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REVIEW ARTICLE

Advancements in Undergraduate Medical Education: Meeting the Challenges of an Evolving World of Education, Healthcare, and Technology

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Abstract Restructuring of undergraduate medical education (UGME) has occurred from time to time over the past century. Many influences, including the persuasive report of Abraham Flexner in 1910, acted to reorganize medical education in the early twentieth century [1, 2]. In his report, Flexner called on American medical schools to enact higher graduation standards and to stringently adhere to the protocols of mainstream science in their teaching. Prior to this report, UGME had changed little over the previous century but over the last several decades, reform within medical education has become routine. This increasing rate of change has been challenging for those within the realm of undergraduate medical education and can be frustrating to those outside this sphere. Today, the Association of American Medical Colleges (AAMC) and Liaison Committee on Medical Education (LCME) are typically the driving forces behind such changes, along with acceleration of advances in medical care and technology. The number of changes in the last decade is significant and warrants review by those interested or involved in education of medical students. This article aims to provide a summary of recent changes within UGME. Within the article, changes in both the pre-clerkship (1st and 2nd years) and clinical years (3rd and 4th) will be discussed. Finally, this review will attempt to clarify new terminology and concepts such as the recently released Core Entrustable Professional Activities (EPAs). The goal of these UGME changes, as with Flexner's reform, is to ensure future physicians are better prepared for patient care.

Keywords Core entrustable professional activities · Psychiatry · Undergraduate medical education

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Overview of the Governing Bodies

Before transitioning into the details of recent UGME changes, it is important for one to first understand the organizations responsible for oversight and accreditation of UGME institutions as they often both initiate and assure implementation of change. These organizational bodies regulating medical schools and medical undergraduate education can be confusing to those not considerably involved in medical education. They include the Association of American Medical Colleges (AAMC) and Liaison Committee on Medical Education (LCME).

Association of American Medical Colleges (AAMC)

The AAMC, founded in 1876 and a non-profit association, is dedicated in part to continual renewal and innovation of medical education. Its membership is comprised of 163 accredited U.S. and Canadian medical schools, nearly 400 major teaching hospitals and health systems, including 51 Veteran Affairs medical centers; and more than 80 academic societies [3]. The AAMC's vision is served through a number of committees, such as the Advisory Panel on Medical Education (APME), a committee consisting of 12 individuals that provide anticipatory guidance and recommendations to the AAMC on issues relevant to medical education.

The AAMC routinely monitors clinical education among its members to identify deficiencies and areas for improvement. Such deficiencies were identified as a result of several exploratory exams and studies that were done at the start of the millennium, resulting in the convening of a task force project on the Clinical Education of Medical Students in 2003 [4]. The group was designed to conduct a comprehensive review of the clinical education of medical students and to effect changes in the design and conduct of the clinical curriculum to improve the quality of medical students' education. The task force included representatives from the seven national clerkship organizations, the Alliance for Clinical Education, and the American Academy on Physician and Patient. The project subsequently produced two reports concerning recommendations for curricula for UGME in both the pre-clerkship and clinical years. The aim of these two reports was to facilitate a more explicit approach to developing medical students' clinical skills and to inspire educators in their commitment to this essential element of physician competency.

Liaison Committee on Medical Education (LCME)

The LCME is the recognized accrediting agency for medical education programs leading to the MD degree in the U.S. and Canada [5]. Accreditation by the LCME establishes eligibility for selected federal grants and programs. Most state boards of licensure require that U.S. medical schools be accredited by the LCME, as a condition for licensure of their graduates. Additionally, eligibility of U.S. students to take the United States Medical Licensing Examination (USMLE) requires LCME accreditation of their school. Graduates of LCME-accredited schools are also eligible for residency programs accredited by the Accreditation Council for Graduate Medical Education (ACGME). The LCME is not responsible for granting institutional accreditation, only programmatic accreditation. Institutional accreditation is established by regional accrediting agencies and is a requirement for federal financial assistance programs. Once this institutional accreditation is obtained, the LCME assumes responsiblity for the continuing accreditation of the medical education programs within the institution.

The LCME is jointly sponsored by the AAMC and the American Medical Association (AMA). Canadian medical education programs on the other hand are accredited through a partnership between the LCME and the Committee on Accreditation of Canadian Medical Schools (CACMS). LCME members consist of medical educators and administrators, practicing physicians, public members, and medical students. The AAMC and the Council on Medical Education of the AMA each appoint seven professional members. Additionally one medical student is appointed each by the AAMC and AMA. The LCME itself appoints two public members, and a member is appointed to represent the CACMS. Lastly, the LCME is represented by ad hoc teams of evaluators who conduct on-site surveys of medical schools. Survey team members are a mix of basic science and clinical educators and practitioners. Members of the LCME and surveyors conducting field evaluations serve as voluntary, peer evaluators. These teams ensure medical education programs can demonstrate that their graduates exhibit general professional competencies that are appropriate for entry to the next stage of their training.

Summary of Recent Challenges and Changes in UGME

Moving Beyond Flexner

One of the tenets of Flexner's philosophy of education is that education must adapt to new knowledge and technology and must therefore be dynamic in nature. More than one hundred years after his report and recommendations for upended medical education, scholars in academic medicine have begun forecasting that the next academic revolution in medical education is around the corner, or indeed, is already happening [6, 7]. Overwhelmingly, the direction of change in the past decade has been toward the idea that learning should be competency based, embedded in the workplace, and related to patient outcomes [7]. Relatedly, there has been significant efforts to define and standardize competency benchmarks across the medical education continuum [6]. The recent movement towards the use of Entrustable Professional Activities (EPAs) is consistent with this trend.

Many reasons have been posited to describe why change in our educational models is needed today. Old educational models heavily focused on mastery of biomedical knowledge, and were founded with assumptions about biomedically-focused care in simpler healthcare settings and teams that no longer match the reality of healthcare today. Not only has there been a growing realization that biomedical knowledge has expanded beyond what a single person can master, but it has also become clear that uncertain and complex healthcare settings and multidisciplinary teams are now the context in which modern medicine is practiced. Hence, it has been suggested that new education models that emphasize critical thinking, lifelong learning skills, knowledge of models beyond the biomedical causes of illness, and ability to work in interprofessional/multidisciplinary teams are clearly needed to meet the needs of the modern medical learner [6–8]. Moreover, there has been growing consensus that medical education should include as many opportunities for interprofessional learning as possible [6, 7]. In psychiatry undergraduate education, these changing trends in instruction have been associated with changes in the methods by which content is taught in the preclinical years, as well as changes in the goals for the clinical (clerkship) years.

Recommendations for Preclerkship Clinical Skills Education for Undergraduate Medical Education in Relation to Psychiatry

The AAMC Preclerkship Clinical Skills Education Task Force was established in 2006 in an effort to begin to establish a national consensus regarding preclerkship clinical skills learning and appropriate outcomes. The monograph that this group produced provides six concrete recommendations for clinical skills education in the pre-clinical years [9]. Although not discipline specific, these recommendations are easily applicable to psychiatry. First, it was recommended that medical schools adopt some core principles to guide the design and implementation of the preclerkship clinical skills curriculum. Foremost among these are that the primary purpose of clinical skills performance learning is to improve patient outcomes, that learning should be interactive and experience-based, that learning should be developmental (i.e., should include gradual and incrementally challenging educational experiences), and that both teaching and assessment of clinical skills is necessary.

Where taking a developmental stance on learning skills is concerned, it is suggested that there are four levels of learning. First, the learner can demonstrate *knowledge* of the material, and then *knows how* the skill is performed. Next, the learner, *shows how* to do so in a controlled or simulated setting, and finally, actually *does* it in clinical practice [9]. Similarly, it is suggested that preclinical competencies link upwards toward clinical/clerkship competencies, which in turn match up to help the learner meet the entry level competencies for graduate medical education, in a developmental fashion. Importantly, it is suggested that learning opportunities be as varied as possible, and include much more than traditional large-group lecture learning. Specifically, use of self-directed learning, small groups, small group seminars/workshops, and simulation is recommended. As mixed methods of instruction are used, mixed methods of assessment also are recommended. Beyond the traditional multiple choice exam, use of essay or oral exams, standardized patient exams, objective structured clinical examinations (OSCEs), and simulation exams can be considered. At the highest levels of competency, direct observation of demonstrated skills with a real or simulated patient, record reviews, or other similar realistic assessment is suggested.

Recommendations for Clerkship Clinical Skills Curricula for Ugme in Relation to Psychiatry

The task force project on the Clinical Education of Medical Students resulted in a 42 page document outlining the recommendations of the committee concerning clinical skills training in medical school [10]. There had been no written curriculum concerning the learning and mastery of clinical skills before the work product of this committee. This process had remained implicit and was presumed to happen with students. The recommendation of this task force was to make clinical skills curriculum for students more explicit. The committee made six recommendations relating to the design and implementation of this curriculum. In summary, these recommendations required medical schools to come up with a common set of shared skills or procedures that medical students must learn. It entreated that medical schools outline these skills in detail, assure they are taught repeatedly throughout the medical curriculum in a step-wise progression, and certify their quality.

With a blueprint of required skills, faculty and students would be in a partnership, each responsible for the teaching and mastery of these described skills. Procedures or skills can include many areas such as engaging the patient in a professional relationship, performing or

initiating clinical tests or procedures, performing a physical or mental examination, and undertaking diagnostic or therapeutic interventions. While psychiatry itself can cover many of the designated procedures, it is best suited to teaching of a number of skill sets. These areas include professionalism, engagement and communication with a patient, and the mental status examination. Psychiatry is also well positioned for providing supervision for teaching certain parts of the clinical history, such as social and psychiatric histories, as well as for selecting and interpreting tests that involve or may affect the central nervous system. Due to psychiatry historically covering issues such as age, gender, culture and other sensitive and diverse topics, the field offers one of the better education opportunities for discussion and application of clinical care within the practical context of the patient-physician relationship. The first decade or more of UGME in the twenty-first century has emphasized clinical skill competency upon completion of medical school.

Core Entrustable Professional Activities (EPAs) for Entering Residency

Over the last several years there has been a shift in thought which has placed more emphasis on preparing medical students to be competent medical providers in their chosen fields on the first day they enter the realm of graduate medical education or residency. A relevant change in undergraduate medical education has been the introduction of the Core EPAs for Entering Residency [11]. Published by the AAMC and derived from the work of Ten Cate, the Core EPAs are defined as "activities that all entering residents should be expected to perform on day 1 of residency without direct supervision" [11–13]. The Core EPAs represent only a portion of what is expected of any medical school graduate, and they are likely only a subset of what is required of a practicing physician or a resident in a particular specialization.

An EPA differs from, but is related to, both competencies and milestones. While a competency typically represents an ability of a person, an EPA describes a unit of professional work that can be entrusted to a learner with appropriate competence; thus an EPA typically integrates several competencies at once [11, 12, 14, 15]. All Core EPAs generally rest on the competencies of trustworthiness and self-awareness, and they also incorporate the "Reference List of General Physician Competencies" expected of physicians, especially interpersonal and communication skills and professionalism [11, 16]. Milestones, relatedly, can be conceptualized as stages of development or outcomes representing increased or decreased levels of performance for a competency; each competency comprising a Core EPA can be linked to pre-entrustable and entrustable milestones, and milestones can be connected with decisions to entrust [11, 14]. Although an EPA framework for undergraduate medical education is a more novel concept than the competency and milestone framework used for graduate medical education, it offers the advantage of putting competencies into a practical and meaningful context of activities actually performed in day-to-day practice [11, 17].

The 13 Core EPAs, as well as their relevant domains of competence, are listed in the Table 1 below. A thorough discussion of each EPA is beyond the scope of this paper, and interested readers are referred to the original AAMC publication for a more thorough explanation for each EPA, with pre-entrustable and entrustable milestone behaviors and vignettes [11].

The AAMC's development of a list of Core EPAs has been praised for its honest reconceptualization of undergraduate medical education as a preparation to safely perform a limited number of general patient care activities on the first day of residency, fitting with a general trend towards competency-based medical education and training that views physician education as developmental and progressive [15, 17–19]. An EPA approach also increases

Table 1 List of 13 core EPAs for entering residency and relevant domains of competence

EPA	Domains of Competence
1. Gather a history and perform a physical exam	PC; KP; ICS; P
2. Prioritize a differential diagnosis	PC; KP; PBLI; ICS; PPD
3. Recommend and interpret common diagnostic and screening tests	PC; KP; PBLI; SBP
4. Enter and discuss orders and prescriptions	PC; PBLI; ICS; SBP
5. Document a clinical encounter in the patient record	PC; ICS; P; SBP
6. Provide an oral presentation of a clinical encounter	PC; PBLI; ICS; P; PPD
7. Form clinical questions and retrieve evidence to advance patient care	KP; PBLI
8. Give or receive a patient handover to transition care responsibility	PC; PBLI; ICS; P
9. Collaborate as a member of an interprofessional team	ICS; P; SBP; IPC
10. Recognize a patient requiring urgent or emergent care and initiate evaluation and management	PC; ICS
11. Obtain informed consent for tests and/or procedures	PC; ICS; P; SBP; PPD
12. Perform general procedures of a physician	PC; ICS; P; SBP; PPD
13. Identify system failures and contribute to a culture of safety and improvement	KP; PBLI; ICS; P; SBP

Information for this table comes from the AAMC report on Core EPAs for entering residency [11]

EPA Entrustable Professional Activities, *PC* Patient Care, *KP* Knowledge for Practice, *PBLI* Practice-Based Learning and Improvement, *ICS* Interpersonal and Communication Skills, *P* Professionalism, *SBP* Systems-Based Practice, *IPC* Interprofessional Collaboration, *PPD* Personal and Professional Development

generalizability of a learner's education and skill to a variety of contexts by synthesizing multiple competencies, emphasizing qualities of work instead of qualities of the learner [18].

Criticism of the Core EPAs has included questioning if each EPA is a stand-alone independent activity, how indirect supervision for different EPAs should be performed, and if the EPAs could be stated more simply [15]. Current conceptualizations of Core EPAs may overemphasize the objective competency components and underemphasize the subjective nature of the trust component [20]. Additionally, much of undergraduate medical education, especially preclerkship, may be viewed as knowledge and skill-based, with limited roles for Core EPAs [18]. More generally, some have critiqued the trend of multiple paradigm changes in medical education over the years, without adequately determining if such changes produce better physicians [21]. Competency-based medical education, which includes EPAs, also can be criticized for being too reductionist and emphasizing assessment of outcome at the expense of attention to the value of learning activities and process [22, 23]. EPAs, however, may help improve competency-based medical education by operationalizing competencies and emphasizing practice as well as education [23].

How EPAs Relate to Medical Students going into Psychiatry

Broadly speaking, emphasis of the Core EPAs in psychiatry clerkship activities can be understood as providing structure to the workplace learning of medical students' clinical education; however, they also may highlight the role and value of clinical experiences as components of pre-clerkship learning [18]. EPAs for entry into clerkship, such as gathering information from a stable patient with a common chief complaint, also have been proposed,

and may be a helpful downward vertical extension of Core EPAs to identify readiness for psychiatry clerkship [24].

Although the EPAs are intended for all graduates of medical school, it has been suggested that specialty-specific EPAs could prove useful for identifying activities for students preparing to enter a specialty, to give clarity as to expectations for that specialty's first day residents, as well as help guide elective experiences of undergraduate medical students [18]. It may be that, as a complement to Core EPAs, psychiatry develops similar EPAs for residents on their first day of psychiatry residency. Possible EPAs for graduate psychiatry learners may include things such as prescribing common medications, managing a psychiatric discharge, or conducting risk assessments, and versions of these EPAs for first-day residents may be considered [25].

Many medical schools are moving to requiring fourth year students to participate in career specific "boot camps" or "advanced AIs" during the last two three months of the final year of medical school. Within the field of psychiatry, the goal of these "boot camps" would be to both teach and ensure mastery of basic psychiatric knowledge and skillsets before students' transition to residency. Students would carry patient responsibilities similar to or slightly less than interns, but would be under closer supervision during this experience. More field specific psychiatry EPAs could be useful in helping to ensure standardization of these experiences across medical schools. These pre-internship experiences are still relatively novel and thus knowledge around both their details and results are limited at this time.

Implementation of EPAs

With the novelty of the EPAs, exactly how to implement EPAs in undergraduate medical education remains unclear. A sensible first step will likely be developing faculty knowledge of and skill in teaching the EPAs [11]. The AAMC also recommends that students should be given many opportunities to practice demonstrating entrustability, with multiple low-stakes, formative assessments. EPAs can be used to assess learners along a dimension of trusting the trainee only to observe the activity, to entrusting the trainee to perform the activity with supervision available, to entrusting the trainee to supervise others in their performance of the activity [14]. Undergraduate learners may progress from not being entrusted to perform an EPA, to performing an EPA with a supervisor directly present, to performing an EPA with a supervisor available but not present [18]. Ultimately, use of the EPAs may help more clearly operationalize when undergraduate learners are entrustable with increasing complex or difficult activities.

Future Challenges

Matching EPAs to GME Milestones

Over the past couple decades, the ACGME has been working towards an accreditation system based on outcomes across six domains of clinical competency [17]. The new accreditation system is based around milestones within the competency domains that residents are expected to demonstrate as they move through residency. These milestones were developed by the American Board of Medical Specialties (ABMS), with a focus on outcomes and learner-centered education while reducing the burden of overly prescriptive accreditation practices which may overemphasize the educational process. An extensive listing and discussion of the psychiatry milestones is beyond the scope of this article, and interested readers are directed to other more in-depth coverage of the topic, as well as in this issue [26].

The AAMC recommends that competencies and milestones be clearly linked to EPAs so faculty and learners are all working towards the same end, and uniting EPAs with ACMGE milestones likely falls under this recommendation [11]. The exact specifications for this, though, have not been officially detailed. Milestones may allow for clearer, more behavioral descriptions of EPAs by providing a common reference point of a standard of performance to be expected [27] The competency domains linked with each EPA will likely provide a roadmap for mapping EPAs to ACGME milestones. Lastly, it also must be considered that ACGME milestones may represent a natural extension of EPAs, as EPAs represent a minimum standard of trustworthiness for the first day resident, while the milestones represent increasingly skilled levels of development a resident progresses through throughout residency and her career. Connecting the EPAs with GME milestones will help emphasize the progressive nature of learning across a unified continuum [18].

Assessing Mastery of EPAs in Medical School and in Residency

At the UGME level, assessment of whether a learner has mastered an EPA typically includes multiple assessment time points that are spread out throughout the pre-clinical and clinical years. Initially, lower-level competencies such as knowledge base are assessed via written examinations. Skills are then developed by providing increasing opportunities for realistic practice with supervision [28]. Finally, higher level skills (i.e., performance) are later typically assessed by using direct observation in the clinical clerkship years [9]. At the GME level, assessment is expanded to include multiple settings and the multiple roles of specialty practice [25].

Summary

Undergraduate Medical Education is an ever changing field, whose pace of evolution continues to intensify due to the exponential growth in both medical knowledge and procedures. Since the time of Flexner, over a century ago, to the recent establishment of core entrustable professional activities, medical education has continued to both adapt and transform to meet the demands of each generation of physicians. With the help of educators within the field of medicine and their associated organizations such as the AAMC and LCME, future change is likely to continue to frequently occur. For this reason, psychiatrists and other mental health professionals heavily involved in the education of medical students should make attempts to stay kept well-informed on general undergraduate medical education developments.

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