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Real decisions of international medical students on choosing elective courses on general, internal, and evidence-based medicine at Kyiv Medical University

Abstract: Supplementing and improving education content as scientific and subject disciplines emerge is a main principle of curriculum development. Students' participation in this process is essential for implementing the standard for quality assurance in the European Higher Education Area. Medical students may benefit from gaining more competence in current issues of general, internal, and evidence-based medicine (EBM). The relevance of such elective courses (ECs) for international medical students has not been studied yet according to the literature review. The study object was a methodology for designing a curriculum in the system of higher medical education using a student-centered approach. The study subject was student-related factors influencing curriculum development in terms of making decisions on choosing ECs by international medical students at a clinical department of a medical university. The study aimed to describe features of students' decisions and determine student-dependent factors regarding the choice of ECs on current issues of general, internal medicine, and EBM by international medical students of Kyiv Medical University (KMU). This explorative, descriptive, comparative cross-sectional pilot study utilized a self-administered web questionnaire, which was answered in April 2024 by 46 international 6th- and 5th-year medical students of KMU coming from eight Asian and African countries (India, Pakistan, Sri Lanka, Iran, Türkiye, Nigeria, Ghana, and Tanzania) and registered in the KMU's Google Workspace. All participants were divided into three groups according to region: South Asia, West Asia, and West and East Africa. The literature review was performed using information analysis methods. The relevance of all proposed topics for ECs on the issues of EBM, rheumatology, and geriatrics was justified by their choice by all study participants with a frequency of 33,33% to 72,22% in different subgroups and by the average number of topics selected of 1,71 to 2,11 per person. Decisions to choose a course on practicing EBM in internal medicine were more often made by sixth-year students (72,22%) and those coming from South and West Asian countries (73,33% and 80,00%, responsively) than by 5th-year students (46,43%) and Africans (42,31%), whose greatest interest was in aspects of rheumatology. Neither gender factor nor current academic performance in internal medicine influenced students' decisions regarding the number and topics of ECs. Our study revealed a lack of student initiative concerning individual offering topics for ECs, facts of non-choice of an EBM

course in some regional subgroups, like a relatively low frequency of choice of ECs in geriatrics (33,33 and 35,71% among 6th- and 5th-year students, respectively), which confirmed the necessity of the guiding role of teachers in implementing a more student-centered approach in curriculum development and the role of student-dependent factor in this process such as their country of origin. The study results are partly consistent with the literature in terms of the need to study EBM at the undergraduate level of continuing medical education (CME), which can be influenced by national or regional features. The authors conclude that the curriculum content is worth adapting to a more student-centered approach, including the possibility of choosing the current issues in clinical medicine such as the EBM approach, etc. We estimated that the international students' choice of ECs topics depends on the year of study and the country of origin. The educators should consider the peculiarities of the different countries' healthcare systems when forming a list of optional educational components for international students in the final years of study.

Keywords: higher medical education, study program development, student-centered approach, elective courses, internal medicine, evidence-based medicine, international students, regional features.

Abbreviations:

CME – continuing medical education;
EBM – evidence-based medicine;
ECs – elective courses;
ECTS – European Credit Transfer and Accumulation System;
ESG – Standards and Guidelines for Quality Assurance in the European Higher Education Area;
HEI – higher education institution;
PHEE KMU – private higher educational establishment "Kyiv Medical University".

Introduction

Medical universities can increase their competitiveness when use the priorities of international students and other national stakeholders in the forming of the list of elective courses (ECs) in the curriculum. This approach increases the quality of higher medical education, the achievement of learning outcomes, and the development of future doctors' general and special competencies and creates individual learning paths.

The curriculum is a core of the higher education institutions' (HEIs') teaching mission. The involvement of students in the study programs' design and careful consideration process is essential for implementing the standard for quality assurance in the European Higher Education Area (*Standards and Guidelines…, 2015*). In Ukraine, even in conditions of war, the medical student cohort is the largest regarding a phenomenon of international student migration, i.e., deliberate temporary movement outside the country of their citizenship for the aim of acquiring knowledge, skills, and competencies and obtaining a degree of higher education (*Brenzovych & Nemesh, 2017*). Many universities develop study programs considering online teaching, and student migration's geography increasingly focuses on safe destinations and a search for ways to improve the effectiveness of international academic mobility programs (*Adamyk & Diachuk, 2023*). Given both global instability and technological development, Kyiv Medical University (KMU) as the best private HEI in Ukraine with its 30-year history provides both online and

offline educational services. Foreign medical students' teaching is organized predominantly in the Polish campus of PHEE KMU, while there are difficulties in attending face-to-face courses due to the lack of safety in Kyiv.

As is known, the curriculum development main principle is to supplement and improve education content as scientific and subject disciplines emerge. The generally accepted position is the critical importance of a study of evidence-based medicine (EBM) issues, like the ways to implement this approach to clinical practice and medical education to improve the quality of medical and educational services. Continuing medical education (CME) on EBM is becoming "a priority in the healthcare process" (*Sabouni et al., 2017*). The great educational value of EBM as a process and a method of decision-making, problem-solving, and self-directed life-long learning is appreciated (*Prasad, 2013*; *Revenok et al., 2016*). Awareness of EBM varies across regions and states being less in developing countries with weak regulations and those dominated by traditional medicine (*Hashem-Dabaghian et al., 2022*; *Moradi & Hosseini, 2017*; *Prasad, 2013*; *Puzanova, 2011*). The situation is different in the homeland of EBM (*Prasad, 2016*; *Revenok et al., 2016*): the discipline was introduced to the foundation year program in the UK. In the USA and Canada, the practice of EBM was included in accreditation standards for medical schools. 20 years ago, 38,5% of medical schools in the USA had a formal EBM curriculum (*Sabouni et al., 2017*). Talking about the quality of education in the conditions of lack of safety, multiple strategies of teaching EBM using online courses, lectures, tutorials, workshops, etc. turned out to be more effective than "face-to-face expert-taught courses", as it was estimated in developing countries (*Sabouni et al., 2017*).

A specialized academic discipline "Internal medicine" is a core of the health professionals' development regardless of their medical specialties in the future. One of the most difficult sections of this discipline to master is the content module "Rheumatology", particularly a diagnosis the rheumatic diseases, considering the objective complexity of their recognizing and limiting the relevant section of the discipline "Propaedeutics of internal medicine" to only the study methods of the musculoskeletal system's examination. As a result, 5th-year medical students at Ukrainian HEIs may start studying this content module without sufficient knowledge of the basics of rheumatology.

Contrary to the global trend of aging populations and specific features of the management of internal and rheumatic diseases in the elderly, neither the "Geriatrics" section nor the propaedeutic nor the EBM approach in this field of gerontology and internal medicine is presented as the main components in the current curricula.

This is personal and international experience to develop a system of CME on the issues of EBM (*Gruzieva & Puzanova, 2015*; *Povoroznyuk & Puzanova, 2019*; *Puzanova, 2011*; *Puzanova, 2018*; *Prasad, 2013*; *Revenok et al., 2016*), like the global trend of population aging and the Decade of healthy aging's challenges (*UN Decade…, 2021*) and learning outcomes in rheumatology as a complicated part of the discipline "Internal medicine" that allow us to predict a benefit for medical students from gaining more competence in the issues of EBM in internal diseases, especially rheumatic and geriatric ones, from outside the formal curricula. So, it seemed reasonable to offer these issues to study on elective courses (ECs). Namely, senior students could benefit most from these topics' implementation, because of their integrative nature and practical orientation.

Despite the obvious relevance of the above topics from the point of view of medical school teachers, their demand for medical students as ECs remains unstudied. The determination of interest of medical practitioners in training by their clinical relevance was evidenced in Nigeria (*Iloh et al., 2020*). Regarding medical students, the year of study at university turned out to be a factor influencing the effectiveness of EBM training (*Çakmakkaya, 2021*).

The need for certain thematic training may be related to the year and current content of curriculum or the type/level in the healthcare system of the institution where the physician works, like to their age, gender, marital status, type of membership, interpersonal interactions, teacher's features, etc. Concerning EBM, a literature review showed that most primary care physicians and medical interns have low knowledge and poor practice of this approach, whereas their attitude towards EBM differs from neutral to positive. Knowledge, attitude, and practice of EBM are better among specialists of tertiary and secondary healthcare institutions (*Alabdullah et al., 2022*; *Ambulkar et al., 2017*; *Sabouni et al., 2017*; *Zanaridah et al., 2021*). Participating in the CME system development on evidence-based prevention in healthcare in Ukraine in 2009-2015, we found low knowledge and skills in EBM and a high need to improve them in 252 Kyiv physicians affiliated with primary link of healthcare (*Puzanova, 2018*), but even having developed a new discipline "Methodology of EBM" and introduced it into a system of CME in Ukraine, we did not study factors related to the student's interest to EBM.

So, international and personal experience suggests the role of student-dependent factors (individual, group, and regional) in their decisions on flexible learning paths, in particular, on the number and topics of preferred educational sections from outside the formal curricula. Regional features of decision-making on the choice of ECs are of particular interest in the context of international student mobility/migration and a significant proportion of medical students among foreign students who receive higher education in Ukraine.

To the best of our knowledge, there is no study of international medical students' decisions regarding the choice of ECs, in particular, dedicated to clinical issues of EBM and other current topics of general, internal, and geriatric medicine.

The study hypothesized that there was no difference in the number and topics of ECs chosen by foreign senior medical students of our university, regardless of student-related factors such as gender, year of study at university, and the country/region from which they came to study.

The study object is a methodology for designing study programs in the system of higher medical education using a student-centered approach, while the subject is student-related factors influencing curriculum development at medical HEI in terms of making decisions regarding the choice of elective courses' number and topics by international medical students at a clinical department.

The purpose of the study was to describe features of students' decisions and to determine student-related factors regarding the choice of ECs on current issues of general, internal, and evidence-based medicine by international medical students of PHEE "Kyiv Medical University", Ukraine.

So, the tasks of the study were:

(1) to justify several topics for ECs on the issues of general, internal, and evidence-based medicine and determine their relevance in a cross-section of international fifth- and sixth-

year medical students who studied the discipline "Internal Medicine" at the Department of Internal and Occupational Diseases of the KMU – in a survey using a self-administered web-based questionnaire;

(2) to explore and evaluate student-dependent factors that may influence survey results;

(3) evaluate the novelty of the results obtained concerning an EC devoted to the evidence-based approach in clinical discipline and practice.

Methods

This was an explorative, descriptive, and comparative cross-sectional pilot study performed on 46 5th- and 6th-year medical students of Kyiv Medical University who came from several Asian and African countries. In this paper, the term "undergraduates" is used to refer to sixth-year students, while the term "senior students" is used to refer to 5th- and 6th-year students. The terms "foreign students" and "international students" are used as synonyms.

Data collection was done using a self-administered electronic questionnaire covering information on the offered topics for ECs, which was answered in April 2024 and registered in the KMU's Google Workspace. The study of the survey results involved analysis in subgroups formed considering student-related factors such as gender and age, year of study, country, and region from which they came. A literature review was conducted to evaluate the novelty of the results obtained and to identify further directions for research.

Main principles and methods of scientific knowledge and research were used in the study including universal ones and methods of a systemic approach, quantitative and qualitative information analysis (bibliographic method and content analysis), systematization of theoretical and empirical data, historical, logical, sociological, and expert assessment. Mathematical statistics methods for processing the obtained quantitative results of the study. Frequencies and percentages were used for reporting descriptive statistics in the study cohort and its subgroups.

Having been applied to the first task of the study, these methods allowed us to identify five topics of ECs, dedicated to critical issues of the discipline "Internal Medicine", and to determine their relevance in the studied cohorts (*Figure 1*; *Figure 2*). These issues were EBM implementation, rheumatic disease diagnosis, and gerontological aspects of internal medicine and rheumatology. Accordingly, the topics were named as follows:

(1) "Basics of diagnosis in rheumatology";

(2) "Basics of geriatrics: Internal diseases in the elderly";

(3) "Rheumatic diseases in the elderly and of the elderly";

(4) "Evidence-based approach in internal medicine".

Thus, most of the topics were determined by the teachers. To answer the question of who should offer ECs, we quote Narges' team, who considered faculty to be a "key to the success of implementing changes both in classrooms and in clinical wards" (*Narges et al., 2013*). By offering the 5th option "Other (Indicate in a comment, which one namely)", we were counting on the student initiative and their constructive suggestions but did not receive any.

The study cohort consisted of 18 6th-year students and 28 5th-year students who came from several African and Asian countries and studied the discipline "Internal Medicine" at the Department of Internal and Occupational Diseases of the KMU at the same time. All participants were aged 20-29 years. A similar age group of 21-30 years was presented in two

recent studies on factors influencing EBM practice in Iran and its institutionalizing in Nigeria (*Mohamadhoseinzadeh Hashemi et al., 2019*; *Nwaichi, 2020*). Gender factor was studied only in one of them (*Mohamadhoseinzadeh Hashemi et al., 2019*). As for our study, then the representation of women and men in the cohorts, depending on the year of study, is shown in tables, and depending on the country from which the students came is given in the Appendix (*Table 2*). In general, 22 men and 24 women took part in the study (*Table 1*).

The sample included 46 representatives from 8 countries, namely 3 African ones (Nigeria, Tanzania, Ghana), 3 South Asian ones (India, Pakistan, Sri Lanka), and 2 West Asian countries (Iran, Türkiye). It was a cross-section, and the participants took part in a survey in April 2024.

The students' answers on the preferable ECs were collected by using a self-administered web-based questionnaire. This questionnaire was an answer to a question of the Google form ("Which elective course(s) would be of the most interest to you personally if you were a 5th-year student now?"), provided at the end of the sessions in the discipline "Internal medicine", but not during practical classes. The survey was voluntary but not anonymous, and all responders returned their answers on time (so, the response rate in our study was 100%). This Google form named "My choice among the elective courses proposed for the future 5th-course medical students" is situated on the topic «Feedback and propositions for the future».

We found in the literature that different tools, including self-administered, paper- and web-based, were used in surveys to assess undergraduates' and postgraduates' attitudes towards EBM, like their knowledge, skills, awareness, practice, needs, and barriers (*Alabdullah et al., 2022*; *Ambulkar et al., 2017*; *Çakmakkaya, 2021*; *Mohamadhoseinzadeh Hashemi et al., 2019*; *Sabouni et al., 2017*). The Noor EBMQ and self-reported composite questionnaires like a composition of McAllister, Berlin, and Zwolsman's questionnaires in a recent Nigerian study (*Oluwadiya et al., 2024*) are used in this research area. Along with a lack of validated national language EBM assessment tools, some questionnaires are considered to be reliable and validated tools (*Alabdullah et al., 2022*; *Çakmakkaya, 2021*).

All answers of the participants of the study were collected and studied in April 2024 after successfully finishing the 11th and the 10th semester in "Internal medicine" responsively by 18 sixth-year students (16 hours of practical classes devoted to different internal diseases and provided in March and April 2024) and 28 5th-year students (22 hours of practical classes in rheumatology and nephrology provided in April 2024).

All students were taught by the same professor, who is one of the developers of the system of CME in the discipline "Methodology of EBM" in Ukraine (*Gruzieva & Puzanova, 2015*; *Povoroznyuk & Puzanova, 2019*; *Puzanova, 2016*; *Puzanova, 2018*; *Revenok et al., 2016*), and a high-degree specialist in both internal medicine and rheumatology. This is significant to note in terms of the teacher factor as a potential confounding factor in the study, as was noted concerning teaching EBM (*Maggio et al., 2013*; *Narges et al., 2013*).

It is worth noting that the basics of EBM methodology were taught to the students in their 4th year of curriculum by a faculty member of the Department of Public Health and Microbiology of the KMU.

The study of students' responses was comprehensive. We used mathematical statistics and expert assessment methods to estimate the role of respondents-related factors such as their age,

gender, year at university, current performance in the discipline "Internal Medicine", and country/region, from which they came.

As for their current performance (average grade point), the KMU grading system is harmonized with the European Credit Transfer and Accumulation System (ECTS), according to which grades are as follows: A means "excellent", B is "very good", C is "good", D is "satisfactory", E is "sufficiently". Receiving any of these grades in terms of awarding of credits means "passed", while grades F and Fx mean "failed". All participants of our study passed the credit in internal medicine, and the representation of their grades among students coming from different countries is shown in the Appendix (*Table 2*).

Concerning the potential role of the regional features, the participants came from 2 Asian and 2 African subregions. These are India, Pakistan, Sri Lanka (commonly conceptualized as South Asian countries), Iran and Türkiye (which are West Asian countries), Nigeria, Ghana (both are West African), and Tanzania (which is a state in East Africa). For the study purpose and given a small sample size, participants from Nigeria, Ghana, and Tanzania were grouped as coming from African countries (*Table 2*).

To evaluate the novelty of our findings and conclusions on senior international medical students' need to improve their ability to use EBM in clinical practice, a literature review was performed. Its first step was a search on the Internet using keywords corresponding to the names of the countries from which the study participants came, just like the search term "evidence-based medicine".

The initial characteristics of the groups of study participants according to the year of study were as follows. The group of undergraduates (i.e., 6th-year students) included 18 persons of average age 25,5 (range from 23 to 29) with a ratio of men and women 1:1. Their distribution according to the countries from which they came was as follows: India – 6, Nigeria 4, Iran – 3, Ghana – 1, Sri Lanka – 1, Pakistan – 1, Tanzania – 1, Türkiye – 1. All students successfully completed the "Internal Medicine" course with practical classes in cardiology, rheumatology, gastroenterology, nephrology, endocrinology, and hematology at the Department of Internal and Occupational Diseases. As for their current performance in the discipline, their distribution according to the ECTS grades was as follows: A – 7 (38,89%), B – 5 (27,78%), C – 4 (22,22%), D – 1 (5,56%), E – 1 (5,56%). In their 6th year at university, the elective courses "eHealth", "Dietetics" and "Laboratory Diagnostics" were provided by the other departments of the KMU.

The 5th-year students' group included 28 persons (13 men and 15 women) of average age 23,6 (from 20 to 29) with a ratio of men and women 1:1,15. Their distribution according to the countries from which they came was as follows: Nigeria – 18, India – 4, Pakistan – 3, Iran – 1, Ghana – 1, Tanzania – 1. All students successfully passed the discipline "Internal medicine" in their 10th semester having practical classes in rheumatology and nephrology at the Department of Internal and Occupational Diseases. According to the ECTS grades, their distribution was as follows: A – 18 (64,29%), B – 1 (3,57%), C – 9 (32,14%).

Results

18 undergraduates participated in the study, as Fig. 1 and Table 1 show. They all completed and returned a Google form, and no one of them chose the last option ("Other"), while the

topics offered were chosen 38 times. On average, there were 2,11 ECs per student in this study subgroup. This result proved a high motivation of undergraduates for additional training in the current issues of the clinical discipline "Internal Medicine", just like their need to be guided in a decision-making process concerning elective courses.

The most popular topic for undergraduates was option № 4 ("EBM in internal medicine") chosen by almost ¾ of them (72,22%). Half of the respondents chose courses related to rheumatic diseases (options № 1 and № 3 – 55,55 and 50,00% responsively). The least popular topic, chosen by only one in three students (33,33%), was "Basics of geriatrics" – option № 2. Thus, the relevance of studying gerontology's clinical issues must be explained to medical undergraduates, while the need for providing EBM in clinical practice is both intuitively felt by them, and is contextual, and is the result of the continuity of the components of the study program.

Only one EC was chosen by a minority of undergraduates – by every third student (6 out of 18; 33,33%) – and in these cases, the topic of EBM predominated (4 out of 6; 66,67%). With the same rate 33,3% (6 out of 18), the undergraduates chose two ECs, and in these cases, the topic of EBM was also a leader (5 out of 6; 83,33%) combining either with "Basics of Rheumatology" (4 out of 6; 66,67%) or with "Rheumatic diseases in the elderly" (1 out of 6; 16,67%). In general, a majority (2/3) of respondents chose either one or two ECs, and a minority (1/3) – three or four topics. Three ECs were chosen by 2 undergraduates (11,11%), who preferred "rheumatologic" topics (№ 1 and № 3) in combination with either EBM (№ 4) or "clear" geriatrics (№ 2). Finally, all four proposed topics were chosen by 3 respondents (16,67%).

Was there a link between the main respondents' demographic features and numbers and topics of chosen ECs? Neither the student's age nor average grade point in the discipline "Internal medicine" turned out to be predictors for the choice of ECs in our study. Women chose only one EC more often than men (*Table 1*). The topic dedicated to EBM was quite equally attractive to both.

As it is highlighted above, the current performance in this group was on average very good: 66,67% of them were graded with A and B according to ECTS. The application of mathematical statistics methods in this small sample did not reveal a dependence of the number of ECs taken on the average grade point in internal medicine. The largest number of ECs (four) were taken by three students graded with A, B, or C. Two students graded with D and E chose one and two ECs responsively. The answers of the students graded A, who numerically dominated in this group (7 out of 18), were distributed as follows: 42,86% (n=3) preferred one EC, 28,57% (n=2) – two, and 14,29% each were those who chose three or four ECs. Most students graded with A in internal medicine (5 out of 7; 71,43%) chose a topic on EBM in internal diseases, but the rest 28,57% did not prefer this course.

The frequency of occurrence and share of ECs in the responses of all sixth- and fifth-year students who made up the study cohort (n=46) are presented in Fig. 2. Compared to the findings in undergraduates (*Figure 1*), the share of those who chose an EBM topic "decreased" due to the enlargement of a sample at the expense of 5th-year students from 72,22% to 56,52%, whereas the share of those who would study a course "Basics of diagnosis in rheumatology" remained at more than half (58,69% vs. 55,55% among 6th-year students).

Talking about fifth-year students (n=28), they all returned their responses (*Figure 1*; *Table 1*), and none chose the option "Other", while the other four named options were indicated in the Google form 48 times. On average, there were 1,71 ECs per student in this subgroup. Like with the undergraduates who chose 2,11 ECs per person, this result proved both high students' motivation for additional training in the current issues of internal medicine and their need for suggestions on the ECs' topics.

So, the most popular and equally interesting for men and women in the 5th year student group was the topic № 1 ("Basics of diagnosis in rheumatology") chosen by 60,71% of respondents (*Table 1*). The EBM-related topic was chosen by less than half of participants (46,43%). Like with the undergraduates, the option "Basics of geriatrics" turned out to be the least popular: it was chosen by 35,71% of students. So, the most interesting topic was the contextual one – a course that complemented a main component of the curriculum, which had been just learned according to the schedule.

Only one EC was chosen by every second 5th-year student (14 out of 28; 50%). The other half of the group chose more options, and it is worth indicating that the share of those who would take four ECs was only 7,14%.

Given the highest interest in the topic related to rheumatology in this study group, a link between current performance in the discipline "Internal Medicine" and the preferred options was suggested. Calculation showed that like in the undergraduate group, a majority of 5th-year students (19 of 28; 67,86%) were graded A or B according to ECTS. Most of them (11 of 19; 57,89%) chose only one EC. The responses of the students graded A, who numerically dominated in this group (18 out of 28; 64,29%), were distributed as follows: 61,11% (n=11) preferred only one EC, 22,22% (n=4) – two, 11,11% (n=2) – three, and 5,56% (n=1) – four ECs. Interestingly almost ¾ of students, who were graded A for learning rheumatology and nephrology and chose only one EC, preferred the related ("contextual") topics – either "Basics of diagnosis in rheumatology" (5 of 11; 45,45%) or "Rheumatic diseases in the elderly" (3 of 11; 27,27%) – in general, 72,73% (8 out of 11). Only two of them would take a course "EBM in internal medicine", and only one student chose "Basics of Geriatrics". Regardless of the number of chosen ECs, EBM was of interest to only 33,33% (6 of 18) students graded A and 77,78% (7 of 9) students graded C in "Internal medicine". The only student, who was graded B in rheumatology and nephrology, did not choose a course of EBM but preferred rheumatology-related topics № 1 and № 3.

Talking the whole studied cohort (n=46), 1,87 ECs per student were chosen (*Table 1*).

Thus, more than half of 5th-year students require more study in the issues of rheumatology although this section of "Internal medicine" is being taught in the current semester as a curriculum's mandatory component. Our study shows that the topic "Basics of diagnosis in rheumatology" is the most popular among the ECs offered for this student cohort, whereas in the final year at university when more knowledge and skills have been accumulated and medical practice has become more advanced, the topic of applying EBM is of greatest interest.

Thereby, from the perspective of a more student-centered approach for designing curricula and developing flexible learning paths, it is worthwhile to propose the elective components of a study program at a clinical department, but no more than two per semester and considering

current content. For 5th-year students, it is reasonable to strengthen their competence in rheumatology and nephrology in the 10th semester by learning an EC devoted to rheumatic diseases. However, considering the demographic trends and prospects (i.e., aging of the global population) and in the absence of the discipline "Geriatrics" in the curriculum, it seems reasonable to offer to 5th-year students namely the topics like "Rheumatic Diseases in the Elderly", "Kidney Diseases in the Elderly", etc. For undergraduates, more integral themes like "Evidence-based approach in internal medicine clinic", "EBM in geriatrics" etc. may be especially interesting and useful.

The regional features of a choice of ECs by the foreign medical students of Kyiv Medical University, estimated in our study, are summarized in the Appendix (*Table 2*). Table 3 shows the distributions of the students' decisions regarding the topic "EBM in internal medicine" in terms of regions and countries from which they came.

The Indian subgroup of our study included 10 participants: 6 undergraduates (2 men and 4 women) and four 5th-year students (3 men and a woman) (Table 2). Their current performance in "Internal medicine" was as follows: undergraduates received B, C, or D (3; 2; 1 person(s) responsively), while 5th-year students were graded A (n=2) or C (n=2). Interesting that the course on EBM in internal medicine was chosen only by the students graded C (n=4) and B (n=3). This topic was chosen by 83,33% of undergraduates (5 out of 6; one man and 4 women) and half of the 5th-year students (2 out of 4; both men), in total by 70,00 % of Indians – by 3 men and 4 women. Namely EBM turned out to be the most popular issue for undergraduates (as taken by 83,33% of them), whereas all 5th-students voted for the "Basics of diagnosis in rheumatology".

The average number of ECs per student in the subgroups was 2,00 in undergraduates and 2,25 in 5th-year students. Regardless of the year of study, half of the students voted for only one EC. As for the other halves, undergraduates chose from two to four ECs, and 5th-year students chose three to four courses per person.

The Pakistan cohort consisted of four men graded either A or C in "Internal medicine": one 6th year student (graded C and chose all proposed topics including EBM) and three 5th-year students (regardless of their grades in internal medicine, they all preferred to study "Basics of diagnosis in rheumatology", whereas the issues of EBM was of interest to 66,67%). Most 5th-year students (2 out of 3) chose three ECs (namely the topics №№ 1, 2, and 4) regardless of their grade A or C in internal medicine, and one student who was graded A chose only the topic "Basics of diagnosis in rheumatology". The average number of ECs per person among Pakistanis turned out to be 2,75.

Concerning the participant from *Sri Lanka*, he was an undergraduate graded A in internal medicine and chose to study both "EBM in internal medicine" and "Rheumatic diseases in the elderly". So, the average number of ECs per student in this subgroup was 2,00.

Thus, the *South Asian subgroup* (n=15, which is 32,61% in the study cohort) consisted of 8 undergraduates (4 men and 4 women; ratio 1:1) and 7 5th-year students (6 men and 1 woman, ratio 6:1), of which 10 were men and 5 were women (ratio 2:1). The topic "EBM in internal medicine" was chosen by a majority in this cohort (11 out of 15; 73,33%) and among their undergraduates (7 out of 8; 87,5%) and 5th-year students (4 out of 7; 57,14%).

As for 5th-year students from the South Asian region, there was no one from Sri Lanka, so, all participants were Indians and Pakistanis and preferred a course on diagnosis in rheumatology

(which expanded and improved the curriculum concerning the main component studied in the 10th semester). The topics devoted to EBM, geriatrics, and rheumatic diseases in the elderly were taken each by 57,14%.

In general, the EBM course was chosen by all those who came from Pakistan and Sri Lanka and by 70% of Indians.

The West Asian subgroup included only 5 representatives from Iran and Türkiye, so its share in the study cohort was 10,87%. Distinctive features of this cohort turned out to be the predominance of women, like Iranians, undergraduates, and those who received an A grade in the discipline "Internal medicine": the proportion of each of these characteristics was 80%.

Most Iranian students (75%) chose a study of EBM and preferred two ECs. A course on EBM was taken by all undergraduates (namely 2 women graded A and a man graded B). This topic was not chosen by one 5th-year student graded A in "Internal medicine"; she decided on the topics "Basics of geriatrics" and "Rheumatic diseases in the elderly".

The only participant from *Türkiye* was a 6th-year student graded A in internal medicine. Her decision was both a course dedicated to EBM along with a "Basics of Diagnosis in Rheumatology".

As can be seen from the Appendix (*Table 2*), a total of 26 *African students* participated in our study, including 22 from Nigeria and 2 each from Ghana and Tanzania.

The Nigerian subgroup was the largest compared to others in our study. It consisted of 4 undergraduates (2 men and 2 women) and 18 5th-year students (7 men and 11 women) and included 9 men and 13 women. Thus, due to 5th-year students, women predominated in the Nigerian subgroup with a share of 59,09%, and male to female ratio was approximately 2:3.

The topic "EBM in internal medicine" was chosen by half of the Nigerian cohorts – both general (11 out of 22) and Nigerians in their 5th and 6th years of university (9 out of 9 and 2 out of 4, respectively). Among the students graded with A in internal medicine, a share of those who chose EBM turned out to be less than half – 46,15% (6 out of 13).

Talking about four Nigerian undergraduates, their academic performance in internal medicine was not homogenous (two persons were graded with A, while the others received grades C and E. The course on EBM was chosen by those whose performance in the discipline was either "excellent" (grade A) or "sufficient" (grade E). In general, 50% of undergraduates (2 out of 4) were interested in EBM. The calculation showed that there were 2,11 ECs per person in this subgroup. More than one elective course were chosen by 75% of Nigerian undergraduates (3 out of 4), and in all these cases the topic "Basics of diagnosis in rheumatology" was taken.

As for 5th-year students coming from Nigeria (n=18), 66,67% of them were graded A (n=11) and B (n=1) in internal medicine. Every third person (33,33%) received a grade of C. In general, 50% of students (9 out of 18) were interested in EBM, and this topic was chosen by 57,14% of men (4 out of 7) and 45,45% of women (5 out of 11). There were 1,83 ECs per student in this subgroup. An almost equal number of participants chose the topics dedicated to either EBM (n=9) or diagnosis of rheumatic diseases (n=10; 3 men and 7 women) or rheumatic diseases in the elderly (n=8; 2 men and 6 women). Every third person was interested in studying geriatrics (n=6; 2 men and 4 women).

All participants from *Ghana* and *Tanzania* (n=4) turned out to be not interested in additional courses on EBM – although their current performance in internal medicine was graded with A

(75%) and B (25%). All of them without exception preferred to study the topic "Rheumatic diseases in the elderly and of the elderly". All undergraduates (n=2) from these African countries took more than one elective course, but none of them chose "EBM in internal medicine".

As Table 2 shows, among all participants who chose a course on EBM (n=26), the shares of students coming from Africa (namely Nigeria, n=11) and South Asian countries (India, Pakistan, and Sri Lanka; a total of 11 persons) turned out to be equal (each of 42,31%), although the sizes of these regional cohorts were different: 26 students were from Africa and 15 from South Asia.

Thus, we found differences in students' decisions regarding the offered ECs and their relation to a year of curriculum and the region and country from which students came.

Information analysis performed according to the objective and the tasks of our study revealed that, concerning knowledge and attitude to EBM training programs for medical students, several cross-sectional studies were provided in Türkiye (*Çakmakkaya, 2021*; *Coşkun et al., 2023*), Iran (*Narges et al., 2013*), etc. Similar surveys were conducted among physicians and other healthcare practitioners of tertiary and secondary link in India (*Ambulkar et al., 2017*), Sri Lanka (*Abeysena et al., 2010*), Iran (*Moosavi et al., 2020*), Nigeria (*Iloh et al., 2020*; *Nwagwu, 2008*; *Oluwadiya et al., 2024*), just like in Syria (*Alabdullah et al., 2022*), and among Ethiopian medical interns (*Yehualashet et al., 2021*), Malaysian emergency doctors (*Ahmad Ghaus et al., 2021*) and primary care practitioners (*Zanaridah et al., 2021*). In 2013, literature data on educational interventions addressing multiple skills on EBM in medical students of 12 different countries were systemically reviewed by Maggio et al. from Stanford University (*Kharaghani et al., 2016*).

As for Ukraine, in 2015 we were the first (*Gruzieva & Puzanova, 2015*) who study the sample of 252 Kyiv primary link physicians concerning their knowledge, skills, and attitude to EBM in the field of medical prevention (*Puzanova, 2018*) using a self-developed questionnaire (*Gruzieva & Puzanova, 2015*). A low level of knowledge and skills on the issue was found, which was consistent with the results of two surveys of tertiary healthcare professionals conducted by other authors in 2005 and 2009. The high need of our study's participants to improve their competence in EBM was found (*Puzanova, 2018*), so we confirmed the need to develop a system of CME on EBM and started to implement it in Ukraine.

Best practices in implementing EBM to improve quality in healthcare and medical education have been studied systematically (*Povoroznyuk & Puzanova, 2019*; *Puzanova, 2011*; *Puzanova, 2016*; *Puzanova, 2018*; *Revenok et al., 2016*). Concerning regional features of choosing ECs by medical students from different African and Asian countries, it is worth noting that some national and regional features of the implementation of EBM have been described by authors from India (*Prasad, 2013*; *Thakkar & Shyam, 2017*), Iran (*Hashem-Dabaghian et al., 2022*; *Kharaghani et al., 2016*; *Mohamadhoseinzadeh Hashemi et al., 2019*; *Moosavi et al., 2020*; *Moradi & Hosseini, 2017*; *Narges et al., 2013*), Nigeria (*Iloh et al., 2020*; *Nwaichi, 2020*), Germany (*Sabouni et al., 2017*), Syria (*Alabdullah et al., 2022*), and much is known about the EBM development by Western countries and China as old and new leaders in this regard, respectively (*Puzanova, 2016*).

Regarding the influence on the quality of clinical practice of EBM training sessions, the literature data are different. For example, the need to enhance EBM skills training in the current medical school curriculums was confirmed in 2021 in Malaysia given the results of a survey of

183 physicians and medical officers from the governmental hospitals' emergency departments (*Ahmad Ghaus et al., 2021*). We found the same conclusion in the other papers, too (*Ambulkar et al., 2017*; *Nwagwu, 2008*; *Subbiah, 2023*). It seems paradoxical that in the sample of 169 surgeons and trainees from 5 southwest Nigerian hospitals described in 2024 (*Oluwadiya et al., 2024*) those who received EBM training were not more likely to use this approach in the clinical decision-making process than those who were never trained, which allowed Oluwadia's team to indicate the need to reevaluate the quality of EBM training provided in the region (*Oluwadiya et al., 2024*).

Quoting articles by African and American authors published in 2008 and 2023, respectively, we note their similarities concerning the importance of EBM studying: "EBM should be part of the undergraduate medical curriculum in Nigeria" (*Nwagwu, 2008*), and "clinical trials training should be a part of medical education" (*Subbiah, 2023*).

It is worth noting the high need to improve the level of EBM consciousness and awareness among Nigerian medical HEIs' teaching staff highlighted 16 years ago (*Nwagwu, 2008*). Their paper (*Nwagwu, 2008*) reported a high rate (47,19%) of a high level of knowledge in EBM among 89 consultants of the teaching hospitals of medical educational institutions, while 52,81% had low knowledge. The study cohort included 82 males and seven females; every third was in the rank of professor and the others were with comparable frequency either lecturers, senior lecturers, readers, or non-academic consultants. Interestingly only 34% assessed their knowledge as low, while 66% had a high assessment of their knowledge. Neither age nor duration of service influenced their awareness of EBM. Concerning gender factors, there was no statistical association found, but more males reported awareness of EBM than females (52,43 vs. 47,57%). The disciplinary specialty turned out to be significant: the highest level of awareness about EBM (range from 65,32 to 72,12%) showed surgeons, obstetricians-gynecologists, and ear, nose, and throat doctors, whereas the lowest level (range from 1,2 to 1,55%) was reported by experts in biostatistics, epidemiology, and biochemistry.

In 2006, in line with global trends and practices, the Nigerian government recognized the relevance of evidence-based policies as a critical requirement for providing comprehensive reforms in healthcare (*Nwaichi, 2020*). In 15 years, as Nwaichi and his team reported, advanced knowledge of evidence-based decision-making was shown only by 1% of 424 Nigerian governmental and non-governmental agencies stuff (although they all were well-educated), whereas 36% did not know this approach (*Nwaichi, 2020*). Thus, a demand for EBM institutionalizing in the country was confirmed.

From regional and historical viewpoints, such a need was recognized in China much earlier than in Nigeria, in 1996 (*Puzanova, 2011*). As for India, then, considering its huge and growing population and the presence of a developed pharmaceutical industry, this country seemed to be a new regional leader in EBM (*Puzanova, 2016*), but a literature review revealed many regional features and barriers for the implementation of this approach in medical practice (*Ambulkar et al., 2017*; *Prasad, 2013*; *Thakkar & Shyam, 2017*). Similar challenges and obstacles to the development of EBM were estimated in Iran (*Hashem-Dabaghian et al., 2022*; *Mohamadhoseinzadeh Hashemi et al., 2019*; *Moradi & Hosseini, 2017*). The developing countries' need to use a multimodal approach to teaching EBM has also been substantiated (*Sabouni et al., 2017*).

In general, the similarity of barriers to EBM implementation and ways to eliminate them at different levels of healthcare systems has been evidenced (*Abeysena et al., 2010*; *Moosavi et al.,*

2020). Although sources of evidence are changing and constantly growing in quantity (*Subbiah, 2023*), the main databases of EBM remain the same. The problem of their low access and poor availability in low-moderate-income countries has long been identified. For example, in Nigeria, the most important EBM resources are well-known for teaching hospital consultants (*Nwagwu, 2008*), but not for most surgeons in the southwest region who still rely on traditional sources of information in their clinical practice (*Oluwadiya et al., 2024*).

In India, all residents have free access to the Cochrane Library, which is the main computer database of EBM (*Prasad, 2013*). Like in China (*Puzanova, 2011*), an international collaboration on EBM started in India in 1995 by providing workshops for medical college faculties and healthcare practitioners. In 2005, the South Asian Cochrane Network (SACN) was established to support EBM development in India and other South Asian countries such as Sri Lanka, Pakistan, Bangladesh, Bhutan, Nepal, the Maldives, and Afghanistan. Despite this, the lack of providing evidence-based cardiovascular prevention by 2993 Indian physicians at any level of healthcare was disclosed in 2009. Low EBM awareness and high misconception that EBM ignored clinical experience were found in 50% of surgeons who participated in the other survey in 2010. As of 2013, it was several attempts to include EBM in undergraduate or postgraduate curricula or exams (*Prasad, 2013*). As Prasad wrote at the time, the aim was to promote research and create a system of CME on EBM. The main perspectives were to develop medical education in EBM, including international collaboration concerning improved curriculums and educational materials.

However, in 2017 acceptance of EBM in India remained low, according to Thakkar and his colleagues (*Thakkar & Shyam, 2017*). Concerning a better situation in tertiary-level medical settings, Ambulkar and his team reported the results of a monocentric paper-based questionnaire survey of 123 anesthesiologists (76% of respondents), intensivists, surgeons and allied perioperative healthcare professionals provided at a Cancer Centre in Mumbai (*Ambulkar et al., 2017*). Given a response rate of 65%, most participants (98%) had a positive attitude towards practicing EBM in perioperative medicine, while only 54% of them had been trained in research methodology. The lack of knowledge of fundamental issues of EBM in this cohort confirmed the need to incorporate EBM into undergraduate medical education (*Ambulkar et al., 2017*).

In Malaysia, as of 2021 (*Ahmad Ghaus et al., 2021*; *Zanaridah et al., 2021*), a suboptimal level of knowledge on EBM was found in a survey of primary healthcare professionals conducted by Zanaridah and his co-authors. In the same year, a high level of knowledge of EBM was proved in half of the 200 emergency doctors in Kelantan. Other features in this cohort, according to Ahmad Ghaus and his colleagues, were positive attitude and good practice of EBM (*Ahmad Ghaus et al., 2021*).

As was reported in Sri Lanka (*Abeysena et al., 2010*), by 2007-2008 some form of training in EBM had been received by 28% of 315 secondary hospitals' physicians. EBM was practiced by 54% and considered to be "fundamental to professional practice" by 77% of participants. The response rate in the survey was 77,4%.

The same category of physicians was studied in a recent Iranian nationwide survey provided with a response rate of only 54,4% (*Moosavi et al., 2020*). 1524 researcher-designed questionnaires were completed, and the results obtained turned out to be similar to the data from the Kyiv sample of primary care doctors (n=252) (*Puzanova, 2018*). The main obstacles to practicing EBM

were similar in Sri Lanka, Kyiv, and Iranian cohorts studied in 2010, 2015, and 2020 respectively, but gender was indicated as a barrier-related factor only in Iran.

Talking about regional features of barriers to EBM teaching and learning at the postgraduate stage of CME, they seem to be similar in different countries (*Abeysena et al., 2010*; *Ahmad Ghaus et al., 2021*; *Mohamadhoseinzadeh Hashemi et al., 2019*; *Sabouni et al., 2017*; *Yehualashet et al., 2021*; *Zanaridah et al., 2021*). Developing countries were in focus of a study of the obstacles to EBM awareness reported by Sabouni and his team in 2017.

Having performed a content analysis of the other paper (*Mohamadhoseinzadeh Hashemi et al., 2019*), we confirm Iranian authors' attention to gender as a factor related to practicing EBM by physicians of Tehran secondary-referral hospitals. There were 150 participants in the survey (a response rate of 79%), including 53,3% males. Concerning causes of non-using research in clinical practice (such as organizational effects, research quality, research skills, and access to research findings), the role of physician features was studied, namely their age (including a subgroup of 21-30 years), gender, level of education (i.e., specialist, subspecialist or general practitioner), marital status, and type of membership (official or contractual). Neither gender nor marital status nor type of membership turned out to be associated with any of the indicated causes of non-practicing EBM. Female gender was not an obstacle to providing research in clinical practice. It was overwork, lack of time, motivation, facilities, and authorities' support indicated as the most important barriers.

So, we found several Iranian publications on their experience on teaching EBM (*Kharaghani et al., 2016*; *Moosavi et al., 2020*; *Narges et al., 2013*) and practicing EBM (*Hashem-Dabaghian et al., 2022*; *Jahangir, 2022*; *Mohamadhoseinzadeh Hashemi et al., 2019*; *Moradi & Hosseini, 2017*) and no any paper from Pakistan in the available databases.

Besides that, the papers dedicated to Syria and Egypt were of interest considering both international student migration from these countries (*Sabouni et al., 2017*) and the Syrian experience of a dramatic decline in the quality of medical services during and after the devastating war (*Alabdullah et al., 2022*). This stimulated Alabdullah and his co-authors to conduct a cross-sectional study of knowledge, attitude, and practice of EBM using a self-designed web questionnaire, which was answered by 214 physicians from secondary and tertiary teaching hospitals. As of 2022, most of them (77,6%) never studied the issues of EBM, a majority had low knowledge and neutral attitude to EBM, and either never or seldom joined CME for an update regarding EBM. In Egypt, in 2013 most physicians considered themselves to be practicing EBM, while in fact, they were not. Sabouni and his co-authors quoted that the other regional feature was wide misconceptions of knowledge in EBM (*Sabouni et al., 2017*).

Authors from Ethiopia (*Yehualashet et al., 2021*) described features related to practicing EBM in a survey of 403 medical interns at a regional state teaching hospital, such as a lack of knowledge, critical appraisal skills, and time for searching evidence, just like a negative attitude towards EBM.

Talking about Türkiye, Sabouni and his co-authors quoted the paper published in 2014 and reported that only 1% physicians of in this country attended EBM courses during their university life (*Sabouni et al., 2017*). As it was written in 2021 (*Çakmakkaya, 2021*), the EBM training ECs for 3rd-, 4th-, and 5th-year students have been individually developed and implemented by several medical schools in Türkiye, and it was suggested the feasibility of teaching the EBM's basics in

the 3rd year of the curriculum, given the results of a 78 students' survey, which evaluated this program's effectiveness using a national version of Fresno test. In 2023, the impact of EBM training on students' beliefs about the origins of COVID-19 was found in a cross-sectional study involving 2577 medical students from 49 medical schools (*Coşkun et al., 2023*).

Literature data indicate the influence on the implementation of EBM of several factors associated with medical students/healthcare professionals such as gender, year of the curriculum, type of membership, regional features and needs, or ethnicity, too (*Mohamadhoseinzadeh Hashemi et al., 2019*). The teachers' features can also be influencing (*Maggio et al., 2013*; *Narges et al., 2013*). In a literature review by L.A. Maggio and his team, it was established that the majority of EBM instructors (60%) were physicians and the majority of teaching interventions (60%) were focused on clinical students, while fewer papers informed on "preclinical" students taught in EBM (*Maggio et al., 2013*).

The obstacles to teaching EBM in Iranian HEIs were described in a qualitative study (*Narges et al., 2013*) from the views of both medical students and clinical academics. The academics suggested the need to teach the faculties first to encourage them to act as role models and provide opportunities to use EBM skills in clinical settings. We noted that at the same time, the implementation of a system of CME in EBM started in Ukraine in different focus groups of national healthcare professionals (*Gruzieva & Puzanova, 2015*; *Puzanova, 2016*; *Puzanova, 2018*; *Revenok et al., 2016*).

Talking about regional and year-dependent features of student choice for EBM in clinical practice as a selected part of curricula, it is worth noting that consistency of clinical guidelines may be important too, e.g., in 2020 Iranian guidelines in preventive services in primary care had a good consistency with the American recommendations than in obstetrics and gynecology (38% vs. 75,6%) (*Kharaghani et al., 2016*). But there is no doubt about the need to teach less integrative but more subject/content-oriented ECs for 5th-year medical students on the principles of EBM.

It was confirmed using information analysis of the mutual interest and convergence of opinions of adherents of traditional medicine and EBM in different countries, just like a study of regional features of the EBM implementation for developing national healthcare systems (*Hashem-Dabaghian et al., 2022*; *Jahangir, 2022*; *Moradi & Hosseini, 2017*; *Prasad, 2013*; *Puzanova, 2011*; *Puzanova, 2016*; *Thakkar & Shyam, 2017*). Various interventions of both Iranian traditional medicine and Chinese traditional medicine acknowledged their ability to solve many clinical needs and challenges (*Moradi & Hosseini, 2017*; *Puzanova, 2011*), although these approaches cannot be completely integrated into the EBM framework because they recognize expert opinion as superior to epidemiologic evidence. As it was reported in 2022, less than half of Persian medicine specialists in Iran were trained in the EBM issues (*Hashem-Dabaghian et al., 2022*). However, a decade ago, more than 10% of all Cochrane systematic reviews were developed by Chinese experts – not limited to aspects of Chinese traditional medicine (*Puzanova, 2011*; *Puzanova, 2016*). Criticism of the quality and applicability of evidence is found in many papers regardless of their origin country (*Jahangir, 2022*; *Moradi & Hosseini, 2017*; *Revenok et al., 2016*; *Subbiah, 2023*; *Thakkar & Shyam, 2017*). Traditional Chinese, Indian, and Persian medicine is based on expert opinion and more oral than translation knowledge written way. Both the "teacher-centric" and "patient-centric" approach remain a paradigm of medicine in most Asian

countries. However, the EBM acceptability and implementation have been improved across the board as a result of its concept development as the integration of research evidence with clinical expertise (either individual or consensus) and a patient's choice and values (*Ambulkar et al., 2017*; *Hashem-Dabaghian et al., 2022*; *Narges et al., 2013*; *Prasad, 2013*; *Revenok et al., 2016*). Nowadays EBM has become more patient-centric than recently (*Ahmad Ghaus et al., 2021*), which is reminiscent of a more student-centered paradigm of modern higher education.

The national context has also been considered by the experts who studied barriers and obstacles to EBM implementation, just like future directions and strategies for EBM education (*Abeysena et al., 2010*; *Ambulkar et al., 2017*; *Iloh et al., 2020*; *Maggio et al., 2013*; *Mohamadhoseinzadeh Hashemi et al., 2019*; *Moosavi et al., 2020*; *Narges et al., 2013*; *Nwagwu, 2008*; *Puzanova, 2011*; *Sabouni et al., 2017*; *Thakkar & Shyam, 2017*). To summarize, the quality and best practices in healthcare and higher medical education imply the implementation of a system of CME on EBM starting from the development of appropriate student competencies at the undergraduate level.

Discussion

Our pilot study had no prototype found in the available literature. To the best of our knowledge, this is the first survey of medical students on the issue of choosing ECs on current medical-and-social issues such as non-communicable (namely internal and geriatric) diseases, and applying EBM to internist's practice. It solved the ECs' topics relevance question offered to senior international medical students coming to the KMU from several African and Asian countries. Being implemented as flexible learning paths and selective components of curricula, these ECs can improve the quality of educational services, develop student competencies, and contribute to improving higher education quality.

The rationale for proposing namely rheumatic diseases, geriatrics, and EBM in internal medicine as priority topics for ECs at the clinical department of KMU for international 5th- and 6th-year medical students was the objective difficulties in both studying rheumatology as a complex branch of internal medicine and a managing rheumatic diseases in clinical practice (*Povoroznyuk & Puzanova, 2019*; *Puzanova, 2018*), just like a global trend of population aging and a need for efforts to provide better medical care for older people, which has been declared the task of the Decade of healthy aging 2021-2030 (*UN Decade…, 2021*), and EBM recognition as an approach to improve quality in health care by integrating the best epidemiological evidence with clinical expertise, given consensus and circumstances, and individual patient's choice and values (*Alabdullah et al., 2022*; *Narges et al., 2013*; *Puzanova, 2016*). The following ECs were offered: "Basics of diagnosis in rheumatology" (as the most complicated part of the subject discipline "Internal medicine"); "Basics of geriatrics: Internal diseases in the elderly" (grounded by a stable global trend of demographic aging); "Rheumatic diseases in the elderly and of the elderly" (to integrate the previous topics' tasks); "Evidence-based approach in internal medicine" (grounded by the need to provide a continuity of teaching the EBM methodology issues at the undergraduate stage of CME); "Other (Indicate in a comment, which one namely)" (because it is necessary to support students' participation in creating flexible learning paths).

The study results allowed us to conclude that all these topics were justified with regard not only to global health essentials and demographic trends, the ESG and recommendations on implementing EBM from global and national undergraduate medical education accreditation

organizations, like the current curricula content in specialty "Medicine", but also concerning students' decisions. Except for the option "Other", all ECs offered were chosen by 33,33 to 100% in certain studied subgroups.

The students' level of competencies according to the year of curriculum turned out to be influencing choosing the ECs. This is in line with the literature data, although more information was found about the postgraduates' opinions (*Mohamadhoseinzadeh Hashemi et al., 2019*; *Yehualashet et al., 2021*). As for sixth-year participants, most of them decided to study more on EBM (72,22%), while 55,55% needed to improve their knowledge in the diagnosis of rheumatic diseases (despite studying this in both 10^{th} and 11^{th} semesters) and 50% chose a new topic on rheumatic diseases in the elderly. The majority chose more than one topic, including EBM in most cases. Students' decisions for a more studying EBM can be explained by their conscious or intuitive choice of the educational course they need for their future professional career and is related to what they had studied earlier at the Department of Public Health and Microbiology at the KMU.

Other student-related factors seem less significant. The fact of the numerical predominance of women over men among patients with rheumatic diseases and in elderly populations is well known. This prompted us to consider the gender factor in the study, but its role was not confirmed, which corresponds to the data of other authors (*Mohamadhoseinzadeh Hashemi et al., 2019*). Neither student gender nor average grade point in the discipline "Internal medicine" in the current semester influenced the topics and numbers of the ECs chosen. Regarding the role of academic performance, future studies should consider the student's grade in the EBM course received in the fourth year of the curriculum.

In our study, participants' educational needs varied depending on their region of origin, e.g., the EBM course in internal medicine was chosen by most undergraduates from West and South Asian countries, but only half of those from Africa. In general, both the year/semester of curriculum and region/country of origin turned out to be the factors potentially influencing students' decisions regarding the number and topics of the ECs offered. This result, to the best of our knowledge, is new in the literature.

Concerning regional features, much has been described by the authors from different regions and countries on issues of awareness, development, and implementation of EBM methodology. Our results are consistent with the literature data about regional features regarding leadership or lag in both the implementation of medical standardization based on the EBM principles and providing a CME system in EBM methodology, in particular, of providing appropriate training at universities.

The regional features regarding less need to study the course "EBM in internal medicine" among African students compared to the other subgroups in our study may be related to both weak EBM process development and standardization weak system in healthcare based on the principles of EBM in some African regions and countries. However, the literature review found that EBM is also "in its early stage" in Iran (*Mohamadhoseinzadeh Hashemi et al., 2019*), while most participants from this country chose EBM in our study.

So, this is unlikely that students from Ghana and Tanzania will choose to study how to promote EBM in clinical practice (*Table 3*) unless there are dedicated efforts by faculty and national policies' clarification regarding EBM. There is also the need to study more 5^{th}-year

students from West Asia to increase the reliability of the study results on this issue, according to the subgroup analysis conducted.

More than 10 years ago, a literature review on the issues of EBM training in undergraduate medical education (such as learner levels, instructors' and settings' features, teaching methods and covered EBM skills) was performed by authors from Stanford University (*Maggio et al., 2013*). Having analyzed 20 English-language papers delivered in twelve countries and published in 2006-2011, Maggio and his co-authors recommended that educators who design EBM interventions "consider trends in medical intervention (e.g., online learning, interprofessional education) and health care (e.g., patient-centered care, electronic health records)" as well (*Maggio et al., 2013*). Regarding our study and further research, this advice should be considered in the development of ECs on clinical practicing EBM – along with a recommended implementation of an EBM assessment tool (*Çakmakkaya, 2021*).

The benefit of the results of our pilot study is that they open the prospect of improving both the quality of teaching, flexible learning paths, and learning outcomes despite some limitations of their applicability such as sample size and subgroups. The competitiveness of our university and its graduates may increase even in conditions of war and a sharp decline in student migration to Ukraine. It can be reached by improving educational services for international students provided considering both their current level of competence and regional features and needs.

Besides, our study confirms the need to improve curricula by including the components dedicated to specific and systemic health disorders of the elderly, whose share in the population structure will reach 30% in different countries soon.

Implementation of a more student-centered learning and teaching approach in foreign students' cohorts seems to be more effective if ECs consider regional needs and characteristics important for the students. Training workshops should be set up for 6th-year students to improve their competencies and skills needed to practice internal medicine on the principles of EBM, whereas 5th-year students need more studying of complicated parts of the curriculum. An effort is needed to clarify the importance of learning geriatrics to all medical students, just like to guide African students to study more on EBM.

To achieve the best practice in the higher education area, further research in this direction is needed. This is a way to generalize the results of our study and to harmonize curricula given a student-centered learning and teaching approach to improve the quality of medical education in Ukraine and other countries.

Limitations of our study are associated with a sample size concerning some subgroups. An important drawback is the non-inclusion of students from Israel and Syria in a cross-section, which was because they were not taught the discipline "Internal medicine" at our department during the survey. Their features concerning the study's purpose need further investigation.

The controlled nature of students' choice of ECs even at the graduate level is confirmed in our study by the fact that none of the participants chose the proposed option "Other". So, a guiding role of the faculty is essential to implement a more student approach in designing the curriculum. It seems reasonable to develop a more comprehensive questionnaire and conduct a survey in a larger sample size. Concerning this, we note that several questionnaires have been used in the surveys with the lowest response rate of 54,4% (*Moosavi et al., 2020*) and the highest

of 100% in our study. In our opinion, this reflects the interest of KMU international medical students in designing curricula considering their educational needs and values.

The overall impression of international medical students' choice of ECs on the EBM issues in internal medicine, rheumatology, and geriatrics at the KMU was as follows: positive attitude and high need. Student-dependent factors influencing their decisions regarding the number and topics of the ECs were both the year of curriculum and the region of origin. Involving senior medical students in designing curriculum is appropriate when ECs are offered to them in several relevant topics on practicing EBM, supplementing current content of the subject discipline, geriatrics as well. Efforts are needed to broadly explain the importance of learning the basics of geriatrics and to guide undergraduates from Africa to choose courses in EBM.

The development of this scientific direction will contribute to accessing the best management of international medical students in terms of stimulating their motivation, self-reflection, and engagement in designing curriculum by introducing ECs on current medical issues considering both year of study and regional needs and features as the influencing student-related factors. Further research is necessary to improve the quality of higher medical education in Ukraine and other countries, especially in conditions of unstable student migration and when teaching international students.

As was highlighted, teaching EBM is a priority in the healthcare process (*Sabouni et al., 2017*). Concerning this, many methodological and organizational issues will arise soon. The critical aspects of implementing EBM are as follows: infectious control; primary link of healthcare; age groups such as children and older adults; quality, sufficiency, and sources of evidence; acceptance of EBM in different countries considering their national and regional traditions of providing medical care; integration of EBM with an individual approach in health care and personalized medicine; development of evidence-based complementary and alternative medicine, too (*Hashem-Dabaghian et al., 2022*; *Jahangir, 2022*; *Povoroznyuk & Puzanova, 2019*; *Prasad, 2013*; *Puzanova, 2016*; *Revenok et al., 2016*; *Subbiah, 2023*; *Thakkar & Shyam, 2017*). These fields require more attention starting from the undergraduate level of CME.

According to Subbiah, a new era of EBM is coming with new types and sources of evidence (*Subbiah, 2023*). As for epidemic control, there is a need to improve the quality of evidence regarding different infectious diseases, which are still the main health problem in the African region, and this direction is being developed in China (*Mosugu, 2021*; *Nwaichi, 2020*; *Puzanova, 2011*; *Subbiah, 2023*). Thus, the content of EC on implementing EBM in clinical practice considers consideration of these regional features. This direction also required study.

Conclusion

The content of the curriculum should be adapted to the student-centered approach, including the possibility of choosing the current issues in clinical medicine such as EBM approach, etc. We estimated that the choice of international students in ECs topics depends on the year of study and the country of origin. The educators should consider the peculiarities of the healthcare system of different countries when forming a list of optional educational components for international students in their final years of study.

Availability of data and materials

The datasets generated and analyzed during the current study are not publicly available due to the institution's policy but are available on reasonable request.

Author contribution

OP put forward a research hypothesis. BI and OPu designed the research study. OPu performed the research and data collection. OP and BI provided help and advice on technology and language. OP, BI, and OPu analyzed the data. OPu wrote the manuscript. BI conducted a writing review. All authors contributed to editorial changes in the manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

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Conflict of interest

The authors declare that they have no competing interests.

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Appendix

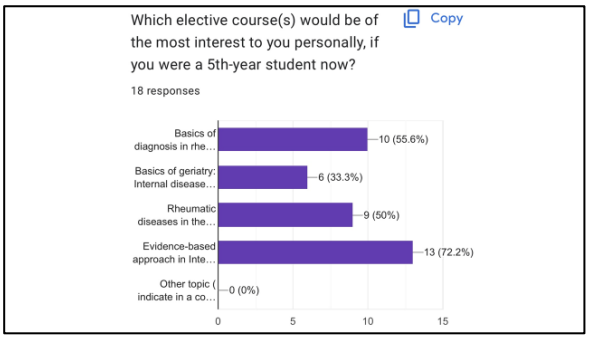

Figure 1. The results of a survey of 18 international undergraduates of Kyiv Medical University about their choice of ECs, collected at the end of a studying the discipline "Internal medicine" in their 11th semester.

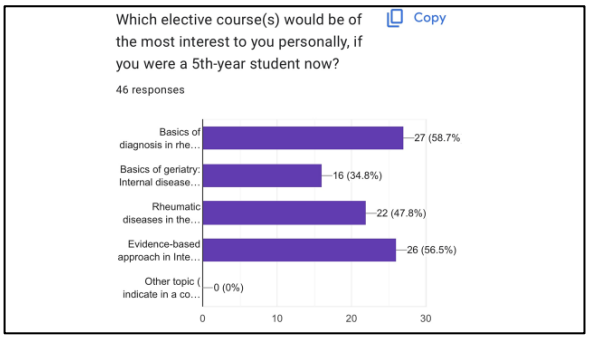

Figure 2. The results of a survey of 46 international medical students of Kyiv Medical University, including 18 undergraduates and 28 5th-year students, about their choices of ECs, collected at the end of studying the discipline "Internal Medicine" in their 11th and 10th semester, respectively

Table 1. Descriptive statistics of participants' choice of ECs given their gender and year of university study

Issue	**6th year students (n=18)**			**5th year students (n=28)**			**Total (n=46)**		
	Men (n=9)	Women (n=9)	Total (n; % of 18)	Men (n=13)	Women (n=15)	Total (n; % of 28)	Men (n=22; % of 22)	Women (n=24; % of 24)	Total (n; % of 46)
Number of ECs chosen:									
–one	1	5	6; 33,33	6	8	14; 50,00	7; 31,82	13; 54,17	20; 43,48
–two	5	2	7; 38,89	2	3	5; 17,86	7; 31,82	5; 20,83	12; 26,08
–three	2	0	2; 11,11	4	3	7; 25,00	6; 21,43	3; 12,50	9; 19,60
–four	1	2	3; 16,67	1	1	2; 7,14	2; 9,09	3; 12,50	5; 10,90
Average number of ECs per student	38:18=2,11			48:28=1,71			(38+48):46=1,87		
Now often an EC was chosen?									
RDs	7	3	10; 55,56	9	8	17; 60,71	16	11	27; 58,70
Geriatrics	3	3	6; 33,33	5	5	10; 35,71	8	8	16; 34,78
EBM	6	7	13; 72,22	8	5	13; 46,43	14	12	26; 56,52

Notes: RDs – a topic "Basics of diagnosis in rheumatology" (№ 1); Geriatrics – a topic "Basics of geriatrics" (№ 2); EBM – a topic "Evidence based approach in internal medicine" (№ 4).

Table 2. Regional features of a choice of ECs by participants (n=46) coming from different regions and countries of Asia and Africa

Region, total number of students (n) & their share (%) in the study cohort	Countries, from which participants came	Features of participants' choice of ECs
South Asia (n=15; 32,61 %)	India (n=10): 6 undergraduates and 4 5th year students	EBM was chosen by 83,33% undergraduates (5 out of 6) and half of 5th-year students (2 out of 4), in total by 70% of participants – men and women (3 and 4 respectively), none of whom was graded A or D in the discipline "Internal medicine" (4 were graded C, 3 – B). EBM was the most popular topic for 6th-year students, but not for 5th-year participants, 100% of whom voted for a topic "Rheumatic diseases: basics of diagnosis". Average number of ECs per student was 2 and 2,25 for the 6th- and 5th-year cohorts respectively. Regardless of year of study, half of participants chose only one EC.

	Pakistan (n=4): 1 undergraduate and three 5th year students	There were no women in this group. Average number of ECs per student – 2,75. Regardless of current performance in internal medicine (students were graded A or C), the most popular topic was "Rheumatic diseases: basics of diagnosis", and the issues of EBM was of interest to 75% of participants.
	Sri Lanka (n=1): an undergraduate	He was graded A in internal medicine and chose both topics "EBM in internal medicine" and "Rheumatic diseases in the elderly and of the elderly". Average number of ECs per student – 2,00.
	Total – 15, with a share of Indians of 66,67%. 8 undergraduates and 7 5th year students, of whom 10 men and 5 women (male to female ratio 1:1 and 6:1 responsively)	A topic "EBM in internal medicine" was chosen by a majority in this cohort (11 out of 15; 73,33%), both among undergraduates (7 out of 8; 87,5%) and 5th year students (4 out of 7; 57,14%). All 5th year students were Indians and Pakistanis and preferred to improve their competence in rheumatology; the ECs dedicated to EBM, geriatrics and geriatric issues of rheumatology were taken each by 57,14%. In general, the EBM course was chosen by all students from Pakistan and Sri Lanka and most Indians (70%).
West Asia (n=5; 10,87 %)	Iran (n=4): 3 undergraduates and one 5th-year student	Most of them (75%) chose the course on EBM and preferred two elective courses. EBM was taken by all undergraduates: 2 women graded A in internal medicine and a man graded B. EBM was not chosen by a 5th-year female student who was graded A in internal medicine and voted for the topics "Basics of geriatrics" and "Rheumatic diseases in the elderly".
	Türkiye (n=1): an undergraduate	EBM was chosen along with a topic "Rheumatic diseases: basics of diagnosis" by a single participant from this country – a female graded A in internal medicine.
	Total – 5, of whom 80% were undergraduates, women, Iranians and those who were graded A in internal medicine	Most (80,00 %) chose EBM and two ECs. In general, EBM was chosen by three women and a man graded A and B responsively in the discipline "Internal medicine".
West and East Africa (n=26; 56,52 %)	Nigeria (n=22): 4 undergraduates and 18 5th-year students	EBM was chosen by half of Nigerian participants regardless of their gender, year of study and current performance in internal medicine. Average number of ECs per student was 2,11 and 1,83 for the 6th and 5th year cohorts respectively. Undergraduates chose mostly "Rheumatic diseases: basics of diagnosis", whereas 5th year students voted for EBM or "Rheumatic diseases in the elderly" almost equally often.
	Ghana (n=2): one each in the 5th- and 6th-year of study	None of them chose EBM, however both were graded A in internal medicine and chose for the "Rheumatic diseases in the elderly". Only this topic

		was chosen by a 5th year female student, whereas a 6th year male participant voted for this EC and the related topics № 1 and 2, too.
	Tanzania (n=2): one each in the 5th- and 6th-year of study	None of these women chose EBM, however both chose for "Rheumatic diseases in the elderly". Only this topic was taken by a 5th-year participant (grade A in internal medicine), whereas a 6th-year student (grade B in internal medicine) chose the related topic № 2, too.
	Total – 26, with a share of Nigerians of 84,62%	No more than half of participants chose a topic "EBM in internal medicine" regardless their year at university, and Nigerian 6th-year students found this topic less interesting than the less integrative "Rheumatic diseases: basics of diagnosis". EBM was not chosen by participants from Ghana and Tanzania.

Table 3. Choice for elective course "Evidence based approach in internal medicine" by participants depending on regions and countries, from which they came

Regions and countries, from which the students came	6th year students		5th year students		Total (n=46)	
	Number and share (%) of those who chose a topic dedicated to EBM					
	13 (out of 18; 72,22%)		13 (out of 28; 46,43%)		26 (out of 46; 56,52%)	
South Asia	7 (out of 8)	87,50	4 (out of 7)	57,14	11 (out of 15)	73,33
India	5 (out of 6)	83,33	2 (out of 4)	50,00	7 (out of 10)	70,00
Pakistan	1 (out of 1)	100,00	2 (out of 3)	66,67	3 (out of 4)	75,00
Sri Lanka	1 (out of 1)	100, 00	–	–	1 (out of 1)	100,00
West Asia	4 (out of 4)	100,00	0 (out of 1)	0	4 (out of 5)	80,00
Iran	3 (out of 3)	100,00	0 (out of 1)	0	3 (out of 4)	75,00
Türkiye	1 (out of 1)	100,00	–	–	1 (out of 1)	100,00
Africa	2 (out of 6)	33,33	9 (out of 20)	45,00	11 (out of 26)	42,31
Nigeria	2 (out of 4)	50,00	9 (out of 18)	50,00	11 (out of 22)	50,00
Ghana	0 (out of 1)	0	0 (out of 1)	0	0 (out of 2)	0
Tanzania	0 (out of 1)	0	0 (out of 1)	0	0 (out of 2)	0