Early Introduction of an Evidence-based Medicine Course to Preclinical Medical Students

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Evidence-based Medicine (EBM) has been increasingly integrated into medical education curricula. Using an observational research design, we evaluated the feasibility of introducing a 1-month problem-based EBM course for 139 first-year medical students at a large university center. We assessed program performance through the use of a web-based curricular component and practice exam, final examination scores, student satisfaction surveys, and a faculty questionnaire. Students demonstrated active involvement in learning EBM and ability to use EBM principles. Facilitators felt that students performed well and compared favorably with residents they had supervised in the past year. Both faculty and students were satisfied with the EBM course. To our knowledge, this is the first report to demonstrate that early introduction of EBM principles as a short course to preclinical medical students is feasible and practical.

KEY WORDS: evidence-based medicine; preclinical medical students; web-based curriculum; problem-based learning; medical education.


The teaching of evidence-based medicine (EBM) has been increasingly integrated into curricula at all levels of medical education.1–4 During residency and in practice, clinicians are reinforcing principles of clinical decision making by asking relevant clinical questions, interpreting medical literature, and applying principles of biostatistics and clinical epidemiology to the care of individual patients. The Medical School Objectives Program developed by the Association of American Medical Colleges (AAMC) advocates incorporation of EBM principles throughout undergraduate education.5,6 Published reports of EBM curricula in medical schools describe teaching that occurs predominantly in the third and fourth year of medical school.7–9 Perhaps because of students’ increased experience with patient care studies. Yet increasingly, medical educators are finding innovative ways of integrating aspects of EBM techniques throughout the 4-year medical school experience, e.g., by teaching search strategies and evidence assessment during preclinical classes, then reviewing strategies for evaluating different types of articles (diagnosis, harm, prognosis, etc.) during clinical rotations.10

At our institution, we began formal introduction of EBM to fourth-year medical students during a required 1-week clerkship in Medical Informatics. This clerkship received the highest clerkship rating in 1999 compared to all other clinical clerkships. Students strongly recommended introducing the material before their third-year clinical rotations. To address their recommendations, we developed an EBM course for first-year medical students, using a format similar to McMaster University’s problem-based learning format.11 We hypothesized that first-year medical students could master EBM principles even without clinical backgrounds, since EBM involves techniques of critically appraising information, rather than comprehensive mastery of a specific field. Therefore, we sought to determine whether first-year medical students could master introductory EBM principles through a short course. Secondly, we sought to assess whether web-based curricula were useful adjuvants in teaching EBM.

PROGRAM DESCRIPTION

Indiana University School of Medicine instructs the second largest medical student body in the country.12 For their first 2 years, 139 of the 279 students in each class are instructed at the Indianapolis center, while all others are instructed at 8 regional centers throughout Indiana. All students pursue their clinical instruction in Indianapolis. Our EBM intervention was implemented only in Indianapolis, since each center locally controls methods employed to teach the statewide core curricula.

After review of AAMC’s Medical School Objectives Program,5,6 United States Medical Licensing Examination Step 1 guidelines,13 and Indiana University School of
Medicine's life-long learning competency and biostatistics requirements,14 we developed a short EBM course for our first-year students, consisting of 8 student contact hours.

In January 2000, our EBM course was conducted as two 1-hour lectures and three 2-hour small-group sessions. Sixteen small-group facilitators with EBM experience included faculty in emergency medicine (8), pediatrics (5), internal medicine (2), and library sciences (1). Small groups consisted of 1 to 2 facilitators and 10 to 11 students. A facilitator's handbook was developed to provide consistent small-group experiences, with detailed objectives, timelines, commonly asked questions and answers, sample dialog, completed “Users’ Guides to the Medical Literature” worksheets,15–19 critical concept summaries, background reading material, small-group teaching strategies, and references. Prior to the course, facilitators met to review the facilitator's handbook, and to discuss teaching/learning strategies.

A 1-hour introductory lecture reviewed standard biostatistical concepts and construction of clinical questions (Table 1). The class was then introduced to clinical questions that would be discussed in small group, after watching Viagra commercials (Pfizer, Washington, D.C.) and part of an “ER” television episode (October 1999). Three small-group, problem-based learning sessions focused on evaluation skills frequently used by clinicians20, assessment of risks/benefits of therapeutic interventions and diagnostic tests, and of causation of harm. During each interactive session, groups discussed a clinical vignette, developed a relevant question, and evaluated a corresponding article: Session 1, therapeutic interventions: Among diabetic patients with erectile dysfunction, how efficacious is Viagra versus placebo in improving successful intercourse?21; Session 2, diagnostic tests: Among head trauma patients with brief loss of consciousness, how well does head CT versus physical examination rule out intracranial hemorrhage?22; and Session 3, causation of harm: Among patients with depression, how strong is the evidence for an associated sexual abuse history?23 Students completed worksheets with questions from “Users' Guides to the Medical Literature.”15–19 We emphasized standard EBM concepts such as question formulation, study design, bias, and statistical test interpretation (Table 1). All classrooms were internet accessible, and during the third small-group session, we demonstrated searching strategies to access MEDLINE and Cochrane articles. At each session's end, critical concepts were reviewed, and students received pocket cards with formulas and key concepts for reference. A final lecture reviewed all major EBM concepts covered in the initial lecture and small groups. Further, the course director (GW) sent out weekly “teaser” clinical questions via a first-year electronic discussion group. Dedicated secretarial support facilitated course coordination.

Students were encouraged to pursue self-directed learning using supplemental online EBM curricula. Using WebCT (University of British Columbia, Vancouver, British Columbia), a program that builds educational websites with graphical and testing capabilities, the course director developed a 20-page web-based EBM curriculum and a practice examination. The website was colorful and easy to navigate. It provided access to a moderated electronic discussion group.

**PROGRAM EVALUATION METHODS**

A multidimensional approach to assessing course performance was used, examining student preparation, performance, and participation, student/facilitator satisfaction, and utilization of supplemental web curricula.

Student performance was assessed using an online practice examination and written final examination. The 60-item online practice exam was programmed through WebCT. Participation was voluntary, as part of formative self-evaluation. Four exam components paralleled the course structure: basic biostatistics, evaluation of therapies, diagnostic tests, and study design. Students could sign on from any internet-accessible site, and could repeatedly submit exam components. The multiple-choice practice exam was open book. Once submitted, incorrect answers were explained, and links to relevant website sections were provided. WebCT stored submitted answers for each attempt by log-in ID, and generated score distributions for each submitted attempt.

Summative performance evaluation was obtained through a proctored written final examination. The 30-item multiple-choice final exam paralleled course objectives and practice exam content, and was felt to reflect relevant problems encountered by practicing physicians. We emphasized understanding EBM concepts, and practical EBM applications to clinical problems, rather than formula memorization. Since clinicians have ready access to statistical formulas in clinical practice, the final exam was open book, with formulas provided. The questions on the final examination were different from those asked during the online examination, although the same concepts and applications were covered. Students chose among 4 answers per question; incorrect answers reflected common errors likely to be made while answering the question (Table 2).

Student participation was noted through small-group attendance and facilitator assessment of student preparation/participation, on the basis of 15 questions in a 50-item written facilitator questionnaire. Student utilization of web-based supplemental curriculum was noted through WebCT, which tracks unique log-in IDs per student, number of times pages are accessed (“hits”) and time spent per page.

Student satisfaction was assessed through anonymous online and written questionnaires. Students completed a 23-item online questionnaire anytime during the course, focusing on their course preparation and satisfaction. After the final examination, a 40-item written questionnaire was distributed, focusing on online curriculum