here we present an EBM curriculum addition integrating an EBM module into the Ob-Gyn clerkship that allowed students to apply what they had learned in preclinical didactic sessions

and case-based learning to authentic patient encounters. Our curriculum addition showed statistically significant improvement in self-reported EBM knowledge and had positive narrative feedback from a full academic year of students. Additionally, as this project was a graded clerkship activity, it provided the medical school administration with the confidence that each medical student can meet the AAMC's Core EPA 7 objective. If deficiencies were noted, the project-specific rubric aided instructors in identifying where these deficiencies existed and how to help correct them.

Although most students expressed positive feelings about the curriculum addition, they also highlighted areas for improvement. Initially, we required the presentation length to be a minimum of 15 minutes and a maximum of 27 minutes. Many students felt this time requirement was challenging to meet when coupled with other curricular requirements while being on a strenuous clinical schedule. Students felt that the time spent learning about one topic in detail detracted from learning about a breadth of other topics in the Ob-Gyn field. For the next academic year, we are considering shortening the presentation length but intend to continue the incorporation of this EBM project.

The grading rubric was primarily created to ensure the AAMC Core EPA 7 objective was met and to identify any students with EBM deficiencies. We specifically included this module in their final clerkship grade due to the time commitment required. Even with the use of the grading rubric, some students perceived that some evaluators graded them more harshly than others. To ensure students were evaluated as objectively as possible, we added a peer-evaluation component. Along with the faculty evaluator, the other students in the group evaluated their peers with the same rubric. Each students' final grade was ultimately determined by an average

of all scored rubrics in their small group. The entire cohort had an average of 96% on the EBM project. Additionally, the rubric provided the faculty an objective method to evaluate their patient case presentation, presentation slides and public speaking skills. These additional skill sets are critical to learners that plan to pursue academic medicine, and also received positive feedback in the Qualtrics surveys.

Another point of feedback was to the lack of resources available to learn research design and statistical analysis in preparation for the EBM project. Students had varying levels of experience and competence with research methods and statistical analysis upon entering the clerkship. In this first iteration, if they had not previously mastered the material, they were expected to self-learn. Based on the feedback and to aid students' learning in the future, we plan to provide on-demand videos and links to educational resources at the time the project is assigned. Additionally, students will be offered office hours with a tutor or faculty member during the clerkship if they require additional assistance.

We would like to highlight several limitations in the incorporation of our curriculum change. One limitation was that as each clerkship cohort of students provided feedback, we were unable to make any major changes to the curriculum in an effort to maintain consistency for students in the same academic class. Another limitation was the use of a faculty-generated, unvalidated rubric. Although standard EBM rubrics exist, such as the Fresno test and Berlin assessment, neither of these rubrics included evaluation of the patient case presentation or public speaking skills. We felt the evaluation of these additional skill sets was paramount for proof of concept. The final limitation was this evaluation was conducted at a single medical school during a single

academic year in a single clerkship. Further research will be necessary to ensure our findings are generalizable to other medical schools or specialties.

This EBM curricular module addition was designed for use in the Obstetrics and Gynecology clerkship, but the principles are applicable to all specialties and could easily be adapted and applied to any clerkship. The presentation session could be implemented as a stand-alone preclinical module using cases, but we believe that the success of this module was the result of longitudinal EBM instruction, culminating in the application of what they had learned in the classroom to real-world patient encounters. We hope other institutions will find this useful and incorporation of EBM education will be implemented more frequently in core clerkships.

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