RESEARCH PAPER

Effect of Educational Intervention on Evidence-Based Medicine "Knowledge, Attitude and Practice" Among Interns at a Tertiary Teaching Hospital

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ABSTRACT

Background: Evidence-based medicine (EBM) has been shown to enhance patient outcomes and have a positive return on investment. The study aims to evaluate the effect of an EBM educational intervention on house officers' (HO) knowledge, attitude, practice (KAP), and skills.

Methods: It is an interventional study to assess the EBM KAP for 70 HOs, consisting of 3 phases: pre-intervention, intervention (disseminating pre-test and providing a 2-day educational course), and post-intervention (disseminating post-test immediately and 3 months later).

Results: The participants' mean age was 25.4±1.3 years, 41% were males. The median score (Q1:Q3) for knowledge, attitude, and practice before intervention was 69.3(66.3:74.7), 71.8(66.8:76.5), and 56.4(43.2:69.1), respectively. The intervention revealed statistically significant improvement in the median scores of knowledge and attitude domains immediately and 3 months post-intervention. The median score of the practice domain showed a statistically significant increase immediately after the intervention. Before intervention, 7%, 16%, and 40% showed high knowledge, positive attitude, and fair/good practice, respectively. These proportions showed statistically significant increases immediately and 3 months later. The median score for the ACE questionnaire increased significantly immediately after the intervention.

Conclusions: EBM educational intervention can be an essential part of HOs' training programs to improve their EBM KAP.

Keywords: ACE Tool, Evidence-based Medicine, Knowledge, Attitude, Practice, Noor Questionnaire.

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INTRODUCTION

Evidence-based medicine (EBM) integrates scientific evidence, clinical competence, and patient values to optimize decision-making [1]. Recognized as a medical milestone since 1840 [2]. EBM is adopted globally by organizations like the Accreditation Council for Graduate Medical Education to enhance education and fellowship enrollment [3]. EBM yields a positive return on investment by improving patient outcomes, such as mortality, adherence, and infection rates [4].

In Egypt, where patients bear two-thirds of healthcare costs out-of-pocket, making unnecessary procedures highly frustrating [5]. The efficiency that EBM implies drives essential cost savings [6]. Well-timed adoption of EBM and its incorporation into daily medical practice by clinicians is essential [7]. Incorporating EBM into medical school curricula and providing ongoing training for graduates can achieve this [8].

EBM is widely accepted in Western education; however, in the Middle East and North Africa (MENA) region, EBM remains novel [3]. Specifically, Egyptian physicians demonstrate a positive attitude toward EBM but lack sufficient expertise [9,10]. Literature shows that while no single educational intervention is superior [11], brief modules successfully improve core EBM competency and skills [12,13].

Because house officers (HOs) are transitioning to independent practice, targeted training is vital for shaping their careers and understanding EBM's value [14,15]. Addressing a gap in the literature, this study tests the effect of a brief educational intervention on the EBM knowledge, attitude, and practice (KAP) of HOs during this critical transitional phase.

METHODS

Study Design, Setting, and Date:

An interventional trial was conducted from January 2022 to June 2024 at the Centre for Social and Preventive Medicine (CSPM), Faculty of Medicine, Cairo University.

Study Population and Sampling:

The target population comprised medical interns (house officers) attending the training program during the 2022/2023 academic year at Cairo University's teaching hospitals. Interns were specifically chosen for this intervention because instilling Evidence-Based Medicine (EBM) principles early in their careers establishes a critical

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foundation for clinical competency before they transition to independent decision-making roles.

During the training year, interns were distributed into six rotation groups. A cluster sampling method was used to select one group, followed by simple random sampling to recruit the necessary participants. The required sample size was calculated using Statulator online software. Assuming a power of 80%, a 5% level of significance, a design effect of 2, and a medium effect size (Cohen's d = 0.5) for the difference in mean scores between pre- and post-intervention matched pairs, a minimum of 67 interns was required. To account for an expected 35% dropout rate, 91 interns were recruited.

The Educational Intervention: The EBM educational program was developed by experts from the Public Health Department. The intervention consisted of 8 sessions delivered over two full days (12 total hours), combining didactic lectures, case-based learning scenarios, and open group discussions.

Day 1: Covered the historical context and core concepts of EBM, formulation of focused clinical questions (PICO format), and detailed overviews of observational and experimental study designs (including confounding, randomization, and blinding).

Day 2: Focused on finding the best evidence (resources, search engine mechanics, PubMed filters, Boolean operators, and MeSH terms), understanding levels of evidence, critical appraisal application, and strategies for implementing evidence in patient care.

Data Collection Tools: Data were collected using self-administered questionnaires in English. A pilot test was conducted with 10 interns (excluded from the final analysis) to ensure the validity, clarity, and time-appropriateness of the tools. The final instrument consisted of four sections:

Section I (Demographics): Collected baseline characteristics and prior EBM/research experience.

Section II (KAP - Noor Questionnaire): A validated tool assessing self-reported Knowledge (15 items), Attitude (17 items), and Practice (11 items) using a 5-point Likert scale. A "not-applicable" option was added to the practice domain for interns lacking exposure to specific clinical situations. Total scores were calculated as percentages and categorized using Bloom's cut-off points (High/Positive/Good: ≥80%; Moderate/Neutral/Fair: 60 to <80%; Low/Negative/Poor: <60%).

Section III (Skills and Competency - ACE Tool): A validated, 15-item dichotomous (yes/no) instrument that objectively measures competency in the four core steps of EBM: asking, searching, appraising, and applying. This objective competency assessment was utilized to distinguish actual EBM skill acquisition from the self-reported practice habits measured in Section II.

Section IV (Feedback and Barriers): Captured participants' opinions on the course, perceived barriers to implementing EBM in their local hospital policy, and suggested facilitating factors.

Data Collection Procedure: The questionnaire was administered at three distinct time points:

Pre-intervention: Baseline assessment.

Immediate Post-intervention: Assessed immediate knowledge retention, attitude shifts, objective skills (ACE tool), and intended future practices.

Three-Month Follow-up: To measure actual sustained EBM practice and skill retention, trainees were followed up via a WhatsApp™ group. Despite multiple reminders, 70 out of the initial 91 participants completed this phase.

Ethical Considerations: The study protocol was approved by the Scientific Committee and the Research Ethics Committee of the Faculty of Medicine, Cairo University (Code: MD-188-2022). Written informed consent was obtained from all participants before recruitment. Data were handled with strict confidentiality in accordance with the revised Helsinki Declaration.

Statistical Analysis: Data were analyzed using SPSS® version 25. Quantitative data were assessed for normality and summarized using mean ± SD or median and IQR, while qualitative data were summarized as frequencies and percentages. Comparisons for categorical variables across time points were performed using Cochran's Q and McNemar tests. For continuous variables, repeated measures ANOVA (with Bonferroni correction) or the Friedman test (with Wilcoxon-signed rank test) were utilized based on data distribution. Independent t-tests or Mann-Whitney U tests were used for subgroup comparisons. Significance was set at $p < 0.05$.

RESULTS

Out of 91 initial trainees, 70 completed the 3-month follow-up, yielding a 76.9% completion rate.

Baseline characteristics: The cohort's median age was 25 (IQR: 25:26), and the majority were female (59%) and Egyptian (82%). While 69% were mindful of EBM and 40% had attended prior EBM courses, actual research engagement was lower: only 41% had participated in research, and 25% had published.

The effect on the percent score of KAP and levels: There was a statistically significant increase in median knowledge and attitude scores both immediately and at the 3-month follow-up. Practice scores significantly increased post-intervention immediately, but experienced a significant decrease at 3 months compared to the immediate follow-up (Table 1). Correspondingly, the proportion of participants achieving high knowledge, positive attitudes, and fair/good practice levels increased significantly at both post-intervention intervals compared to baseline (Table 2).

Factors affecting baseline percent score: Baseline knowledge scores were significantly higher among those with an excellent graduation grade (71.3±6.5%) and prior EBM training (72.3±6.1%). Similarly, Egyptian nationality and prior EBM training were significant positive factors for baseline attitude scores.

Relation between percent score of EBM KAP: A significant positive moderate correlation existed between knowledge and attitude scores across all three time points, as well as between their score changes at 3 months (Table 3).

The effect on the percent score of the ACE questionnaire: Median competence in EBM skills increased significantly immediately after the course but showed a significant decline at the 3-month mark (Table 4).

Regarding EBM practice, 70% found the time to read research papers a difficulty facing physicians. More than half found the skills to net search/critically appraise evidence and the organization's support to practice EBM as difficulties.

Table 1: EBM KAP percent score before, immediately after, and 3 months after intervention among study participants (n=70)

Measure	Pre	Post-1	Post-2	P-value	Pairwise analysis
Knowledge domain					
Mean ± SD	69.4 ± 7.5	73.3 ± 8.5	77.5 ± 8.4	<0.001*	P1=0.001, P2<0.001, P3=0.250
Median (IQR)	69.3(66.3:74.7)	72.7(68:80)	76(73.3:82.7)		
Min-Max	32-84	48-90.7	60-94.7		
Attitude domain					
Mean ± SD	72.3 ± 7.7	75 ± 9.5	77.9 ± 8.1	<0.001†	P1=0.036, P2<0.001, P3=0.091
Median (IQR)	71.8(66.8:76.5)	76.5(67.6:80.6)	78.2(72.9:82.4)		
Min-Max	57.7-94.1	54.1-97.7	58.8-95.3		
Practice domain					
Mean ± SD	54.9 ± 17	64.2 ± 12.2	61.6 ± 11.6	<0.001*	P1<0.001, P2=0.172, P3=0.005
Median (IQR)	56.4(43.2:69.1)	65.5(56.4:73.2)	63.6(54.1:69.1)		
Min-Max	14.6-85.5	14.6 -85.5	25.5-87.3		

*Friedman's test; using Bonferroni-adjusted Wilcoxon signed-rank test for pairwise analysis; †Repeated measures ANOVA; using a post hoc test with Bonferroni correction for multiple comparisons; (P1= pre- vs. post-1); (P2= pre- vs. post-2); (P3= post-1 vs. post-2).

Table 2: Proportion of Participants Achieving Categorized Knowledge, Attitude, and Practice Levels before, immediately after, and 3 months after intervention (n=70)

Domain	Level	Pre N (%)	Post-1 N (%)	Post-2 N (%)	P-value*	Pairwise analysis
Knowledge	Poor/Moderate	65(92.9)	52(74.3)	48(68.6)	<0.001	P1=0.011, P2<0.001, P3>0.999
	High	5(7.1)	18(25.7)	22(31.4)		
Attitude	Negative/Neutral	59(84.3)	47(67.1)	38(54.3)	<0.001	P1=0.047, P2<0.001, P3=0.210
	Positive	11(15.7)	23(32.9)	32(45.7)		
Practice	Poor	42(60.0)	22(31.4)	25(35.7)	<0.001	P1<0.001, P2=0.002, P3>0.999
	Fair/Good	28(40.0)	48(68.6)	45(64.3)		

*Cochran's Q test, using Bonferroni-adjusted McNemar test for pairwise analysis; (P1= pre- vs. post-1); (P2= pre- vs. post-2); (P3= post-1 vs. post-2).

Table 3: Correlation between HOs' EBM KAP percent scores at baseline, immediately, and 3 months after intervention (n=70)

Time-point		Baseline		Post 1		Post 2		Immediate change		Change at 3-months	
Domain		**"Kn"**	**"A"**	**"Kn"**	**"A"**	**"Kn"**	**"A"**	**"Kn"**	**"A"**	**"Kn"**	**"A"**
"A"	**ρ***	0.342†	X	0.659†	X	0.400†	X	0.196	X	0.391	X
	P-value	0.004		<0.001		0.001		0.103		0.001	
"P"	**ρ***	0.04	0.042	-0.134	-0.089	0.1	0.112	-0.041	-0.012	0.173	0.023
	P-value	0.741	0.727	0.269	0.464	0.409	0.358	0.736	0.923	0.152	0.85

*Spearman rho correlation coefficient, † = positive moderate correlation, "A": attitude, "P": practice, "Kn": knowledge

Table 4: Median percentage score of EBM skills before, immediately after, and 3 months after intervention among study participants (n=70)

Measure	Pre	Post-1	Post-2	P-value*	Pairwise analysis
Mean ± SD	59.4 ± 14	65.6 ± 10.3	57.6 ± 13.9	P <0.001	P1=0.011, P2=0.931, P3<0.001
Median (IQR)	60(52:66.7)	66.7(60:73.3)	60(53.3:66.7)		
Min-max	26.7-86.7	46.7-86.7	20-93.3		

*Friedman's test, using Bonferroni-adjusted Wilcoxon signed-rank test for pairwise analysis; (P1= pre vs. post-1); (P2= pre vs. post-2); (P3= post-1 vs. post-2).

DISCUSSION

Statement of principal findings: This study verified that a brief educational intervention significantly improved medical interns' EBM knowledge, attitude, practice, and skills (ACE scores) immediately post-intervention. While improvements in knowledge and attitude were sustained at three months, self-reported practice and objective skill competencies experienced a significant decline from their immediate post-intervention scores. The most prominent barriers to EBM practice were a lack of time to read research, deficient searching and critical appraisal skills, and an absence of organizational support.

Strengths and weaknesses of the study: The study's strengths include the utilization of validated objective tools alongside self-reported metrics, as well as a 3-month follow-up to assess retention. However, the study was limited by its brief, condensed nature and a restricted applied component due to house officer (HO) time constraints. Additionally, the absence of a control group and a lack of data on long-term outcomes beyond three months limit the generalizability of the sustained effects.

Strengths and weaknesses in relation to other studies:

At baseline, about 7% of HOs had a high level of knowledge. This was lower than that of resident physicians in Syria (9.8%) [20], and significantly lower than Malaysian emergency (49.7%) and primary care (32.9%) practitioners [21,22]; likely due to variation in professional experience. The HOs' mean attitude score (72.3 ± 7.7%) is comparable to US nursing leaders (71.1 ± 9.7%) [23], but less than Taiwanese nurses (78.7 ± 9.2%) [24]. The percent of HOs with a good/fair level of EBM practice (40%) before intervention exceeded the findings of the Syrian and Malaysian studies [20-22].

The baseline mean ACE score (59.4 ± 14%) was consistent with a Qatar study (59.3 ± 10.7%) [3], higher than Iranian post-graduate trainees (27.6 ± 11.5%) [25], and lower than undergraduates at Buckingham Medical School [26].

Effect of educational intervention: Immediately post-intervention, HOs achieved a 3.9% mean knowledge score improvement, comparable to findings by Chao et al. [24]. At follow-up, HOs showed sustained improvement (by 8.1%), likely due to constant communication via mobile application groups, contrasting with studies that reported regression [24]. Immediately, attitude and practice scores significantly improved by 2.7% and 9.3%, respectively. At three months, attitude improvement remained significant (5.6%), but practice improvement did not. These results are lower than those achieved across all domains by nurses in Taiwan [24], and the USA [23], which may reflect differences in educational approaches. ACE tool scores showed a significant immediate improvement of 6.2%, similar to Bowers and colleagues [27], but less than that achieved by dental students receiving a 1-year EBM course [28].

Difficulties to EBM practice: The most common barriers hindering EBM implementation included "lacking time to read research papers" (70% agreement), mirroring reports from Egyptian nurses (100% agreement) [29], and Malaysian practitioners [22]. "Deficient skills to net search/critically appraise the evidence" ranked second (52.9%), aligning with Qatar internal trainees [3] and Egyptian nurses working at Alexandrian hospitals [29]. "Absent organization support" ranked third (51.4%), which is consistent with Beijing doctors [30], but it was in the 5th rank with only 3.8% agreement among Qatar internal trainees [3].

Unanswered questions and future research: Since objective skills and actual practice significantly deteriorated after three months, future research must address how to prevent this decline. Studies are needed to determine the efficacy of continuous, integrated EBM training versus standalone workshops. Furthermore, future trials should incorporate control groups and investigate whether improved EBM competency translates directly into measurable improvements in patient care outcomes and clinical decision-making over extended, multi-year periods.

CONCLUSIONS: This brief educational intervention successfully and significantly increased HOs' knowledge and attitude scores both immediately and at the three-month mark. It can also significantly increase the percent score of the practice domain immediately after the intervention, though this increase was not fully maintainable three months later. Incorporating an EBM curriculum into the house officers' training program and providing organizational support (e.g., free access to medical journals) are recommended to facilitate mastery of EBM skills.

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