Viewpoint

From Competence to Expertise: The Role of Meaningful Experience in Physician Training

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Abstract

The fundamental goal of medical education is to develop physicians who can independently provide safe and effective patient care. This requires learners to acquire not only knowledge but also meaningful experience to progress along the continuum from novice to expert. In the last several decades, however, medical education has undergone numerous transformations that have resulted in decreased clinical experience for medical students and residents alike. These transformations include the increasing complexity of health care delivery in the inpatient and outpatient settings; duty hour restrictions; and the explosion of digital technologies, including the electronic health record and AI. Additionally, the introduction and broad acceptance of competency-based medical education, which is focused on demonstrable behaviors rather than the time spent in training, risks exacerbating this loss of meaningful clinical experience if implemented without attention to trainees' need for clinical volume, variation, and redundancy. While these changes in the number and intensity of patient encounters in educational programs are multifactorial in origin, when combined, they jeopardize the acquisition of experience, the development of expertise, and the resulting quality of patient care. In this Viewpoint, our aim is to discuss the importance of meaningful experience in the development of expertise; highlight threats to its achievement resulting from the intersection of 3 transformations affecting medical training (the increased complexity of 21st-century health care systems, expansion of the electronic medical record and AI, and flawed understanding of the full implications of competency-based medical education as presently implemented); and present solutions for medical educators, academic institutions, and accrediting bodies. Our views are based on our perspectives and observations, as well as insights from the literature.

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KEYWORDS

experience; expertise; competency-based medical education; digital technologies; artificial intelligence; AI; clinical reasoning; graduate medical education; deskilling

The Importance of Meaningful Experience

On January 15, 2009, shortly after takeoff, Captain Chelsey "Sully" Sullenberger's aircraft struck a flock of geese, damaging both engines. With minutes to act, Sully ditched the aircraft onto the Hudson River, ensuring the safety of all 155 passengers and crew members and avoiding what could have been a fatal catastrophe. What allowed him to accomplish this life-saving feat?

Deliberative practice across a range of conditions allows experts such as Sully to react appropriately in high-stakes situations, particularly when new or unforeseen circumstances arise. Aviation training reflects the importance of experience in the development of expertise. Training reforms since the Colgan

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Air Flight 3407 crash require that pilot school graduates log 1500 hours as copilots under a range of weather and mechanical conditions and have dedicated meaningful experience in various domains before captaining commercial airliners. It is one thing to demonstrate competence in the knowledge and skills of the core procedures of a pilot under routine conditions; it is something else to be able to expand upon those under more challenging circumstances. This extensive preparation, meaningful experience, and time are deemed necessary to independently fly a plane when lives are at stake.

While it is a different profession with different skill sets and limitations, medicine is not dissimilar from aviation. Physicians, like pilots, must develop the expertise necessary to make life-dependent decisions in a variety of circumstances—a process requiring the acquisition of both knowledge *and* experience. We intuitively recognize the value of experience when we request advice from a senior colleague in managing a difficult presentation of a disease or when we choose to refer a high-stakes surgical case to a surgeon who has performed that surgery 1000 times rather than on 10 occasions; it is not that they are not both competent, but basic competence may not suffice under less ordinary conditions. Historically, medical education has provided this experience for trainees through time-based training programs that included extensive patient encounters with graduated responsibility [1]. Many have criticized this traditional educational model for its perceived shortcomings: challenging work-life balance for trainees, concerns about medical errors, and variable assessment practices in graduate medical education (GME) [2-4].

In part because of these concerns, medical education has been systematically reducing the number and, at times, the continuity of meaningful patient care experiences for medical students and residents. In undergraduate medical education, there has been a steady decline in clinical activities during the fourth year and a movement toward accelerated 3-year programs [5,6]. While the Liaison Committee on Medical Education mandates that medical schools establish a tracking system to monitor clinical or simulated experiences for a student, such as exposure to a patient with chest pain, abdominal pain, or shortness of breath, it does not define the quantity or extent of these encounters [7]. Furthermore, it does not specify whether the focus is on the symptom vs the specific disease state, and there is no required number of patients for any given disease. The student is required to obtain a history, demonstrate a physical examination, generate a differential diagnosis, and participate in the care of a single patient with that symptom to satisfy the competency.

In GME, multiple factors have jeopardized the acquisition of clinical experience: the increased complexity of health care delivery, crowded hospitals with boarding in emergency departments, duty hour restrictions, the proliferation of digital health care technologies, and the oftentimes flawed or inadequate implementation of competency-based medical education (CBME). In this Viewpoint, our aim is to discuss the relationship between experience and expertise; describe how modern medical training environments may unintentionally limit the kinds of experience that foster adaptive expertise based on our observations and support from evidence in the literature; and pose solutions for educators, academic institutions, and accrediting bodies.

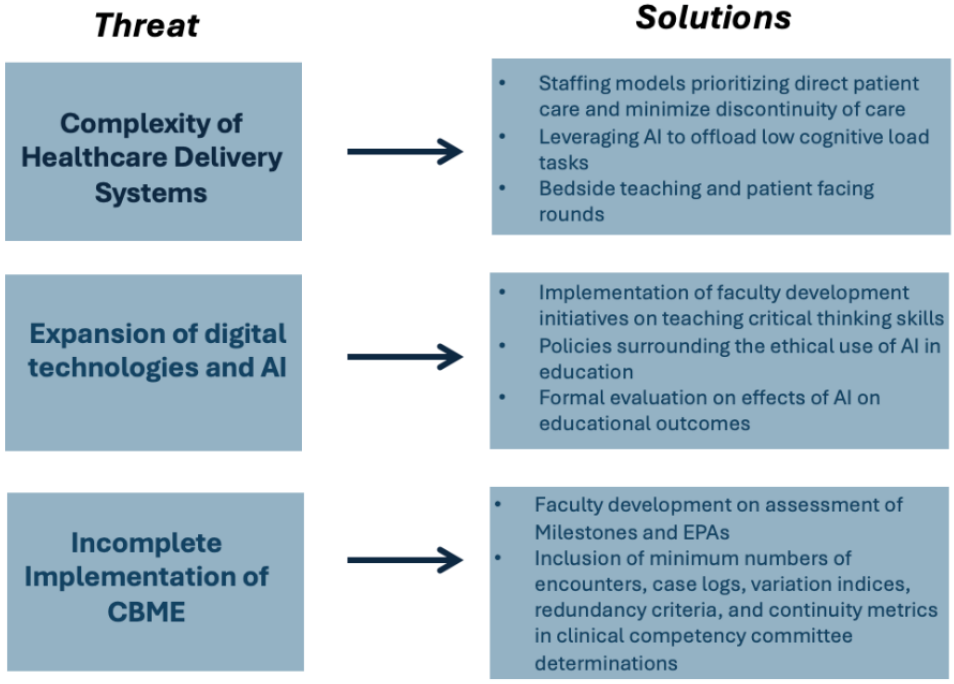
Experience and Expertise

What is expertise, and why is it important? In his model of adult skill acquisition, Dreyfus [8] outlines 5 stages: novice, advanced beginner, competent, proficient, and expert. These stages differ in the degree of intuition demonstrated by a practitioner. Less experienced learners tend to depend on rules and guidelines and illness scripts, while experts rely on strong foundational knowledge supplemented by intuition honed through extensive experience (eg, there is something about this story that just does not feel right for diagnosis X). This experience allows experts to recognize subtle nuances in a case and devise situationally appropriate responses to unfamiliar, ambiguous, and unstructured problems.

In their classic work on cognitive metaphors, Mylopoulos and Regehr [9] outline the construct of an adaptive expert, an individual who has significant clinical experience and can solve a problem that may appear unique by using a store of foundational knowledge. The ability to sense and appreciate that there is something different and then reason to a new solution characterizes the adaptive expert. This requires substantial clinical volume with variation and redundancy with respect to disease states during training. With the goal of developing physicians who can independently provide effective patient care and continue on the trajectory toward becoming an adaptive expert, medical educators should examine several recent changes that threaten medical trainees' acquisition of experience: the increased challenges associated with 21st-century health care, expansion of the electronic health record (EHR) and its effect on independent reasoning by students and trainees, introduction and adoption of AI, and impact of the implementation of CBME as the primary means of assessment and determination that one is ready for the next "level" or completion of training (Figure 1).

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Figure 1. Threats to meaningful experience in the development of expertise. CBME: competency-based medical education; EPA: entrustable professional activity.



Increasing Complexity of Health Care Systems

Threat

The first threat to the cultivation of experience relates to the current health care system and its effect on direct patient care in training programs. The increasing complexity of health care delivery, including crowded emergency departments, shorter patient lengths of stay, and staffing shortages, has forced trainees to devote substantial time to nonclinical tasks such as documentation, billing, insurance navigation, scheduling, and multiple handoffs. These factors erode a sense of clinical continuity [10], limiting the full picture of the patient's disease and treatment.

The increased reliance and time spent engaging with the EHR also threatens time spent at the bedside and engaging in direct patient care. While the EHR certainly allows better centralization of medical records and standardization of care, its complexity comes at the cost of significant user time. A study in the ambulatory setting at one academic program conducted in 2017 to 2018 found that residents spent an average of 45.6 minutes in the EHR per patient, with 13.5% of that time spent after hours. While the residents showed improvement in efficiency with the EHR, there was no significant increase in patients seen per day or time spent in the EHR after hours [11]. A prospective, multicenter investigation of first-year internal medicine interns on clinical inpatient shifts using time-motion observations conducted in 2016 found that in a 24-hour period, a mean of only 3.0 hours was spent in direct patient care [12]. Concurrently, duty hour restrictions have resulted in fewer patient encounters across multiple specialties [13,14]. At our medical center and other academic centers with whom we have communicated informally, an internal medicine intern today admits a small fraction of the patients evaluated in the past. Over the course of 12 months at our institution, an intern in medicine admits fewer than one-quarter the number of patients admitted by an intern 30 years ago (internal data, 2026). While these data remain preliminary, institution specific, and not yet generalizable, the drop we observe warrants further investigation. There is growing concern as well about the clinical competence of surgical residents, who are not participating in a sufficient number of operative cases and/or having sufficient autonomy to be able to perform independently [15,16]. In a national survey in general surgery, program directors reported that trainees were less prepared than 10 years prior, citing duty hours and increased supervision among factors diminishing autonomy [17].

The impact of suboptimal experience has coincided with declining board examination pass rates across multiple specialties, including internal medicine and emergency medicine [18,19]. In emergency medicine, the reason for this decline is likely multifactorial, including the recent proliferation of new programs affiliated with for-profit institutions as well as the decrease in new patient volume due to the COVID-19 pandemic and boarding [20]. The decline in internal medicine board examination pass rates coincided with the COVID-19 pandemic, during which trainee experience and encounters were limited, and has since plateaued. While in both specialties these correlations are multifactorial and associated with pandemic-era and program-level factors, the educational effects of reduced patient exposure warrant further investigation.

Furthermore, when one adds the discontinuity of care associated with increased handoffs due to restricted duty hours, concerns about patient safety arise [21,22]. In 2 national cluster randomized trials of surgery and internal medicine residents, however, flexible hours were found to be noninferior with respect to death or serious complications compared to standard

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or restricted work hours [23,24]. Furthermore, program directors in the internal medicine trial were less likely to report dissatisfaction with elements such as intern ownership of patient care, time for reflection, real-time feedback from attendings, frequency of handoffs, teaching opportunities, and continuity of care in the flexible hour model. The amount of time trainees spent in direct patient care and educational activities, however, did not significantly differ between the groups [25]. We recognize the well-intentioned desire to improve the wellness of trainees and concern for fatigue-related errors, and the implementation of duty hour restrictions certainly puts these aims at the forefront. Whether its benefits support the resulting effects on education, continuity, and time spent on patient care remains unclear. It is one thing to be deemed competent based on interactions with a 25-year-old patient with asthma and quite another to subsequently be confronted with a 75-year-old patient with asthma and a history of congestive heart failure and coronary artery disease. Nevertheless, reduced clinical experience, if not compensated for in other ways, threatens the development of true competence, let alone expertise in patient care. In the end, the recognition of one's shortcomings upon graduating from a residency program in which adequate clinical experience was lacking may compromise one's sense of accomplishment, which is essential for personal well-being [26].

Proposed Solutions

With the increasing complexity of the health care system, program directors and educational leaders need to advocate for the prioritization of staffing models that minimize trainee time spent performing nonclinical duties such as patient scheduling and similar administrative tasks that do not require physician oversight. This may allow for more opportunities for patient contact and clinical learning experiences during the workday. Furthermore, with the tremendous expansion in AI capabilities, educators can also leverage its benefits for certain time-consuming tasks that do not require the cognitive abilities of physicians or threaten the acquisition of critical thinking skills. There is evidence to show that using AI for medication reconciliation, for example, can decrease the administrative burden of clinicians [27] and, thus, allow more time for patient-facing clinical experience.

In light of duty hour limitations, institutions and frontline educators should reprioritize patient exposure as they structure teaching rounds and workflow, ensuring that time in the clinical space is patient facing. One strategy for this includes reincorporating bedside rounds, which have seen a significant decrease [28], to allow for more patient-facing interactions and exposure to clinical competencies such as physical examination techniques and effective communication skills [29]. Bedside rounds have been shown to be preferred by patients [30], and bedside teaching has had a positive effect on education, including the ability of preceptors to provide feedback [31]. Re-examination of staffing models that introduce discontinuity of care through handoffs, such as admission-only services, may also be warranted.

Expansion of the EHR and AI

Threat

A second threat to trainees' experience involves the expansion of the EHR and digital technologies, including AI. Increasing reliance on templated notes and "copy/paste" practices designed to maximize hospital revenue have made it easier to go through the motions of patient care without engaging in novel clinical reasoning [32]. We recognize that protocols embedded in the EHR can improve care, particularly for routine procedures and practices. Nevertheless, it is critical for trainees to gain experience thinking through clinical problems without relying excessively on these automated management aids. This will allow them to recognize when deviation from protocols is needed.

Similarly, AI has quickly become ubiquitous in clinical care. While AI can certainly improve efficiency for low–cognitive load, time-consuming tasks as noted above and serve as a beneficial learning resource, medical students and residents are using large language models across a variety of high–cognitive load tasks such as development of differential diagnosis, management plans, and documentation [33,34]. Lack of safeguards around the use of AI puts clinicians at risk of deskilling (degradation of established competencies in already trained clinicians), misskilling (acquisition of incorrect clinical reasoning patterns through uncritical adoption of erroneous or biased AI outputs), and never-skilling (failure to develop the foundational reasoning competencies during formative training). The effect of AI on deskilling or, potentially worse, never-skilling in the learner population remains theoretical and warrants investigation [35]. Without ever having developed these clinical reasoning skills, students and trainees risk not being able to recognize hallucinations, omissions, and faulty logic in AI output, nor will they be able to develop adequate prompts to maximize the output of AI, which could compromise patient care. The reduction in clinical experience and the confidence to use well-developed clinical and reasoning skills only worsens this problem. It is one thing to use AI as a tool to check on the completeness of one's assessment and/or treatment plan. It is another, however, to be so dependent on AI that a physician cannot function without it.

Proposed Solutions

Given the rapidly expanding digital landscape and unlimited access to generative AI tools, educators must recognize potential negative downstream effects on their learners. Training programs must prioritize faculty development initiatives focused on teaching critical thinking skills to trainees in the age of the rapidly expanding EHR, readily available protocols, and explosion of AI tools for answering clinical questions. Frameworks for this have been developed, including DEFT-AI (diagnosis, evidence feedback, teaching, and recommendation for AI use) [36]. Requiring students and residents to truly write their notes (as opposed to templates and carrying forward the prior notes) and present without reading directly from a prior note may improve assessment of their reasoning skills and should also be considered [37]. Institutions should develop and implement policies surrounding the use of AI in students and

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trainees and ensure AI-free portions of the program [35] so clinical reasoning skills can be cultivated. The Association of American Medical Colleges has published principles for the use of AI in medical education, outlining the need for maintaining a human-centered focus, the need for ethical considerations, and the need for evaluation of how AI tools affect educational outcomes [38]. Well-designed, prospective studies investigating the efficacy and educational effect of this are needed.

Incomplete Implementation of CBME

Threat

A third change bearing scrutiny is the flawed or incomplete implementation of CBME in many training programs. CBME, if not implemented appropriately, can undermine trainees' acquisition of experience. Theoretical justifications for CBME are compelling and include the desire for clear learning outcomes, personalized training paths, and clear societal accountability. CBME correctly rejects the assumption that time spent in training alone guarantees readiness to provide appropriate care, relying on the development of "competency" as defined by tools such as milestones or entrustable professional activities (EPAs) [39-42]. CBME aims to ensure that all graduates possess the necessary knowledge, skills, and behaviors as demonstrated through measurable outcomes, ultimately to improve patient care and accountability to society [42]. CBME as designed, however, often varies from CBME as commonly enacted in many programs. For instance, outcome markers such as the EPAs include the ability to perform a physical examination but do not necessarily confirm that the learner can detect abnormalities or nuances that come with time and meaningful experience. With limited numbers of patient encounters and reliance on a CBME rubric alone, the learner may never have exposure to a patient with particular anomalies or one with multiple problems concurrently.

Despite its conceptual appeal, empirical evidence supporting CBME's efficacy remains mixed. Over two-thirds of published articles about CBME are commentaries rather than empirical research [43], and a recent review found only inconsistent empirical support for CBME's foundational assumptions [44]. A recent retrospective analysis of patient outcomes after endovascular aneurysm repair found that lower milestone ratings of vascular surgeons during their surgical training were associated with major complications in early surgical practice [45]. Similarly, in primary care, a retrospective study of practicing physicians who trained from 2015 to 2019 found that those who scored higher on professionalism and interpersonal skills and communication milestones in the previous 6 months of residency received better patient experience ratings in their first year of unsupervised practice on the Consumer Assessment of Healthcare Providers and Systems Clinician and Group Survey [46]. On the other hand, a retrospective analysis of a cohort of over 6000 hospitalists who completed training in 2016 to 2018 and were treating Medicare fee-for-service beneficiaries found that board examination scores correlated with lower 7-day patient mortality and readmission rates. Their milestone ratings, however, showed no clear association with 7-day mortality and readmission rates, 30-day mortality and readmission rates, length of stay, and subspecialist consultation frequency [47]. It is important to note that these studies were all correlational and not designed to test all formative or readiness uses of milestones and that the milestones were designed to describe the progressive level of performance of a trainee. Nevertheless, the data raise concerns about the present use of CBME. Prospective investigations are needed to determine whether the milestone ratings alone or combined with both the quantitative and qualitative types of experience that trainees have can truly gauge readiness for independent practices and patient outcomes.

While CBME *in principle* emphasizes robust competency assessment across a range of contexts, CBME *in practice* often devolves into resource-intensive administrative exercises in which clinical competency committees ensure that trainees receive the necessary approval to advance at the expected pace [48]. EPA levels are designed to be determined by observable behaviors and provide a forward-looking assessment of generic clinical skills; it is unclear that they predict the individual's readiness to respond to a more complex and unknown instance in the future. They do not account for the entirety of the actual clinical environment and real-world practice [49,50]. Additionally, the underlying rationale behind "entrustability" parallels the framework by Dreyfus [8] of novice to expert [40], further necessitating the need to consider experience as a critical factor on this scale. Competence is a necessary but not sufficient goal for graduates of a GME program.

Furthermore, the assumption that meeting the competencies, as defined by these instruments as a listing of the basic skills of a physician, guarantees competence in a novel situation is misguided; if a medical resident has never seen a patient with status asthmaticus or acute pulmonary edema, can they be deemed competent upon graduation? If a general surgical resident has never performed a hernia repair, are they competent? While case logs are required in surgery and time requirements spent in different venues are defined in nonprocedural fields, the role of the trainee caring for those patients and the exact disease states are not specified. To be sure, no trainee will have exposure to every disease or possible procedure in their training, but a competency-based model that does not explicitly incorporate clinical experience may obscure the loss of training in core areas. The implementation of CBME alone cannot substitute for a system that ensures sufficient trainee experience across relevant practice domains.

Proposed Solutions

With CBME now standard across training programs, clerkship and program directors need to ensure that determinations of competence truly represent a learner's stage on the path to expertise. Dedicated training on how these designations should be made along with accounting for experience may provide more accurate predictive assessments of abilities. For example, GME programs can revamp clinical competency committees to ensure that milestone ratings promote learner development and readiness for unsupervised practice [51] with consideration of case logs and exposure to certain disease states and presentations. This could include defining minimum numbers of encounters or procedures, a case mix or variation index,

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redundancy criteria, continuity metrics, encounter definitions, and review intervals. In 2025, the Review Committee for Emergency Medicine recommended for the first time a minimum number of emergency department patient encounters for completion of residency. It also advocated for extending training to 48 months across all programs to better accommodate today's health care and educational environment [52]. While the latter recommendation comes with significant costs, including financial considerations, equity issues in reduced training environments, and trainee opportunity costs, that must be weighed against its potential benefits, it is an albeit controversial possible solution to address insufficient experience. We encourage other medical specialties and accrediting bodies to follow suit in explicitly defining numbers and ranges of various clinical experiences.

Conclusions

Educators, institutions, and accrediting bodies must remain steadfast in their commitment to ensuring that educational methods and assessment practices acknowledge *experience* as a fundamental pillar of expertise. The increased complexity of the health care delivery system and GME regulations resulting in fewer patient encounters, diminished trainee autonomy, the proliferation of digital health care technologies and AI, and overreliance on CBME alone threaten authentic experience. It is important to note that our supporting evidence is drawn largely from select US specialties, and we caution extrapolation to other training structures where health care, duty hours, and assessment models differ. Regardless of system, however, we should not compromise the education of future physicians or patient care by neglecting the importance of meaningful experience.

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Generative AI Use

The authors declare that generative AI was not used in the preparation of this manuscript.

Authors' Contributions

NMD was responsible for conceptualization, writing—original draft, writing—review and editing, and project administration. AAI was responsible for writing—review and editing. RMS was responsible for supervision, conceptualization, and writing—review and editing.

Conflicts of Interest

None declared.

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Abbreviations

CBME: competency-based medical education
EHR: electronic health record
EPA: entrustable professional activity
GME: graduate medical education

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