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# Modern approaches to preparation of scientific research in dentistry in the world of the “Evidence-Based Medicine” concept

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## Summary

The concept of “Evidence-Based Medicine” provides generalization and interpretation of scientific information to select the best strategies for prevention, diagnosis, treatment, risk assessment of their application to a particular patient, ways to analyse their own clinical experience, experimental research, and the latest developments. Although Evidence-Based Medicine has long been a vital component of scientific activity, the adoption of these principles while carrying out the research remains a relatively slow process in dentistry. Our study aimed to assess the methodological contribution of Evidence-Based Medicine principles to the preparation of scientific research in dentistry, which can be integrated into specific learning scenarios for dental students. We believe teachers should evaluate educational programs to overcome gaps in periodontology, emphasizing preventive dentistry courses in both bachelor and graduate programs. Such topics should be studied at the first stage of learning. At the same time, the importance of ensuring a balanced combination of research and clinical experience as one of the steps to optimizing educational programs for dental students should not be underestimated.

## Introduction

Due to the limitations in the understanding and use of published data, the concept of Evidence-Based Medicine (EBM) was revived in the early 1990s (Djulgovic, Guyatt 2017).

This concept soon found support in various countries around the world (Mellis 2015).

The operation of Evidence-Based Medicine centres in Ukraine plays an important role in the work of the national health service (Moskalenko et al. 2014). Therefore, the Order of the Ministry of Health of Ukraine of 28.09.2012 No 751 “On the creation and implementation of medical and technological documents for the standardization of medical care in the Ministry of Health of Ukraine” regulates the introduction of Evidence-Based Medicine in Ukraine (nakaz MOZ Ukrainy 2012; Lertpimonchai et al. 2017).

The concept of “Evidence-Based Medicine” provides a summary and interpretation of scientific information to select the best tools and technologies for prevention, diagnosis, treatment, and risk assessment of their application to a particular patient, an analysis of generalized data from individual clinical experience, experimental research, and the latest developments. Clinical epidemiology is the scientific basis for Evidence-Based Medicine, which is based on the following regulations (Uvarenko, Ledoshchuk 2010):

- In most cases, diagnosis, prognosis, and treatment outcomes for a particular patient are not predetermined, so they should be based on probability.
- This probability for a particular patient is best assessed based on previous experience with similar patients.
- Since clinical observations are conducted by doctors with dif-



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ferent experience among patients with different behaviours heterogeneity can bias the results and lead to false conclusions.

- Any observations do not exclude the effects of chance.
- To avoid false conclusions, doctors should rely on research based on strictly scientific principles and use methods to minimize systematic and random error analysis.

In regards to the concept of Evidence-Based Medicine, the process and requirements for research have changed. This mandates a completely new level of preparation - careful justification and clarity of presentation, the ability to objectively assess the most important aspects of work, as well as confidence in conclusions and results. This requires the formation of knowledge, skills, abilities, and worldview of the scientific research authors (Atallah 2018). It should also be remembered that Evidence-Based Medicine has emerged from a significant increase in scientific information; the rapid introduction of new technologies and drugs actively studied in numerous clinical studies, often ambiguous and sometimes even contradictory; the increasing availability of information that requires careful analysis and generalization; and the need for –and specialists know about these concepts and thus cannot use them appropriately (Lozada-Martínez et al. 2021).

To find out how often health professionals use EBM in their routine practice, Lafuente-Lafuente et al. (2019), surveyed 144 doctors, 64 nurses, and 24 pharmacists who studied at graduate schools at six universities in France and Switzerland. Overall, 14.2% of respondents said they use EBM regularly in their daily

practice, and 15.6% said they rarely use EBM. The rest of the respondents know about EBM, but have not used it (33.1%); 31.9% of respondents have only heard about EBM, and 4.0% did not know what EBM is. Regarding the use of EBM-related sources, 83.4% used monthly clinical guidelines, 47.1% used PubMed databases, 21.3% used the Cochrane Library, and 6.4% used other medical databases. Fewer pharmacists (12%) reported using EBM in their practice than nurses (22%) or doctors (36%). The most common obstacles to EBM practice were lack of general knowledge of EBM, lack of critical assessment skills, and lack of time. According to the authors, only a small proportion of health professionals – apart from doctors, nurses, and pharmacists - reported regular use of EBM in their careers. Although most were interested in EBM, they seemed hampered by a lack of knowledge, skills, and time (Lafuente-Lafuente et al. 2019).

The principles of Evidence-Based Medicine should be mastered from the beginning of students' studies, which would contribute to the choice of appropriate approaches to the diagnosis and treatment of patients by young doctors (Tilson et al. 2011). Thus, Velichko, along with co-authors (2021), found that most students, namely 50 / 60 (83.3%), would be guided by knowledge gained during training, personal clinical experience, and consultation with more experienced colleagues. The data of randomized studies ranked second (Fig. 1). Medical students, however, have insufficient knowledge of the resources of Evidence-Based Medicine and do not have sufficient motivation and knowledge of English to use Evidence-Based Medicine in education (Thus et al. 2021).

The structure of future doctors' readiness for scientific research (SR) is represented by interlinked components such as motivational objectives, cognitive information, and procedural functionalities. The segments of the motivational target component are the interest in the subject and process of SR, the desire for creative activities, the value of knowledge, and the desire for professional development through SR. Cognitive information includes medical and general research knowledge. Components of the procedural-functional component are technological skills (computer skills and use of IT technologies); communication skills (communication with participants in SR and professional activities); organizational skills (research planning and organization of SR phases); foreign language professional language skills (knowledge of a foreign language); reflexive (self-esteem, self-control) (Karpenko 2019).

### Objective

Investigation of the methodological contribution of Evidence-Based Medicine to the preparation of scientific research in dentistry, which can be integrated into specific learning scenarios for dental students.

### Theoretical part

Based on proven data, treatment planning in dentistry helps doctors to ensure the use of the most modern treatments, based on the arguments obtained from a thorough review of diagnostic information and alternative treatments, as well as data on actual results (Dhar 2016).

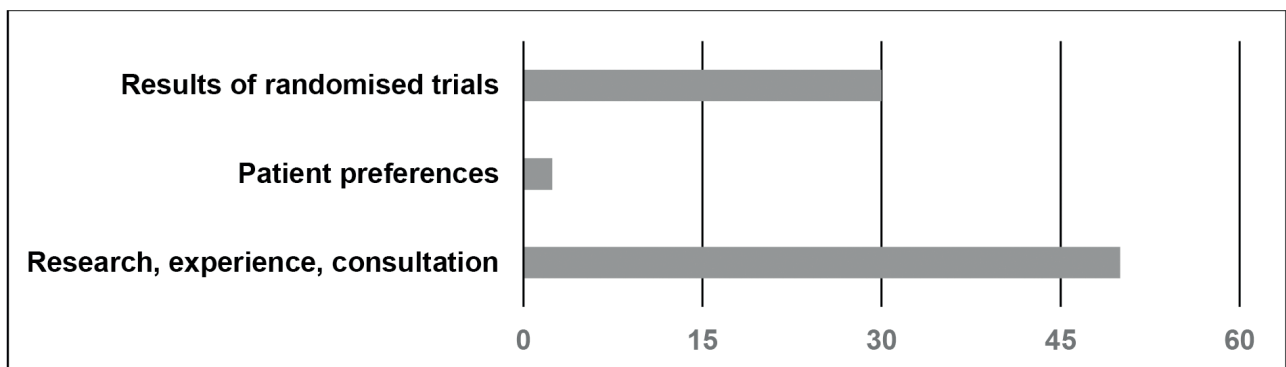


Fig. 1. The vision of the bases for future doctors' further practice (according to Lozada-Martínez et al. 2021).

The American Dental Association (ADA) is at the forefront of developing EBM in dentistry. The ADA defines the term “evidence-based dentistry” (EBD) as an approach to oral care that requires Medicine, assessment of clinically relevant scientific evidence related to the oral condition, medical status, and medical history, with clinical evidence of the dentist, experience, and preferences of the patient. The ADA identifies three main areas of EBD: relevant scientific data, patient needs, and preferences, and dental experience. Since patient needs/preferences and clinical experience are subjective and may vary, relevant scientific evidence is crucial (ADA). EBD is mainly based on two components. The first is the research component, in which scientific evidence related to the case must be obtained from available literature, such as PubMed, Embase, Medline, and Google Scholar. The second, the clinical component, involves the evaluation of the collected data and its use of Medicine, to support the patient (Dhar 2016).

Among the available evidence structures, systematic reviews and meta-analyses rank first and contribute to obtaining the highest level of evidence, followed by randomized clinical trials (RCT). These are followed by non-RCTs, cohort studies, case-control studies, cross-sectional studies, case studies, and expert opinions. To build a solid, evidence-based foundation, appropriate research and educational activities are needed to evaluate the best evidence available in dentistry and identify information that will help physicians provide optimal dental care to patients (Ismail 2004). An intervention is considered convincing if supported by at least one systematic review of several well-designed RCTs. Well-conducted systematic reviews or meta-analyses assess the quality of the evidence and confirm the strength of the recommendations for clinical decision-making (Richards, Lawrence 1995).

The System for the Evaluation, Development, and Evaluation of Recommendations (GRADE) is used to assess the quality of evidence and recommendations in systematic reviews and conclusions of clinical practice. The GRADE process assesses the de-

sign of the study, the risk of bias, inaccuracy, inconsistency, indirectness, and the degree of effect achieved. Based on the assessment, summary tables are created, and recommendations for strong, moderate, or poor quality are analyzed to balance the consequences of different intervention options (Guyatt 2011).

There are gaps in established knowledge in many research publications in several areas of dentistry (Chalmers 2010). Therefore, I. A. Mejàre et al. (2015) evaluated systematic reviews carried out in pediatric dentistry. Low-quality systematic examinations in areas of pediatric dentistry, such as behavioral problems / dental anxiety, risk assessment and diagnosis of caries, prevention, non-operative and operative caries treatment of milk and permanent teeth, prevention, and treatment of periodontal diseases, traumatic treatment damage to permanent milk teeth were revealed. Out of the 81 systematic reviews, 38 had a low to moderate bias potential, 50% of which were for caries prophylaxis. The quality of the evidence was high for the preventive effect of daily fluoride toothpaste use and moderate for resin-based material fissure sealing. The quality impact evidence of other interventions was poor or very low. This review provided valuable insights into areas where work is needed (Mejàre et al. 2015).

Even with high-quality research, practitioners often cannot study examinations in detail and obtain relevant information. It is therefore crucial to develop clinical guidelines and critical summaries that can be useful to all (Bader, Frantsve-Hawley 2013). One of the main obstacles to the implementation of EBD is also a large amount of information, including websites and magazines. Another obstacles are the needs and preferences of patients, which leads to everything else being pushed into the background. Finally, the experience of the doctor and the lack of motivation to change what has worked well over many years of practice can also be a problem (Kao 2006).

Existing training deficiencies are considered one reason for the prevalence of inflammatory periodontal disease, as they cause problems of competence of periodontology spe-

cialists and the degree of full mastery of all methods used in dentistry to care for patients with periodontal disease (Hosing et al. 2016). The prevention of periodontal disease and hygiene education is the weakest link, as inadequate oral hygiene increases the risk of periodontal disease by 2-5 times (Makarian 2016).

A low level of dental literacy and a lack of hygienic awareness and skills among medical students studying at the faculties of pharmacology, medical care, and pediatrics (n = 96) have been observed. This situation is strengthened by the phobia of dental diseases, which affects 73.95% of the patients. Although 89.58% of students consider dentistry integral to both general health and human social well-being, only 10.4% follow all principles and support dental health. Most students do not have full knowledge of periodontal disease and its consequences, suggesting that the emphasis of the population on periodontal disease prevention remains low. There is also a lack of effectiveness in promoting healthy lifestyles by the media, teachers in educational institutions, and health care in general (Makarian 2016). Dental students' knowledge, attitudes, and practices in terms of oral health are particularly important because they affect their ability to provide information to their patients. Dental students are future “providers” of oral hygiene, so they must motivate patients to maintain their oral health (Kumar 2010).

Nowadays, there is an imperfection in the methods of teaching periodontology in all departments of the dental profile, which often does not correspond to the actual work of the dentist in practical health care.

The specialty of periodontology was recognized by the ADA in 1947, and by the end of the 1940s, academic programs were developed to train specialists in this field at several US universities for a year. The duration of training subsequently increased to two years and a three-year postgraduate program specializing in periodontics was introduced. At the same time, when assessing the knowledge of oral health, attitudes, and practices of dental students, it was found that scores increase significantly as dental students master the educational program (Ahamed et al. 2015). Accord-

ding to our data, only a few studies are devoted to assessing dental students' knowledge of the health of periodontitis, methods of prevention and treatment of periodontal disease, and the relationship between oral hygiene and periodontal disease.

Ahmad et al. (2019) assessed the impact of oral health knowledge on periodontal conditions among dental students ( $n = 296$ ) (Ahmad et al. 2019). At Riyadh Elm University, Kingdom of Saudi Arabia, students attend lectures on basic sciences and laboratory courses for the first three years. Students of the first three courses formed Group 1 ( $n = 89$ ). In the 4th-6th year, dental students are involved in various sections of dental years and begin clinical practice. These students were included in Group 2 ( $n = 133$ ). Since the university adopted a graduate program, graduate students were classified as Group 3 ( $n = 74$ ). During the training, the scores obtained in the evaluation of students increased significantly: the average score in Group 1 was 2.97, in Group 2 – was 3.98, and in Group 3 – was 4.22. It was found that the prevalence of gum disease and periodontal disease of varying degrees in the study is high. Thus, the scores of the gum index among students in Groups 1, 2, and 3 were 1.13: 1.16, and 0.96, respectively. Clear gums were considered healthy if the gingival index was  $<0.1$  (according to the classification Løe 1967). In other words, mastering the educational program from bachelor's to postgraduate education has led to changes in behaviour and improved oral health, but this was not reflected in periodontal diagnosis. However, the assessment of oral hygiene practices in graduate students was lower than in students, which the authors attributed to high levels of stress (proven modified risk factor for periodontal disease) compared to students in other specialties. Because this study was cross-cutting, these features may not directly relate to the curriculum but can be used as an indicator of the necessary changes in both bachelors and graduate programs. In addition, this study was conducted at only one university. Multi-centered research is needed to summarize the results (Ahmad et al. 2019).

The European Federation of Periodontology (EFP) has introduced a course in postgraduate education in periodontology, which consists of

lectures, seminars, group discussions, and literature reviews on all topics related to periodontology. The proposed approach of the EFP draws students' attention to the key issues of periodontology and stimulates creative thinking and more thoughtful analysis of specialized literature. The program also includes the implementation of research work, which should be published in a written report suitable for publication in an international peer-reviewed journal (Tsepov, Nykolaev 2010).

Therefore, to train competent clinicians, dental schools around the world focus on EBD in their curricula. To make the right EBD clinical decisions, the dentist must perform 5 steps: gather the best evidence from electronic databases; critically evaluate the evidence for its reliability, reliability, relevance, and bias; integrate the evidence with the patient's own experience, needs, and preferences; evaluate the EBD process and the result (Bayne, Fitzgerald 2014). Due to many published articles in numerous databases, and the difficulty of critically evaluating such evidence, dental students' education helps them learn the principles of EBD and their use in future practice (Azarpazhooh et al. 2008).

The EFP program also includes clinical training, where the specialist practices manual skills in diagnosis, therapeutic and surgical treatment in periodontology, as well as some aspects of implantology. This clinical program is organized in cooperation with clinical departments of dental higher education institutions, departments of university clinics, or postgraduate education centers, which allows the specialist to acquire the practical skills necessary to handle complex cases (Binshabaib et al. 2019).

As an example, the experience of student education in Finland, where comprehensive teaching of research principles is important in medical and dental schools and studies, does not end until the candidate presents an independent research project and defends a master's thesis (Nieminen et al. 2007). The training program for dentists in Finland is designed for 5 years. The curriculum includes a course on scientific thinking and research principles. Students are invited to consider any proposed research project topics, but most choose their

topic from existing ones at the university's departments and clinics. Faculty members of the departments are supervisors of master's theses. 256 master's theses were analysed. Using a standardized questionnaire, the authors identified several characteristics for each paper. The surname of the student was used to assess whether scientific publications were published on the research materials, in publications indexed in the databases of medical articles. The number of citations received by each publication was also studied. Most articles (69.5%) were essentially statistical, often combined with a large literature review or laboratory method development. Only 61 papers (23.8%) were published in indexed scientific journals. The average number of citations per year was 2.7 (range, from 0 to 14.7). According to the authors' conclusions, the proportion of published articles was small. The quality of these papers and their dissemination to the scientific community should be improved (Nieminen et al. 2007).

The dental curriculum also includes working with patients in the university's clinics during the three to five years of studies, and health care practice is allowed during vacations after the four years of studies. One of the important criteria for becoming a dentist in Finland is the ability to extract information from multiple databases and effectively use it to prepare and critically evaluate a research project (Nieminen, Virtanen 2017).

## Conclusions

Our review of literature and experiences led us to conclude that educators should further evaluate educational programs to overcome existing gaps in periodontal health care. There should be an emphasis on preventive dentistry courses in both undergraduate and postgraduate curricula, as the burden of periodontal disease can be reduced through intensive oral health maintenance campaigns. In addition, such topics should begin to be taught in the first phase of studies. The importance of balancing research and clinical experience should not be underestimated as a step in optimizing educational programs for dental students. The mastery of SR skills by students will contribute



to the systematization of knowledge, the development of research skills, self-organization, and self-development. That stated, even though EBM has long been an important component of scientific activity, the adoption of EBD principles in scientific research in dentistry and periodontics remains a relatively slow process.

### Ideas for further research

The involvement of students from higher medical institutions, including dental and educational institutions, in SR, is based on the need for future specialists to acquire, improve, and develop professional competencies. However, the problem of involving dental students in scientific activities has not been sufficiently developed. This requires determining the readiness of dental students in different courses for scientific activities and identifying factors contributing to the awareness of students in general medical and dental disciplines (in particular, periodontics) and the principles of the organization of this type of activity. Follow-up research should ensure that students are trained to master significant amounts of specialized information through participation in EBD-based research activities. We identify the following future work to be done: disclosure of the key concepts of EBM and EBD in the framework of research work, development of examples of research problems, and their solution, which will lead to further specialization of dental students.

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