The Biophysicist

Integrating CURE in Basic Medical Courses: The Perspective of Mexican Medical Students

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Medical education is organized differently in different countries, based largely on their health care needs and priorities. The current model used in Mexico is Flexner's model, which divides medical education into a preclinical section (consisting of college-level courses, equivalent to an undergraduate program of study in the United States) and a clinical section (consisting of a medical internship and social service experience) (1). The preclinical period has two phases: a basic science phase and a clinical science phase. These phases focus on developing clinicians specializing in clinical medicine or surgery. Thus, the phases do not cover medical research, global health concerns, health policy, or other perspectives. We believe that modern physicians need to be familiar with research even if they are not actively engaged in it currently and do not plan to become researchers in the future. According to the CanMEDS framework of competencies for medical doctors, physicians need to acquire scholarly abilities to enable them to contribute to the application, dissemination, translation, and creation of new knowledge about human health and health care (2).

It is therefore our view that medical students and institutions must seek out opportunities to strengthen weaknesses in education for future clinicians and nonclinicians. To develop new strategies to improve medical education, an exciting and novel approach is CURE, for course-based undergraduate research experiences (Fig 1). CURE is a new way for medical school professors to introduce and better engage students in conducting scientific research. CURE is a group learning experience that prompts students to address original research questions (3). By doing so, students are exposed to the scientific reasoning employed in research.

Learning basic science as a medical student in Mexico is challenging because most of the instruction follows the classic model where professors teach theory, and the exams mainly focus on recall of factual information. This is instead of testing the problem-solving skills that are needed for clinical or research applications.

Developing research skills helps students better understand basic science subjects, such as biophysics, which have diverse medical applications. For instance, having an understanding of biophysical

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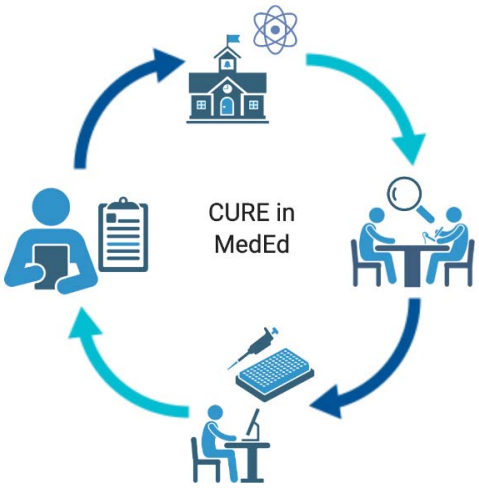

Fig 1. Course-based undergraduate research experiences in medical education.

thinking can help physicians understand the pathophysiological basis of diseases like Hutchinson–Gilford progeria syndrome. In this disease, a mutation in the gene encoding A-type lamins results in alterations in the structural and mechanical properties of lamina in patients. Thus, knowledge of biophysics research helps students connect their knowledge (and skills) stemming from their study of the physical sciences to key life sciences questions and helps them develop an understanding of physiological processes and the instrumentation used for disease diagnosis from first principles.

In our opinion, the perfect time to study medicine from a research-oriented perspective is during the period when basic science subjects are taught. Our first experience with CURE was during our clinical biochemistry course, taken during the first year of the undergraduate curriculum. The main objective was to learn the methodology of the research process, and our initial training consisted of performing an in-depth primary literature review and analysis of a specific protein of interest in clinical biochemistry. In the second year, during our immunology course, we developed the methodology needed to carry out a research investigation related to a topic covered in the course. At first, this was challenging, but with the help of our professor, we learned the basic principles of research and how to think scientifically. These new skills allowed us to develop solid approaches to tackle the scientific questions being asked and helped us better understand and integrate our knowledge of the course's core material.

CURE's success as a teaching tool has been documented in the literature and has shown that educators can employ student-led research projects in pharmacology and physiology, for instance, to strengthen student learning during medical school. The projects being carried out can also provide students with an opportunity to practice and better refine both their oral and written communication skills and to learn teamwork. All of these outcomes are possible without sacrificing academic performance (4–6). For us in the Mexican and Latin-American medical education communities, CURE therefore has the potential to help physicians in training strengthen, expand, and improve both their clinical and research skills. In the future, we believe the program will empower medical students to become physicians and researchers better able to treat individuals and communities, thus ultimately improving health care.

Our membership to Asociación Mexicana de Médicos En Formación (AMMEF A.C.: Mexican Association of Physicians in Training civil society organization) has enriched our perspective on undergraduate medical education. AMMEF teaches us about advocacy and how to be "agents of change." We are therefore empowered to seek new educational strategies to enhance our medical curriculum and our undergraduate research experiences. Our involvement with AMMEF has shown us new learning strategies and has opened our eyes to new career paths that are open to physicians, such as research, including research in biophysics.

AUTHOR CONTRIBUTIONS

HSM-S and IG-O designed the research idea and wrote the paper. AR-M and JA-H wrote and reviewed the paper. MFR-E and JAG-D wrote the paper and contributed to ideas.

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