ORIGINAL REPORT

Teaching Evidence-Based Medicine More Effectively

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Abstract- Evidence-based Medicine (EBM) is becoming an integral component of graduate medical education competency and a requirement for grad medical education practice-based learning core competency. This study tries to compare the efficacy of conferences utilizing small-group discussions with the traditional conference method in enhancing EBM competency. The participants in this randomized controlled trial (RCT) were 170 members of the medical faculty who were divided into two groups of 86 (intervention) and 84 (control). Following the intervention, EBM competency was assessed by a written examination. statistical analysis made use of chi-square test, independent sample *t*-test and relative risks for univariate analysis. Mantel-Hanszel was used for bivariate analysis. Cox proportional hazard models were used to evaluate multivariate-adjusted associations between EBM educational intervention and EBM knowledge, attitude and skills. A new indicator of number needed to intervention (NNI) was defined and computed. Results: The results proved conference along with small-group discussion to be a more effective teaching method with P=0.001 on knowledge, P<0.001 for attitude and skills P<0.001 in an EBM exam when compared with medical faculty members who did not participate in EBM educational intervention (n=84). Moreover, they had also increased confidence with critical appraisal skills, and searching EBM resources. Conclusions: Conferences followed by small-group discussions significantly enhance EBM knowledge, attitude, critical appraisal skills and literature review skills.
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Introduction

EBM is becoming a component of medical education curricula (1). Training in EBM has been widely implemented throughout medical schools and residency curricula worldwide. Yet, because of logistic difficulties, limited time allotted for EBM training, small sample size, frequent rotation of students and residents, few studies have looked at the effectiveness of EBM training (2). The integration of EBM training into resident's established clinical venues offers theoretical educational advantages and confronts the challenge of practicing EBM under the imperatives of real time patient care. Initial responses to this formidable challenge are promising, but their feasibility and effectiveness remain to be explored. EBM curricula cover the identification, appraisal and application of evidence in the context of individual patient scenarios (3). A recent randomized study done in the US found that medical students were not able to adequately use quality evidence to guide clinical practice (4). Most studies have measured attitudes toward practicing EBM rather than actual skills. Many of the studies that attempt to measure actual EBM skills have focused on teaching appraisal skills but not the other core competencies of EBM practice (2,5,6).

More recent studies have looked out on EBM skills including EBM literature review skills (7) evidence retrieval, (8) EBM training in graduate medical education (3) and evaluating successful teaching to derive sequentially focused questions , searching , and apply the information acquired from the literature to specific clinical questions (9).

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EBM offers a systematic and structured approach to medical education aiming to sensitize physicians to important and updated advances in their practicing field (10,11). Teaching EBM should be evaluated and guided by evidence of its own efficacy (12). To shed light on the efficacy of a two-day course of conference utilizing small group discussions compared with the traditional method of sheer lecturing, we performed a randomized controlled trial of the EBM competency for the medical faculty. This paper focuses on designing and performing a course in EBM designed for medical teachers.

Patients and Methods

Study design: A randomized controlled trial with blind outcome assessment was used. There were 86 medical faculty members allocated to the intervention group and 84 to the control group. The medical faculty members attending in Educational development center of Tehran University of Medical Sciences (TUMS) were assigned to either group through simple random sampling. EBM training course consisted of 12 two-day programs (6 hours per day). Each session consisted of EBM conferences followed by small-group discussions and group activities. Each conference including introduction to EBM, information mastery, introduction to critical appraisal ,how to read different category of articles ,designing focused clinical questions , patients values and level of evidences .Group discussions consisted of appraising different board of topics of treatment ,diagnosis , prognosis and systematic reviews. Control group receiving traditional training course other than EBM based module.

Pre-intervention assessment was performed for both groups at the beginning of the courses. Knowledge, attitude and practice were assessed through standardized inventories. Questionnaires of knowledge and attitude evaluation were designed and standardized, and EBM competency was performed using Fresno test.

At the end of each program, EBM competency of the participants in the two groups was assessed by a written examination.

On the completion of the sessions, a number of pre-specified outcomes were detected at 11 months of follow up: knowledge and attitude toward EBM and EBM competency in practice (as dependent variables). The performance of medical faculty was evaluated for improving searching skills and evidence retrieval, critical appraisal skills, forming focused clinical questions, addressing patients values in clinical practice (decision making toward diagnosis and treatment), preparing useful clinical journal clubs and implementation of level of evidence.

To assess EBM skills taught in the intervention module, the Fresno test, (13) a validated test of EBM competence was employed. Fresno test consisted of seven clinical scenarios and open ended questions on training EBM course topics with an overall score of 156.

A standardized questionnaire was implemented to evaluate knowledge and attitude of medical teachers.

Data concerning independent variables of age, gender and academic rank of the faculty members were collected.

Statistical analysis made use of chi-square test, independent sample t-test and relative risks for univariate analysis. Mantel-Hanszel was used for bivariate analysis. Cox proportional hazard models were used to evaluate multivariate-adjusted associations between EBM educational intervention and EBM knowledge, attitude and skills.

A new indicator of NNI was defined and computed. This indicator measure number of medical faculty members needed to educate for reaching pre specified out comes.

Ethical considerations

The study protocol was reviewed and approved by the Vice Chancellor for Research and Ethical Committee of Tehran University of Medical Sciences. In this research the intervention was educational module. The privacy and confidentiality of personal information of the study participants were protected. Study participants were informed of the objectives, methods and institutional affiliation of the researchers and participated in the educational programs voluntarily.

Results

Table 1 demonstrates such baseline characteristics as age, gender. These variables were gathered for 170 faculty members, 86 of whom formed the intervention group and 84 were placed in the control group.

Relationship of EBM educational intervention to educational outcomes, skills, knowledge and attitude for the two groups were measured during the 11-month follow up period, and compared (in univariate model) with the control group (n=84) conferences followed by small-group discussions (n=86) scored significantly higher on an EBM training course.

Comparison of increased scores in EBM knowledge, attitude and skills demonstrated a statistically significant

difference between the two groups. The results are reported in table 2.

The relationship of EBM educational formats to the outcomes based on age, gender and academic rank: There was a statistically significant, positive and direct correlation between age and increases in knowledge scores (R=0.37, *P*<0.001).There was no significant relation found between age and improvement in attitude scores. However, there seems to be negative but statistically significant correlation between age and EBM related skills (R= -0.27, *P*<0.00l)

Table 3 shows the means and standard deviations (SD) of change in EBM educational end points among females and males.

Association of academic rank of medical faculty member to change in attitude (*P*<0.00l) and improvement of EBM related skills (*P* =0.008) were statistically significant in univariate analysis. Beyond scores reported earlier we analyzed the results of adapted Fresno test in detail among conference and small group participants in table 4.

Table 1. Baseline characteristics of study groups of comparison of EBM training course with traditional educational module in faculty members

Variables		Control group	Intervention group	Significance level
Age (year) Mean ± SD		38.41 (± 7.82)	42.34 (± 9.16)	NS
Gender (%)	Female	27 (32.1%)	31 (36%)	*P* = 0.001
	Male	57 (67.9%)	55 (64%)	

SD: standard deviation

NS: non significant

P calculated from independent sample t-test and pearson chi 2 test

Table 2. Comparison of increases in scores of knowledge ,attitude and skills of EBM training course with traditional educational module in faculty members

Variables	Intervention group Mean ± SD	control group Mean ± SD	Significance level
Increase in knowledge score	17.84 (± 12.89)	10.35 (± 1.81)	*P* = 0.001
Improvement in attitude score	18.62 (± 7.80)	6.10 (± 0.73)	*P* = 0.001
Improvement in EBM related skills	40.29 (± 25.92)	12.50 (± 1.67)	*P* = 0.001

SD: standard deviation

P calculated from independent sample t-test

Table 3. Means and SD of EBM educational end points in both genders of EBM training course with traditional educational module in faculty members

Variables	Female	Male	Significance level
Increase in knowledge score (Mean ± SD)	12.75 (± 2.12)	14.38 (± 1.46)	NS
Improvement in attitude score (Mean ± SD)	12.74 (± 1.50)	13.10 (± 0.85)	*P* = 0.010
Improvement in EBM related skills (Mean ± SD)	31.94 (± 3.89)	25.89 (± 2.31)	*P* = 0.043

SD: standard deviation

EBM: evidence based medicine

NS: non significant

P calculated from independent sample t-test

Table 4. In detail results of adapted Fresno test scores (mean ± SD) of seven questions of clinical scenario in intervention group after 11 months follow up

Question(total score)	Mean	SD
Q_1 (0 – 12)	5.06	3.76
Q_2 (0 – 24)	6.87	4.67
Q_3 (0 – 24)	11.25	5.31
Q_4 (0 – 24)	4.87	3.86
Q_5 (0 – 24)	3.12	0.63
Q_6 (0 – 24)	11.68	9.58
Q_7 (0 – 24)	9.87	10.21
Total (0 – 156)	52.75	26.20

Our EBM educational intervention resulted in significantly increased EBM knowledge, attitude and confidence as well as performance with critical appraisal skills and choosing EBM resources.

EBM educational endpoints were also treated as categorical variables. Knowledge, attitude and skills above 50% change were considered to have increased. A new indicator NNI (number needed for intervention) was defined and computed. NNI calculated as NNT (number needed to treat). NNI for knowledge, attitude and skills were 3, 21 and 13 respectively.

Multivariate analysis: in a Cox proportional hazard model that controlled for potential confounders of the effect of the educational formats on end points (including age, gender and academic rank) conference along with small group discussion participants remained at significantly higher level of change in knowledge P=0.013, attitude P=0.036 and EBM related skills P=0.027 at 11 months follow up.

Discussion

Knowledge, attitude, and performance on EBM related skills of those participating in conference integrated with small group discussion proved to be significantly higher than those of the non-participants.

To the best of our knowledge, there was not found a study with randomized controlled design to look at the combination of conference and small group discussion in teaching EBM competency to the faculty members.

The efficacy of previous intervention on EBM competency has been inconsistent. Nevertheless, our findings support Thomas *et al.* (1) which studied 46 residents' increased EBM knowledge, increased confidence with critical appraisal skills, and much higher satisfaction. They also reported a higher level of satisfaction with the small-group discussion format. Conference participants didn't demonstrate improved EBM skills relative to the reference groups (1).

Dinkevich *et al*. (2) demonstrated that a brief training module of three or four weekly two-hour seminars was effective in improving EBM skills of pediatric residents. A systematic review of 23 studies in EBM training demonstrated that residents' EBM skills were more probably to progress when the sessions of training was at least eight hours (2,14).

Ghali *et al*. (9) concluded that a mini-course of four sessions in which students learn to desire focused questions, search Medline , review articles critically and apply information from the literature to specific clinical questions, improved student skills and attitude. Rosenberg *et al*. reported that a three-hour interactive training sessions significantly improved the student's ability to search databases (8).

Michael (3) declared that the integration of EBM training into residents' established clinical venues impose theoretical educational advantages .FIESCHI M demonstrated the feasibility of computer-aided learning and the benefits of distance teaching over the internet (15). Pitkala *et al*. concluded that the EBM course triggering students' critical thinking, developing social learning and group processes and improved their attitudes towards information retrieval and critical appraisal skill (10).

McAlister *et al*. showed that incorporation of EBM into the practice by the physicians may not be predicted by any demographic or practice-related independents variables. The most common reason to increased use of EBM by clinicians is the lack of knowledge and unfamiliarity with the basic skills, rather than skepticism regarding the concept (16). Edwards *et al*. demonstrated the efficacy of an EBM-based curriculum to introduction and application of skills required for critical appraisal and implementation of retrieving evidence from the medical literature (17). McCLuskey *et al*. reported that evidence-based practice skills and knowledge improved markedly with an educational intervention. However changes in behavior will take years or more (13).

The advantage of our study is its randomized design with a reasonable sample size enabled us to detect the differences.

We found that an EBM educational intervention consisting of 12 two-day workshops of 6 hours per day (a total of 144 hours) was associated with an increased in knowledge, attitude toward EBM, and skills as measured by improvement in critical appraisal, using EBM resources, addressing patients values in clinical practice and implementation of the level of evidence

correctly. In conclusion, EBM Conferences combined with small-group discussions enhance skills (NNI=13), knowledge (NNI = 3), and attitude (NNI=21) in medical faculty members after an 11-month follow-up period. Independent factors of age, gender , and academic rank did not demonstrate a statistically significant relationship with the out comes.

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