Educating Medical Students in Laboratory Medicine

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Conferring a professional degree on a person implies that the person awarded that degree, through his or her education as a student, has attained certain levels of understanding and competency in defined areas of knowledge. A professional degree also implies that the person is qualified to seek a higher level of education, be that a residency training program in medicine, dentistry, or veterinary medicine; a clerkship in law; or graduate education in a related field. To educate effectively, organizations providing that education must be able to assume that graduates of professional programs have the knowledge and competency to be successful in their programs. Attaining this common body of knowledge is what curricula are designed to provide and tiered examinations are designed to assess. It is also assumed that these curricula, examinations, and degrees are in some way designed in an integrated and cohesive manner to ensure that students receive an education that will prepare them for the current state of training and, eventually, practice. Thus, it is (or should be) expected that this common body of knowledge includes all of the pertinent areas of medicine. To a great extent, this indeed happens: curricula at different medical schools are far more similar than they are dissimilar. Yet there are gaps in this education that defy common sense and reason, one of which is the lack of a requirement for formal education in laboratory medicine at all medical schools.

This phenomenon is difficult to understand: the number, type, and complexity of laboratory tests has increased markedly during the past 50 years, and health care providers increasingly rely on laboratory tests to make diagnoses, assess the efficacy of therapy (or even to predict the outcome of therapy), and follow the natural progression of diseases. The pressures to see ever higher numbers of patients in many settings limits the time that providers can collect data from interviewing and examining patients, a state that forces providers to rely more and more on the results of laboratory tests, imaging studies, and other types of information generated by health care professionals outside of direct patient care. Why, then, is so little attention paid to teaching medical students about laboratory medicine during medical school? Why is such education not mandated by accrediting agencies? Is informal education about laboratory medicine gained through clinical rotations sufficient to eliminate the need for formal coursework? Would implementing the proposed curriculum described in this issue of the Journal meet the needs of medical students? Or are there better alternatives to a standardized curriculum? What would it take to make laboratory medicine a core part of medical school curricula? What should be the next steps to integrate such a curriculum into overall medical school curricula?

Why Is So Little Attention Paid to Laboratory Medicine in Medical School Curricula?

The answer to this question is complex, and the reasons may vary somewhat among medical schools, but the main reason is likely to be the same at most schools. Medical school curricula are derived from a tradition that spans thousands of years and many cultures. If one looks back through history, it is striking how little medical school curricula have changed over the centuries. Following the Flexner report of 1910, medical school curricula in the United States became more standardized and rigorous, with an emphasis on the scientific basis of medicine. Since the publication of that report, medical school
curricula in the basic sciences have evolved to include classes in gross and microscopic anatomy, biochemistry, microbiology, neurosciences, pathology, pathophysiology, pharmacology, and physiology. Although the specific content within each of those subjects has changed over the years (with the exception of gross anatomy), these subjects remain entrenched in standard medical school curricula. Certainly medical education has moved toward the molecular basis of disease and toward more refined methods of diagnosis and therapy, but the subjects are nearly identical to those taught 100 years ago. This slow and incremental change in medical education at least partly explains why laboratory medicine is not a required course at many medical schools: few, if any, major shifts in curricula have occurred in nearly a century. Inertia is a powerful force in health care, no less so in medical education.

A second reason is that, as a group, medical educators apparently do not see the necessity for formal education in laboratory medicine. The most common approach to teaching laboratory medicine to medical students is similar to the approach to learn clinical medicine: within the context of individual patient care during clinical rotations. This approach has a number of flaws. First, there is more to laboratory medicine than the clinical use of laboratory tests. Second, this approach is not and cannot be standardized among students or schools. Third, during medical school, students are unlikely to see sufficient numbers and types of cases that would expose them to many aspects of laboratory testing. Last, it depends entirely on the ability of clinicians to teach laboratory medicine to students, most of whom also have had no formal education or training in laboratory medicine.

A third reason is that such a change would require other subjects to be curtailed or eliminated and resources allocated to teaching laboratory medicine, changes that would need to overcome long-standing political opposition to substantive changes in curricula. It would also require resources that are increasingly scarce in many academic medical centers.

Why Is Such Education Not Mandated by Accrediting Agencies?

It might seem that the answers to this question are the same as those to the first question, namely inertia combined with fiscal and political realities, but they are not. If accrediting agencies saw value in changing the way medical students are educated in laboratory medicine, they would require it. The real question, then, is why do these agencies not see this value? To a certain extent, one can only speculate as to the answer because there has not been a systematic study of the issue that demonstrates or refutes the value of such a change in education. Accrediting agencies are, justifiably, reluctant to issue mandates for sweeping changes in curricula in the absence of persuasive evidence that such change is necessary. To date, no one has published the results of a study that conclusively show that the current method of teaching medical students (and educating residents) in laboratory medicine needs to be changed. Until such information is available, it is difficult to believe that any accrediting agency would mandate that the teaching of laboratory medicine be changed in a fundamental way. If accrediting agencies had such information, and it was persuasive, they would stand a much better chance of mandating changes that will require addressing the aforementioned fiscal and political realities.

Another reason that accrediting agencies have not mandated change is that they may simply be unaware of the changes ongoing in medicine and health care. The changes that have occurred in laboratory medicine and in clinical care are incremental and often seemingly minor. One only need look through successive editions of textbooks to see how little really changes over short spans of time and that most of the information remains useful over the years. In the absence of sudden and dramatic changes in medicine and health care delivery, it is unlikely that those who oversee medical education are going to recommend sudden and dramatic changes in education.

Is the Informal Education Gained Through Clinical Rotations Sufficient to Eliminate the Need for Formal Coursework?

There certainly is a widespread perception among the professionals who are educated in clinical pathology and laboratory medicine that health care providers would benefit from more rigorous and formal education in laboratory medicine, but there are few hard data to support or refute that perception. Several studies cited by Smith et al1 demonstrate that consultations by laboratory personnel can have an effect on improving patient care and in controlling costs, but these findings do not prove in any way that the changes were due to a lack of knowledge on the part of the provider who asked for the consultation. That connection may well exist, but there are no published data to prove it. Other studies cited by Smith et al1 indicate that the ability of providers to order and interpret laboratory tests correctly has declined through time, but again there is no evidence that a fundamental change in medical school curricula would solve this problem. What is needed, therefore, are objective studies that assess various approaches to teaching laboratory medicine to students, which of these approaches is the most effective, and how these approaches might be implemented effectively during medical school. As noted by Smith et al,1 the results of a few small studies suggest that residents in clinical specialties do not acquire the necessary knowledge to order and interpret laboratory tests in the most effective manner. Certainly there is abundant...
One might fairly ask how much residents in clinical medicine really need to know about laboratory medicine, other than selecting the best tests for their patients with specific conditions. This question has a simple answer: in addition to test selection and interpretation, laboratory medicine also consists of a large body of medical knowledge that is directly related to patient care. Perhaps the best example is transfusion medicine, in which it is not important for providers to know very much about how tests are performed, but it is crucial that students and residents understand the major blood groups, the implication of antibodies directed against RBC or platelet antigens, proper use of blood components, and the potential consequences of using the wrong blood products. In the same way, it would do most providers well to understand more about antimicrobial susceptibility testing, the practical limitations of serologic diagnosis of infection, and the strengths and drawbacks of different approaches to the diagnosis of infectious diseases, particularly related to the use of nucleic acid amplification tests. Other examples exist for all areas of laboratory medicine. Thus, the notion that residents in clinical specialties are likely to learn this body of knowledge as part of their care of patients is woefully naive: the residents are trying to learn all of the other aspects of knowledge needed for their specialty and perform their daily duties as house officers—all within an ever-shrinking number of duty hours. If anything, time to learn laboratory medicine will be among the first things to vanish for clinical residents as their training is further limited by restrictions on duty hours. In the unlikely event that the lengths of residencies are extended to make up for these lost hours, it would be possible to include more training in laboratory medicine, but it seems unrealistic to think that other specialties will devote much, if any, of this additional time to learning information outside of their area of expertise.

One also might fairly ask whether clinicians are in the best position to teach their residents about laboratory medicine. The answer to this question, with some exceptions, is obvious: most clinicians do not receive formal education in laboratory medicine, or they receive limited education during a fellowship. It is common sense that teaching and educating should be done by those with the appropriate expertise. Where clinical attending physicians do have a vital role, one that is complementary to that of laboratory professionals, is in the day-to-day use of laboratory tests as a component of the evaluation and treatment of patients. Laboratory professionals should not expect clinicians to be experts at laboratory medicine, just as clinicians should not expect laboratory professionals to be experts in clinical medicine. The two roles are complementary, but one cannot substitute for the other.

Would Implementing the Proposed Curriculum Described in This Issue of the Journal Meet the Needs of Medical Students?

It has been said that the best way to begin is to begin. No one has proposed anything better than this curriculum, so there is little point in debating its merits. One could quibble endlessly as to what should be included or not included in each subject, particularly about the relative allocation of time for each subject, but there comes a point where the perfect becomes the enemy of the good. The real answer to this question should be that it depends on how the curriculum is implemented and with what rigor. Any meaningful curriculum for teaching medical students laboratory medicine will require dedicated time within the overall medical school curriculum, effective teaching by knowledgeable faculty, well-designed assessments, and continuous improvement through time. The curriculum proposed by Smith et al would be an excellent starting place. It also provides a powerful starting point for educators, as there is little point in approaching one’s administration to request a slot in the overall curriculum unless one has something to put there.

A second point bears emphasis: Because some medical schools already offer laboratory medicine as part of their curricula, it would make sense to standardize those curricula among schools. The curriculum proposed by Smith et al obviously would meet that need.

Another benefit to implementing the proposed curriculum is that it would provide accrediting and testing organizations with a starting point to develop more rigorous assessments of medical student knowledge in laboratory medicine.

Are There Better Alternatives to a Standardized Curriculum?

One such alternative, relying on clinicians to provide what can only be called indirect education in laboratory medicine, has already been discussed. Are there others? Could
teaching of laboratory medicine be incorporated into standard pathology courses? Or into courses other than pathology? The answers to each of these questions would appear to be “no.” Laboratory medicine is a discipline, whether it is referred to as clinical pathology or laboratory medicine, and it should be taught as such. Everything we do in medicine is related, but we do need to create (admittedly artificial) structures on which to base education, training, and patient care. This point may seem obvious to the point of being trivial, yet despite the move within education to what is called interdisciplinary studies, there does need to be structure to create the appropriate context for education and training. A medical microbiologist, for example, is educated to approach the diagnosis of infectious diseases in a certain way. That person’s context is very different from that of an infectious diseases specialist, yet if their education is done correctly and their roles are clearly defined, it is possible to create complementary roles in such a way that the end result is better for patient care. The same is true for all disciplines within laboratory and clinical medicine: because no one person can know everything or do everything, it takes a number of people with overlapping skills to provide the best patient care.

**What Would It Take to Make Laboratory Medicine a Core Part of Medical School Curricula?**

The first and most obvious answer is that educators would need to recognize and acknowledge that omitting the topic from the curriculum creates a major gap in the knowledge and competency of medical students. Next, it would require the allocation of student time and institutional resources to make such a course effective. Most important, it would require the will to make such a change.

**What Should Be the Next Steps to Integrate Such a Curriculum Into Overall Medical School Curricula?**

This is the most difficult question to answer. For all of the reasons noted previously, changing medical school curricula has proved to be one of the most challenging tasks in education. Taking that into account, it should be noted that some medical schools have required courses in laboratory medicine, others have recently undergone major changes in their overall curricula, and the increasing role of laboratory data in patient care is not likely to decrease through time. In many ways, now is the best time—and the best opportunity—for laboratory professionals to have a greater role in medical education.

Because most institutions in the United States consider laboratory medicine to be part of their departments of pathology, chairs of pathology departments need to make this a priority. Similarly, deans of medical schools need to make this a priority. Thus, the most important steps for changing the medical school curriculum will be political. To argue for such a change, laboratory professionals must be able to present a logical and persuasive case for the change and that the change ultimately will be cost-effective. To do so, laboratory professionals need better and more persuasive data regarding the role of laboratory testing in patient care, how laboratory professionals contribute to patient care on a day-to-day basis, and why mandating laboratory medicine as a core component of medical school curricula would improve medical student education. The most persuasive argument is that the absence of formal training in laboratory medicine leaves medical school graduates unprepared for residency and future roles as physicians.

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**References**

