

Evidence-based Medicine (EBM) for Undergraduate Medical Students

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Abstract

Introduction: Teaching evidence-based medicine (EBM) to practitioners and residents will improve their performance. There is insufficient evidence regarding the teaching of EBM in undergraduate medical education. We aimed to determine whether an EBM workshop would improve undergraduate medical student's ability to form clinical questions and search databases, as well as their attitudes towards EBM. **Material and Methods:** This was a quasi-experimental study on fifth- and sixth-year medical students of Isfahan University of Medical Sciences. In a 4-day workshop, students learned and practised how to form clinical questions, perform literature searches and carry out critical appraisals. We assessed the student's ability to form a clinical question and their performance in searching and identifying the best clinical literature to answer the question, before and after the workshop. Students' attitudes were assessed using the Likert scale 15-item questionnaire on the last day of the workshop. Wilcoxon signed ranks test was performed to compare pre- and post-tests. **Results:** The workshop increased students' scores in developing clinical questions ($P = 0.004$, mean rank = 14) and search skills ($P < 0.001$, mean rank = 12.50). It also improved students' attitudes towards EBM [mean = 3.76, (standard deviation = 0.7)]. The course allowed students (79.2%) to appreciate the need for EBM education for medical students. The students also commented that the course showed them the importance of EBM knowledge in effective clinical performance. **Conclusions:** EBM workshop for undergraduate medical students increased their ability to form clinical questions and carry out appropriate literature searches. It also improved their attitudes towards learning and applying EBM.

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Introduction

The practice of evidence-based medicine (EBM), which integrates individual clinical expertise with the best available evidence from systematic research,¹ demands a set of skills. These skills help clinicians retrieve, appraise and apply the current best evidence.²

Incorporating EBM principles throughout undergraduate medical education is recommended by famous associations, e.g. the Association of American Medical Colleges (AAMC).³ In response to these recommendations, the teaching of EBM and its associated skills took hold in medical schools, especially in the third and fourth year of education. Perhaps it is because of students' experience increased with patient case studies.⁴ There is evidence of the effectiveness of educational intervention and the value

of EBM curricula from controlled studies based on workshops and team activities. They have focused on learning the skills of EBM such as question formation, literature searches and critical appraisal.⁵ Outcomes of these interventions have been demonstrated through various measures including multiple-choice tests, KAP (knowledge, attitude, practice) questionnaires, clinically based tests, observations and self-reports.⁶ Few reports, however, have assessed the impact of such interventions on undergraduate students. As the American Medical Association has noted, the existing quality of evidence for teaching EBM is poor, and there are few assessments of the efficacy of current curricula in this regard.⁷

Here, we have approached the development of an EBM assessment instrument by the validation process. We report

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our experience with a workshop that introduces EBM throughout the fifth- and sixth- years of medical school and describe our method of evaluating the attitude and practice of the skills of EBM such as question formation, literature searches and critical appraisal of students.

Material and Methods

Study Design

This was a quasi-experimental study on fifth- and sixth-year medical students at Isfahan University, School of Medicine (August 2005). Students, who had previously received a short course in research methods in the school, were invited to participate in an EBM workshop. We assessed the change in their EBM skills and attitudes after the workshop. A baseline assessment of participants' knowledge of the different steps of EBM was conducted.

Educational Intervention

The course was a 4-day workshop consisting of four 2-hour lectures and four 1-hour small group sessions. At first, students learned to formulate questions based on common clinical scenarios into answerable clinical questions. They were then introduced to appropriate sources for obtaining the best evidence, including databases and search strategies. After that, we had lectures on understanding levels of evidence, and how to critically appraise an article.

After each lecture, small group sessions were conducted to provide a context in which students could improve their performance. Each group consisted of a facilitator and 8 students. Facilitators were medical doctors experienced in EBM practice and teaching, who had also undertaken special faculty development programmes in group learning skills.

A facilitator's handbook was developed to provide consistent and identical small-group activities and experiences. It included detailed objectives, timelines, commonly asked questions and answers, sample dialogue, (chapters 1-4 of "How to learn EBM" book by socket), a few EBM references and small group teaching strategies. Prior to the course, facilitators met to review the facilitator's handbook, and to discuss teaching/learning strategies. In the first group session, students learned to develop focused clinical questions through a discussion on actual clinical scenarios.

In the next session, they learned to search MEDLINE and PubMed in a productive and time-efficient manner to identify information sources related to the same question. Online web facilities for searching MEDLINE and PubMed were prepared in the classroom.

In the critical appraisal process (third session), groups were working on the concepts of internal validity (are the study's results valid?), and external validity (do the results

of this study help me in the care of my patients?). In the last group session, students performed the whole process from beginning to end, applying a new scenario.

Assessments

Two simulated case scenarios were given to the students, at the beginning and at the end of the workshop. We assessed students' ability to choose an appropriate clinical question for each scenario (at the beginning and at the end of the workshop). We used a multiple-choice exam where incorrect answers reflected common errors in formulating clinical questions. The questions were about therapy, diagnosis, harm or prognosis.

Students were asked to complete a MEDLINE and PubMed search based on a standardised question relevant to the clinical case (e.g. "How effective are anti-inflammatory drugs in treating lower back pain in adults over the age of 25?"). The students had to create and perform a search strategy to find appropriate evidence. They performed a literature search before and after the workshop, and submitted a printed copy of the search strategy for final scoring. Two blind investigators evaluated the search strategies. Blinding codes were determined and hidden by the main investigator. Point values were assigned to search tactics used; with a total of 100 points for each search, and higher point values were assigned to more important search tactics.⁸

Finally, students' attitudes towards the course efficacy were assessed by a 15-item questionnaire using the Likert scale (#1: strongly disagree, #5: strongly agree). Three faculty members had checked the questionnaire validity in the case of content and face. The reliability was tested through a pilot study and the Cronbachs' alpha was equal to 0.69. Students' participation was voluntary and all information kept confidential.

Statistical Methods

We calculated median and mean scores, standard deviations and Interpercentiles (25, 75). Wilcoxon signed ranks test was performed in order to compare students' scores in forming clinical questions and search skills. The mean ($\pm$ SD) score for students' attitudes towards the course effectiveness and frequency of agreement with a few questionnaire's items is presented.

Results

Twenty-four students with mean age of 23 years (SD = 0.8) attended the workshop; 15 (63%) were female. All participants responded to the pre- and post-workshop evaluations (response rate = 100%).

Medians (Interpercentiles 25, 75) of pre- and post-test in asking clinical question were 1 (0, 2) and 2 (1, 2) respectively.

Table 1. Mean Scores and the Frequencies of Strongly Agree and Agree Answers Towards Attitude's Items

number	Items	Mean	SD	%
1	It is necessary to hold evidence-based medicine (EBM) course for pre-clinical medical students.	4	0.93	83.3%
2	It is necessary to know EBM steps for doing clinical performance effectively.	3.8	0.63	79.2%
3	My ability is for clinical decision-making is improved by this course	3.9	0.8	70.8%
4	At the end of the course, I have problems asking clinical questions from patient information	3.3	0.71	8.3%
5	This course increased my ability to search databases	4.5	0.72	95.8%
6	I am interested to study about EBM after this course	3.6	1.1	62.5%
7	The course had excessive contents unnecessary for clinicians' practical needs	4.8	0.71	8%
8	This course made me aware of the importance of applying articles in clinical practice properly.	3.7	0.58	79.2%
9	It is difficult to use EBM steps in our country	2.1	0.86	12.5%
10	After understanding EBM steps, my ability to obtain patients' history increased	3.1	0.7	33.3%
11	I recommend my friends to participate in EBM course	4.1	0.89	83.3%
12	Duration of this course was too short to learn EBM steps	2.3	1.1	66.7%
13	At the end of the workshop, I understood the goals of this course	3.1	0.63	53.3%
14	This course changed my attitudes towards clinical decision-making	3.6	0.81	65.5%
15	The course consisted of more theoretical contents rather than being practical.	3.5	1.08	54.2%

The workshop increased students' ability to form clinical questions ($P = 0.004$, mean rank = 14). 37.5% (9) of students answered multiple choice questions correctly before workshop, but it was 70.8% (17) after intervention.

Means ($\pm$ SD) of search skill evaluations were 26 ($\pm$ 6.9) and 83.5 ($\pm$ 13.7) before and after the workshop respectively. Their search skills also improved after the workshop ($P < 0.001$, mean rank = 12.50). At the beginning of the course, minimum and maximum scores in search skill were 15 and 40, but they were 45 and 100 after the workshop.

Students agreed on the workshop's effectiveness and its impact on their attitudes towards EBM (mean = 3.76, SD = 0.7). Frequencies of agree and strongly agree answers to the 15-item questionnaire are shown in Table 1.¹ Cronbachs' alpha for the questionnaire was 0.73.

Students found small groups helpful (85%) and achieved the goal of the workshop (80%). They enjoyed the workshop (87%) and considered the materials appropriate for their educational level (100%). They believed that team working outcomes were well discussed (93.8%) and planning was appropriate (88.1%).

Discussion

The results indicate that the EBM workshop improved undergraduate medical students' ability to develop clinical questions, as well, as their search skills and attitudes towards EBM. Findings show that introduction of clinically relevant EBM materials for medical students are practical, feasible and desirable.

Other reports have focused on different types of EBM

courses for students such as workshops, morning reports, obstetric rounds, and journal clubs.⁹⁻¹¹ Our results support previous finding among all these types, EBM workshops appear to be the most effective educational method in terms of improving students' skills.¹²

Before the workshop, we were unsure if the contents of EBM were interesting and understandable or boring and irrelevant to undergraduate students with little clinical experience. Our students' positive attitudes were similar to those in British and Australian studies¹³⁻¹⁵ and showed that the material was appropriate for undergraduate learners and improved their attitudes towards EBM. Gruppen et al have shown that brief training sessions on EBM searching skills have a marked beneficial effect on the quality of EBM literature searches and performance outcomes.¹⁶ Considering previous experiences, our special focus on improving skills in developing clinical questions and literature searching was an appropriate educational goal.^{12,17}

EBM skills have traditionally not been covered in undergraduate or postgraduate education. Medical educators and medical colleges have the singular responsibility of indoctrinating the principles of EBM as a concept and a religion necessary for being an efficient, compassionate, and responsible clinician in medical students during their formative years of training.¹⁸ However, the ultimate goal of educators is to enable learners to use EBM in their daily practice of medicine and view literature searches as a fundamental skill (similar to history-taking and physical examination).¹⁹

However, issues of concern persist, regarding the

appropriate time to teach EBM.²⁰ Some practitioners believe that EBM curricula would be more effective for postgraduate medical students (residents) because they understand the importance of EBM and will be able to apply it in clinical practice.²¹ Thus, integrating EBM into a postgraduate curriculum may improve EBM application in clinical care and teaching, and may be a cost-effective way to reinforce EBM skills.²²

On the other hand, many EBM curricula involve undergraduate medical students in their clinical years.²³ There is also evidence showing that most EBM principles can be introduced to pre-clinical medical students and may encourage them to think more critically about therapeutic and diagnostic decisions. It may also motivate students to learn more during concurrent pre-clinical courses. Nevertheless, without a clinical context, students may fail to recognise the applicability of literature searches and epidemiological concepts covered in the retrieval and critique of articles.²⁴ This is why students in their fifth and sixth years of study were selected as the main target population in this study.

We can say that the practice of EBM depends less on learners and medical knowledge and more on their ability to apply methodology to clinical studies, but the content and level of education should obviously match with the audience inquiries.^{25,26}

Since “the students in this study” were in pre-internship years and they had had limited opportunities to develop their EBM skills in clinical decision-making, they were not in a position to integrate critical appraisal of the literature with patient care. Thus, critical appraisal skills were not evaluated as in some other studies.^{12,17} As soon-to-be interns, students need to coalesce EBM and problem-solving skills and teach these skills to others.

We considered the key features of our successful method to be active clinical relevant content, student involvement in group activities, and expert teachers and facilitators. While the participants were interested and motivated, it is important to note that they found the course a good motivator to learn and practice EBM.

EBM principles need to be reinforced through application and integrated repetition in students’ internship years. These introductory courses can familiarise students with the key concepts and motivate them to learn and practice EBM. Further studies on students’ future practice and their confidence in evidence-based decision-making in authentic clinical scenarios are needed. We should mention that our small sample size limited us to making generalised assumptions. However, it is unlikely that a larger sample size would dramatically change our conclusion. It is important that for students, EBM skills would improve their future performance in clinical decision-making. Most notably,

our assessment of EBM skills acquisition was performed immediately after the course, so long-term outcomes were not measured. Finally, the results of this study raised concerns regarding students’ abilities to transfer their EBM skills to simulated clinical encounters.

In summary, the 4-day EBM workshop for fifth- and sixth-year medical students encompasses clinical question development, MEDLINE searching and attitudes towards learning and practicing EBM principles. Assessing students, long-term retention of EBM principles and their application of those principles during clinical rotations would be a desirable next step.

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