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Investigating the Availability and Utilization of Evidence Based Medicine Education for Medical Students in Sudan: a cross sectional study

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Abstract

Introduction

Evidence-based medicine (EBM) is "the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients. It has become an essential part of practicing in all the aspects of healthcare.

Objective :we aimed to investigate the availability and utilization of evidence based medicine education for medical students in sudan.

Methods :

The study employed a descriptive cross-sectional online survey of Sudanese medical students via convenience sampling. Data collection spanned from September 18, 2023, to March 10, 2023, disseminated through various social media platforms. The questionnaire, developed with input from faculty members, covered sociodemographic data, search engine usage, evidence-based medicine (EBM) skills, attitudes toward EBM, and knowledge of EBM terms. Randomization of questions and response validation were utilized to minimize bias. Data were collected via Google Forms and analyzed using R and SPSS software. Statistical tests included t-tests, Mann-Whitney U, chi-square, or Fisher exact tests, with significance set at $p < 0.05$.

Results:

The cross-sectional study encompassed 1201 Sudanese medical students from various private and public schools. Most participants were female (61.0%), with a mean age of 22.36 ± 2.36 years. Majority were fourth-year students (25.4%), followed by second (20.1%), third (21.0%), and fifth-year (22.6%) students. Over half (51.3%) had attended previous EBM training, with 71.4% having taken research methodology courses. However, only 50.4% read scientific literature monthly or less, and 30.8% never did. Google, Wikipedia, and Google Scholar were predominant search engines. Students who attended EBM training showed significantly higher usage of various databases. Medical books were the primary source of information (92.4%). Self-reported EBM skills varied, with no significant difference between trained and untrained students. Attitudes towards EBM were generally positive, though variations existed. Understanding of EBM terms varied, with case report being the most recognized study design term. In patient care, most students rated their EBM skills as average.

Conclusion :

Medical students lack knowledge and skills related to Evidence-Based Medicine (EBM) and have a neutral attitude towards its use in healthcare practice. Many rely on non-scientific search engines for medical information due to limited access to institutional resources. They primarily obtain medical information from books and lecture notes, highlighting the need for education on accessing scientific literature.

1. Introduction

Researchers defined evidence-based medicine (EBM) as “conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients” [1]. EBM was focusing on how clinicians can use published literature. Thereafter, the concept was broadened to include the patient-doctor relationship in clinical practice and integrating patient’s preference with the physician’s experience and the best available research evidence in the decision-making process [2]. Because of the importance of EBM in building clinical practice on a scientific basis, there is a focus on making the source of evidentiary based skills and information accessible to clinicians by developing reliable clinical practice guidelines [2]. EBM practice can be applied in five steps: step one; converting the current clinical scenario into an answerable question using PICOS mnemonic, step two; identifying the best available research evidence by performing a proper literature review across various databases, step three; critical appraisal of the evidence for its validity, impact, and applicability, step four; applying the results of the appraisal with the clinical experience and patient’s values, and step five; evaluating the process and finding ways to improve it in the future [3]. EBM has improved diagnosis, clinical judgment, and decision making [4]. Additionally, better outcomes were observed in patients who received evidence-based medical care [5]. EBM is of utmost importance in developing countries for its cost-effectiveness and efficient use of healthcare resources [6, 7]. Medical students are the future health care providers. Therefore, there is an increasing emphasis on exposing them to EBM during their pre-clinical and clinical education [8]. Nowadays, EBM has become a core part of the undergraduate medical education curriculum in many countries. Each step was discussed, and the students were trained on translating the appraised evidence into clinical practice, this enhanced student’s critical thinking and life-long learning [9]. Among the Iranian medical students, only 245 % were familiar with the concept of EBM [10]. In a Hungarian study [11]; students reported average skills in identifying patient’s clinical questions, and finding and critically appraising the scientific literature, and poor skills in detecting the knowledge gaps. Less than 0 % of the Hungarian students had advanced EBM skills [11]. Unfortunately, EBM is not adequately implemented in medical curricula of some developing countries [12], including Sudan where most of the medical students' curricula lack EBM tuition. The practice of EBM among physicians in Sudan was found to be less than 5.3 % [13]. Most of the Sudanese physicians have not received proper training in EBM [14]. Lack of skills was the main barrier in 5.6 % of those physicians [13]. However, medical students’ awareness, skills, and attitudes towards EBM practice in Sudan are still unknown. With a better understanding of the situation, educational and practical efforts can be developed to implement EBM into our health system. Therefore, this cross-sectional study is the first attempt to provide valuable evidence of medical students’ awareness, skills, and attitudes toward proper EBM practice.

2. Methods

Methods Study design

We conducted a descriptive cross-sectional online survey of Sudanese medical students from different medical schools using convenience sampling. The electronic survey was published on diferent social media platforms between 18 September 2023 and 10 march 2023 and could be accessed by anyone with the link. Information about the study was shared with a group of collaborators to facilitate data collection. Initial contact was not made with respondents before commencing the study. Study information inviting individuals to contribute to a study that investigated and to provide valuable evidence of medical students’ awareness,

skills, and attitudes toward proper EBM practice during the conflict in Sudan was disseminated, including the Participant Information Sheet (PIS) and link to the survey. The PIS included information regarding the study's aims, the protection of participants' personal data, survey length, and their right to withdraw from the study at any time. Participants were informed that this was a voluntary survey without any monetary incentives. The target population included Sudanese medical students , irrespective of their location within or outside Sudan, during the conflict period (first 8 months of conflict). Inclusion criteria were only validated in the survey asking participants to participate only if they want to .

Data collection

An online self-administered questionnaire was developed based on recent literature16–19, with further input from faculty members of the Department of Public Health and Community Medicine at the University of alzaiem alazhari, Khartoum Sudan. The questionnaire covered various domains, including sociodemographic data, The second part included two questions to assess the most commonly used search engines and sources of information .

The third part: included six questions to measure the skills in evidence-based medicine among undergraduate medical students and consist of a 5-point Likert scale answers in 5 scales from poor {1} to advanced {5}.

The fourth part: included eleven statements of questions to measure attitude toward using EBM in their future work as a health care professional among participating undergraduate medical students.

The last part: To assess the knowledge of evidence-based medicine terms related to statistics, epidemiology and study design .the questions were distributed with randomization to reduce the possibility of response bias and response validation (completeness check) for all the mandatory items was activated to prevent missed answers in the submitted responses and respondents were able to review and change their answers using a 'back button' function. To ensure questionnaire clarity and relevance, a pilot study involving 30 medical students from diverse academic backgrounds was conducted. Feedback was used to help improve the wording of the initial survey questions although respondents felt the majority of the questions were clear, relevant, and specific. Data collection was facilitated through Google Forms and distributed by a group of 26 collaborators to personal and professional groups, and via social media platforms including Facebook, WhatsApp, Twitter, and LinkedIn. Study information was also posted on Sudanese social media groups for students and reminders to complete the questionnaire were posted on days 3 and 7 of the data collection period. Respondents' IP addresses were not collected to maintain anonymity and confidentiality. However, Google Forms only permitted one submission from the same IP address.

Data management and statistical analysis

Responses were stored in Google Sheets secured with a password. Only the study team had access to participants' responses. We analyzed and described data using R software version 4.0.2, and the Statistical Package for Social Sciences (SPSS) software version 26 (https://www.ibm.com/docs/en/spss-statistics/26.0.0). Continuous data were presented as mean ±SD, and categorical data were presented as numbers (percentage). We used the Kolmogorov-Smirnov test to check the normality of the data. To find a

significant difference between groups, we used an independent t test for normally distributed data and Mann-Whitney U afterrejecting the null hypothesis of the KolmogorovSmirnov test of normal distribution. We used the Chisquare test or Fisher exact test to find if there was a significant difference between the groups for categorical data. A P-value less than 0.05 is considered significant.

Ethical approval

The study received a favourable opinion from the Research and Ethics Committee, University of alzaiem alazhari, Khartoum Sudan, adhering to ethical standards outlined in the 1964 Helsinki Declaration and its later amendments and other approved ethical guidelines. Informed consent was included in the data collection tool and obtained from all participants. The Checklist for Reporting Results of Internet E-Surveys (CHERRIES) was followed to ensure comprehensive and accurate reporting of the study findings. We confirm that all methods were carried out according to relevant research ethics guidelines and regulations. Before filling out the questionnaire, all the participants provided informed consent that was included at the beginning of the online questionnaire.

Data availability

The data set used and/or analyzed during the study are available from the corresponding author on reasonable request.

3. Results

participants information:

our cross sectional study included 1201 medical students nearly all private and public school from Sudan. the mean age was found to be 22.36 ± 2.36 (mean + SD), with most of the participants being female 61.0% (n=733), most of the students were fourth year 25.4% (n=305) and the rest almost equally divided amongst second 20.1% (n=241), third 21.0% (n=252) and fifth year 22.6% (n=272).

there is an increase in attendance of EBM training, as 51.3% of all students have previously attended an EBM training whether online or offline. this ratio is reflected on other variables as we will see, while majority 71.4% (n=857) of the students have attended research methodology courses. but when it comes to reading scientific literature, 50.4% of the students read scientific literature monthly or less, and 30.8% never read it all. the ruling majority of 93.5% (n=1123) have internet access at their homes or universities. As shown in Table (1)

Table 1: Baseline characteristics of medical students who completed the online survey in Sudanese universities (n = 1201)

Variables		Overall; n (%)	EBM Training; n (%)		P value
			Yes; 616 (51.3)	No; 585 (48.7)	
Age in years (mean ± SD)		22.36 ± 2.36	22.92 ± 2.35	21.76 ± 2.22	.184
Sex	Male	468 (39.0)	266 (43.2)	202 (34.5)	.003
	Female	733 (61.0)	350 (56.8)	383 (65.5)	
Marital status	Single	1149 (95.7)	583 (94.6)	566 (96.8)	.048
	Married	52 (4.3)	33 (5.4)	19 (3.2)	
	Divorced	00	00	00	00
	Widowed\widower	00	00	00	00
Educational year	Second	241 (20.1)	68 (11.0)	173 (29.6)	.000
	Third	252 (21.0)	101 (16.4)	151 (25.8)	
	Fourth	305 (25.4)	177 (28.7)	128 (21.9)	
	Fifth	272 (22.6)	194 (31.5)	78 (13.3)	
	Sixth	131 (10.9)	76 (12.3)	55 (9.4)	
Received or attended any physical or online course in biostatistics (yes)		689 (57.4)	470 (76.3)	219 (37.4)	.000
Received or attended any physical or online course in Research methodology (Yes)		857 (71.4)	549 (89.1)	308 (52.6)	.000
Family member (parent, sibling, spouse,.etc) working in health care services (Yes)		746 (62.1)	393 (63.8)	353 (60.3)	.120
Frequency of reading scientific literature:	Daily	41 (3.4)	22 (3.6)	19 (3.3)	.000
	Weekly	185 (15.4)	110 (17.9)	75 (12.8)	
	Monthly or more	605 (50.4)	336 (54.5)	269 (46.0)	
	Never	370 (30.8)	148 (24.0)	222 (37.9)	
Internet access at your university or home (Yes)		1123 (93.5)	581 (94.3)	542 (92.6)	.146

Which of the following do you have:	Private computer or laptop	670 (55.8)	373 (60.6)	297 (50.8)	.000
	Tablet	255 (21.2)	137 (22.2)	118 (20.2)	.210
	Smart phone	1034 (86.1)	531 (86.2)	503 (86.0)	.934
	Never	11 (0.9)	5 (0.8)	6 (1.0)	.465

main sources of health information among sudanese medical students:

easy to expect that google, wikepedia and google scholars are the three giant search engines used, 86.2% of students use google (n=1035), 50.5% use wikipedia (n=638) and 44.8% use google scholar (n=538), 50.5% use medline (n=606) and 33.7% use Medscape (n=405).

significantly higher percentage of students who attended EBM training use the following compared to their counterparts who didn't: Medline (59.9% vs 40.5% p value < 0.001), Medscape (40.7% vs 26.3% p value < 0.001) Cochrane Library (13.8% vs 3.9% p value < 0.001), Scoupus (6.8% vs 1.4% p value < 0.001), Web of science (16.1% vs 8.0% p value < 0.001) and Embase (6.8% vs 1.9% p value < 0.001)

medical books are the main sources of health information for 92.4% of the students (n=1110), followed by: scientific journals for 48.1% (n=578), professional guidelines for 43.0% (n=517) and lecture notes for 43.8% (n=526) of the students.As shown in Table (2)

Table 2: Search engines and main sources of health information among Sudanese medical students (n = 1201)

Variables		Overall; n (%)	EBM Training; n (%)		P value
			Yes; 616 (51.3)	No; 585 (48.7)	
Search engines used:	Google	1035 (86.2)	517 (83.9)	518 (88.5)	.013
	Google scholar	538 (44.8)	340 (55.2)	198 (33.8)	**.000**
	Wikipedia	638 (53.1)	335 (54.4)	303 (51.8)	.200
	Pubmed/Medline	606 (50.5)	369 (59.9)	237 (40.5)	**.000**
	Medscape	405 (33.7)	251 (40.7)	154 (26.3)	**.000**
	Cochrane Library	108 (9.0)	85 (13.8)	23 (3.9)	**.000**
	Scoupus	50 (4.2)	42 (6.8)	8 (1.4)	**.000**
	Web of science	146 (12.2)	99 (16.1)	47 (8.0)	**.000**
	Embase	53 (4.4)	42 (6.8)	11 (1.9)	**.000**
	Ovid	35 (2.9)	27 (4.4)	8 (1.4)	**.001**
	Connected papers	130 (10.8)	85 (13.8)	45 (7.7)	**.000**
Main sources of health information:	Medical books	1110 (92.4)	573 (93.0)	537 (91.8)	.244
	Scientific journals	578 (48.1)	305 (49.5)	273 (46.7)	.176
	Electronic media	387 (32.2)	198 (32.1)	189 (32.3)	.951
	Professional guidelines	517 (43.0)	283 (45.9)	234 (40.0)	.022
	Leaflets	112 (9.4)	66 (10.7)	47 (8.0)	.115
	Lecture notes	526 (43.8)	268 (43.5)	258 (44.1)	.835
	Opinion of health professionals	500 (41.6)	257 (41.7)	243 (41.5)	.949

self-reported skills in EBM:

we reported students' rating of their own skills in six main areas: Locating professional literature, Searching online databases, Critical appraisal of a scientific publication reporting findings from clinical research, Identifying knowledge gaps in practice, Critical appraisal of available scientific literature and Identifying patient-relevant clinical questions. most students reported having limited experience for all 6 areas, followed by average experience, with some variation in students' percentages between skills. there was no significant variance between students who have attended EBM training and those who haven't in most of these skills as the overall score is 2.44 ±0 .91 vs 2.38 ± 0.97 which corresponds to the same range of: limited experience-average mentioned above As shown in Table (3)

Table 3: Responses on a 5-point scale to the question: "How would you rate your skills in the following areas?" among Sudanese medical students (n = 1201)

Parameter	Value							P value
	n (%)					Mean ± SD		
	Poor	Limited experience	Average	Above average	Advanced	Students with EBM training	Students without EBM training	
Locating professional literature	380 (31.6)	352 (29.3)	274 (22.8)	141 (11.7)	54 (4.5)	2.27 ± 1.13	2.29 ± 1.19	.096
Searching online databases	180 (15.0)	363 (30.2)	316 (26.3)	251 (20.9)	91 (7.6)	2.79 ± 1.14	2.73 ± 1.18	.152
Critical appraisal of a scientific publication reporting findings from clinical research.	384 (32.0)	369 (30.7)	267 (22.2)	145 (12.1)	36 (3.0)	2.25 ± 1.10	2.22 ± 1.12	.181
Identifying knowledge gaps in practice (fields where not enough scientific literature is available to answer specific clinical question)	352 (29.3)	367 (30.6)	268 (22.3)	180 (15.0)	34 (2.8)	2.37 ± 1.38	2.26 ± 1.11	.356
Critical appraisal of available scientific literature.	378 (31.5)	370 (30.8)	260 (21.6)	152 (12.7)	41 (3.4)	2.27 ± 1.09	2.24 ± 1.17	**.042**
Identifying patient-relevant clinical questions.	247 (20.6)	340 (28.3)	317 (26.4)	222 (18.5)	75 (6.2)	2.67 ± 1.16	2.55 ± 1.19	**.013**
Mean overall score						2.44 ± .91	2.38 ± .97	.142

Attitudes of medical students towards using EBM in health care practice:

we did not find any significant differences between the attitude of students who have attended the EBM training and their counterparts who have not. the majority of students either strongly agreed or agreed on most of the areas except on three areas:

1. **All types of studies are of equal value**
2. **EBM means an unrealistic burden to health care professionals in the daily routine patient care**
3. **Textbooks are the most optimal source of information, when a question regarding the care of patients should be answered**

in which the majority chose different options as mentioned in the below table. As shown in Table (4)

Table 4: Response frequency and means of ratings to the question: “On a scale ranging from ‘strongly disagree’ to ‘strongly agree’ how would you rate your opinion about the following statements?” among Sudanese medical students (n = 1201)

Questions	Value							P value
	n (%)					Mean ± SD		
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Student with EBM training	Student without EBM training	
Evidence based medicine (EBM) is important for the practical work of physicians	52 (4.3)	3 (0.4)	100 (8.3)	414 (34.5)	430 (52.5)	4.31 ± .97	4.29 ± .95	.884
During my studies, I would like to improve my skills in applying EBM during my practical work as a medical profession	46 (3.8)	22 (1.8)	121 (10.1)	433 (36.1)	579 (48.2)	4.23 ± .99	4.23 ± .95	.298
EBM is important for patients to receive the optimal treatment	55 (4.6)	23 (1.9)	143 (11.9)	444 (37.0)	536 (44.6)	4.15 ± 1.02	4.15 ± 1.01	.808
EBM facilitates decisions about individual patient's care	48 (4.0)	40 (3.3)	180 (15.0)	461 (38.4)	39.3)	4.06 ± 1.02	4.05 ± 1.01	.972
EBM considers the personal expertise of physicians	43 (3.6)	70 (5.8)	259 (21.6)	466 (38.8)	363 (30.2)	3.86 ± 1.03	3.87 ±1.03	.744
EBM considers views and preferences of patients regarding their own therapy	47 (3.9)	83 (6.9)	277 (23.1)	449 (37.4)	345 (28.7)	3.78 ± 1.07	3.82 ± 1.03	.345
It is important to incorporate research results into healthcare practice	47 (3.9)	35 (2.9)	128 (10.7)	447 (37.2)	544 (45.3)	4.16 ± 1.01	4.18 ± .98	.724
All types of studies are of equal value	130 (10.8)	259 (21.6)	274 (22.8)	309 (25.7)	229 (19.1)	3.21 ± 1.27	3.20 ± 1.28	.977

BM means an unrealistic burden to health care professionals in the daily routine patient care	137 (11.4)	253 (21.1)	293 (24.4)	293 (24.4)	225 (18.7)	3.16 ± 1.29	3.19 ± 1.26	.608
Textbooks are the most optimal source of information, when a question regarding the care of patients should be answered	79 (6.6)	227 (18.9)	283 (23.6)	371 (30.9)	241 (20.1)	3.38 ± 1.19	3.40 ± 1.19	.804
s a future healthcare practitioner, I find life-long learning as vital	51 (4.2)	50 (4.2)	156 (13.0)	406 (33.8)	538 (44.8)	4.12 ± 1.04	4.09 ± 1.07	,667
Mean overall score						3.86 ± .70	3.86 ± .70	.766

Knowledge of terms related to EBM:

Sample size was found to be the most understood term as 49.6% (n=596) of the participants can understand it and explain it to others, followed by other statistical terms like: mode 48.5% (n=582) and median 46.1% (n=554).

case report was the most known term related to study design with a ruling majority of 46.8% (n=262) of the students understanding it and capable of explaining, while meta-analysis is not as well-understood term as only 19.9% of students fully understand it.

in epidemiology, we find that prevalence and incidence are the most understood terms, as 43.2% and 43.6% of students fully understand them, respectively. As shown in Table (5)

Table. 5 Self-reported understanding of evidence-based healthcare-related terms among Sudanese medical students (n = 1201)

	Value; n (%)				
	I understand and I could explain to others	Some understanding	Do not understand, but would like to understand	Do not understand, but I think, it wouldn't be helpful to me to understand	No idea about this
Parameter					
Terms related to study design:					
Case report	562 (46.8)	428 (35.7)	139 (11.5)	26 (2.2)	46 (3.8)
Cohort study	414 (34.5)	445 (37.1)	306 (17.2)	37 (33.1)	66 (5.5)
Randomized control trial	415 (34.6)	390 (32.5)	268 (22.3)	48 (4.0)	80 (6.7)
Meta-anylsis	239 (19.9)	418 (34.8)	382 (31.8)	62 (5.2)	100 (8.3)
Systematic review	393 (32.7)	434 (36.1)	270 (22.5)	34 (2.8)	70 (5.8)
Cross-sectional study	480 (40.0)	411 (34.2)	188 (15.7)	52 (4.3)	70 (5.8)
Case-control study	498 (41.5)	420 (35.0)	168 (14.0)	52 (4.3)	63 (5.2)
Terms related to statistics:					
Confidence interval	365 (30.4)	385 (32.1)	298 (24.8)	43 (3.6)	110 (9.2)
Sample size	596 (49.6)	347 (28.9)	152 (12.7)	52 (4.3)	54 (4.5)
Mode	582 (48.5)	318 (26.5)	200 (16.7)	46 (3.8)	55 (4.6)
Median	554 (46.1)	349 (29.1)	187 (15.6)	42 (3.5)	69 (5.7)
Interquartile range (IQR)	295 (24.6)	371 (30.9)	369 (30.7)	52 (4.3)	114 (9.5)
Standard deviation (SD)	444 (37.0)	393 (32.7)	248 (20.6)	40 (3.3)	76 (6.3)
Precision and accuracy	297 (24.7)	407 (33.9)	348 (29.0)	55 (4.6)	94 (7.8)
Representative sample	357 (29.7)	408 (34.0)	295 (24.6)	47 (3.9)	94 (7.8)

Test power	218 (18.2)	357 (29.7)	437 (36.4)	60 (5.0)	129 (10.7)
P-value	306 (25.5)	390 (32.5)	351 (29.2)	57 (4.7)	97 (8.1)
Type I and type II errors	232 (19.3)	367 (30.5)	515 (34.6)	65 (5.4)	122 (10.2)
Terms related to Epidemiology:					
Relative risk	442 (36.8)	371 (30.9)	283 (23.6)	27 (2.2)	78 (6.5)
Absolute risk	369 (30.7)	492 (32.6)	317 (26.4)	44 (3.7)	79 (6.6)
Odd ratio	334 (27.8)	371 (30.9)	353 (29.4)	47 (3.9)	96 (8.0)
NNT (number needed to treat)	263 (21.9)	328 (27.3)	438 (36.5)	49 (4.1)	123 (10.2)
Sensitivity of a diagnostic test	382 (31.8)	346 (28.8)	328 (27.3)	49 (4.1)	96 (8.0)
Specificity of a diagnostic test	392 (32.6)	349 (29.1)	314 (26.1)	53 (4.4)	93 (7.7)
Heterogeneity	245 (20.4)	349 (29.1)	409 (34.1)	61 (5.1)	137 (11.4)
Publication bias	295 (24.6)	349 (29.1)	373 (31.1)	54 (4.5)	130 (10.8)
Lost to follow-up	270 (22.5)	327 (27.2)	417 (34.7)	44 (3.7)	143 (11.9)
Randomization	405 (33.7)	375 (31.2)	278 (23.1)	58 (4.8)	85 (7.1)
Intention-to-treat analysis	228 (19.0)	312 (26.0)	452 (37.6)	77 (6.4)	132 (11.0)
Prevalence	519 (43.2)	351 (29.2)	218 (18.2)	38 (3.2)	75 (6.2)
Incidence	524 (43.6)	355 (29.6)	207 (17.2)	40 (3.3)	75 (6.2)
Positive predictive value	336 (28.0)	338 (28.1)	365 (30.4)	53 (4.4)	109 (9.1)
Hierarchy of evidence	256 (21.3)	309 (25.7)	436 (36.3)	70 (5.8)	130 (10.8)
Clinical effectiveness	293 (24.4)	366 (30.5)	387 (32.2)	57 (4.7)	98 (8.2)
Practical guideline	329 (27.4)	355 (29.6)	359 (29.9)	51 (4.2)	107 (8.9)

Evidence-based medicine	443 (36.9)	399 (33.2)	240 (20.0)	45 (3.7)	74 (6.2)

EBM and patient care:

majority of students reported that their skills in practicing EBM in patient management is average except of rating the validity of an article, 39.3% reported their skills as average and 39.3% reported them as below average.As shown in Table (6)

Table 6.

Parameter		N (%)
Management of patients, clinical articles are:	Not at all important	30 (2.5)
	Minimally important	82 (6.8)
	Important	514 (42.8)
	Very important	288 (24.0)
	Essential	287 (23.9)
When presenting a patient, how would you rate your skills at formulating a key clinical question?	Outstanding	39 (3.2)
	Minimal	222 (18.5)
	Below average	170 (14.2)
	Average	550 (45.8)
	Above average	220 (18.3)
For a specific clinical question, how would you rate your skills at finding the best clinical evidence to answer the question?	Outstanding	32 (2.7)
	Minimal	261 (21.7)
	Below average	207 (17.2)
	Average	504 (42.0)
	Above average	197 (16.4)
For a selected article, how would you rate your skills at appraising The validity of the article?	Outstanding	33 (2.7)
	Minimal	319 (26.6)
	Below average	472 (39.3)
	Average	472 (39.3)
	Above average	135 (11.2)

4. Discussion

Evidence-based practice has become a crucial component of general practice and primary healthcare delivery, especially with the public’s expanding access to health-related information and demand for accountability. EBM encompasses all aspects of the clinical decision-making in medicine, from diagnosis to treatment. The knowledge and skills for EBM is becoming a core competence to be acquired by all physicians (14).

In comparison to similar studies, our findings indicate an increased engagement in Evidence-Based Medicine (EBM) training, with 51.3% of students having attended sessions, either online or offline. This contrasts with a study in Iran where 71.5% reported no education on EBM or online search methods.2 The observed rise in EBM training participation suggests a positive trend in enhancing students' familiarity with these crucial practices in medical education(15).

The findings from this questionnaire reveal that a majority of medical students exhibited lack of knowledge of EBM and its fundamental concepts. The assessment of knowledge across six key areas related to EBM, including locating professional literature, searching online databases, critical appraisal of scientific publications, identifying knowledge gaps in practice, appraising available scientific literature critically, and identifying patient-relevant clinical questions, yielded consistently low scores(16). A study conducted in Iran similarly indicates limited knowledge. Additionally, other studies have highlighted a low level of awareness of evidence-based medicine among general practitioners in countries such as Norway, Sudan, and England 3 4 5. On the contrary, a study conducted with occupational therapy students in Ireland reported substantial knowledge and awareness.6 Similarly, another study focusing on medical students in Peshawar, Pakistan, also revealed a comparable level of understanding and awareness(17).

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Moreover, our analysis indicates that there is no significant difference in skill levels between students who attended EBM training and those who did not. This suggests a consistent trend in the assessed competencies, emphasizing the need for targeted interventions to enhance understanding and proficiency in EBM among medical students(18)."

The understanding of certain terms related to EBM terms varied among participants. Notably, "sample size" emerged as the most comprehensible statistical term, with 49.6% capable of explaining it. Other statistical terms like "mode" and "median" followed closely, with 48.5% and 46.1%, respectively. In terms of study design, "case report" stood out as the most recognized term, with a substantial majority of 46.8% of students comprehending and explaining it(19). Conversely, "meta-analysis" was less well-understood, with only 19.9% of students having a full understanding. In the field of epidemiology, "prevalence" and "incidence" were the most understood terms, with 43.2% and 43.6% of students, respectively, demonstrating a comprehensive understanding(20).

In a study in Iran Most students reported they do not understand but would like to understand some of the technical terms used in EBM. "Incidence rate" was the term best understood, while "Prevalence" was understood the least.2 In a Sudanese study, doctors exhibited varying knowledge levels about several EBM

terms. The meaning of risk factors was known by 67 (83%) respondents, and the definitions of relative risk, absolute risk, and sensitivity were known by 56 (70%)(21).

The participants overwhelmingly exhibited a positive attitude towards Evidence-Based Medicine (EBM) and recognized its significance in patient management. Notably, no notable differences surfaced in the attitudes of students who received EBM training compared to their counterparts(22). The majority of students expressed strong agreement or agreement on various aspects, reflecting an overall positive stance towards EBM. This trend aligns with findings in medical literature from Iran, Pakistan, and Sudan, suggesting a promising foundation for the incorporation of EBM into the medical curriculum (23). Conversely, a study among physical therapy students in the Netherlands reported a less optimistic attitude toward EBM(24).

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The consensus among the majority of our respondents is Evidence-based medicine (EBM) is important for the practical work of physicians, and guaranteeing optimal treatment for patients. The survey highlights a shared ambition among medical professionals to enhance their EBM application skills in practical settings. This aligns with findings from studies conducted among both students and general physicians, emphasizing the widespread recognition of EBM's pivotal role in elevating healthcare practices and outcomes(25).

in India, a survey study was carried out among physicians working in top government and private hospitals in Hyderabad (India) revealed that physicians have positive attitudes toward EBMP. They also agree that EBMP is obligatory on the part of physicians—professionally, ethically, and legally. They indicated a high usage rate of print and electronic sources, which suggests that health science libraries should be equipped to support physicians in EBM(15).

Despite the availability of easy and free access to evidence-based resources, the predominant source of health information for medical students in Sudan remains medical books, with 92.4% relying on them, followed by scientific journals. Like a study in Hungary suggested that students depend on textbooks and expert opinions when seeking clinical information(26).Interestingly, only a minority of respondents were aware of Evidence-Based Medicine (EBM) resources, a trend observed in other studies as well.

Notably, students who underwent Evidence-Based Medicine (EBM) training demonstrated notably higher usage rates for specific sources, including Medline, Medscape, Cochrane Library, Scopus, Web of Science, and Embase. This underscores the significance of Evidence-Based Medicine (EBM), emphasizing its importance in guiding students towards additional resources that offer substantial benefits in their academic and professional pursuits(27).

The Cochrane Library, recognized as a primary source for systematic reviews and meta-analyses, is underutilized among students, reflecting a lack of awareness. Similar observations were made in studies conducted in Norway, where over half of respondents were aware of the Cochrane Library but did not use it 13. In a Canadian study, only 5% of practicing clinicians used the Cochrane Library regularly(14).

The majority of students assessed their skills in applying Evidence-Based Medicine (EBM) to patient management as average. A study among resident doctors in Sudan, shows only 10% incorporated EBM into

50% to 100% of their clinical practice(4).

Sudan lacks of studies exploring undergraduates' opinions on EBM, prompting our investigation into their knowledge and attitudes. While our findings reveal a generally positive disposition and reasonable awareness of research among students, the actual completion of projects, presentations, and publications remains limited. This underscores the importance of cultivating a EBM culture among medical students. Addressing this requires further research, especially in developing and validating tools to assess Evidence-Based Practice (EBP) competencies in undergraduate curricula. Additionally, we need to broaden our research focus to evaluate how these competencies translate into real-world workforce settings. Enhancing evidence-based medicine skills in students not only enriches their academic experience but also contributes to a more research-informed and competent healthcare workforce, ultimately benefiting patient care and medical practice(1).

5. Limitations :Top of Form

While our study provides valuable insights, it is essential to acknowledge its limitations. Firstly, its cross-sectional design restricts the ability to establish causal relationships. Secondly, reliance on questionnaires introduces response bias, relying solely on participants' self-reporting. Although a commendable response rate was achieved, inherent limitations persist. The sample's representativeness may be impacted by the political circumstances in Sudan and financial constraints, limiting internet access for some students and potentially excluding their perspectives. These factors, combined with the specific university focus, emphasize the need for cautious interpretation and consideration of external factors influencing the study's scope and generalizability.

6. Conclusions and recommendations

Medical students lack knowledge and skills related to Evidence-Based Medicine (EBM) and have a neutral attitude towards its use in healthcare practice. Many rely on non-scientific search engines for medical information due to limited access to institutional resources. They primarily obtain medical information from books and lecture notes, highlighting the need for education on accessing scientific literature. To address this gap, intervention studies and EBM training are necessary to improve students' EBM knowledge. Additionally, university staff should focus on teaching secondary research methods such as systematic review and meta-analysis, as many students are unfamiliar with these concepts. Practical sessions should be included in the curriculum to enhance EBM skills, and the Ministry of Higher Education should promote the importance of EBM through scientific meetings and research involvement opportunities for students.

Declarations

Ethical approval and consent to participate

Ethical approval of the study was obtained from the IRB of Alzaiem Alazhari University. (reference number is not available).

Informed written consent from each participant was guaranteed before partaking in the study and confidentiality of the participants was secured.

The study was carried out according to the relevant ethical guidelines and regulations.

Consent for publication

Not applicable

Availability of data and material

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

Competing interest

The authors declare that they have no competing interests.

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Authors' contribution

M.H.J.A , EH, FS, MH: idea conception, study design. SA: Questionnaire design. AS,KM: Data collection and data creation. TA: Analysis planning, data analysis and interpretation. RA,LE,AM,MA,AH,OY,AY,EA,EA,SM and OA. Manuscript drafting. HA: Study design and Supervision. All authors revised the manuscript and approved it for publication.

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