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ENHANCING EVIDENCE-BASED MEDICINE COMPETENCE IN THIRD-YEAR STUDENTS THROUGH BASIC SCIENCE RESEARCH TRAINING: OUTCOMES AND FINDINGS

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ABSTRACT

Background: In 2022, for the first time, the Faculty of Medicine, Dai Nam University applies scientific research methods to 3rd year medical students.

Objective: To evaluate the impact of the Medical Scientific Research Methods module on medical students' skills and knowledge.

Methods: This pre-test post-test pilot study used a prospective descriptive exploratory method by non-probability convenience sampling of all people participating in the course "Medical science research methods," which was compulsory for 3rd-year medical students, Faculty of Medicine, Dai Nam University, from August to December 2022. The study invited a total of 89 students from two classes to participate. At the beginning of the course, 82 students completed the survey, while 66 students responded to the second survey after completing the course.

Result: This study demonstrated that an undergraduate research methods course had a meaningful impact on medical literature search behaviors, understanding of medical research terminology, and confidence in evidence-based medical practice among students. However, despite these positive results, the knowledge and skills of students in evidence-based medicine were limited.

Conclusion: The scientific research methods course has significantly improved students' EBM knowledge and skills, albeit with some limitations. However, this study highlights the need for continued training programs and practical experience in medical research to enhance further and maintain learners' proficiency in EBM.

Keywords: Evidence-based medicine, Basic Science Research Training, EBM.

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1. INTRODUCTION

The importance of evidence-based practice (EBM) in medicine is growing, and healthcare professionals must use the best available evidence to make informed decisions about individual patient care. Studies have shown that access to research findings, and scientific publications can improve analytical reasoning, communication skills, and patient care outcomes for medical staff [1]. In addition, by participating in medical research, students can enhance their skills and prepare for future research opportunities after graduation [2]. Therefore, it is essential to provide medical students with fundamental knowledge of EBM and research methods from the beginning of their university education.

In Vietnam, many undergraduate medical training programs now require students to take courses in scientific research methods rather than solely providing training at the graduate level. Dai Nam University's Faculty of Medicine has introduced a new module in 2022, "Medical Scientific Research Methods," which is mandatory for all third-year medical students. The module, which consists of 60 hours of theory and practical sessions, covers literature search and evaluation, research ideation, research design, and research proposal development. Our study aims to assess the effectiveness of this module to contribute to program adjustments and recommendations for improvement. Specifically, we aim to evaluate the impact of the Medical Scientific Research Methods module on medical students' skills and knowledge.

2. MATERIALS AND METHODS

Study design

This pre-test post-test pilot study used a prospective descriptive exploratory method by non-probability convenience sampling of all people participating in the course "Medical science research methods," which was compulsory for 3rd-year medical students, Faculty of Medicine, Dai Nam University, from August to December 2022.

From August to December 2022, a non-controlled before-after intervention study was conducted on all university medical students who took part in the "Medical Science Research Methods" course, which is mandatory for third-year medical students at the Faculty of Medicine, Dai Nam University. The study used non-probability convenience sampling for data collection and included both a pre-test and post-test assessment.

Participate

The study invited a total of 89 students from two classes to participate. At the beginning of the course, 82 students completed the survey, while 66 students responded to the second survey after completing the course.

Data collection

The participants were asked to complete a set of self-assessment questions twice, first before the course in August 2022 and then after completing the course in December 2022. The surveys were sent to all students in the two classes via a survey link, and the data was collected anonymously online using Google Forms.

Tools use

The questionnaire used in the study consisted of similar questions asked twice - before and after the course. The questionnaire was developed based on a previous study conducted in Hungary [3] and included the following components: 1) Personal information such as age, gender, academic performance in the previous semester, and place of residence; 2) Tools used for searching medical documents; 3) Understanding of terms related to study design, statistics, and epidemiology; and 4) Self-assessment of skills related to evidence-based medicine practice.

Variables and Measurements

The study collected the following information on demographic characteristics such as age, gender, educational level, living area, and academic results for the most recent semester. In addition, we gathered information regarding the tools used by participants when searching for medical documents. The study counted the number of medical information/ documentation search engines used by students, including Google Scholar, Pubmed, Medline,

Medscapes, Cochrane, Scopus, Web of Science, Embase, books, or other medical literature, and noted how many were recommended by the course. The study also assessed students' knowledge of terms related to research design, statistics, and epidemiology by asking about seven, ten, and eighteen terms, respectively. Participants self-assessed their understanding of these terms on three levels: understand and can explain, understand a little, and do not understand. Finally, the study included six questions for students to self-assess their ability to identify inquiries related to patients, find relevant scientific literature, use online databases to search for information, and critically evaluate the scientific literature they found.

Ethical

The study did not involve any differential treatment of the students who participated, and their participation was entirely voluntary. In addition, there were no adverse consequences for the participants due to their involvement in the study.

Statistical analysis

Data were downloaded from Google sheets and cleaned with Excel. We used Stata version 14.0 software (Stata Corp LP, College Station, Texas, US) to analyze the data. We describe the percentages of understanding and competence that students self-assess by frequency and rate; we describe the evidence-based medical practice skill scores over the mean and standard deviation. The Chi-square test and the Wilcoxon-Mann-Whitney test were used to compare the difference between proportions and mean values in a group of students before and after the course.

3. RESULTS

A total of 82 students participated in the survey before the course, and 66 responded to the survey at the end of the course. The study found that the distribution of participants by sex, place of residence, and academic achievement in the most recent period was equivalent at both time points.

Table 1. Demographic characteristics of respondents

Characteristics	Before n=82		After n=66	
	n	%	n	%
Gender				
Male	42	51.2	32	48.5
Female	40	48.8	34	51.5
Habitat				
City	50	61.0	39	59.1
Countryside	32	39.0	27	40.9
Academic achievement				
Excellent	13	15.9	12	18.2
Good	68	82.9	53	80.3
Weak	1	1.2	1	1.5

The results presented in Table 2 indicate that the percentage of students who do not use the correct method of searching for medical documents decreased from 18.3% before the course to 10.6% after the course. In contrast, the percentage of students who used three or more of the recommended ways to search for documents increased from 8.5% before the course to 39.4% after the course. This difference was found to be statistically significant with a p-value of less than 0.01.

Table 2. Habits of searching medical documents before and after the course

Number of recommended document search methods	Before n=82		After n=66		p
	n	%	n	%	
0	15	18.3	7	10.6	<0.01
1	39	47.6	19	28.8	
2	21	25.6	14	21.2	
≥3	7	8.5	26	39.4	

Table 3 indicates a significant increase in the understanding of all surveyed concepts after the course (p<0.01). Before the class, the percentage of students who understood and could explain these concepts ranged from 1.2% to 9.8%, while after the course, this percentage significantly increased, ranging from 9.1% to 36.4%. Conversely, the rate of students who did not understand 60% or more of the concepts decreased to less than 35% across all contents.

Table 3. Understanding of the basic concepts of evidence-based medicine

Terms	Before n=82			After n=66			p
	Understand and be able to explain n (%)	Understand a little n (%)	Not understand n (%)	Understand and be able to explain n (%)	Understand a little n (%)	Not understand n (%)	
Relating to study design							
Case report	3 (3.7)	29 (35.4)	50 (61.0)	20 (30.3)	36 (54.6)	10 (15.2)	<0.01
Cohort study	2 (2.4)	10 (12.2)	70 (85.4)	17 (25.8)	36 (54.6)	13 (19.7)	<0.01
Randomized controlled clinical trial	5 (6.1)	22 (26.8)	55 (67.1)	12 (18.2)	40 (60.6)	14 (21.2)	<0.01
Synthetic analysis	4 (4.9)	25 (30.5)	53 (64.6)	10 (15.2)	42 (63.6)	14 (21.2)	<0.01
System overview	1 (1.2)	18 (22.0)	63 (76.8)	9 (13.6)	41 (62.1)	16 (24.2)	<0.01
Cross-sectional study	1 (1.2)	12 (14.6)	69 (84.2)	21 (31.8)	34 (51.5)	11 (16.7)	<0.01
Case study	3 (3.7)	27 (32.9)	52 (63.4)	16 (24.2)	37 (56.1)	13 (19.7)	<0.01
Regarding statistics							
Confidence interval	4 (4.9)	17 (20.7)	61 (74.4)	16 (24.2)	35 (53)	15 (22.7)	<0.01
Sample Size	4 (4.9)	18 (22)	60 (73.2)	24 (36.4)	30 (45.5)	12 (18.2)	<0.01
Mode	5 (6.1)	11 (13.4)	66 (80.5)	9 (13.6)	37 (56.1)	20 (30.3)	<0.01

Terms	Before n=82			After n=66			p
	Understand and be able to explain n (%)	Understand a little n (%)	Not understand n (%)	Understand and be able to explain n (%)	Understand a little n (%)	Not understand n (%)	
Interquartile range	3 (3.7)	4 (4.9)	75 (91.5)	6 (9.1)	39 (59.1)	21 (31.8)	<0.01
Standard deviation	5 (6.1)	17 (20.7)	60 (73.2)	15 (22.7)	35 (53.0)	16 (24.2)	<0.01
Accuracy	7 (8.5)	22 (26.8)	53 (64.6)	14 (21.2)	38 (57.6)	14 (21.2)	<0.01
Representative form	7 (8.5)	14 (17.1)	61 (74.4)	16 (24.2)	37 (56.1)	13 (19.7)	<0.01
Strength test	3 (3.7)	13 (15.9)	66 (80.5)	8 (12.1)	35 (53.0)	23 (34.9)	<0.01
P . value	2 (2.4)	7 (8.5)	73 (89.0)	8 (12.1)	40 (60.6)	18 (27.3)	<0.01
Type 1 error and type 2 error	2 (2.4)	10 (12.2)	70 (85.4)	8 (12.1)	37 (56.1)	21 (31.8)	<0.01
Epidemiological related terms							
Relative risk	4 (4.9)	24 (29.3)	54 (65.9)	12 (18.2)	40 (60.6)	14 (21.2)	<0.01
Absolute danger	4 (4.9)	24 (29.3)	54 (65.9)	11 (16.7)	38 (57.6)	17 (25.8)	<0.01
Odds ratio OR	4 (4.9)	7 (8.5)	71 (86.6)	11 (16.7)	32 (48.5)	23 (34.9)	<0.01
Number needing treatment for NNT	4 (4.9)	6 (7.3)	72 (87.8)	8 (12.1)	33 (50.0)	25 (37.9)	<0.01
Sensitivity of a diagnostic test	5 (6.1)	14 (17.1)	63 (76.8)	14 (21.2)	37 (56.1)	15 (22.7)	<0.01
The specificity of the diagnostic test	4 (4.9)	16 (19.5)	62 (75.6)	16 (24.2)	35 (53)	15 (22.7)	<0.01
Heterogeneity	3 (3.7)	17 (20.7)	62 (75.6)	11 (16.7)	36 (54.6)	19 (28.8)	<0.01
Publishing bias	3 (3.7)	5 (6.1)	74 (90.2)	7 (10.6)	29 (43.9)	30 (45.5)	<0.01
Lost parachute in vertical tracking	4 (4.9)	10 (12.2)	68 (82.9)	7 (10.6)	33 (50)	26 (39.4)	<0.01
Random	8 (9.8)	17 (20.7)	57 (69.5)	16 (24.2)	34 (51.5)	16 (24.2)	<0.01
Analysis of intention to treat	6 (7.3)	12 (14.6)	64 (78.1)	9 (13.6)	38 (57.6)	19 (28.8)	<0.01
Popularity	7 (8.5)	23 (28.1)	52 (63.4)	12 (18.2)	39 (59.1)	15 (22.7)	<0.01
Incidence rate	8 (9.8)	21 (25.6)	53 (64.6)	24 (36.4)	30 (45.5)	12 (18.2)	<0.01
Positive predictive value	4 (4.9)	13 (15.9)	65 (79.3)	11 (16.7)	36 (54.6)	19 (28.8)	<0.01
Evidence hierarchy	3 (3.7)	5 (6.1)	74 (90.2)	7 (10.6)	32 (48.5)	27 (40.9)	<0.01
Clinical efficacy	6 (7.3)	20 (24.4)	56 (68.3)	14 (21.2)	35 (53.0)	17 (25.8)	<0.01
Practice introduction	6 (7.3)	20 (24.4)	56 (68.3)	16 (24.2)	37 (56.1)	13 (19.7)	<0.01
Evidence-based medicine	7 (8.5)	14 (17.1)	61 (74.4)	20 (30.3)	34 (51.5)	12 (18.2)	<0.01

Based on the findings presented in Table 4, it can be observed that there was an improvement in the self-assessed evidence-based medical practice skills of the students after completing the course. Specifically, there was an increase in the percentage of students who rated themselves highly in critical assessment skills for scientific literature (24.2% to 7.3%) or existing documents (21.2% to 11%). Additionally, the average competency score of self-assessment also showed a significant increase in the abilities to locate technical documents, critically evaluate scientific publications, assess knowledge gaps, and review existing scientific documents.

Table 4. Self-assessment of evidence-based medical skills

Skill	Before n=82				After n=66			
	Least n (%)	**Medium n (%)**	**Good n (%)**	**Mean (sd)**	**Least n (%)**	**Medium n (%)**	**Good n (%)**	**Mean (sd)**
Locating professional documents	25 (30.5)	45 (54.9)	12 (14.6)	2.8 (0.8)	11 (16.7)	37 (56.1)	18 (27.3)	3.1 (0.8) *
Search online database	18 (22.0)	41 (50)	23 (28.1)	3.1 (0.8)	10 (15.2)	30 (45.5)	26 (39.4)	3.3 (1.0)
Critical evaluation of a scientific publication or clinical research report	34 (41.5)	42 (51.2)	6 (7.3)	2.6 (0.7)	19 (28.8)	31 (47.0)	16 (24.2) [a]	2.9 (1.0) *
Identifying knowledge gaps in practice (Areas where there is insufficient scientific literature to answer a particular clinical question)	32 (39)	42 (51.2)	8 (9.8)	2.7 (0.8)	16 (24.2)	38 (57.6)	12 (18.2)	2.9 (0.9) *
Evaluate and critique existing scientific documents	37 (45.1)	36 (43.9)	9 (11.0)	2.6 (0.8)	18 (27.3)	34 (51.5)	14 (21.2) [a]	2.9 (0.9) *
Identify clinical questions relevant to the patient	24 (29.3)	43 (52.4)	15 (18.3)	2.9 (0.8)	12 (18.2)	35 (53)	19 (28.8)	3.1 (0.9)

**p<0.05, Wilcoxon-Mann-Whitney test; [a] p<0.05, Chi-square test*

4. DISCUSSION

This study demonstrated that an undergraduate research methods course had a meaningful impact on medical literature search behaviors, understanding of medical research terminology, and confidence in evidence-based medical practice among students. These findings align with earlier research indicating that similar programs positively affect health science students in general and medical students in particular [1-4]. However, despite these positive results, the knowledge and skills of students in evidence-based medicine were limited.

The ability to find, evaluate, and critique medical information is essential for evidence-based practice, particularly in today's age of information overload, where quality varies across sources [6][5]. A wide range of tools and methods are available for finding medical information, including search engines like Google, Google Scholar, and Yahoo, as well as databases like MEDLINE, PubMed, and Medscape [6]. In this study, students were trained to search for medical evidence using Google Scholar, Pubmed, Medline, Medscapes, Cochrane, Scopus, Web of Science, and Embase, emphasizing online resources that are updated regularly. Before the course, almost 20% of students

did not use any of the recommended search methods, but after completing the course, this figure dropped to 10.6%. Furthermore, the proportion of students who reported using three or more guided methods increased significantly from 8.5% to 39.4%. These findings are consistent with previous reports showing that EBM training can increase the use of recommended search tools [3]. However, a high percentage of students still rely on search engines like Google and Wikipedia, which can lead to unreliable or non-authoritative sources.

Students' understanding of EBM-related terms showed significant variation before and after the course. The pre-course rates of comprehension and explainability of the concepts ranged from 1.2% to 9.8%, with a better understanding of epidemiology terms and a lower understanding of study design terms. This could be attributed to the familiarity with specific terms encountered in other subjects by medical students. After the course, the rates of understanding and explainability for these terms increased to 9.1% - 36.4%. Many literature reports also support the efficacy of EBM training programs in improving knowledge [7, 8]. The research findings indicate that the students were able to gain basic EBM knowledge through the training program. Although there was a substantial increase in the proportion of students who could explain several concepts, the overall level of understanding is still limited. This study highlights the necessity for specialized and practical training programs to equip medical students with comprehensive EBM experience and skills.

The study assessed students' EBM-related skills before and after the course. The results indicate a significant increase in the proportion of students who self-assessed their evidence-based medical practice skills as good after completing the course, which was aligned with the course's objectives of enhancing skills in literature searching, critical evaluation, identifying knowledge gaps, reviewing the literature, and more. Similar studies have also demonstrated the effectiveness of similar courses in improving EBM practice skills [7-9]. However, the results of this study also show that the average level skill self-assessment rates accounted for mainly both before and after the study. Nonetheless, the average self-assessment scores remained low after the course, indicating that many students lack confidence in practicing evidence-based medicine. This may be attributed to the fact that these skills require practical experience and time to develop. The introductory course can only serve as a foundation for students to enter the EBM practice arena. Although the mean scores on self-assessment were significantly higher after the course than before, the improvement may have been subjectively assessed, as before the course, a lack of knowledge may increase a student's confidence in their abilities. In this study, some students identified that their EBM competence was lower than previously thought after completing 60 hours of study.

The present study aimed to assess the impact of the "Scientific Research Methods" program on enhancing the knowledge and skills of medical students at Dai Nam university. However, there are several limitations to this study. The uncontrolled design of the before-after study restricts the ability to establish a causal relationship between the intervention and the observed outcomes. Furthermore, relying on self-reported measures for evaluating knowledge and skills may introduce potential bias and subjectivity in the results.

5. CONCLUSION

The scientific research methods course has significantly improved students' EBM knowledge and skills, albeit with some limitations. However, this study highlights the need for continued training programs and practical experience in medical research to enhance further and maintain learners' proficiency in EBM.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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