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Evidence based medicine summer school for undergraduate medical students using innovative methods

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Background: **There is a clear need to train next generation clinicians in order to keep up-to date and ensure the best practice for patients. The aim of this study was to report the procedure of summer school held in Tabriz University of Medical Science, 2013. Students learnt about Evidenced Based Medicine (EBM) efficiently. Incorporating, interactive and innovative teaching methods were highlighted in this study.** ***Method:*** **A one week Summer school was held involving 60 medical students in Tabriz University of medical sciences in August 2013. They had learned about EBM and how to apply it using modern interactive ways, including Team-Based Learning (TBL), seminar-style presentation, introducing EBM journal club by using acting, moreover Interactive approaches, encouraging the sense of creativity and inspiration. Effectiveness of workshops was assessed utilizing pre- and post-course questionnaire and reflective journals.** ***Results:*** **29students completed the pre-and post-course questionnaire.82.8% (24 trainees) gain knowledge about the definition of EBM. 75.9% (22 trainees) partly trusted in the quality of articles which are published in well-known journals because they feel the need to critically appraise the evidences by themselves. Selecting the best evidences for answering clinical questions, students rely on RCTs 37.9% (11) and systematic reviews 27.6% (8).According to the outcomes of reflective journals, they referred to systematic reviews as the most difficult part and found appraising tools the most useful course.** ***Conclusion:*** **This EBM summer school deepened the medical students' impression of EBM and was efficient, according to the results of the post-course questionnaire. They found this summer school useful, fun and satisfying.**

INTRODUCTION

The practice of evidence-based medicine (EBM), integrates individual clinical expertise and patient values with the best available evidence from systematic research (1). Learning EBM for undergraduate students also is considered of great importance since it provides an integration of knowledge, cognitive skills, and behavior which promotes lifelong learning for future medical graduates(2). It's a must for a physician to keep abreast with expanding knowledge during his professional life (3, 4). So there is a clear need to train next generation clinicians in order to keep up-to date and ensure the best practice for patients. The movement of evidence-based practice, in order to provide a professional use of research, started in medicine in the early 1990s. Following its considerable effects on medical field, it spread across a number of other fields, including education(4). In recent years, raising attention to Evidence Based Medicine (EBM) has led to the fact that nowadays clinicians are consuming a substantial time attending Evidence Based Training programs (such as: workshops, journal clubs and conferences)by the means of becoming competent in the skills required (4, 5). Individual workshops covering different steps of EBM had been held world widely. In recent years the number of such workshops has increased in Iran; however, the main focus has been on the effect of educational interventions on graduates rather than under-graduate students, moreover the methods of teaching were rarely studied. We agree on the recognized need for EBM training, but always methods and the way it's done affects the final result. There are some studies assessing the effectiveness of such workshops on medical students, (6-8) what all these studies have in common is that there is an obvious effect on trainees (7) at least on increasing self-confidence (9) It can also lead to development of professional competencies (10). In some countries EBM is considered as an important component of an undergraduate medical education curriculum that promotes lifelong learning and critical thinking (11). In addition to the

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great importance of EBM learning, incorporating modern, interactive and innovative teaching methods is essential. However, there is debate about the effectiveness of various EBM teaching and learning activities, resulting in a lack of consensus on which methods constitute the best educational practice (12). One of the strategies to increase educational quality is alternation of teaching methods from a time consuming and tedious didactic approach to a practical and more interactive approach. This summer school was held in Tabriz University of Medical sciences, August 2013. Last summer was considered as a good opportunity for undergraduate students, a time that they had more free times to concentrate, to participate in a one-week summer school consisting of workshops covering the skill to be familiar with EBM. The teaching methods, which made this study outstanding, were mainly different from the similar workshops. Small group activities, also known as Team-based Learning (TBL) is an active learning method which can improve problem solving and communicating skill (13). Seminar-style presentation was a great fortune to practice presenting skill in front of the audience (14). Introducing evidence based medicine journal club by using drama and acting, Moreover Interactive approaches, encouraging the sense of creativity and inspiration used for teaching concepts of EBM in an efficient way. Incitation of students' creativity by doing craft works was another concept of this workshop. We all deserve the best educational methods so it's rational to appraise before propagating an idea, hence this evaluation of summer school's attendees with two sets of questionnaires was planned, attendee's abilities were assessed before and after the workshops so that their gained skills can be estimated and further decisions can be made on the future programs according to their needs.

RESULTS

Pre- and post-course questionnaire

60 students attended the summer school program by observing manual advertisements. Not all of the participants (60 trainees) were able to fill the questionnaire due to some exclusion criteria, about 12 students were exactly educated in the EBM field prior to workshops since they were responsible for being co-facilitators during the whole procedure and about 13 students were post graduate, 6 were residents of community medicine as facilitators. So they were excluded from pre-post questionnaire study to decrease related biases. Therefore other participants (29 trainees) completed the pre-and post-course questionnaire with the mean age of 23.72 (SD=6.146). 75.9% were female (22trainees), so 24.1% were male.

Students` answers to the first question which is probing their knowledge about EBM and their attitude toward EBM before and after the summer school indicated that this procedure had corrected their previous false or incomplete impression they had about EBM. Due to the first question, 82.8% (24 trainees) gain knowledge about definition of EBM during this summer school. The second question, which asks about PICO and "how to answer to it" indirectly, showed that after summer school 24.1% (7 trainees) use RCTs for answering their clinical questions and 31% (9 trainees) use systematic reviews for this aim. Also, 79.3% (23trainees) use PubMed as a reliable database and 10.3% (3trainees) use clinical guidelines. These are considerable because before this summer school 51.7% (15 trainees) of these students have used textbooks and 80% (12 trainees) of these numbers don't rely only on text books after summer school. The third question asks about selecting the best evidences for answering clinical questions in which students reported that totally they rely on RCTs (37.9% = 11 trainees) and systematic reviews (27.6% = 8 trainees) and 31% (= 9 trainees) of them use both of these references. Forth question assesses a student`s knowledge on different type of studies which are used in EBM. The information about these studies and students' knowledge on them are shown in table1. The final question of this questionnaire declares that how much students have confidence of quality of articles which are published in well-known journals. 17.2% (5 trainees) never rely on the name of the journals so they are almost always suspicious about quality of papers. 75.9% (22 trainees) partly rely on them because they will critically appraise the evidences by themselves, so they won't always rely on published papers in well-known journals and 6.9% (2 trainees) basically rely on them.

Reflective journals (portfolios)

Daily reflective journals were a means of assessing the participants` gained knowledge and their opinions and emotions about the whole course. Most of the participants liked the idea of group activities and small group projects with the help of facilitators. They also were surprised with their own classmates as co-facilitators. They mentioned that the most important feature of the summer school was creative group activities and interactive training. They were interested in the idea of big canvas because they printed their feelings about what they have learnt on the white canvas. One of the most exciting moments was journal club which was performed by co-facilitators. As they expressed journal club made them aware of the real aim of an EBM journal club and showed them the conditions and problems of a usual one. Attendees also liked the course of critically appraising the articles so that they can use RAMBOO tool and appraise their articles in a short time and they claimed that this can be the most useful course for their future carrier. They also talked about the difficult parts of the course, they referred to systematic reviews as the most difficult part and they claimed that they need extra class on this subject. Following there are some sentences extracted from reflective journals: "learning steps of EBM is very useful because it can affect many aspects of my future career" or "I didn't think that 4 alphabets beside each other (PICO) could be this much useful in identifying articles". One of the students was surprised by seeing his own picture on the board which was captured in the first day and other students were responsible for making related PICOs for the photo, this is the creativity in teaching the PICO. Coffee trial was one of the most interesting events for students because they were witnessing a real trial and even involving in it, they claimed that they could detect the biases by themselves. For undergraduate students even working with facilitators can be surprising because they don't have such an experience. Reflective journals' results are shown in table 2.

The "big canvas project"

The final portrait made by the participants according to their reflection about EBM and the workshops is shown here (figure1).

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Table 1 Perceived knowledge on type of studies

Type of study	Pre-course	Post-course	p-value
Cohort	48.2%(14 trainees)	58.6% (17 trainees)	0.000
RCT	48.2%(14 trainees)	58.6% (17 trainees)	0.00
Clinical trial	34.4% (10 trainees)	48.2% (14 trainees)	0.000
Systematic review	34.4% (10 trainees)	62.1% (18 trainees)	0.000
Meta-analysis	34.4% (10 trainees)	53.6% (15 trainees)	0.000
Guidelines	44.8% (13 trainees)	71.4% (20 trainees)	0.000

Table 2 Reflective Journals' results

Main question	General answer	An example of specific answer
What were important parts of EBM summer school?	Learning level of evidence	"I didn't think 4 alphabets besides each other could be useful in identifying articles"
	Critically appraise the evidence	
	Learning about biases	
	Learning how to make a clinical question (PICO)	
What you learnt about EBM?	Gaining best results in minimum time	" I learnt that EBM can help me in my future carrier to make the best decisions in the short time"
	Critically thinking	
	shared decision making	
What surprised you?	Small group activities	" I was surprised that we could learn in small groups better than individually"
	Learning RCT by doing coffee trial	
	Painting on a big canvas	
	EBM journal club theatre	
What disturbed you?	Short time of summer school	" we didn't have enough time for learning difficult parts better"
	Many formulas of diagnostic tests	
What was difficult for you?	Learning about systematic reviews and RevMan	"systematic reviews really confused me, I hope I can learn them later"
	Using guidelines	
	Learning about biases	

Figure 1 Big canvas

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DISCUSSION

Keeping up with the pace of exponential growth of research and knowledge has led to the emergence of evidence-based medicine (EBM) as the new paradigm and nowadays increasing interest in EBM shifted the agenda from whether to teach EBM to how to teach it (16, 17). Failure to engage in EBM may cause significant repercussions and harm for the health of individuals and ignorance of available research evidence may cause missing important opportunities to benefit patients and avoid probable harms. It is therefore essential that medical students receive foundational training about EBM in early stages of their training (18, 19).

The most important and at the same time most neglected point is the methods to train EBM for the students, especially for the preclinical students which have less perception about clinical problems and bedside studies. There is a lack of studies describing step by step EBM teaching using innovative methods which integrate fun into training in order to get better outcomes. This study revealed that Innovative and recent methods involving sense of interaction and excitation and fun can have a significant effect on EBM learning even in preclinical students.

Results obtained from the questionnaires indicated poor knowledge of students about basic concepts of EBM before the workshop. A similar workshop was conducted in Iran, Isfahan Medical School, it revealed that the workshop has improved students' attitude toward applying and learning EBM and the ability to formulate answerable clinical questions and identify the best evidence through appropriate literature searches. Also a before-after study in Iran showed that a short course in EBM will significantly improve the skills and knowledge of undergraduate medical students(20) .

A recent systematic review characterized evidence based medicine (EBM) educational interventions for medical students. Results obtained from this systematic review indicated that the EBM training was delivered in a classroom (75%), clinic (25%), and/or online (20%) environments and the major focus was on the clinical students (60%) (18).

A RCT claimed that students training EBM produced higher scores in attitudes, knowledge and self-reported critical appraisal skills compared with a randomized control group (21).

There had been some studies evaluating the effects searching skills training on undergraduate medical students. A study provided evidence that a single, brief training session can have a marked beneficial effect on the quality of subsequent, short-term EBM literature searching performance outcomes (6), while an RCT claimed that a single EBM workshop did not result in statistically significant changes in literature searching skills (9).

Pre- and post-course questionnaire

In this study, we asked students to note which topics they would prefer to be covered in this workshop. This was to obtain students' field of interest and lack of knowledge in EBM. Results showed that most of students were satisfied by the topics provided and they claimed that these topics have widely observed their areas with lack of knowledge. We had an aim of familiarizing undergraduate students with EBM so that they can use it in their future clinical decision makings (22, 23). So before starting this summer school, we asked them about EBM in pre-test. After the course we followed them by filling the post-test questionnaire, it was necessary to evaluate their progress during the course. Evaluating students` gained knowledge indicated that this summer school had helped them deepen their impression on EBM and what EBM is, because majority of them (82.8%) have find out about EBM after the course. Our second question which asked them about ways of answering PICO has improved because they had learned about evidence searching methods during the course. Gruppen et al have revealed that brief training sessions on EBM searching skills have a marked beneficial effect on the quality of EBM literature searches and performance outcomes (6). There was a higher report of use of RCTs and systematic reviews after the course , it is obvious that students use frequently textbooks, original articles, journals ,Internet resources, teachers and residents as sources of information in health care (24). These are resources which are used in daily practice of medicine. Third question talks about selecting the best evidences for clinical questions in which students reported that after learning about EBM they mostly use high level of evidences such as RCTs and systematic reviews specially Cochrane reviews and major of them use both of these studies to achieve to the best evidences for their clinical questions. Next question wanted students to define different types of studies in EBM and it indicated that after the course they learned about them especially about systematic reviews due to results. Last question was probing their opinion on whether relying on journals or not, indirectly shows their intention to use critically appraise the evidences but this cannot be referred as a significant source to judge about their ability to critically appraise the evidence. Other studies haven't found a significant improvement in critical appraisal skills, probably due to several factors inherent to the complexity of educational research interventions in healthcare settings (25). Some studies, including randomized controlled trials of EBM teaching, didn't find a change in attitudes, probably due to the shorter duration of the workshops and related activities (26). But in some other studies they witnessed increase of knowledge score from 36 to 58% (27). These differences are probably due to the different natures of educational interventions and durations of courses and also participants (21). Since our course was short, we didn't expect many differences between pre- and post-test results. A limitation of our summer school was its short period that could cause not very significant results but they were acceptable though. Also we couldn't measure long term effects of the course on students due to their different majors and long distances. Another limitation was lack of control group in our study because all the participants had the right to be educated on EBM, we used pre- and post-tests for comparing the results.

New methods of learning EBM

In recent decades Medical education has begun taking a big step from didactic approaches to a problem-based and more self-directed approach (28, 29). Thus, education based on creative thinking will play a great role in modern education (29). In this section creative approaches made by authors to increase education level of the students will be discussed.

Art and Craft works: Use of humanities(art, drama, poetry and so on) in medical education has become really popular (30). In the EBM summer school group work time was not only a time to talk and discuss, it was rather a time for consolidation of

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learned knowledge and skills with the help of art and craft works. Building a level of evidence pyramid, drawing “steps of EBM” scheme are examples of current approaches (Noting that this didn’t interfere with the traditional PBL small group curricula).

The big canvas project was another project; that was completed not only by individual groups, but also by all the participants. So everyone was free to express their inspiration and feelings about the workshop without limitations. We didn’t expect the participants to involve in this part willingly. They have painted many creative and artistic figures (Figure 1).

The coffee trial: using a practical and an Interventional example for teaching RCT studies was another example of the new approach. Two groups of students were selected randomly. An intervention occurred where, a group got coffee with caffeine and the other got coffee without caffeine. Increase in PR (pulse rate) was estimated in both groups. Afterwards the audience guessed which group got which type of coffee.

Seminar-style presentation: Seminars are a way of motivating and involving participants through discussion and interaction with facilitators. Oral presentation of information and facilitation of discussion by students through seminar presentation are now one of the most discussed matters in medicine (31). Seminar-style presentation at end of our summer school, improves students` presenting skills in front of a large number of audience by giving them more self-confidence. This can help them in their future carrier life.

Designing PICO for artistic pictures: use of artistic paintings as tools to increase awareness among medical students has become really common (32). For example students were given some newspaper pictures for making PICOs. In the first day of workshops some photos were captured students during their group activities and the next day students were ought to make some PICOs for so-called photos.VTS(visual thinking strategies) was the concept used in this survey (32). VTS was first introduced by Abigail Housen, a cognitive Psychologist, and Philip Yenawine, an art educator. In this strategy the teacher shows a finely selected artistic piece and the students give their opinions. Several benefits are resultants of this method. As Reilly and colleagues have mentioned: all students can freely give their opinions about the piece; they learn to value each other’s comments as a means of their different viewpoint of the piece; each comment is acknowledged and finally the facilitator, although maintaining neutral, shows interest in each comment (32). The reason of value of our study is the fact that Reilly and colleagues’ study was on residents of medicine (32); but in current study we took a new approach and VTS was used in first/second year medical students. The final outcomes were quite impressive.

Theatre’s fourth wall project: communication training is known to be a central part of medical education (33). There has also been a rapid growth in awareness of the value of using drama and acting in health education (33). The forth wall project was one of the newest in its types. In our study fourth wall method was used in the act of an evidence-based journal club, which its purpose is helping medical staff in critical appraisal of medical articles (34, 35) and keep them up to date and help to improve clinical decision making (36). The fourth wall is a metaphor designating "the space separating the audience from the action of a theatrical performance, traditionally conceived of as an imaginary wall completing the enclosure of the stage" (33). In this type of theatrical act it seems there is a wall between the actors and the audience so they couldn’t relate themselves with the actors. The audiences feel they’re watching a real world scene rather than seeing an artistic performance so what the audience saw was pretty much a real scene of a journal club. After the act the audience guessed every actor was symbol of which characters in a journal club. To our knowledge although there were studies about use of drama to present the scene of a clinic and doctor-patient relations (33); no study has evaluated use of drama in EBM journal club. Actors of this performance were the co-facilitators instead of professional actors. The audiences were quite surprised to see their classmates acting. Above all; to them, definition of the EBM journal seemed like a piece of cake!

One of the schemes of the current study was the small group activities based on fundamentals of PBL (Problem based learning). PBL is used in many medical schools worldwide. It is a more practical and interactive learning method. Unlike its deceptive name PBL is not about solving a problem; it is actually a process of using a problem to increase knowledge and learning. It also influences other attributes such as teamwork communicational behavior and so on (37, 38). Hosny and et al concluded that integrating EBM into PBL can be more interesting and stimulating than traditional PBL (39). The biggest highlight of PBL is the role of facilitators(tutors).The Tutor is the person who facilitates group work process, gives a boost to students’ self-esteem and helps the chair to put the program on track (37, 40, 41). The tutor’s responsibility is not to teach, the tutor is rather a person who encourages active listening, tolerates silence, makes appropriate interruptions and sparely uses personal content expertise (40, 42). In our study tutors were selected from content experts so they can use their expertise to fully manage the group. With all the benefits, use of expert tutors might produce a role modeling behavior amongst students (40). and prevent them from being self-directed learners (28); to prevent these problems, student co-facilitators were selected from students for this position. Eagle et al recommended that non- expert tutors prepare by clarifying course goals and case objectives, studying the clinical problem, and talking to those with relevant experience (43). So it can be more useful for students to have both expert and non-expert facilitators. The main drawbacks of the lecture method are the passive nature of the audience and the limited opportunity for feedback but TBL (team based learning) is the new strategy used mainly in preclinical periods of medical education (13). TBL, as an active learning method, can be a highly effective tool for developing both students' mastery of basic conceptual material and their higher-level thinking and problem-solving skills. Communication skills that are essential for physicians are developed by this method (13).

Knowing the fact that real world Problems are quite ill-structured (28), questions discussed in small groups were rather Socratic questions (44). The difference between a Socratic question and a per se question is that Socratic question is systematic, disciplined, deep and usually focuses on fundamental concepts (45) with all the controversies. It has been proven that PBL during medical school has a positive effect on development of students' critical thinking (46, 47) and Compared with other

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traditional curricula greater professional competency is seen in PBL curricula (44).

CONCLUSION

In summary, this one-week EBM summer school for undergraduate students deepened students` impression of EBM and corrected their attitude toward its applications and functions and would enable medical students to become efficient physicians who rely on evidences in future career in healthcare system. Also, learning EBM with innovative, creative and interactive methods leads to better levels of understanding. Participants' satisfaction is a crisis for assessing the whole procedure. These kinds of summer schools should be expanded to let medical students familiarize with EBM so that they can spend their free time usefully and enjoyable hoping to be a future EBM physician. There is no conflict of interest in this study.

METHOD

Settings and participants

Summer school started with 60 participants in Tabriz University of medical sciences in EDC (education development center) and taught them different aspects of EBM in one week from August 17 to August 22, 2013. Medical science students, which attended this summer school program, were studying different fields such as medicine, pharmacy, dentistry, health and nutrition sciences. Most of the participants were first or second year students and some of them were postgraduate students who felt the need to learn about EBM. This EBM course was given by EBM instructors and a group of residency students of community medicine as facilitators and a group of expert students from the student committee of EBM center as co-facilitators. Participants were divided into 6 groups, each consisting 10 so that they can do group activities in less time. Each group had one content expert as facilitator and two co-facilitators.

Educational topics

According to pre-test results and expert opinions following subjects were included in the program: Basics of EBM and epidemiology including different study types (cross sectional, cohort, randomized controlled trials, systematic reviews and meta-analysis) and their level of evidence, defining and using PICO in study conduction and search strategy, evidence based methods of article searching, critical appraisal tools for RCTs and diagnostic studies, introduction to Cochrane systematic reviews and its conduction strategy and working with review manager software(RevMan) and presenting basics of clinical guidelines and their adaptation.

Daily reflective journal

Students were asked to write down their scientific achievements on a daily reflective journal. The contents included their daily acquired knowledge and skills and its influence on their future work. They were also free to write down their suggestions, opinions and critics. Reflective journals helped us know the true impressions of each part of this summer school because it's the participants' own writings. This reflective journal consists of 6 parts as six days of whole summer school, each day in a different color. In these reflective journals, participants were asked about their opinions on what they think was new in each day of summer school and it also consisted of different parts such as what surprised them, what disturbed them, what is the use of their gained knowledge and what was difficult or important for them. These journals were filled in English.

The "big canvas project"

A big white canvas was placed on the wall of the workshop area. Students were free to express whatever they think\imagine about EBM and the workshops on the canvas. The final portrait made by the participants turned into the symbol of the ICEBM summer school.

The "best boot competition"

Students were asked to right down/express what they have learned with their own artistic inspiration on a poster in every group. There comes a perfect excuse for a competition! In the final day, a boot was a place for every group to present the posters, reflective journals and other creative works done by them. In a competition- with the teachers as judges -the best boot was selected and the students in the winning group were rewarded.

Group activities

We designed some small group activities for most of the taught subjects so that participants can practice their gained knowledge with their group members. In our summer school the biggest highlight of problem based learning (PBL) is the role of facilitators(tutors). The tutor's responsibility is not to teach, the tutor is rather a person who encourages active listening, makes appropriate interpretations and does not use his/her own knowledge much. In our study 6 tutors were selected from content experts so they can use their expertise to fully manage the group. Preventing problems such as making the participants self-directed, 12 student co-facilitators were selected from students' committee of EBM center in Tabriz University of medical sciences for this position. So the students won't be after imitating the facilitators; and the competition with their co-facilitator classmates stimulates their self-esteem. Although facilitators in this study were content experts, both facilitators and co-facilitators went under heavy and strict educational programs to be ready for their duty.Our facilitators helped students in group works which were in subjects of learning levels of evidences in EBM, designing clinical questions (PICO), critically appraising the evidences with RAMBOO tool and so on.

Seminar–style presentation

In the last day of summer school, each group should have presented a seminar describing their own works and achievements during week by one of the group members. They also gave useful feedbacks for organizers of summer school for better plans in future. The best presentation has been awarded.

Journal club

A journal club is a group of individuals who meet regularly to evaluate critically the clinical application of the latest medical literature. An evidence-based journal club was held, using the standard EBM methods substituting traditional ones. In our study fourth wall theatre method was used in the act of an, the audience

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was masked about each actor`s character and they should have guessed their characters at the end of role playing. For this purpose the co-facilitators ran an evidence based scenarios involving 11 characters which were selected based on a real journal club characters. In the this scenario, there were several characters, for example, there was an expert and experienced person who didn't believe in EBM and appraising the articles and intended to continue traditional and old methods and criticized even gathering for the aim of EBM journal club we can call this character as a "dinosaur"! Another character was a person who just represents a harm article (the selected article for journal club) without any sense of responsibility. Also, there was an epidemiologist who insisted on statistical validity of evidences and bothered physicians who were not familiar with complicated statistical formulas. Journal club`s facilitator which was a leading character emphasized EBM`s goals and application of appraising tools. This character wanted participants to find best evidences from the article or other references, and insisted on group work and saving the time using yes/no/unclear cards to express their opinion on each question of the rapid appraisal tool. There was also a coordinator who managed the session by involving participants and giving them responsibilities for who followed the content expert and didn't involve in group discussion. For example, giving them a specific duty such as searching for update cases, summarizing the whole session and etc. Coordinator had a leading role too because she could make the session useful by concentrating their attention and make them give some useful comments in order to resolve the main problem by using their own capacities. There were also some scenes presenting what can be seen in routine journal clubs; a sleepy surgeon who had a busy day, a physician who was in a hurry to visit his patients and the coordinator tried to manage them in the best way so that they felt responsibility toward the journal club.

Pre- and post-course questionnaire

A self-determined questionnaire has been designed for this study, which consists of pre- and post-tests. This questionnaire has been used for a similar study, so its reliability is proved (15). Before starting the course pre-test questionnaires were filled by participants and then during the one week course they learned more about EBM and after finishing the course they filled the post-test questionnaire with their gained knowledge. The questionnaire consists of 5 open questions. The first question is about what EBM is and students wrote down their ideas on EBM which is a basic subject. Second question asks about references which they use for answering their clinical questions so it refers to PICO indirectly. Third question probes students` ideas on which evidences are the best ones for answering clinical questions. Forth one wanted students to write down their own definitions on different kinds of studying such as RCT, cohort, guidelines. Last question asks students whether they rely on articles according to the published journal or not. This question indirectly refers to importance of critically appraise the evidence.

Data analysis

Data was analyzed using statistical software SPSS v16.0. The chi-square test and Fisher's exact test were used for comparing categorical variables and we also used McNemar Test. Summarizing questionnaire data was done using frequencies and descriptive summaries for categorical data, and means, ranges, standard deviations.

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