In 1910, the Flexner report laid the foundation for medical education in the United States as we know it today (Flexner 1910). The report raised standards and defined an approach to physician training that has persisted into the 21st century. Flexner emphasized the scientific basis for medical education, and this in turn led to the medical school model of two years of foundational education in the basic sciences followed by two years of education in clinical medicine. In 2010, 100 years after Flexner, a number of authors commemorated the occasion by commenting on the state of medical education, how it had evolved, and whether the system was adequately serving the needs of patients. Those perspectives helped to identify ongoing challenges and how they might be addressed. Many called for an examination of whether the model once again needed to be evaluated (Frenk et al. 2010; Irby et al. 2010).

Responding to concerns about the preparation of graduates to deliver care in our current health care system, experts called for standardized outcomes and individualized learner pathways to achieve them, integration of material across traditional areas, attention to an environment of inquiry, and professional identity formation. The medical education community has responded, and much has been achieved in the last decade, but much work remains to be done (Skochelak 2010).

Revisiting the Flexner report at its centennial stimulated efforts to improve medical education for the next 100 years, including collaborations across institutions and organizations. The American Medical Association (AMA) Accelerating Change in Medical Education Consortium is one such collaboration. In 2013, the AMA created the Accelerating Change in Medical Education initiative to address four specific aims:

1. Create competency-based assessment and flexible individualized learning plans.
2. Develop exemplary methods to achieve patient safety, performance improvement, and patient centered team care.

The graduate medical education environment is very different and, in some ways, more complex than the undergraduate medical education environment.

There is an ongoing tension between the delivery of clinical service and education of learners in graduate medical education, which necessarily impacts efforts at curricular reform.

The next step in our evolution is to critically examine how structures and institutions may hinder progress toward charting a path of continuous professional development in physician education and meeting the needs of patients and populations.

The necessary institutional reforms demand collaboration and cooperation of the type demonstrated through communities of practice such as the Accelerating Change in Medical Education Consortium.
3. Understand the health care system and health care financing.
4. Optimize the learning environment, including pedagogy, tools, and technology.

The AMA solicited proposals from U.S. medical schools and awarded grants to eleven medical schools in a first wave. In 2016, the AMA funded an additional 21 schools for similar projects of smaller scope. The consortium has since grown to 37 schools who meet regularly to share ideas in an energetic and successful effort, as described in the preceding papers.

We estimate that the innovation work of the medical schools in the consortium has impacted the educations of over 23,000 students thus far. Many of those students are moving on to the next phase of their professional development in residency training. To continue to support their growth, it was necessary to consider whether a similar program in graduate medical education (GME) could stimulate ongoing innovation in physician professional development. In 2018, the AMA Board of Trustees committed $15 million to fund Reimagining Residency, a group of innovation projects in GME.

As we developed parameters for this program, we recognized that the GME environment is very different and, in some ways, more complex than undergraduate medical education (UME). Residency programs tend to be more aligned with specific specialties and with their local clinical departments than with the institutions that sponsor them. Those sponsoring institutions support diverse specialty curricula across many programs and often deliver those curricula in multiple clinical locations. Furthermore, GME is not a purely educational activity. Residents and fellows are employed front-line health care professionals in the systems in which they work. There is an ongoing tension between the delivery of clinical service and education of learners in GME. Changes to one necessarily affect the other. It can be challenging to modify a curriculum due to these service requirements and practical constraints.

To address these challenges, the request for GME proposals emphasized collaboration—between programs within an institution, between institutions, and across specialty organizations and state medical societies. We believed collaboration to be important to achieve outcomes that were generalizable beyond the specific programs in which they were studied and that might be applicable to GME in general. The arching aims of the initiative were to build upon the UME experience by addressing:

- The continuum of medical education, particularly the transition from UME to GME.
- Preparation for practice in the health care system of the 21st century.
- Well-being in the learning environment for trainees and all who work with them.

The response to the request for proposals was vigorous, with 252 letters of intent submitted representing over 300 organizations with responsibility for GME in the United States. The enthusiasm for the initiative affirmed our impression that there is significant opportunity for and interest in innovation in GME, and that funding for these efforts was welcome. Eleven Reimagining Residency projects have been funded and will complete their work over the next 5 years.

Importantly, the teams responsible for these GME projects have joined the Accelerating Change in Medical Education Consortium and are collaborating with the existing UME members. Rather than establish a separate GME innovation consortium, we seek to model a continuous path of professional development through innovation efforts that are broadly applicable across the spectrum of physician training. The areas explored by the consortium to date are relevant to the GME projects, and the work of the GME projects will build upon and contribute understanding to the ongoing work of the consortium’s member schools. The design is intentionally synergistic.

As these GME projects were beginning in late 2019, we all confronted a global health crisis due to a novel coronavirus. In addition to its impacts on populations and the capacity of our systems to meet their health care needs, the COVID-19 pandemic has raised important questions about medical education and its ability to adapt to rapidly changing circumstances. Early in the pandemic, out of an abundance of concern for their safety, medical students in the United States were removed from clinical contact with patients. This raised the paradoxical question of how to provide clinical education outside of a clinical environment. Students in earlier phases of their training who were receiving primarily didactic education in the classroom were transitioned to remote learning on virtual platforms. Residents and fellows were redeployed to clinical areas, often outside of the discipline in which they were training, to meet the demand to care for patients. These assignments were sometimes at the expense of experiences that were required to complete their programs and become board eligible in their selected specialty. The look and feel of medical education and the entire learning continuum were transformed almost overnight.

More importantly, the COVID-19 pandemic has exposed significant structural vulnerabilities in our medical education system. As necessary learning experiences were interrupted, valid concerns were raised about our rigid, time-based approach to medical education. Medical school in the U.S., for example, is generally a 4-year curriculum in which certain requirements must be met. If large groups of students were unable to meet those requirements due to the impact of COVID-19, would their graduations and preparation for residency training be delayed? If not, and requirements were waived in the interest of preserving on-time advancement, what was the value of those requirements toward their professional development in the first place?

In GME, as clinical experiences necessary to complete residencies and become eligible for board certification were put on hold indefinitely, would this delay transitions to independent practice? Would institutions have the clinical volume to support new cohorts of residents alongside the ongoing needs of current trainees? These issues lead to questions about the outcomes of training and our ability as a medical education community to assess them. Having historically relied on time as a proxy for competence, we now must confront our responsibility to adequately assess
clinical skills following varying durations of exposure and depth of experience.

COVID-19 has had other impacts that define further areas for work in medical education. In addition to interrupting clinical experiences, the pandemic has led to cancellation, delay, and modification of milestones on the path to becoming a physician. High stakes tests such as USMLE Steps 1 and 2 were delayed or cancelled, raising questions about how the absence of these data would impact progression at schools where they are graduation requirements. Furthermore, the use of USMLE examination scores in the residency application process has implications for how program directors will select candidates for interview and rank them in upcoming matches when those data are missing. The practice of doing ‘away rotations,’ clinical assignments that often serve as auditions at institutions to which a student is applying for residency, and of visiting residency programs for in-person interviews have been interrupted. This limits further the data upon which applicants and program directors will base decisions about ranking in the Match and consequently heightens anxiety about that process.

It is important to recognize that the COVID-19 pandemic has not created these issues in medical education. The pandemic is a stress that has manifested vulnerabilities in our medical education system that have been present for a long time. Calls for better systems to assess competency and for the use of time-variable advancement have been issued before (Andrews et al. 2018). Now, this long-held interest is being replaced by a very real need for these approaches to support a healthy medical education system moving forward. Licensing examinations as graduation requirements and as components of the residency application have previously been identified as significant stresses for residents achieved the skills to engage in independent practice within their discipline. This was a move away from process-based medical education toward outcomes-based education. It shifted the emphasis in medical education away from what was offered and toward what was learned. The interest in outcomes naturally led to work on methods to assess educational outcomes, both at the program and the individual level. This work included improving approaches to assessing necessary clinical skills to augment the traditional knowledge-based testing that had been previously relied upon as a measure of learner achievement. At the ACGME, this was manifest through development of groups of specialty-specific milestones to measure residents’ progress toward competence in six broadly defined areas: medical knowledge, patient care, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice. For some of these, such as milestones related to medical knowledge, there were existing tools like knowledge-based examinations that could be used for assessment. In other areas, such as professionalism, new tools needed to be developed. For many of the milestones, this work on assessment is ongoing.

As residencies adapted to milestones-based assessment, medical schools worked to define standards for students that would represent their professional development in a competency-based environment. Led by the Association of American Medical Colleges (AAMC), schools developed a series of thirteen Core Entrustable Professional Activities for Entering Residency (CEPAER) (AAMC 2014). Rather than the broad personal attributes described by the ACGME milestones, entrustable professional activities (EPAs) represent clearly defined units of work. An example is performing a complete history and physical examination. EPAs are more discrete and easily observed in the clinical environment than milestones. A single EPA may require competency in several milestone areas. Following the example of the history and physical, this depends upon medical knowledge and communication skills, among others. EPAs may be mapped to milestones and vice versa. But the exercise of mapping one to the other is difficult and may not adequately encompass the merits of either (ten Cate 2014). A significant challenge in competency-based medical education remains the development of a harmonized system for defining and assessing a physician’s progress (and, in some cases, regression) over the course of their entire professional life, from medical school through retirement.

One of the Reimagining Residency projects addresses this issue. Investigators at Stanford University are coordinating an effort through the Council of Residency Directors in Emergency Medicine to develop a set of specialty-specific tiered EPAs to provide specific, measurable outcomes for each level of training, supporting the transition from medical school to residency and allowing for robust assessment throughout the continuum of medical education. These EPAs will integrate multiple competencies and map to ACGME milestones for the purposes of tracking resident progress in that system. This project is looking beyond training and into practice. In order to address the criticism of EPAs that they lack the granularity to be used as effective workplace-based assessments, the investigators will also develop a set of observable practice activities (OPAs) to augment the EPAs. OPAs are a set of learning objectives.

**Competency-based medical education**

Nearly 30 years ago, the Accreditation Council for Graduate Medical Education (ACGME) launched its Outcomes Project (Swing 1998). The Outcomes Project was an effort to assess residency programs based not only upon whether those programs provided an appropriate environment and access to experiences for residents to learn, but upon whether residents achieved the skills to engage in independent
and activities that are readily observable and measurable in daily practice, lending heightened specificity to the EPA s. The aim of this project is to create an assessment system that can be applied across the continuum of professional development. From these elements, the investigators will create a dashboard to track evolving competence, support assessment and coaching, and develop learning analytics to guide future professional development.

This work is important. If competency-based medical education is to be fully realized, it will be dependent on the quality of assessment. For the assessment of competence to be meaningful, it must be consistent across all phases of a physician’s clinical experience. Our current systems provide meaningful information about students’ progress toward meeting graduation requirements and residents’ progress toward board eligibility, but we lack a unified system to place a physician along a continuum of professional development at any given point in time. This has implications for mid-career training in new skills, re-entry into practice for those physicians who may have taken time off from their practices, and for establishing board eligibility when it has lapsed. Reliable assessments that are directly applicable to the practice of medicine are needed.

Reliable assessments of competency necessarily lead to exploration of time variability in medical education. Currently, the phases of a physician’s professional development are divided into neat time allotments—four years of medical school, three years of residency (or more depending on the specialty), and a year or more of fellowship training. It is assumed that a trainee who successfully completes the offered curriculum during those time periods is ready to move onto the next phase of their professional life. The time spent in clinical immersion and learning is accepted as an adequate proxy for competence. However, as systems for assessing competence become more reliable it raises valid questions about how much time is necessary to achieve required skills and whether that time frame is the same for all learners. Some small pilots have addressed this question. The Education in Pediatrics Across the Continuum (EPAC) project showed that, for a small cohort, students could be successfully advanced from medical school to pediatrics residency based upon rigorously assessed competencies rather than completing 4 years of medical school and that some learners advanced more quickly than others (Andrews et al. 2018). Advancing to residency in a time variable fashion raises practical issues for medical schools related to their graduation requirements and for residency programs related to their ability to accommodate new residents at times during the year other than the traditional July 1 start date. These factors, as well as the effort required to administer assessments, impact the generalizability of these findings to larger classes and other disciplines.

Through Reimagining Residency, colleagues at Massachusetts General Brigham in Boston are studying the feasibility of time-variable advancement from residency to practice based upon rigorous assessment of competency. Using a model similar to the one used in EPAC, several residency programs at their institution will continuously assess their trainees’ readiness for independent practice. This project, titled ‘Promotion in Place,’ will create an opportunity for those residents who have demonstrated competency to practice independently in the same environment in which they have been training for the duration of what would have been the time frame for their residency. This approach addresses the practical issues of what a resident might do when they graduate early and helps the institution continue to meet the service demands of the residency program despite several of its members completing early. There are a host of practical considerations for this project. What exactly will graduating residents do, and how will they be paid? How will graduation with fewer than the board-required months of training affect board eligibility? If competency is rigorously assessed, what will be the consequences at the individual and program level when a trainee is deemed to have not met competency standards by the traditional conclusion of their program? That the project is raising these questions and will inform answers to them may be as substantial a contribution as actually graduating residents early.

Health systems science

Through the Reimagining Residency initiative, Pennsylvania State College of Medicine is leading a collaborative effort with Geisinger Health System, Allegheny Health Network, and Kaiser Permanente that expands on its work in health systems science to define the characteristics of ‘health systems citizens’ and the clinical environments that support their development. Despite making health systems science a curricular priority over the last 5–10 years, some practitioners demonstrate aptitude for and behaviors consistent with this model while others do not. Through a deeper understanding of how these skills develop, the project’s investigators hope to define scalable models that health systems, residency programs, and medical schools can adopt to support competency in this important area.

Montefiore Health System has a long history of engagement in social medicine, working to meet the needs of its community in the Bronx that is consistently the poorest county in New York state. An important component of delivering effective care to their population is understanding and addressing the social determinants of health (SDoH) that impact outcomes beyond the services they directly provide to individuals. Their Reimagining Residency project will develop a curriculum around SDoH that will contribute to the professional development of their residents and faculty. In addition to better preparing those groups to practice in their community, this project may enhance physician well-being, as well. For example, if residents and faculty feel more agency in their ability to address SDoH in the care of their patients, enhanced feelings of efficacy in meeting their patients’ needs may mitigate stresses that lead to burnout.

Maine Medical Center (MMC) is building on a previously conducted pilot project that was supported by the ACGME Pursuing Excellence in Innovation program (Wagner et al. 2016). The Interprofessional Partnership to Advance Care and Education or ‘IPACE’ project demonstrated reduced lengths of stay, lower costs, and high patient satisfaction through a redesigned team structure on an internal medicine unit. An interprofessional team rounded together to develop a single plan for a single patient delivered through
a single communication and a single note in the chart (Hallen et al. 2020). The project emphasized team learning, full care team involvement, patient and care team cohorting, and rapid cycle quality improvement with all team members. Their Reimagining Residency project will adapt learnings from this small pilot to other specialties, ambulatory areas, and rural locations. They also intend to create unique fourth-year medical student experiences for students who rotate at MMC to inculcate these principles of interprofessional practice.

Transitions

The transition from medical school to residency has become one of the most discontinuous points in physician education. As students move from one phase of their training to the next, little information about their aptitudes and educational trajectory is shared despite the fact that much is known about their strengths and gaps in their attainment through their experiences in medical school. In the interest of ensuring a successful match, students and schools are reluctant to share unvarnished assessments of educational experience. Residency programs, being ill-equipped to adapt their curricula to the individual needs of the learner, may be more likely to use that information to select residents for training than to promote individualized training. Two Reimagining Residency projects aim to address this to enhance ongoing professional development at this important transition.

The Association of Professors of Gynecology and Obstetrics (APGO) has witnessed dramatic increases in numbers of applications to obstetrics and gynecology residency programs. This seems to be due, in part, to overreliance on objective measures of performance such as USMLE Step scores to screen applicants for interview and/or selection. The absence of holistic review of materials submitted when applying increases the stress and uncertainty of the process for applicants, leading them to address this by applying to more programs than is necessary to secure a residency position. APGO hopes to mitigate this by creating a more transparent application process with greater sharing of information about applicant and program priorities to promote a better sense of fit between applicant attributes and program environment. Furthermore, they will set standards for communication about applications and interviews that all programs will follow to reduce uncertainty for applicants. Finally, they propose to pilot an early acceptance program for their residencies (Hammoud et al. 2020). Similar to a college early decision program, APGO postulates that allowing students to apply early to a small number of programs in which they are highly interested will lead programs to fill many of their slots with well-suited applicants through holistic review of a lower number of applications. This, in turn, should lead to less competition for remaining slots in the ‘regular’ match that follows. There are many practical issues to address for a pilot like this to be feasible. The exercise of developing this approach promises to raise and address many questions about our current system of residency selection and will inform thinking about the process moving forward.

At the NYU Grossman School of Medicine, faculty have experience with a robust UME coaching program that guides the trajectory of their students during medical school. Building on that experience, NYU is developing a parallel GME coaching program to provide similar learning support during residency. They are recruiting GME coaches, providing faculty development to them, and incorporating coaching into their job descriptions to make this service available to all entering residents. Immediately following the Match, students matched to NYU residencies will be assigned a GME coach and begin to communicate with them about priorities for the residency training. NYU is in a somewhat unique position given that 40% of their medical students remain at NYU for their residency training. They will use this environment to promote communication between UME and GME coaches for learners who continue at NYU. Those students will be responsible for arranging a meeting between their UME coach, their GME coach, and themselves shortly after the Match. This sharing of information from UME to GME is expected to enhance the transition from UME to GME and promote adaptation of the residency curriculum to individual needs. NYU students who do not remain at NYU for residency will carry their UME coaching outcomes forward in the form of an app that they can apply to their training elsewhere. The quasi-experimental design of this project, contrasting the experiences of students who stay at NYU for residency with those who depart, and with those who matriculate at NYU for residency from other medical schools, promises to inform the value of active transfer of information from UME to GME to enhance educational outcomes.

Learning environment

There are many concerns about well-being in residency due, in large part, to the history and culture of GME. At one time residents were predominantly male, lived in hospitals, and had fewer specialty options for training. Residency has changed in many ways but has not evolved in some of its cultural expectations. There remains a tacit perception that residency is meant to be hard, something to be survived. Recently, the negative effects of these threats to well-being have been appreciated and reforms have begun. Since 2003, duty hours have been regulated. More recently, residency programs are required to explicitly account for their efforts to promote well-being. And policies such as those governing vacation and family leave are being re-examined. Two projects supported by Reimagining Residency are explicitly addressing these issues.

A collaboration between Vanderbilt University Medical Center and the University of Mississippi Medical Center will promote professional identity formation through a curriculum focused on professional personae, independent of specialty. The premise is that there is more to becoming a physician than assimilating the technical skills of your discipline. One’s career path and the environment in which those skills will be applied is also important and contributes significantly to professional satisfaction. Through a collaborative effort, residents at both of these medical centers will pursue professional identities across specialties. Curricula will support paths such as ‘curious physicians’
who may be interested in academic research careers and ‘structurally humble physicians’ who wish to serve the underserved. Five of these professional identities have been defined, and the well-being and satisfaction of learners who pursue them will be monitored. It is suspected that, in addition to promoting well-being, these efforts will lead to a workforce better prepared to meet the needs of patients.

Internal medicine programs at Johns Hopkins University School of Medicine, Stanford University School of Medicine, and the University of Alabama at Birmingham School of Medicine are collaborating to study well-being in residency and its influences. The ‘GME Laboratory’ project will gather data about residents’ experience, describing how they spend their time and exactly what they do and then correlate those data with measures of well-being and clinical skills. Through a series of active and passive means, from survey instruments to geographic locator badges, the investigators will develop a database and then use it to address hypotheses about what compromises well-being and contributes to burn-out and clinical skills development in the learning environment. Are residents better off if they spend less time on the electronic health record? Do residents develop better clinical skills if they spend more time at the bedside? In the medical profession we have made assumptions about the answers to these questions. This project will address them in a data-driven manner.

Workforce

Given its emphasis on meeting the local needs of the training institution and on individual autonomy in specialty choice and practice location, GME is regarded as a weak influence on workforce composition and distribution. In the United States, physicians and specialties are not distributed in a way that meets patients’ needs in terms of specialty and geographic access. Can medical education be adapted to better meet the needs of patients in specific areas?

The University of North Carolina School of Medicine has developed a Fully Integrated Readiness for Service Training (FIRST) program to accelerate workforce generation in family medicine. This program transitions select students to a three-year family medicine residency following three years of medical school, and then offers three years of early career mentorship as graduates establish practice in an area of need in the state. This ‘3 + 3 + 3’ model is now being expanded to include other specialties (general surgery, pediatrics, and psychiatry) and other regions of the state beyond the main campus in Chapel Hill, NC, including Cone Health in Greensboro and two Area Health Education Centers (AHEC) based in Asheville and Wilmington, respectively. This dedicated effort provides a path for interested students to realize their vision of serving these communities without having to piece it together themselves. It should lead to heightened professional satisfaction that will benefit not only the physician but also their patients.

There are significant health care disparities in the corridor between Portland, Oregon and Sacramento, California where most communities are rural, and many are historically home to native and indigenous peoples. Past work has demonstrated that one of the most significant drivers of practice location following residency is the community in which one trains (LeFevre and Colwill 1983). The University of California, Davis and Oregon Health & Science University are collaborating to address the health needs of the region by emphasizing training in those rural locations. The California Oregon Medical Partnership to Address Disparities in Rural Education and Health (COMPADRE) project will reach into the medical school selection process to identify potential medical students who are likely to practice in the communities from which they come. Once admitted to medical school, the project will promote early exposure to those communities through service projects and clinical training at those locations, rather than at the urban academic medical center. Students will have access to opportunities to complete their residency training in a network of 31 programs in those rural areas, integrating themselves into the communities from the early stages of their training. It is assumed that many of the graduates of this program will continue to live and work in the areas it serves. There is promise that this will be a more effective way to generate a physician workforce that meets the needs of these rural communities than recruiting graduates who may be unfamiliar with the areas.

Conclusion

Physician training in the United States has become a discontinuous path that may not meet the needs of the patients whom its graduates will serve. Medical school, residency training, and ongoing professional development exist in relative isolation from one another. There is limited sharing of information across the continuum. Paths to serve the needs of specific populations are not always clear. These factors, in turn, contribute to stress in training and practice and compromise professional satisfaction. The 11 Reimagining Residency projects described here are ambitious. In their own ways, each of them aims to create a path that is more continuous and more integrated with the delivery of health care. If even some of the outcomes they aim to achieve are realized, the initiative will have been a success.

One hundred years ago, the Flexner report promoted change in medical education. Some of those changes raised standards, contributing to a medical education system in the United States that has produced groundbreaking medical discovery and a physician workforce that is among the most skilled in the world. Most of these advances are due to instructional reform, changing the way medicine is taught. But the Flexner report, through its narrow focus, also compromised diversity, teaching, patient care, and health promotion in important ways (Sullivan and Mittman 2010). The next step in our evolution is to critically examine how structures and institutions may hinder progress toward meeting the needs of patients and populations. This will require ongoing instructional reform, but also institutional reform (Frenk et al. 2010). The necessary institutional reforms demand collaboration and cooperation of the type demonstrated through communities of practice such as the Accelerating Change in Medical Education Consortium. Sharing approaches enhances innovation, and collaborative efforts lead to more rapid and full adoption of new ideas. Furthermore, regulatory and certifying bodies...
will be more likely to engage with innovation when a critical mass of institutions is pursuing reforms.

The AMA Accelerating Change in Medical Education Consortium has done much to address the calls for change from the Lancet Commission on Education of Health Professionals for the 21st Century and others a decade ago. Yet work remains to be done to disseminate best practices, promote necessary structural reforms, and confront new challenges. As we look to the future of medical education innovation, the process will be guided by collaborative efforts paving the way toward transformation.

Acknowledgments

The authors would like to thank their home institutions, fellow members of the American Medical Association’s (AMA) Accelerating Change in Medical Education Consortium, and the AMA for their support of innovation.

The AMA Supplement is sponsored and supported by The American Medical Association.

Disclosure statement

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

Disclaimer

The opinions expressed in this article are those of the authors and do not necessarily reflect American Medical Association policy.

Funding

This work was funded in part by the American Medical Association.

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