REVIEW ARTICLES

TRANSFORMING MEDICAL EDUCATION IN THE 21ST CENTURY: THE ROLE OF COMPETENCY-BASED MEDICAL EDUCATION

TRANSFORMANDO LA EDUCACIÓN MÉDICA DEL SIGLO XXI: EL ROL DE LA EDUCACIÓN MÉDICA BASADA EN COMPETENCIAS

Fernando Ramos-Zaga (iD) [1]

ABSTRACT

Introduction: With the changing landscape of medical education, it is crucial to critically examine existing approaches and frameworks. competency-based medical education (CBME) emerges as a promising paradigm shift, which prioritizes learner-centered, outcome-oriented development of skills, knowledge, and attitudes. **Objective:** To identify the essential structural and procedural adjustments needed for effective implementation of CBME. It underscores the importance of reorganizing educational institutions, adapting instructional and assessment techniques, and fostering acceptance of CBME in the classroom. **Results:** To effectively deliver CBME, it is imperative to restructure educational institutions to focus on competency-based curricula and personalized instruction. Also, there is a need to modify teaching and assessment strategies to facilitate continuous assessment and active learning. **Conclusions:** Adopting CBME principles can enable medical education to produce professionals equipped with the skills necessary to meet the dynamic demands of modern medicine.

Keywords: Education; Medical; Competency-based education; Evaluation of Medical School Curriculum; Delivery of health care; Clinical competence; Quality improvement . (Source: MESH-NLM)

RESUMEN

Introducción: Con el panorama cambiante de la educación médica, es crucial examinar críticamente los enfoques y marcos existentes. La educación médica basada en competencias (EMBC) surge como un prometedor cambio de paradigma, que prioriza el desarrollo de habilidades, conocimientos y actitudes explícitas centrado en el alumno y orientado a los resultados. **Objetivo:** Identificar los ajustes estructurales y procedimentales esenciales necesarios para una implementación eficaz de la EMBC. Se subraya la importancia de reorganizar las instituciones educativas, adaptar las técnicas de instrucción y evaluación y fomentar la adopción de la EMBC en el aula. **Resultados:** Para impartir con eficacia la EMBC, es imperativo reestructurar las instituciones educativas para que se centren en planes de estudios basados en competencias y en la enseñanza personalizada. Asimismo, es necesario modificar las estrategias de enseñanza y evaluación para facilitar la evaluación continua y el aprendizaje activo. **Conclusiones**: Adoptar los principios de EMBC puede permitir que la educación médica produzca profesionales equipados con las habilidades necesarias para satisfacer las demandas dinámicas de la medicina moderna.

Palabras clave: Educación médica; Educación basada en competencias; Evaluación de los Planes de Estudios de las Escuelas de Medicina; Atención a la Salud; Competencia clínica; Mejoramiento de la Calidad. (Fuente: DeCS-BIREME)

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INTRODUCTION

The field of medical education is in a constant state of evolution, closely intertwined with the ever-changing landscape of healthcare delivery. To meet the challenges of the 21st century, thoroughly evaluating the frameworks and operational procedures of medical education programs is crucial. The diverse geographical distribution of health systems in the world, influenced by sociocultural, economic, and health factors, further exacerbates these challenges. Consequently, the primary concern lies in the imperative to revolutionize medical education to effectively meet the demands of contemporary healthcare while considering regional disparities within health systems.

CBME (Competency-Based Medical Education) is characterized by its dedication to adapting medical training to the various competencies required by modern healthcare professionals [1]. The development of skills, knowledge, and attitudes, all within a framework that prioritizes student-centered methodologies and outcome-oriented objectives, forms the core of CBME's philosophy [2], offering a comprehensive and innovative approach that has the potential to drastically change the structure of medical training programs by prioritizing competencies in medical education [3]. Thus, it adapts to the changing needs of the healthcare sector and trains medical professionals who possess the clinical knowledge, skills, and qualities necessary to meet the complex demands of contemporary medicine.

The limitations of traditional time-based curricula in medical teaching are increasingly recognized [4]. These must form healthcare professionals who possess not only clinical competence but also the essential qualities of adaptability and lifelong learning necessary to navigate an ever-changing healthcare landscape. It is increasingly believed that these traditional educational models must fulfill the objectives of a comprehensive medical education. Therefore, exploring and applying CBME strategies, which offer a viable solution to these challenges by prioritizing the achievement of specific competencies and milestones, is crucial. This approach allows for a more personalized and outcome-oriented medical education experience.

In the contemporary healthcare landscape, the world's health systems face several challenges due to the increasing demand for healthcare, rapid technological advancements, and evolving patient expectations [5]. These complex factors demand a healthcare workforce that goes beyond clinical competence and requires adaptability, innovation, and active participation in improving healthcare services. Consequently, urgent reform of medical education to adapt to these pressing needs is necessary. Medical education must transform to meet these changing needs and emphasize the development of critical thinking and problem-solving skills, along with a strong commitment to the continuous improvement of healthcare quality, in addition to competence and clinical knowledge.

The effective implementation of CBME requires a holistic approach that encompasses both structural and procedural changes in the educational environment. Firstly, it is fundamental to reorganize educational institutions to adapt curricula and assessment methods to CBME principles, which means abandoning traditional time-based curricula and moving to competency-focused frameworks that prioritize the acquisition of specific knowledge and skills [6]. Additionally, to fulfill CBME's focus on personalized learning and continuous assessment, modifying teaching and assessment strategies is imperative. Educators must employ pedagogical approaches that facilitate self-directed and active learning and foster the development of clinical competencies [7].

To make the effective implementation of CBME possible, exploring and examining strategies for introducing the necessary procedural and structural adjustments is essential. This involves reorganizing educational institutions, adapting teaching and assessment methods, and promoting an environment conducive to CBME in the classroom. The objective of this literature review is to identify the essential structural and procedural adjustments needed for the effective implementation of CBME. By aligning medical education with the evolving healthcare landscape and producing competent and adaptable healthcare professionals, this review aims to address the changing

Development
Continuing Education

The suitability of innovations in CBME for use in undergraduate and residency training programs requires medical educators to recognize the need to expand and standardize the application of CBME's basic principles at all levels of medical education. This requires a thorough reevaluation of the current educational system, which the division of medical education defines in separate and non-integrated silos for postgraduate, undergraduate, and continuing education [8]. At the undergraduate level, the transformative shift toward CBME should naturally flow into residency, fellowship, and independent practice areas. When correctly applied, this educational continuum benefits the entire patient population, as well as medical trainees and their mentors.

CBME has emerged as a paradigm shift in medical education, emphasizing the importance of educational continuity throughout the different stages of medical learning. This approach aims to seamlessly integrate assessment into educational activities, allowing for a comprehensive evaluation of progress [9]. By aligning assessment with the continuous educational experiences of medical students, CBME promotes a more complete understanding of their competencies and the development of reflective practice skills[10]. This emphasis on continuity ensures that assessment is not isolated or disconnected from the learning process but is an essential component of it, encouraging students to critically reflect on their experiences and continually refine their skills.

Through collaboration between various stakeholders and policymakers, it is possible to determine the essential competencies that students must acquire throughout their training at each level. This collective effort aims to streamline medical education by eliminating the need for redundant teaching of basic competencies as students progress [11]. To facilitate this transformative change, existing organizational policies that hinder the smooth transfer of student performance data across different educational levels must be reevaluated.

Achieving optimal training outcomes depends on the successful implementation of a robust system that encourages and incentivizes constant information exchange related to performance, allowing subsequent rotations to be more accurately aligned with the principles of continuous improvement. Therefore, cultivating an environment that promotes transparent and sincere communication among all stakeholders, regardless of their varying levels of training, is essential. Creating a conducive atmosphere that facilitates the exchange of knowledge gained from both successes and failures is crucial to avoiding an endless learning curve and ensuring steady progress.

Transitioning to a CBME Model

To enhance the effectiveness of CBME, it is essential to deviate from the traditional time-based approach. The current practice of organizing medical training based on fixed time intervals, often used to assess competence, requires significant modification. This calls for a more flexible use of time as a valuable learning resource, allowing better alignment with students' individual learning trajectories and ultimately leading to overall improved outcomes in medical training. Recent academic studies suggest that moving away from a rigid time-based framework can significantly enhance students' development and competency acquisition [12,13]. A significant factor in the constantly evolving field of medicine is the implementation of longitudinal rotations, bridging connections among various stakeholders. These rotations effectively promote continuous interactions between physicians and patients, mentors and learners, as well as students and other healthcare team members [14]. Fostering this sustained continuity is vital for promoting holistic professional growth, improving patient care standards, and creating an environment conducive to training and constructive feedback.

Educators have the opportunity to enhance their understanding of students' competencies in various areas through constant observation during longitudinal rotations. This deeper insight allows educators to make informed decisions about the level of autonomy students should have in providing healthcare[15]. Interestingly, this paradigm shift underscores the importance of reallocating time to strengthen these meaningful relationships based on continuity, rather than merely extending the training period. As a result, faculty members can make well-informed decisions on when to entrust learners according to each individual's unique learning journey.

Traditional time-based models raise concerns about the continuity of healthcare services by learners. If a student leaves a training module too soon, there can be gaps in patient care unless an immediate replacement is available [16]. To mitigate risks associated with the time-based model, a different hybrid approach that combines a competency-based teaching and assessment framework with a time-based structure is a viable solution. This hybrid approach allows work rotations to be more reliably scheduled, ensuring continuous patient care [17].

In the training realm, it is crucial to offer students a level of adaptability that takes into account which learning pathways and individual skill acquisition goals should be maintained regardless of the specific pedagogical approach used [3]. Ensuring that personnel limitations or rigid schedules do not prevent students from rapidly progressing through different learning modules[18] is imperative. Additionally, educational institutions must establish mechanisms to support recovery, especially for those who may struggle or show incompetence in basic competencies[19]. Training programs face a formidable challenge in developing and implementing strategies that foster and cultivate this indispensable flexibility; keeping in mind the imperative goals of optimizing student progress and addressing competency shortfalls in contemporary educational environments.

In the field of medical education, adopting CBME represents a significant shift toward a more dynamic approach, focusing on systematic assessment and promotion of students based on their ability to demonstrate specific competencies. Given the growing popularity of CBME, it is crucial to collect comprehensive data on its effects, necessary for developing a deeper understanding of the time commitments required for learners to achieve competence in different areas of their professional growth. Leveraging data, educators and institutions can make informed adjustments and improvements to the CBME framework, leading to transformative outcomes.

Healthcare Personnel Management and CBME

In medical education, collaboration and agreement among key stakeholders and regulators are vital for developing a curriculum that emphasizes the importance of maintaining educational continuity. The effective implementation of this collaborative effort has the potential to greatly assist health systems in preparing for future demands in the field of human health[20]. A fundamental aspect of this effort is using reliable estimates provided by prestigious governmental and professional organizations to determine the number of specialized medical professionals needed to serve specific patient populations[9]. With this information, adjustments to the curriculum and job allocations can be made to ensure an adjustment to the anticipated demand for healthcare services.

When embarking on the transformative journey towards such curricular improvements, it's worthwhile to consider specialized organizations thoroughly examining health-related data from various sources, which will facilitate identifying relevant health issues and developing trends[21]. Both undergraduate and postgraduate medical curricula should thoughtfully incorporate learnings from these units integrating the assessment of local healthcare needs.

Interprofessional education plans play a crucial role in improving the quality of patient care outcomes. Research suggests that the development and implementation of such curricula can be highly beneficial in the field of medical education. To achieve educational continuity and effectively prepare healthcare staff, it is essential for stakeholders, policymakers, health intelligence units, and interprofessional learning objectives to collaborate and integrate their efforts in the ever-evolving landscape of medical education.

CBME in the Reform of Health Systems

The inherent relationship between the training of physicians with the necessary competencies and the parallel development of health systems that meet societal expectations in terms of accountability and performance[22]. At the heart of this assertion is the understanding that training competent physicians requires medical education with health system reform [23]. Achieving the highest levels of best practices in all aspects of patient care within the health system will be a formidable achievement. This transformative process requires significant time investment, as well as effective resource allocation and coordinated collaboration among all stakeholders in the field of medical education.

Furthermore, a crucial element of the CBME is the development of curricula that empower healthcare professionals from all backgrounds. These educational programs serve as a platform to equip participants with the knowledge and skills necessary to excel in the intricate realm of healthcare [24]. The fundamental pillars of these curricula revolve around promoting autonomy, imparting the ability to navigate complexity, and cultivating the aptitude to establish strong social connections within the healthcare sector. The training provides individuals with the necessary knowledge to function independently and effectively manage the various challenges they encounter in their professional trajectory. Acquiring the necessary competence to handle complexity allows students to skillfully identify and address complex medical situations. Additionally, promoting strong social bonds in the healthcare sector fosters collaboration and teamwork among professionals, leading to the development of an advanced system that improves the overall health landscape for the benefit of all stakeholders.

The Technological Revolution in CBME

Significant changes in the delivery of medical education curricula are needed to ensure that students and tutors can easily access relevant information and assessment tools. The integration of internet-based technologies throughout the teaching and assessment process is crucial for achieving this goal. An effective method is the use of internet platforms to distribute important basic content materials to supervisors, making them more accessible and efficient compared to the traditional method of organizing physical textbooks or printed materials [25].

E-learning technologies have the potential to profoundly revolutionize education and encourage greater collaboration and adaptability within the classroom[26]. These innovative tools redefine the role of the teacher, harmonizing it with a blended learning model that seamlessly integrates face-to-face interaction and virtual learning [27]. Also, the incorporation of web-based technologies also encompasses the field of assessment and shows greater effectiveness in this vital aspect of medical education [28]. The use of web-based assessment forms, available for download on smartphones through secure servers, can streamline the assessment process for students and improve the timely delivery of feedback[26]. This approach ensures that essential assessments are carried out promptly and eliminates the outdated problem of delays caused by misplaced papers. The success of this transformative initiative requires close collaboration between information technology professionals and medical educators to develop easy-to-use applications hosted on secure servers [29].

In summary, the use of internet-based servers to consolidate assessments offers the invaluable advantage of allowing tutors and students constant availability of past and present performance measurements. This accessibility facilitates the continuous improvement of individualized educational plans for students, enabling residents to actively participate in their educational journey. Also, it provides them with the necessary resources to effectively respond to formative and summative feedback throughout their training, fostering a culture of continuous improvement in medical education.

Challenges and considerations in the implementation of CBME

The implementation of CBME could raise concerns about the necessary feedback and additional time needed to teach and assess students[30]. To address this issue, collaboration between national accreditation bodies and universities is crucial to equip attending physicians with the necessary competencies[31]. Effective feedback, both formative and summative, is a key aspect of CBME and therefore requires comprehensive training of those responsible for this task[32]. It is important to recognize that without acceptance and support from educators, the sustainability of CBME is at risk.

For example, CBME requires the establishment of a more comprehensive feedback framework, which can pose challenges related to resources and faculty expertise[30]. Faculty members must receive adequate training to provide constructive feedback and assessments in line with CBME principles[31]. The increased frequency and depth of feedback required by CBME can overload current teaching and clinical responsibilities, which could affect the overall quality of teaching[33]. Adopting CBME often requires a significant increase in time commitment from both faculty and students in training[34]. Competency-based assessment involves a comprehensive evaluation of students across multiple domains and milestones, requiring meticulous documentation and periodic assessments with additional demands on the already tight schedules

of both educators and students[35]. Faculty members may need to devote more time to assessment activities, curriculum development, and meetings related to CBME implementation[36]. On the other hand, trainee students may find it difficult to balance the increased assessment workload with clinical tasks and other educational responsibilities[37].

Therefore, the ability of medical students to understand the crucial interactions between these components serves as a test bed for their professional growth and preparation to practice medicine in the future. Medical training programs are primarily responsible for fostering and preserving this delicate balance. Part of their mandate involves creating a learning environment where students fulfill their duties diligently and adhere to the fundamental principles of safe and effective patient care.

The cost of change

Successful implementation of the proposed changes, particularly the transition to CBME, requires a significant investment of time and financial resources[36]. To effectively carry out this transformation, a comprehensive approach is needed, including sharing best practices from forward-thinking institutions, collaborating with accreditation agencies, specialty boards, and training center managers, as well as developing standardized curricula and assessment tools suitable for widespread adoption[38]. To effectively implement CBME, it is vital that the medical education community learns from the experiences of institutions that have successfully adopted this approach. By sharing this valuable knowledge on a global scale, the community can leverage its strengths and avoid repeating past mistakes[39]. This exchange of knowledge plays a crucial role in ensuring the success and effectiveness of CBME implementation.

Furthermore, it is essential to have experienced individuals in training institutions, specialized committees, and accreditation organizations who can effectively guide the transition to CBME[40]. Their support is vital in facilitating the adaptation of training

programs during this transformation phase. They can contribute to the development of standardized training programs and assessment tools that can be used by various training centers in different locations [41]. Applying this uniform approach makes the implementation process more effective, eliminating the need for individual centers to create their own exclusive resources.

Obtaining the necessary financial support to carry out the desired transformation in training methods can be a challenging endeavor, as it depends on the specific regulatory landscape of each training institution [42]. Consequently, it is crucial that leaders at all levels secure the necessary funding for the desired change. It is of utmost importance to present compelling arguments that highlight the significant advantages that could arise from this change, particularly in improving the delivery of healthcare in terms of both effectiveness and efficiency[43]. This advocacy effort underscores the vital role that insightful leadership plays in realizing this transformative vision, requiring not only a clear articulation of the anticipated benefits but also skillful navigation through the intricate financial complexities that may vary across different jurisdictions.

CONCLUSIONS

Continuing education highlights the importance of a smooth transition from undergraduate to postgraduate medical education. It aims to align the various stages of medical education to ensure a cohesive and integrated approach, which has numerous advantages for all parties involved in medical education. It promotes consistency in the educational journey of physicians in training by facilitating a smooth progression from acquiring basic knowledge during undergraduate studies to the specialized competencies required at the postgraduate level. Moreover, it not only enhances the understanding of medical practice but also instills a sense of confidence and preparedness in students as they embark on their professional careers. To implement CBME, a significant revision of medical education is necessary, requiring a thorough review and modification of the current framework to make a smooth transition from traditional time-based educational models. It is essential to reassess the

allocation and use of instructional time and consider the diverse learning paces of each student. Additionally, CBME emphasizes the importance of providing students with ongoing training experiences that allow them to gradually acquire and master new competencies over time. These procedural and structural changes are crucial for the successful implementation of CBME, as they foster a student-centered approach and facilitate the acquisition of essential medical competencies in a more personalized and relevant manner.

CBME plays a crucial role in the long-term strategic planning of healthcare human resources. It represents an effective approach to addressing the evolving landscape of healthcare by tailoring medical training to the anticipated needs of the sector. By identifying and fostering the specific competencies needed to meet the healthcare needs of the population, CBME allows for precise calibration of the medical workforce. This alignment ensures that healthcare professionals are prepared to face new health challenges, adapt to demographic changes, and optimize the use of healthcare resources. Incorporating CBME into medical training empowers health systems to improve their responsiveness and adaptability to the constantly evolving demands of the sector, thereby facilitating the provision of efficient and sustainable healthcare services in the future.

In contemporary medical education, CBME is considered essential in effectively functioning health systems. A notable aspect of this integration is the incorporation of information technology, which plays a fundamental role in enhancing the effectiveness of medical education. Particularly in the context of CBME, the use of internet-based technologies has become a crucial tool for delivering curricula and conducting assessments. Online learning environments offer the advantage of instant access to educational materials and allow for continuous observation and assessment of student development, in accordance with the CBME principles of continuous improvement and feedback. As a result, the interplay of information technology and systemic integration highlights the modern development of medical education by ensuring that

medical professionals possess the necessary knowledge and skills to meet the ever-changing demands of healthcare delivery. The importance of effective feedback and evaluation within the framework of CBME highlights the development of faculty.

With the emphasis on achieving certain competencies and benchmarks, CBME requires that educators have the training and knowledge necessary to provide insightful and useful feedback that supports the personal and professional development of students. Additionally, the changing nature of medical education requires a paradigm shift in which students take an active role in their education, rather than acting as passive recipients. Encouraging students to take an active part in their education is essential because it aligns with current educational theories and enhances the learning process by involving them in self-assessment and reflective practice.

The success of implementing reforms in CBME in medical education systems fundamentally depends on careful financial planning and wise resource allocation. Due to the financial implications of transitioning to CBME, a thorough assessment of the current budgetary framework and identification of potential funding sources to support the creation of course materials, faculty training, assessment tools, and infrastructure improvements are required. Moreover, the crucial role of leadership in securing and overseeing the distribution of these assets becomes evident as a key factor in determining the effectiveness of CBME implementation. Effective leadership involves not only cultivating institutional acceptance and advocating for financial investments but also establishing transparent mechanisms for resource allocation, prudent financial management, and ongoing monitoring and adjustment of financial strategies to address the

evolving needs and challenges associated with adopting CBME.

It is strongly recommended that future academic research be conducted on the long-term impact of CBME on healthcare outcomes. This research should focus on comparing traditional time-based training methods with CBME approaches, paying special attention to tracking the development of clinical skills, decision-making ability, and subsequent patient outcomes over an extended period. Furthermore, this study should explore the effects of CBME across various medical specialties and consider factors such as resource allocation to support CBME initiatives, faculty preparedness for its implementation, and the adaptability of training programs across disciplines. The findings of these studies will enhance our understanding of the long-term effects of adopting CBME in medical education and provide valuable empirical evidence of its effectiveness in improving the quality of healthcare delivery.

To integrate the principles of CBME into conventional medical teaching systems, a comprehensive restructuring of curricula is necessary, entailing a shift from time-based teaching to a competency-focused approach. As part of this transition, it is crucial to reevaluate and redesign curricula, prioritizing the acquisition of practical skills as the main goal of learning. To ensure accurate assessment of students' competencies, the adoption of performance-based assessment methods, such as workplace-based assessments, is essential. To this end, faculty members must receive specialized training and professional development opportunities to effectively apply CBME, enabling them to guide, assess, and educate students within this innovative framework.

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Correspondence: *Fernando Ramos-Zaga.*
Address: *Av. Nicolás Ayllón 8510, Ate, Lima-Perú.*
Telephone: *(+51) 988647997*
E-mail: **fernando.ramos@upn.edu.pe**

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