Interdiscip J Virtual Learn Med Sci. 2016 September; 7(3):e12177. doi: 10.5812/ijvlms.12177.

Published online 2016 September 30. **Research Article**

Clinical Residents' Viewpoints on Their Knowledge and Practical Capabilities: The Effect of an EBM Course on Focus

Zahra Karimian,[1,*] Javad Kojouri,[2] Asiyeh Salehi,[3] and Behdad Amiri[4]

[1]PhD in Higher Education Administration, Assistant Professor of Center of Excellence for Electronic Learning in Medical Sciences, Medical School, Shiraz University of Medical Sciences, Shiraz, Iran

[2]MD, Full Professor of Cardiology Department, Faculty of Medicine, Shiraz University of Medical Science, Shiraz, Iran

[3]Ph.D, Population and Social Health Research Program, Menzie Health Institute Queensland, Griffith University, Australia

[4]MA, English Language educational Department of Fars Province, Shiraz, Iran

[*]*Corresponding author*: Zahra Karimian, PhD in Higher Education Administration, Assistant Professor of Center of Excellence for Electronic Learning in Medical Sciences, Medical School, Shiraz University of Medical Sciences, Shiraz, Iran, E-mail: karimian_z@yahoo.com

Received 2015 October 09; **Revised** 2016 September 05; **Accepted** 2016 September 30.

Abstract

Background: Commitment to evidence-based medicine (EBM) means the informed and fair use of the best evidence for accurate diagnosis and treatment decisions for patients. This approach attempts to improve the quality of clinical decision-making. The current study aimed to investigate the effects of EBM training courses on the theoretical knowledge and practical skills of clinical residents.

Methods: A quantitative method based on a quasi-experimental single group design was used in this study. Two researcher-made questionnaires and one test were used as the major instruments for evaluating the satisfaction, knowledge and practical capabilities of participants. The content validity of the questionnaires was confirmed by five educational experts in medical education and clinical practices, and the reliability was calculated through Chronbach's alpha (r = 0.92 and 0.93). The questionnaires were distributed among all 110 junior clinical residents who participated in the EBM workshop; 62 residents completed the questionnaire. The gathered data was analyzed through SPSS version 14 using paired t-test and Pearson's correlation.

Results: Participants took a high level of satisfaction (means of all items were higher than the cut-off points) from the evidence-based medical course. Participants' knowledge and practical abilities were significantly broadened as a result of attending the EBM course ($P < 0.01$). In addition, a positive significant correlation was found between the knowledge scores and practical ability scores of residents who participated in the EBM course (r = 84%).

Conclusions: More emphasis needs to be placed on developing the practical skills of residents in the EBM course. It is also essential that clinical ward residents be required to make clinical decisions based on evidence-based medicine.

Keywords: Evidence-Based Medicine, Education, Residents, Knowledge, Practical Capabilities

1. Background

Evidence-based medicine (EBM) is a research-oriented approach developed in 1992 by Guyatt et al. at McMaster University, Canada. Despite its short history, this approach has been adopted by medical faculties worldwide (1). The EBM approach applies the best objective evidence to provide qualified and accurate diagnostic and/or therapeutic decisions for patients (2). EBM attempts to improve the quality of clinical decision-making through developing and reinforcing students' questioning ability, information searching skills, critical evaluation of evidence, and utilization of the results obtained from analysis and criticism of documents and evidence (3, 4). EBM applies valid and up-to-date scientific evidence to make clinical decisions more objective and reduces the impact of problems originating from subjective views, obsolete information, and linear and non-critical deductions (1).

EBM is a concept recently adopted into the tertiary education in medical sciences in Iran (5). In the general orientations of the Iranian National Comprehensive Health Map, the health instruction system was revolutionized to privilege human capital and support the elites as well as innovators so that the health services are represented by erudite, capable, efficient professionals who play a major role in enhancing individual and societal health (5). In addition, the Human Development Index (HDI) established the new medical education approaches by focusing on student-based learning methods and reinforcing the meta-cognitive capacities of medical students, including analytical and critical thinking (6). Furthermore, the instructions of the education undersecretary of Iran's Ministry of Health and Medical Education underlined the conceptual extension, propagation, and establishment of EBM in both clinical and educational systems. One of the main target groups in this program is clinical residents, because they play a significant role in providing qualified health

care services as well as training (5).

Rider et al. considered medical residents as teachers in hospitals (7). According to the literature, undergraduate medical students receive a great part of their learning through interaction with medical residents (8-12). Sanchez-Mendiola et al. showed that residents spend more than 32.5% of their time giving instructions to lower-grade medical and para-medical students (13). Therefore, medical residents are a valuable potential resource in the medical science faculties, given that they have close and direct contact with undergraduate students and consequently could have a substantial influence on their clinical learning (14). Hence, active, lifelong, and self-ruled learning methods such as EBM need to be considered by medical residents (13).

Because residents play a significant role in clinical decision-making, presenting health care services, and training other students, they were selected as the appropriate sample for this study. Although the EBM course is held for residents in Iran's medical schools as a continuous program, to the best of the researchers' best knowledge no research has been conducted into the effectiveness of such courses in improving the EBM knowledge, insight, and skills of residents at Shiraz University of Medical Sciences. This study examined the effectiveness of the EBM course and the factors influencing its application at Shiraz University of Medical Sciences. More specifically, it aimed to examine the level of satisfaction of medical residents after attending the EBM course, the participants' knowledge and practical capabilities after the EBM course, and to explore the relationship between the knowledge scores and practical capability scores of residents.

2. Methods

This study was conducted in 2013 using a quantitative approach based on a quasi-experimental single group design. All 110 junior clinical residents at Shiraz University of Medical Sciences in September 2013 participated in the EBM course. A researcher-made questionnaire was sent to all participants one month after the course, and 80 questionnaires were returned, of which 62 were answered completely and were appropriate for use in the investigation. Because the EBM course had been intended for all junior residents, it was not possible to compare responses with test and control groups.

The EBM course was held for five working days (30 hours) per week for four weeks, and residents were expected to participate five days per week. Participants were excluded from the research sample if they were absent more than one day per week.

The course content included 15 major EBM subjects. Content selection was based on the guidelines of Greenhalgh and Donald (2), and were also confirmed by a team of clinical specialists at Shiraz University of Medical Sciences.

The intervention method included mini-lectures, group discussions, and self-directed learning. For each subject, a short 10 to 15-minute lecture was presented by the instructors, followed by practical activities. Based on the nature of EBM, after the lectures, the residents were divided into small 2-3-member groups and followed these stages in a stepwise manner:

1- Ask a structured clinical question;

2- Write a clinical scenario;

3- Search the resources in university databases;

4- Evaluate the collected articles and select the best one, mentioning the reasons for the selection;

5- Provide the final clinical decision and criticize it (one of the group members reports the result).

The teamwork was supervised by five EBM instructors. Because of the need for practical activities, a wireless Internet connection was available in the workshops, and participants were asked to bring their personal laptops. The list and description of team activities including required practices were organized into workbooks and provided to the participants.

2.1. Instrument for Evaluating Satisfaction

The residents' satisfaction with the EBM course was assessed using a researcher-made questionnaire adapted from the DREEM questionnaire (15). The content validity of the questionnaire was confirmed by five educational experts in medical education and clinical practices, and the reliability was calculated through Chronbach's alpha (0.92). This questionnaire comprised five domains including 30 items which assessed residents' knowledge, interpersonal skills, satisfaction with the teaching method, general feelings regarding the course, and the workshop facilities on a 4-point Likert scale ranging from high = 4 to low=1. The score of 2.5 was considered as the cutoff point.

2.2. Instrument for Self-Evaluation of the Knowledge

The residents' views regarding the influence of the EBM course on their knowledge was assessed using the quasi-experimental single group design comprised of 15 EBM subjects based on a 0 - 10 rating scale. The content of the questionnaire was adopted from Greenhalgh and Donald's workbook on evidence-based health care (2). The content validity of the questionnaire was confirmed by five medical education experts (2). To calculate the reliability of the questionnaire, Cronbach's alpha was used (r = 0.93). One month after the course, participants were asked to

score their pre-course and post-course knowledge based on all 15 EBM subjects. Although the evaluation of the residents' knowledge based on self-assessment might be subjective and inaccurate, the individuals' views were checked against the different pre-course and post-course scores. Considering that the questionnaires were presented to participants one month after the course, the post-course scores indicated to some extent how much the learning had settled in their minds. The scores may have been lower than if the residents had answered the questionnaires immediately after the course.

2.3. Instrument for Evaluating the Practical Capabilities

The practical capabilities of residents were assessed with a test designed by five medical education experts from Shiraz University of Medical Sciences based on the PICO format (P = population, I = intervention, C = comparison, and O = outcome) (16).This included writing a clinical scenario, searching articles from valid databases, critically assessing articles, and considering appropriate indices in the article critique. The skills were evaluated by verifying a real patient case in each resident's specialty field and recording the skill scores on blank forms in a workbook. Teachers rated the practical activities based on a 1-10 rating scale. Each skill was scored between 0 and 2, with the total score of practical capabilities being 10. Residents were expected to gain 5 out of 10 as the minimum score. The practical test questionnaire was sent for participants one month after they had finished the course. The profile of the research design is summarized in Figure 1.

Non-confidential information was asked from participants in the questionnaires. All participants in the study were informed of the research objectives and gave informed consent to participation. The questionnaires were kept completely anonymous. Results of the research were sent to the Shiraz University of Medical Sciences vice chancellor for education.

3. Results

Of the 62 participants in the study, 19 (31.7%) were male and 41 (68.3%) were female, and all were within the age range of 25 to 40 years; the mean age was 31.1 $\pm$ 4.1. The findings of this study were categorized into three main sections: residents' satisfaction with the EBM course; residents' knowledge and practical abilities; and the relationships between their knowledge and their practical capabilities scores.

3.1. Residents' Satisfaction with the EBM Course

All 110 questionnaires were completed. The residents' level of satisfaction with different aspects of the EBM course showed a mean score higher than 2.5, indicating the minimum satisfaction. Among the five domains of satisfaction, interpersonal skills, teachers, and knowledge, knowledge had the highest scores in comparison with other domains. Among the 30 items of satisfaction in the EBM scale, the items with the highest mean scores were related to "giving feedback to residents by teachers" (3.56), "instructions will be useful in the future" (3.52), "residents encouraged to criticize" (3.45), "the course was based on a necessity" (3.40), and "team-working in learning" (3.43) (Table 1).

3.2. Residents' Knowledge and Practical Abilities

Of the 110 questionnaires sent out, 62 were returned completed. A total of 41 of the 62 respondents were female (68.3%) and 19 were male (31.7%). The findings show that participants' level of knowledge significantly increased after the course ($P<0.001$). The total mean score of residents' self-evaluation increased from 2.82 (out of 10) pre-course to 6.54 post-course (Table 2).

According to the scoring results of the EBM practical ability test, the "critical appraisal of article" skill and the "ability to identify the correct criteria for choosing a good article" received the lowest scores; the highest scores belonged to "ability to search for an article" and "writing a clinical scenario". The mean score of all residents was 5.9 out of 10, indicating a medium level of practical ability (Table 3).

3.3. Correlations Between Knowledge and Practical Capabilities

Pearson's correlation analysis showed a positive significant relationship between the knowledge score and the practical ability score of residents who participated in the EBM course ($r = 0.84$, $P < 0.01$).

4. Discussion

The 21st century is characterized as the information explosion century. On one hand, individuals break through new frontiers of knowledge every day; on the other hand, they are faced with a huge bulk of unrefined information. Hence, it is essential to distinguish net from gross value in the era of voluminous knowledge (2). This issue is of particular importance in the medical sciences where the ability to use up-to-date science is required to understand these complexities. Medical residents are working in an era when the volume of evidence can double within a few months. In order to make effective decisions, they need

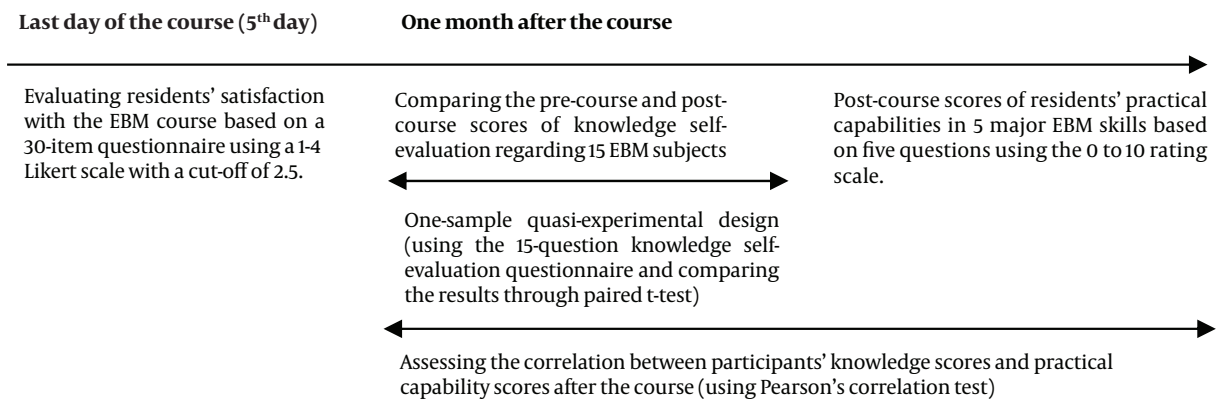

Figure 1. The Quasi-Experimental Single Group Design

to select valid medical evidence from thousands of articles which are published annually in hundreds of prestigious medical journals. Such an important task is not possible unless medical students and residents have sufficient knowledge and skill in recognizing and ranking the validated evidence. Hence, they increasingly need knowledge, analytical skills, and discernment in selecting the most correct and relevant medical knowledge from the bulk of information generated so as to comprehend and criticize the medical literature and make correct and well-informed clinical decisions (2).

A literature search revealed that the efficiency of conducting an EBM course for medical students has been discussed in several studies (3, 7, 17-28). According to the findings of the current study, the EBM course selected for study significantly increased the level of satisfaction, knowledge, and practical ability of the medical residents sampled. This finding is in agreement with those of previous studies. For example, in a study conducted by Srinivasan et al., an EBM course was applied to the curriculum of undergraduate medical students, and the results showed that both students and faculty members were satisfied with it. From their point of view, EBM was relevant and applicable to their academic majors (20). However, the results of Holloway et al. showed a low level of satisfaction with the EBM course, which is not consistent with the results of the current study (21). The disparity may be explained by the fact that their statistical sample was composed of undergraduate medical students, suggesting that none of the five domains of the EBM course were applicable or useful in the undergraduates' medical learning at that stage. Considering that three domains of EBM - "asking a correct clinical question", "critical assessment of articles", and "clinical decision-making" - require a relatively high level of medical knowledge and experience, the undergraduate medical students might not have had the pre-requisites for entering the EBM course; and this could explain their low satisfaction with the course.

The findings showed that EBM enhances the knowledge and practical capabilities of medical residents. This finding is in agreement with those of previous studies which indicated that EBM courses significantly enhanced the knowledge, practical skills, and abilities of students in terms of investigation, library skills, self-reported ability, and also the ability to criticize scientific articles (18, 21, 28). Karimian et al. found in their study that training through an EBM course had a positive impact on the practices of residents in clinical decision-making (29).

According to a Delphi study conducted by Salehi et al. in 2014 regarding the medical educational forum in Iran, the EBM approach was considered by the majority of faculty members to be one of the first priorities for enhancing the quality of the medical education system (30). Another study by Bigdeli et al. investigated the methods required for applying an EBM course in Iranian traditional medicine using semi-structured interviews with medical experts in Iran. The results of their study suggest that the EBM approach can be developed and extended by reinforcing students' and residents' critical thinking using continuous programs such as the inclusion of EBM in student homework, question-answering sessions, the simulation of clinical cases, concept mapping, and the critique of coworkers (31). Hence, according to the findings of the current study and of other studies conducted in Iran, EBM is an effective education method in Iran. This indicates that EBM courses need to be prioritized in tertiary medical curricula.

Although this study showed that through the application of EBM in their training, medical residents have

Table 1. Mean of Residents' Scores for Satisfaction with Different Aspects of the EBM Course (Sample Size = 62) (Range: 1 - 4, cut-off point: 2.5)

	Question	Mean Score
Knowledge aspects of the course		3.09 ± 0.31
1	The EBM course encouraged me to participate more.	2.98 ± 0.42
2	What I have learnt will be useful in the future.	3.52 ± 0.33
3	The course enhanced my motivation for educational activities.	2.68 ± 0.13
4	I think that the course lessons will increase my progress.	2.81 ± 0.60
5	The course included active instruction and learning based on participants' needs.	3.40 ± 0.51
6	I feel that the course objectives were appropriate to my needs.	3.32 ± 0.22
7	The EBM course helped me develop my self-confidence.	2.98 ± 0.27
8	I think I have gained what I expected from this course.	2.79 ± 0.23
9	My problem-solving and critical evaluation skills were increased in this course.	2.80 ± 0.41
10	The learning objectives of the course are clear to me.	2.89 ± 0.62
11	This instruction encourages me to be a critical learner.	3.45 ± 0.33
Interpersonal skills		3.38 ± 0.37
12	My relationships with other participants have grown in this course.	2.78 ± 0.34
13	I was not stressed during the course.	3.01 ± 0.45
14	I found good friends during the course.	3.43 ± 0.32
15	The EBM course helped increase my self-confidence in the clinical environment.	3.01 ± 0.61
16	I gained good opportunities to develop my interpersonal skills.	3.21 ± 0.31
17	Participation in the team work was enjoyable for me.	3.43 ± 0.25
18	I think the course will be useful in the education of my students.	2.93 ± 0.25
Teachers		3.26 ± 0.22
19	The course sessions were managed correctly and decisively.	3.35 ± 0.47
20	The course instructors provided conditions for helpful criticism.	3.09 ± 0.23
21	Clear examples and explanations were presented on teaching lessons to learners.	2.83 ± 0.34
22	The course teachers had sufficient knowledge and information.	3.33 ± 0.41
23	The course executives gave feedback to participants.	3.56 ± 0.21
Feeling		3.00 ± 0.34
24	I was rarely tired during the course.	3.11 ± 0.36
25	The educational space was calm, desirable, and devoid of stress.	2.99 ± 0.39
26	I had a good feeling participating in this course.	2.80 ± 0.31
27	I had no problem in asking questions and in having ambiguities clarified.	2.87 ± 0.38
Facilities		2.81 ± 0.41
28	Education scheduling (lectures, teamwork, and time-outs) was appropriate.	2.67 ± 0.45
29	Education space (ventilation, brightness, and voice loudness) was appropriate.	2.87 ± 0.38
30	The course was held at an appropriate time.	2.89 ± 0.53

gained higher scores in questioning, resource searching, and scenario writing, there are still some deficiencies identified in their performance, particularly in the use of best article selection criteria and the ability to critically assess articles. It seems that more emphasis is needed on developing the practical skills of residents in the EBM course. Furthermore, residents in clinical wards are required to make clinical decisions based on evidence-based medicine. Im-

Table 2. Comparison of Pre-Course and Post-Course Residents' Knowledge of EBM Using Paired T-Test (Sample Size = 62, Range: 1 - 10, Cut-Off Point: 5)

Knowledge aspects of the program		Mean	SD	df	T	P Value
Theoretical concepts, explanation of importance and necessity	Pre	3.67	2.15	60	14.54	< 0.001
	Post	7.57	1.63			
PICO subject	Pre	2.46	1.79	58	17.35	< 0.001
	Post	6.81	1.76			
Information proficiency, knowledge management and 5S	Pre	2.31	1.75	54	16.32	< 0.001
	Post	5.87	1.91			
Acquaintance with EBM databases	Pre	3.15	1.99	59	16.56	< 0.001
	Post	7.45	1.81			
Rules and methods of scientific querying in resources and databases	Pre	3.31	2.07	61	14.76	< 0.001
	Post	7.26	1.97			
Critical assessment of articles	Pre	2.78	1.96	59	12.27	< 0.001
	Post	6.42	2.33			
Use of articles relevant to screening and diagnosis tests	Pre	2.60	1.88	57	12.58	< 0.001
	Post	6.26	2.35			
Use of articles relevant to random controlled trials (RCT)	Pre	2.78	1.84	57	13.53	< 0.001
	Post	6.57	2.13			
Use of articles relevant to drug trials	Pre	2.75	1.97	60	11.85	< 0.001
	Post	6.16	2.38			
Calculating the number of people needing treatment	Pre	2.59	2.03	60	13.17	< 0.001
	Post	5.59	2.39			
Use of systematic and meta-analytic review articles	Pre	2.79	1.97	60	14.40	< 0.001
	Post	6.65	2.48			
Use of case study articles – chance of survival	Pre	2.66	1.90	60	15.13	< 0.001
	Post	6.33	2.24			
Use of qualitative-descriptive articles	Pre	2.98	2.06	60	13.85	< 0.001
	Post	6.21	2.25			
Analysis of articles relevant to rare phenomena – Case control	Pre	2.73	1.94	59	14.61	< 0.001
	Post	6.25	2.03			
Acquaintance with guidelines and how to prepare them	Pre	2.57	1.90	60	14.33	< 0.001
	Post	6.38	2.04			
Total mean score	Pre	2.82	1.65	61	18.79	< 0.001
	Post	6.54	1.69			

Abbreviations: SD, Standardized Deviation; df, Degree of Freedom.

proving the required facilities and providing additional resources such as increased funding for libraries and up-to-date references could be beneficial for enhancing EBM (32).

Although this study was conducted among medical residents in one of Iran's major universities, the sample may not have been representative of other universities in Iran and should be extrapolated with caution. In addition, the residents who participated in this study faced heavy workloads and had limited time to take part in this research, especially those in surgery and anesthesia departments. Thus, the results of this study should be generalized with caution. Furthermore, as the effect of the edu-

Table 3. Mean Scores of Practical Abilities test of Residents After the Course (Sample Size = 62)

Scores of Practical Abilities Test in EBM Skills		Mean (out of 2)	SD
1	Ability to write a clinical scenario	1.35	0.32
2	Ability to ask a structured clinical question	1.33	0.33
3	Ability to search the resources in appropriate databases	1.4	0.28
4	Ability for critical assessment and selecting the best article	0.97	0.26
5	Ability to realize the correct criteria of choosing a good article	0.91	0.27
Sum (out of 10)		5.90	1.01

Abbreviation: SD, Standardized Deviation.

cational intervention was evaluated by use of a questionnaire, the results may be less valid in comparison with more objective methods such as observation.

Acknowledgments

The authors are grateful to the residents at Shiraz University of Medical Sciences who filled out the questionnaires. The contributions of those in clinical departments who helped with collecting the questionnaires are also greatly appreciated. This article is based on a medical education MSc thesis sponsored and granted by Shiraz University of Medical Sciences with the project number 92-6703.

Footnotes

Authors' Contribution: Study concept and design, Zahra Karimian and Javad Kojouri; analysis and interpretation of data, Zahra Karimian; drafting of the manuscript, Zahra Karimian, Behdad Amiri, and Asiyeh Salehi; critical revision of the manuscript, Zahra Karimian and Javad Kojouri; statistical analysis and data abstracting, Zahra Karimian and Behdad Amiri.

Conflict of Interests: None declared.

References

1. Glasziou P, Del Mar C, Salisbury J. Evidence based medicine workbook. London: BMJ Publishing Group; 2010.
2. Greenhalgh T, Donald A. Evidence based health care workbook. ; 2000.
3. Finkel ML, Brown HA, Gerber LM, Supino PG. Teaching evidence-based medicine to medical students. *Med Teach.* 2003;**25**(2):202–4. doi: 10.1080/0142159031000092634. [PubMed: 12745533].
4. Montori VM, Guyatt GH. Progress in evidence-based medicine. *JAMA.* 2008;**300**(15):1814–6. doi: 10.1001/jama.300.15.1814. [PubMed: 18854545].
5. MHME . Comprehensive health map. *Ministiry of Health and Medical Education, Islamic Republic of Iran.* 2009.
6. Sackett DL, Straus SE, Richardson W. S. , Rosenberg W, Haynes RB. How to practice and teach EBM. Edinburgh: Churchill Livingstone; 2000.
7. Rider EA, Federman DD, Hafler JP. Residents as teachers–a faculty development approach to programme development. *Med Educ.* 2000;**34**(11):955–6. doi: 10.1046/j.1365-2923.2000.0784k.x. [PubMed: 11107032].
8. Wilson FC. Teaching by residents. *Clin Orthop Relat Res.* 2007;**454**:247–50. doi: 10.1097/BLO.0b013e31802b4944. [PubMed: 17091017].
9. Armstrong E, Ashford I, Freeman J, Koller C, Pistoria M, Stello B, et al. Developing the teaching skills of residents through interactive resident-as-teacher workshops. Washington, DC: AAMC IME; 2001.
10. Mann KV, Sutton E, Frank B. Twelve tips for preparing residents as teachers. *Med Teach.* 2007;**29**(4):301–6. doi: 10.1080/01421590701477431. [PubMed: 17786741].
11. Morrison EH, Hollingshead J, Hubbell FA, Hitchcock MA, Rucker L, Prislin MD. Reach out and teach someone: generalist residents' needs for teaching skills development. *Fam Med.* 2002;**34**(6):445–50. [PubMed: 12164622].
12. Whittaker LJ, Estes NC, Ash J, Meyer LE. The value of resident teaching to improve student perceptions of surgery clerkships and surgical career choices. *Am J Surg.* 2006;**191**(3):320–4. doi: 10.1016/j.amjsurg.2005.10.029. [PubMed: 16490539].
13. Sanchez-Mendiola M, Graue-Wiechers EL, Ruiz-Perez LC, Garcia-Duran R, Durante-Montiel I. The resident-as-teacher educational challenge: a needs assessment survey at the National Autonomous University of Mexico Faculty of Medicine. *BMC Med Educ.* 2010;**10**:17. doi: 10.1186/1472-6920-10-17. [PubMed: 20156365].
14. Busari JO, Scherpbier AJ, van der Vleuten CP, Essed GG. The perceptions of attending doctors of the role of residents as teachers of undergraduate clinical students. *Med Educ.* 2003;**37**(3):241–7. doi: 10.1046/j.1365-2923.2003.01436.x. [PubMed: 12603763].
15. Cocksedge ST, Taylor DC. The National Student Survey: is it just a bad DREEM?. *Med Teach.* 2013;**35**(12):e1638–43. doi: 10.3109/0142159X.2013.835388. [PubMed: 24050781].
16. Fineout-Overholt E, Melnyk BM, Schultz A. Transforming health care from the inside out: advancing evidence-based practice in the 21st century. *J Prof Nurs.* 2005;**21**(6):335–44. doi: 10.1016/j.profnurs.2005.10.005. [PubMed: 16311228].
17. Dickersin K, Straus SE, Bero LA. Evidence based medicine: increasing, not dictating, choice. *BMJ.* 2007;**334 Suppl 1**:s10. doi: 10.1136/bmj.39062.639444.94. [PubMed: 17204750].
18. Dorsch JL, Aiyer MK, Meyer LE. Impact of an evidence-based medicine curriculum on medical students' attitudes and skills. *J Med Libr Assoc.* 2004;**92**(4):397–406. [PubMed: 15494754].
19. West CP, Jaeger TM, McDonald FS. Extended evaluation of a longitudinal medical school evidence-based medicine curriculum. *J Gen Intern Med.* 2011;**26**(6):611–5. doi: 10.1007/s11606-011-1642-8. [PubMed: 21286836].
20. Srinivasan M, Weiner M, Breitfeld PP, Brahmi F, Dickerson KL, Weiner G. Early introduction of an evidence-based medicine course to preclinical medical students. *J Gen Intern Med.* 2002;**17**(1):58–65. doi: 10.1046/j.1525-1497.2002.10121.x. [PubMed: 11903776].
21. Holloway R, Nesbit K, Bordley D, Noyes K. Teaching and evaluating first and second year medical students' practice of evidence-based medicine. *Med Educ.* 2004;**38**(8):868–78. doi: 10.1111/j.1365-2929.2004.01817.x. [PubMed: 15271048].
22. Nieman LZ, Cheng L, Foxhall LE. Teaching first-year medical students to apply evidence-based practices to patient care. *Fam Med.* 2009;**41**(5):332–6. [PubMed: 19418281].

23. Wanvarie S, Sathapatayavongs B, Sirinavin S, Ingsathit A, Ungkanont A, Sirinan C. Evidence-based medicine in clinical curriculum. *Ann Acad Med Singapore.* 2006;**35**(9):615–8. [PubMed: 17051277].
24. Schilling K, Wiecha J, Polineni D, Khalil S. An interactive web-based curriculum on evidence-based medicine: design and effectiveness. *Fam Med.* 2006;**38**(2):126–32. [PubMed: 16450235].
25. Rhodes M, Ashcroft R, Atun RA, Freeman GK, Jamrozik K. Teaching evidence-based medicine to undergraduate medical students: a course integrating ethics, audit, management and clinical epidemiology. *Med Teach.* 2006;**28**(4):313–7. doi: 10.1080/01421590600624604. [PubMed: 16807168].
26. Kljakovic M. Practising GPs teaching medical students evidence based medicine–a questionnaire survey. *Aust Fam Physician.* 2006;**35**(12):999–1002. [PubMed: 17149476].
27. Ismach RB. Teaching evidence-based medicine to medical students. *Acad Emergen Med.* 2004;**11**(12):1283–6.
28. Aronoff SC, Evans B, Fleece D, Lyons P, Kaplan L, Rojas R. Integrating evidence based medicine into undergraduate medical education: combining online instruction with clinical clerkships. *Teach Learn Med.* 2010;**22**(3):219–23. doi: 10.1080/10401334.2010.488460. [PubMed: 20563945].
29. Karimian Z, Kojuri J, Sagheb MM, Mahboudi A, Saber M, Amini M, et al. Comparison of residents' approaches to clinical decisions before and after the implementation of Evidence Based Medicine course. *J Adv Med Educ Prof.* 2014;**2**(4):170–5. [PubMed: 25512942].
30. Salehi A, Harris N, Lotfi F, Hashemi N, Kojouri J, Amini M. Reform in medical and health sciences educational system: a Delphi study of faculty members' views at Shiraz University of Medical Sciences. *East Mediterr Health J.* 2014;**20**(3):151–61. [PubMed: 24950072].
31. Bigdeli S, Kordafshari G, Soltani Arabshahi K, Shams Ardakani MR, Mohammadi Kenari H. Evidence-based Iranian traditional medicine schemes and threats [In Presian]. *Educ Strat Med Sci.* 2013;**6**(1):17–23.
32. Karimian Z, Kojouri J, Sagheb MM. The review of barriers to implementation and institutionalization of evidence based medicine in clinical wards from residents and clinical attending attending physicians viewpoints [In Persian]. *J Med Educ Dev.* 2016;**8**(20):87–98.