Evidence based medicine workshop

Randomized controlled trial of the efficacy on physician's knowledge and skills

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ABSTRACT

الأهداف: تقييم تأثير ورش عمل الطب المبني على البراهين على المعرفة و المهارات لأطباء الرعاية الصحية الأولية في استخدامه على المدى القريب و البعيد.

الطريقة: أجريت دراسة تجريبية باستخدام استبيان معد مسبقاً قبل ثم بعد ورشة عمل عن الطب المبني على البراهين، ثم قام الأطباء بالإجابة على نفس الاستبيان بعد 4 أشهر لتقييم مستوى الوعي بمكونات الطب المبني على البراهين، شاملة تكوين السؤال، والبحث في الأدبيات، والتقييم النقدي، ثم مدى قابليتها للتطبيق على المريض. تم اختيار عينة تمثل أطباء الرعاية الصحية الأولية بطريقة عشوائية ثم تم تعيينهم بطريقة عشوائية إما إلى المجموعة التجريبية أو الضابطة. المجموعة التجريبية قسمت إلى عدة مجموعات لحضور ورشة عمل عن الطب المبني على البراهين عقدت على عدة فترات متتابعة ابتداء من 26 أكتوبر إلى 8 نوفمبر لـ 59 طبيب. أما بالنسبة للمجموعة الضابطة فقد تم عقد مجموعة من نشاطات التعليم الطبي المستمر لهم تم خلالها جمع الاستبيانات منهم قبل المجموعة التجريبية ثم بعد 4 أشهر.

النتائج: حسنت ورش العمل أداء الأطباء في جميع مكونات الطب المبني على البراهين من 20.0%±38.9% قبل ورشة العمل إلى 10.6%±81.4% بعدها مباشرة وحافظت على هذا التحسن إلى حد ما بعد 4 أشهر ليصل المعدل إلى 10.0%±66.8% $p<0.001$.

خاتمة: حسن عمل ورش عمل عن الطب المبني على البراهين على قدرة الأطباء على تكوين السؤال، والبحث في الأدبيات، والتقييم النقدي، والتطبيق، والاتجاهات للطب المبني على البراهين.

Objectives: To assess the effect of evidence based medicine (EBM) workshop on knowledge and skills of physicians towards EBM use in the near future, as well as in the long run.

Methods: This is a randomized controlled trial conducted in the primary health care administration center in Dammam, Saudi Arabia between October and November 2008. Fifty-nine primary care physicians in the intervention group participated in the EBM workshops while 89 physicians from the control group attended other primary health care activities other than EBM workshop. The main outcome was to measure the change in the participants' level of awareness and competencies in EBM components (including formulation of questions, literature searching, critical thinking and appraisal) using a pre-designed questionnaire before, immediately after, and 4 months after the workshop.

Results: Evidence based medicine workshops improved physician's scores in all components of EBM, from 38.9%±20.0% at pre-test to 81.4%±10.6% post-test, and sustained this improvement to a lesser degree to 66.8%±10.0% 4 months post-intervention test ($p<0.001$ for the differences in all scores).

Conclusion: Participating in EBM workshop significantly enhanced physicians' ability to formulate questions, performed literature search, critical appraisal, and applied best-evidence in clinical practice, which retained up to 4 months post-test.

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Practicing and teaching evidence-based medicine (EBM) has become an important instrument in modeling and teaching the skills involved in formulating questions, searching, reading, interpreting, and using the medical literature to improve patient care. Several published studies[1-5] have evaluated the teaching of EBM, which offer disappointing conclusions on the effectiveness of such programs,[6] which attributed inadequate teaching and evaluation methods.[1] In Saudi Arabia as well as in other Arabian Gulf countries, EBM seminars and workshops were conducted in different places. However, published literature that described its impact on trainee's knowledge, skills, behavior and attitude is scarce. Knowing the impact of short EBM workshop will help further research on different methods of teaching EBM. It may identify the most effective method for the learning, with the ultimate goal of improving health services delivery and patient care. The objectives of the study were to identify the effect of participating in an EBM workshop on the knowledge, and skills of physicians towards EBM up to 4 months post-test.

Methods. Eastern province is one of the largest provinces in Saudi Arabia. It is served by a total of 112 primary health care centers (PHCCs) distributed in 14 sectors run by 270 physicians. Approval for conducting the research was signed by the General Directorate of Health Affair in the Eastern Province, and distributed to all PHCCs in the Eastern Provinces in order to facilitate the research by stakeholders in each sector.

This randomized controlled study was conducted over 4 weeks starting 18th of October 2008. The study population was composed of all physicians in PHCCs from the Eastern Province. The physicians were selected using a random sampling technique after obtaining the list of all physicians in each PHCC. Allocation concealment to take up workshop and other educational activities was carried out by random number table. The assignment of physicians in each arm was concealed by folding each name of physicians included in this study in a peace of paper and then picking the permitted number of experimental group from each sector.

The first group consisted of 61 physicians. This was the intervention group, who attended a workshop of 3 days on knowledge and skills of EBM. The workshop included formulating questions, retrieving the related evidence, critical appraisals, and EBM statistical terms, in addition to application of evidence in practice. The control group consisted of 92 physicians who attended another course or activity related to PHCCs (other than EBM) according to the requirements of each sector. The EBM workshops were conducted subsequently in 3 separate batches for the intervention group, which was organized by administrator in each sector in order to run the work smoothly in their area. The main outcome measure was the performance on an EBM skills test that would be administered 3 times over 4 months, at baseline and at 2 time points post-workshop. Post workshop Test I assessed the immediate effectiveness of the EBM workshop in the intervention group (primary outcome), and 4 months post-test II assessed for retention after 4 months. This was carried out by inviting them to attend an updated guideline in Primary Health Care course for 4 days, which was conducted at Primary Health Administration Center.

The control group received the questionnaires one week before the start of the EBM workshop. It was collected mostly during their weekly activities of continuing medical education in their sectors. For those who could not attend the activities due to shortage, or inconvenience to the sectors, distribution of the questionnaire was carried out through their PHCCs, and the collection was carried out as soon as possible so that they do not lose commitment or get overburdened. Four months post-test was collected 4 months after the first questionnaire.

Two independent EBM experts (not the investigator) assessed the practical performance of the participants against a "gold standard" adopted from Fresno test.[7] The assessors were blinded to assigned groups and whether it is pre-or post-test. The clinical cases were changed, and the wording of the multiple choice questions (MCQ) were changed in a manner that would minimize the recall bias. The weighting score in 4 skills and the contents were the same in pre- and post-test. Feedback was given after finishing the last post-test (after 4 months). The course duration was 7 hours per day for 3 consecutive days. The module designed to teach core EBM skills included: 1) formulating answerable clinical questions, 2) searching for evidence, 3) critical appraisal skills including validity and applicability, 4) understanding levels of evidence and quantitative results for therapy, and diagnosis articles targeted to improve "user" behavior applicability of evidence.

The tool of data collection was pre-designed questionnaire which consisted of 6 parts. Part of it was developed by the investigator. It was designed to test the validity of the evidence and quantities related to EBM. The other part is literature searching and its applicability. Open ended questions were adopted from the Fresno Test,[7] which related to answering free-text questions about formulation of question and retrieving of evidence. Finally, the part for the attitude

test was adopted from the McColl et al[8] study. Internal consistency of the questionnaire was evaluated using Cronbach's Alpha. The overall internal consistency of the knowledge questionnaire was high (Cronbach's Alpha coefficient =0.896).

The questionnaire was validated for its contents. It was sent to 5 faculty experts in EBM to seek their opinion on its content. Scoring for physicians' knowledge on EBM was carried out as follows: each true answer is given a score of "1". There were 4 major divisions that have been studied namely: general EBM knowledge (full sub score=10), formulating question (full sub score=6), literature search (full sub score=12), critical appraisal skills of validity (full sub score=14) understanding of the importance and precision of the evidence through statistical values (full sub score=8), and applying in patients (full sub score=6). The total knowledge score was 56. The study was explained to the selected physicians and verbal consent was taken from the physicians before the study. Names and data were treated confidentially and would not be used for any other purpose.

All variables were checked for accuracy and completeness, and then coded. Data was then entered into a personal computer and the Statistical Package for Social Science (SPSS Version 16) was used for data entry and analysis. Scores (%) of data were recorded and the total were obtained for each score. Frequency distribution tables were constructed. Student's t-test was used to assess the relation between the EBM knowledge scores and gender, nationality, and Internet access. One-way analysis of variance was carried out for comparison of EBM knowledge scores and qualification, specialties, professional title, place of work, and place of graduation. Chi-squared test was used for comparison of EBM knowledge and access to bibliographic databases, literature search and the arms of the study. The mean of EBM knowledge score pre-test, immediate post-test, and 4 months post-test were compared using repeated measurement. Comparison of the mean knowledge score of pre-test and 4 months post-test among control group was carried out using Paired t-test after taking the percentage of their total score. Correlation coefficient was computed to find out the relation between EBM scores, age, and duration of graduation. For exploring the relationship between age, gender, nationality, and intervention and EBM knowledge scores (4 months post-test), multiple regression was conducted. A p-value of <0.05 was considered "statistically significant" throughout the study. Confidence intervals (CI) were constructed with the 95% range.

Results. Pre-test was received from 59 out of 61 in the intervention group, and 87 out of 92 among the control group. Four months post-test was taken by 142 participants out of 146 participants included in both arms of the study with 97.3% response rate (**Figure 1**). Female participants were more than males (59.6%). The mean age of the respondents was 38.08±9.24 years. More than half of them were Saudis (57.2%). The mean number of years since graduation was 12.48±9.27 years. The mean number of patients seen by physicians was 44.46±22.89 per day.

Table 1 summarizes baseline demographics and other characteristics for all the participants. The 2 groups were well balanced with respect to these characteristics. Regarding EBM knowledge, the mean score of critical appraisal and mean scores of the statistical term were significantly higher in the control group (p=0.012 and p=0.016). However, no statistical significance was shown in the total EBM knowledge (**Table 2**).

The mean score of the general concept of EBM and its component of the control group was 25.43±12.13, and that for the study group 21.68±11.13, (p=0.06). The mean score of the immediate post-test was 45.4±6.1, and 4 months post-test was 37.4±5.6, while the mean score of the control group for the 4 months effect was 26.8±10.9. Using repeated measurement of the knowledge score after transforming it into percentage shown significant improvement of EBM score immediately post-test from 38.9±20.0% pre-intervention to 81.4±10.6% (p<0.001), whereas the knowledge score at 4 months post-test was 66.8±10.0% with significant decline than the immediate post-test (p<0.001), but still scoring significant improvement compared to the pre-test period (p<0.001), (**Table 2**). the same improvement was found on all sub classification of

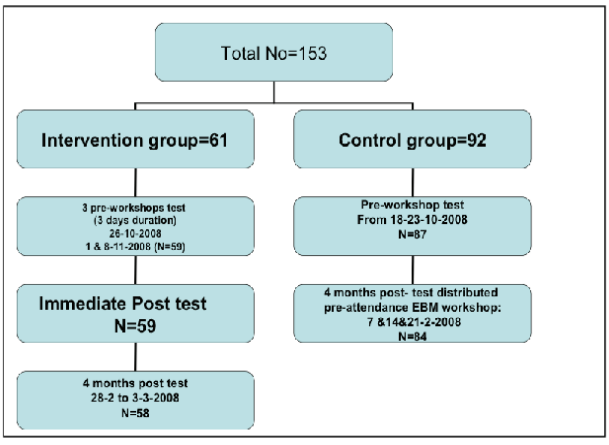

Figure 1 - Flow chart of the study design.

Table 1 - Characteristics of the study group versus control group.

Variables	All the participants n (%)	Study group n (%)	Control group n (%)	*P*-value
Gender				0.230
Men	59 (40.4)	20 (33.9)	39 (66.1)	
Women	87 (59.6)	39 (44.8)	48 (55.2)	
Age (mean±SD)	38.08±12.48	37.02±8.29	38.83±9.4	0.234
Qualification				0.800
Bachelor	109 (75.2)	46 (78.0)	63 (73.3)	
Master	20 (13.8)	6 (10.2)	14 (16.3)	
Fellowship	9 (6.2)	3 (5.1)	6 (7.0)	
PhD	3 (2.1)	1 (1.7)	2 (2.3)	
Board	4 (2.8)	3 (5.1)	1 (1.2)	
Title				0.511
Residents	120 (82.8)	51 (86.4)	69 (80.2)	
Specialist	18 (12.4)	5 (8.5)	13 (15.1)	
Consultant	7 (4.8)	3 (5.1)	4 (4.7)	
Specialty				0.408
General Practitioner	110 (76.9)	48 (81.4)	62 (73.8)	
Family medicine	12 (8.4)	5 (8.5)	7 (8.3)	
Public health	2 (1.4)	1 (1.7)	1 (1.2)	
Internist	4 (2.8)	0 0	4 (4.8)	
Obstetrics and Gynecology	4 (2.8)	2 (3.4)	2 (2.4)	
Others	11 (7.7)	3 (5.1)	8 (9.5)	
Access to internet	125 (88.0)	51 (87.9)	74 (88.1)	0.976
Bibliography access to information	73 (52.5)	33 (60.0)	40 (47.6)	0.154
Average frequency for consulting the data/month				0.89
Never/month	5 (6.8)	2 (6.1)	3 (7.5)	
Once/month	15 (20.5)	7 (21.2)	8 (20.0)	
2-3 times/month	37 (50.7)	18 (54.5)	19 (47.5)	
>3 times/month	16 (21.9)	6 (18.2)	10 (25.0)	
Heard about EBM concept	116 (80.6)	46 (79.3)	70 (81.4)	0.757

EBM - Evidenced Based Medicine

Table 2 - Percentage of the mean score of the evidenced based medicine (EBM) knowledge and skills in the studied participants.

Mean score of EBM	Intervention			*P*-value Time 1 versus Time 2	*P*-value Time 2 versus Time 3	*P*-level Time 1 versus Time 3	Control			
	Pre-test (95% CI) Time 1	Immediate post-test (95% CI) Time 2	4 months post-test (95% CI) Time 3				Pre-test	*P*-value Time 1 for 2 arms	Four months score in control group	*P*-value of control group
General knowledge	60.9±24.0 (54.6-67.2)	85.2±14.2 (81.5-88.9)	81.4±13 (77.9-84.8)	<0.001	<0.001	<0.001	59.5±25.3	0.956	67.4±19.9	0.002
Question formulation	20.7±26.4 (13.8-27.6)	74.7±26.9 (67.6-81.8)	54.0±28.7 (46.5-61.6)	<0.001	<0.001	<0.001	25.2±29.8	0.352	25.2±30.2	1.000
Literature searching	27.2±23.2 (21.1-33.3)	82.6±18.4 (77.8-87.5)	79.7±21.3 (65.1-76.3)	<0.001	<0.001	<0.001	31.9±25.4	0.265	39.2±26.2	0.004
Critical appraisal	40.8±27.0 (33.7-47.9)	83.1±12.8 (80.0-86.5)	72.7±14.9 (68.8-76.6)	<0.001	<0.001	<0.001	52.8±26.7	0.012*	52.6±27.0	0.948*
Statistical term	27.2±23.2 (21.1-33.3)	73.5±20.7 (68.1-79.0)	75.5±22.0 (51.8-63.3)	<0.001	<0.001	<0.001	38.0±28.2	0.016*	36.5±29.2	0.573*
Applicability of evidence	55.5±37.0 (45.7-65.2)	85.9±17.6 (81.3-90.6)	82.8±20.0 (77.5-88.0)	<0.001	0.247	<0.001	63.1±31.9	0.219	69.4±29.3	0.077
Total knowledge score	38.9±20.0 (33.7-44.2)	81.4±10.6 (78.6-84.2)	66.8±10.0 (64.1-69.4)	<0.001	<0.001	<0.001	47.4±25.1	0.06	47.8±19.4	0.868

Time 1 - pre-test, Time 2 - immediate post-test, Time 3 - four months post-test, CI - confidence intervals

Table 3 - Coefficient of predictor variables in the regression analysis of evidence based medicine (EBM) knowledge scores.

Knowledge scores	Coefficient	T	*P*-value
EBM general knowledge			
Age	-0.32	-0.034	0.732
Gender	-0.054	-0.59	0.558
Intervention	0.219	2.60	0.010
Nationality	-0.037	-0.367	0.714
Score of question formulation			
Age	-0.045	-0.55	0.583
Gender	-0.077	0.957	0.340
Intervention	0.539	7.32	<0.001
Nationality	0.175	2.00	0.048
Score of literature searching			
Age	0.055	0.704	0.482
Gender	-0.155	-0.2.05	0.042
Intervention	0.578	8.329	<0.001
Nationality	0.021	0.255	0.799
Score of critical appraisal			
Age	0.072	0.875	0.383
Gender	-0.132	-1.660	0.099
Intervention	0.525	7.177	<0.001
Nationality	0.040	0.460	0.646
Score of the statistical term			
Age	0.083	1.001	0.319
Gender	-0.096	-1.197	0.233
Intervention	0.513	6.940	<0.001
Nationality	-0.026	-0.300	0.764
Score of applicability of evidence			
Age	0.056	0.613	0.541
Gender	-0.176	-1.987	0.049
Intervention	0.304	3.721	<0.001
Nationality	0.154	1.584	0.116
Score of total knowledge			
Age	0.067	0.867	0.388
Gender	-0.148	-1.967	0.051
Intervention	0.585	8.422	<0.001
Nationality	0.044	0.538	0.592

EBM knowledge. There was insignificant improvement in total EBM knowledge among the control group (**Table 2**). Although, there was a significant improvement in some of its components, namely general knowledge and literature search (p=0.002 and p=0.004).

Regression analysis in **Table 3** revealed that the intervention is the only predictor for the total EBM knowledge differences (p<0.001).

Discussion. In Saudi Arabia, most studies have measured attitudes toward practicing EBM rather than actual skills.[9,10] Worldwide, most of the studies that attempted to measure actual EBM skills have focused on one or 2 skills of EBM, not its whole core competencies.[11] This is the first study in the Arab countries to objectively evaluate the efficacy of an EBM educational course on physicians' knowledge and skills through pre-test and 2 post-tests. The overall response rate was 96.7%, and the rate of follow-up of the respondents was 97.3%. This figure is very high and not easily achieved in randomized studies. It could be attributed to the rewards given to respondents in terms of free EBM workshops and other free primary health care workshops. Evaluation of perceived knowledge and skills in EBM was subjective and often led to overestimation of the real knowledge of EBM.[12] The choice of measurement method is a crucial step in the evaluation of educational interventions because many evaluation methods are not sensitive enough to measure the effectiveness of the interventions, which could lead to incorrect interpretation of results.[13] Finding a practical method for the assessment of the 4 components of EBM was challenging. The goals of the instrument of this study include differentiating between people who are knowledgeable and skilled in EBP from those who are not (a discriminative instrument). They also include measuring the changes in the knowledge and skills during a period of time.

The Fresno Test[7] and Berlin Questionnaire[14] represent the only instruments that evaluate all 4 EBP steps. In taking the Fresno Test, trainees perform a realistic EBM tasks, however, more time and expertise are required to grade this instrument.[11] The multiple-choice format of the Berlin Questionnaire restricts assessment to EBM applied knowledge, although it is easier to implement. Part of this study uses Fresno test score of the open ended questions, which require examinees to show higher order thinking in response to a genuine task. These questions are scored by using a standardized grading system.[15] In this study, multiple choice questions were added to explore further EBM components and enhance the discrimination of EBM expertise. At least 3 types of validity were obtained from the instrument of this study: face validity, content validity by 5 experts in EBM, and construct validity, where the questionnaire has the ability to discriminate between different levels of EBM expertise, reflected by significantly higher scores among consultants and family physicians, because it is part of their curriculum to acquire skills of critical appraisal, and sometimes all components of EBM. In addition, internal reliability using Cronbach's alpha was very high.

Evidence-based medicine knowledge. This study demonstrates a strong evidence of the impact of short workshops on the physician's knowledge, skills and application of EBM. Furthermore, it increases their ability to critically appraise literature and interpret quantitative statistical terms used in clinical study. The results of our study is in agreement with other studies.[2,3,16,17] It is unlikely that improvement in the

scores among physicians were due to other factors except the intervention; particularly in light of the large magnitude of improvements in the score, aside from the regression analysis which revealed that only intervention affect the total EBM knowledge scores of the control and the study group. Although decline of scores of the 4 months post-test was noted, it was still significantly higher than the pre-test. Thus, this study answers the question of the systematic review[6] raised about sustained effectiveness of the intervention. The baseline skills of physicians in formulating questions in this study was unacceptably low, which was in agreement with the study that examining the primary care physicians in formulating a good search question, finding an optimal search strategy, and interpreting the found evidence.[18] Regarding control group, although no statistically significant improvement in the total EBM knowledge was observed, there was a significant improvement in some components of EBM knowledge, which can be explained by the influence of the study group and their curiosity to know on what has been covered in the course. In addition, they were also part of the study, which indirectly improved their behavior by asking about EBM. This study could be extended by an examination of possible dose-response relationship, in which longer or repeated educational interventions produce a corresponding enhancement of the quality of performance of physician's competencies in applying EBM. Another extension would be to examine the persistence of these skills beyond the span of the 4-month period. Although the impact of the intervention appears substantial, it is not known how long the effects might last. Compared to other published studies, this study adopted more rigorous methods with appropriate follow-up. However, it lacks the evidence for being applied in the real clinical practice

This study can be generalized for several reasons. First, it is a randomized controlled trial. Second, the participants are from different levels of experience and training, and represent all the nationalities of physicians working in PHCCs in Saudi Arabia.

Limitations of the study can be summarized as, inability to release all physicians in each group at the same time because of work shortage which may influence the baseline knowledge of the control in comparison to the intervention group, and lack of financial fund reflected by inability of researchers to invite experienced EBM tutors to run the workshop, in addition to lack of time to assess the reflection of EBM course in the behavior from the records.

The investigator recommends the following, based on the study results and related needs: 1) Disseminating EBM training to all practicing physicians and evaluation of the impact of these interventions in practice and outcome. 2) Integrating EBM in educational curriculum of medical colleges, in addition to postgraduate program. 3) Providing the computer system in the PHCCs linked to EBM websites.

In conclusion, participating in EBM workshop significantly enhanced physicians' ability to formulate questions, performed literature search, critical appraisal, and applied best-evidence in clinical practice, which retained up to 4 months post-test.

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