Medical Education

Medical Education—Three-Legged Stool or Five-Wheeled Work Chair?

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I am going to speak about medical education, reflecting first on the substantive change in what we call "patient material" on the inpatient units, the changes in clinicians' experience with these patients, and the resulting impact on the education of students and house officers. Considering both exposure to the facts of clinical medicine and the acquisition of capability in its practice, I will then examine the nature of the process by which young physicians develop expertise. Finally, I will move beyond that tripod of goals—knowledge, skills, and attitudes—that seems to drive the curriculum of the medical school and conclude by exploring additional considerations that are important enough to turn the triad (the three-legged stool) into a pentad (the five-wheeled work chair).

With the recession of the 1980s, American business began examining its operating bottom line in detail and not only discovered the relatively large chunk of its pretax profits that went toward health care premiums for workers but also uncovered the revelation that a market that had dictated to them for years was, in fact, theirs. When the Washington Business Group on Health first assembled, gathering several dozen of the nation's largest employers, nothing may have been more astounding to them or more important to us than the appreciation of the fact that only a handful of American employers purchased health care for some 25% of the population of this nation. And when one is that good a customer, they recognized, one moves into a buyer's market. The power had shifted in the physician-patient-hospital-payer dynamic, and, as a result, a series of controls has emerged, all too familiar by now. The impact has been of major consequence to both office and hospital procedures, to patient convenience, comfort, and care, and to the educational opportunity provided our trainees.

Let's examine the changes taking place in inpatient care. Earlier discharge, admission on the morning of an operation, and more stringent requirements on justifying admission all make for an increased intensity of illness on the average, which means not only an increased use of resources but also an increased pace of work for residents, increased stress on the job, a greater demand for work performance and productivity, and less time available for reflection and personal study. The psychological space of the inpatient unit has shifted, too. With sicker patients or, rather, with more patients in the sicker phases of their illnesses, and with earlier discharges, the opportunities for gratification—seeing clearly that one has done well for a patient—are less available to counterbalance the mounting stress.[1] Furthermore, to the extent that an inpatient admission is related primarily to the carrying out of a complicated diagnostic or therapeutic procedure, the learning experience tends to shift toward technology disembodied from the person and isolated from the exquisite responsibility and privilege of the physician-patient relationship.

Even more significant than these shifts in intensity, stress, and psychological reward is the qualitative change in what we once labeled "patient material"—that is, in the specific nature of the illness with which a house officer contends. Today there is a trimming of the spectrum of illness welcomed by third-party payers on the inpatient unit. Yet education in clinical medicine calls not simply for a disembodied awareness of the pathophysiology of a disease during its most intensive phase, but rather an experiential familiarity with as full a spectrum of the illness as is practicable, ideally from cause to cure or defeat. To the extent that we truncate the trainees' involvement in that full spectrum by shaving days off both ends of the inpatient experience, we are altering the subject matter of that education. We are altering the quality of that education.

It is a matter of more than lost days and more than vanished experience with an appropriately broad spectrum of illness. Preoperative physical examinations and tests done in anticipation of admission typically are now done by others, rather than the house staff later assigned to the actual inpatient admission. Medical patients bring pressures for the admitting internist—in advance of a patient's arrival and of a student's and resident's workup—to schedule essential diagnostic procedures and critical consultations. Such alterations in the nature of the process of inpatient care create a major qualitative disruption to the trainees' cognitive experience, clearly altering the education to be derived.

In many teaching hospitals, there is a sharp change of pace. Where census has not declined parallel to the drop in length of stay, as at Boston's Beth Israel Hospital, there are more admissions. To the business office this growth in market share may be a happy event, but it represents a tightening of the noose on the department chairs as well as the house staff because, in most cases, there has not been a comparable increase in house-staff numbers to compensate. Payment limits prevent the recruitment of more residents or other professional help.

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For example, at Beth Israel Hospital, medical and surgical beds remain occupied at 90% despite a significant decline in length of stay. Each year we seem to admit more patients who stay for fewer days. In the past we have increased house-staff numbers somewhat but can afford additions no longer. As a result, we have had to rearrange residents' schedules in medicine, taking them from other rotations to create a night-time relief corps so that no resident regularly assigned to an inpatient unit will have to work up more than six patients on a given day.

When I was a house officer at the Massachusetts General Hospital in the Department of Medicine, two or three admissions was a reasonable expectation. Four was a heavy load, five was heroic, and six—which might have come about once a month—won you a place in the hall of heroes in house-staff mythology and a well-phrased compliment from Holly Smith, who was then chief resident. Today, how well can one work up six sick patients in one evening? How well can one keep them clear in one's mind? How well can one manage those cases? And, is this the way to learn medicine?

Look at the surgical house officer. At Beth Israel, about 40% of patients having inpatient surgery are same-day admissions. The resident's experience, therefore, is often a hurried and harried preoperative check; the real contact becomes that with an operative field and not with a person. How does that truncated experience relate to the awareness a surgical resident will require when he or she is in practice? To the extent that most trainees will spend most of their careers dealing with much of those things we have now moved out of the inpatient experience, how valid does today's teaching hospital inpatient experience remain as the basic core of medical training?

In the past, the set of activities that involve the management of patients pretty much overlapped the set of activities that led to the desired education of our trainees. And the pace of work was such that time could be taken in the day's schedule of hospital work for discussion and reflection with peers and senior physicians. Today, however, those two sets of activities—the provision of care and management of patients, on the one hand, and the educational experience necessary for learning and mastering clinical medicine on the other—are increasingly divergent. That loss of congruence reflects our conclusion: the traditional teaching hospital inpatient experience, reshaped by contemporary financial pressures, is moving away from its time-honored role as the fundamental locus of curriculum for graduate medical training.

Let's now move beyond the *substance* from which trainees learn, for we teach more than facts to our students and house officers. Because medicine is both an art and a science, we are engaged as well in teaching them how to be physicians. David Eddy, a physician and mathematician, Director of the Center for Health Policy, Research and Education of Duke University (Durham, NC), comments on the complexity of medical decision making.[2] "One of the greatest accomplishments of the medical profession," he states, "is the development of methods that reduce the decisions faced by physicians to a manageable size and enable physicians to derive the correct answers." Focusing on three processes, making a diagnosis, selecting diagnostic tests, and choosing a treatment, he points out that the ninth revision of the *International Classification of Diseases* lists no fewer than 25,000 first-order codable conditions. There are about 3,000 biomedical journals, and MEDLINE, which contains the citations published in *Index Medicus,* has about 4.2 million records of scientific articles and each month adds about 25,000 more. Memory alone cannot be relied on even though most physicians do, in fact, acquire, store, and are capable of retrieving in a reasonably orderly fashion vast amounts of information.

Even having the facts is meaningless in the face of inadequate information processing for diagnosis. Eddy observes

> [H]umans are notoriously poor at manipulating probabilities . . . [but they] are excellent at making one-by-one comparisons. The diagnostic heuristic transforms the diagnostic problem from a calculation of hundreds of probabilities into a smaller number of comparisons.

What is it that enables a capable clinician confronting a complex diagnostic problem to pick a few features of a patient's illness, use these to generate a list of possible diseases, consider these few possibilities one by one in relation to the explanation of most or all of the patient's signs and symptoms? It is at least in part a matter of matching patterns. But the question is, how are these patterns visualized and articulated? Eddy emphasizes, "the solutions developed by the profession to solve the diagnostic and treatment problems in the past do not work as well for the problems the profession will face in the future." It is not only the growth of knowledge, the burgeoning technology for diagnosis and treatment, and the limited experience that trainees confront in the inpatient situation. The rising costs of medical care, the controls superimposed by payers, issues of liability, increasing empowerment on the part of patients, and a greater sensitivity of clinicians to the needs of patients render the mastery of doctoring an ever-growing challenge.

How does this mastery develop? How does a trainee progress from novice to expert? The phrase, "from novice to expert,"[3] may be familiar to you. It is the title of a splendid volume by a colleague of yours, Patricia Benner, PhD, who is a nurse and a professor at the University of California, San Francisco, School of Nursing. Dr Benner's inquiry, as the subtitle of her book points out, is toward "excellence and power in clinical nursing." It deals with two subjects, both of which are worth study. One is a lucid exposition of what nursing really is, what nurses really do. The other, of relevance to our inquiry, examines the process in nursing practice of moving from novice to expert.

Some of Dr Benner's thinking derives from the studies of a mathematician and systems analyst, Stuart Dreyfus, and a philosopher, Hubert Dreyfus, who developed a model of skill acquisition out of their studies of chess players and of airline pilots. Their model delineates five levels of proficiency: novice, advanced beginner, competent, proficient, and expert. The movement from one to another level reflects changes in three general aspects of skilled performance: first, moving from relying on abstract principles to the use of past concrete experience as paradigms; second, a change in the learner's perception of the situation demanding a response—that is, where the situation is seen less and less as a compilation of equally relevant bits and more and more as a complete whole in which certain parts are more relevant than others; and third, the passage from detached observer to involved performer, no longer standing outside a situation but engaged in it. Benner interviewed pairs of nurses from several hospitals, each consisting of one beginner and one expert. The interviews focused on patient care situations the pair had in common. The nurses were asked to reflect on

clinical knowledge related to the situation that they had found particularly difficult to teach or to learn, and the reports were analyzed to see if there were characteristic differences in the two descriptions of the same clinical incident that might lead to some taxonomy in understanding the progress from novice to expert. Many interviews were held with other nurses as well.

Benner suggests that stage one, the novice, enlists persons with no experience of the situations in which they are expected to perform. Novices are taught about the situations they will confront in terms of objective attributes—weight, intake and output, vital signs, and the like—as Benner puts it, "features of the task world that can be recognized without situational experience." And they are taught context-free rules to guide action: for example, weight gain and an intake that is consistently higher than output by more than 500 ml could indicate water retention that would call for restricting fluid until the cause of the imbalance and further action are decided. Rule-governed behavior typical of the novice is limited and inflexible. Because there is no experience, rules must be given, but rules legislate against expert performance because they do not delineate the most relevant tasks.

Advanced beginners have coped with enough real situations to begin an awareness of "meaningful situational components" that are recognizable only in the light of past experience. For a nurse it might be, for example, a patient's readiness to learn about his or her ileostomy. Guidelines may be given by the instructor: Does the patient ask questions about the operation or the dressing change? Does the patient look at or handle the wound? Because these guidelines relate to the clinical situation and are not context-free rules, only an advanced beginner can begin to formulate actions as a result.

Stage three is competence, typified by the nurses who have been working in a similar situation for several years and now can see their actions in the light of longer term plans. Emerging from a perspective of experience, each plan is based on a conscious and analytic contemplation of the patient and the patient's problem, and it gives a competent nurse the beginning of a feeling of mastery, a sense of being able to cope with the many contingencies of clinical nursing. Competence brings about the conscious, deliberate planning that helps achieve efficiency and organization in a clinical endeavor. Benner points out, however, "There is a sophomoric quality to the competence stage. The clinical world seems organized, finally, after great effort."

Proficiency is the title of the fourth stage, and proficient performers begin to look at a situation as a whole, where the perspective is not so consciously thought out but rather "presents itself" based on experience and recent events. Proficient nurses understand immediate events in terms of the expected whole picture and are able to modify their plans in response to the uniqueness of a clinical course. Proficient nurses recognize when the expected normal picture does not materialize; they consider fewer options than do competent nurses and focus more sharply on the most meaningful region of a problem. Benner comments,

> The proficient performer is best taught inductively, by beginning with a clinical situation and having the performer supply his or her ways of understanding the situation. When situations are introduced that exhaust the performer's way of understanding and approaching the situation, then a fruitful area of necessary learning has been uncovered.

The uppermost stage, that of expert, may seem at first contrary to the traditional expectation. The expert does not rely on analytic principles—rules and maxims—to connect an understanding of the situation to an appropriate action. An expert nurse, Benner says, "with an enormous background of experience, now has an intuitive grasp of each situation and zeros in on the accurate region of the problem without wasteful consideration of a large range of unfruitful, alternative diagnoses and solutions." Experts operate from a deep understanding of the total situation and may well reply, when asked why they did something, "because it felt right," before going on to articulate in more comprehensible terms the reasoning of the earlier stages. Stuart and Hubert Dreyfus are quoted by Benner,

> As long as the beginner pilot, language learner, chess player, or driver is following rules, his performance is halting, rigid, and mediocre. But with the mastery of the activity comes the transformation of the skill which is like the transition that occurs when a blind person learns to use a cane. The beginner feels pressure in the palm of the hand which can be used to detect the presence of distant objects such as curbs. But with mastery the blind person no longer feels pressure in the palm of the hand, but simply feels the curb. The cane has become an extension of the body. . . . the performer is no longer aware of features and rules, and his/her performance becomes fluid and flexible and highly proficient. The chess player develops a feel for the game; the language learner becomes fluent; the pilot stops feeling that he/she is flying the plane and simply feels that he/she is flying.

In my mind, these are ideas of extraordinary insight, and they apply not only to nursing but have relevance to teaching and learning in clinical medicine. Certainly, the notion of moving from a context-free set of rules to a more holistic grasp of the complex clinical situation where one's diagnostic insights, further inquiry, and choices of therapy "feel right" even as they are articulated as defensible on the basis of specific knowledge, characterizes my senses of clinical competence. To me, the beautifully delineated decision trees, with their sets of multiple probabilities, represent little of the way that real medicine is practiced.

Looking at clinical medicine, Dr J. S. McCormick of the University of Dublin writes in *The Lancet* "that recognition, based on knowledge and experience, is the mainspring of diagnosis and that the diagnostic process is simple, straightforward and in need of demystification."[4] He argues that physicians presented with a symptom, the complaint that often opens a new consultation, immediately develop notions of its cause. The guesses develop from the age and sex of the patient, from the context of the illness, and from the specialty of the physician. In practice, he points out, symptoms are often simple: a sore throat speedily and properly leads the physician to having a look, typically without undertaking a systems review or inquiring about the patient's sexual history. The normal diagnostic tasks of physicians, he argues, are straightforward and do not rely on the imaginative generation of hypotheses but on knowledge and experience—knowledge of probability and the ability to recognize common presentations and physical abnormalities. The apparent diagnostic acumen of senior clinicians, he argues, may be in large measure déjà vu; having seen it before, they can now recognize it again. And experience may tend to protect against diagnostic error by enabling physicians to recognize those pieces of information that are discordant and ring warning bells to say that things may not be as simple as they seem at first. McCormick concludes,

> Diagnosis . . . is . . . the essential task of the physician. . . . it follows that an important part of medical education is learning how to make correct diagnoses and how to diminish the possibilities of error. . . . although knowledge and experience can lead to making the same mistakes with increasing confidence, they remain the basis of our diagnostic skill.

Also writing in *The Lancet* some four months later, Dr. E. J. M. Campbell of McMaster University (Ontario, Canada) emphasizes that problem solving is normally hypothetico-deductive, which is, he adds, "a fancy way of saying that, when faced with a problem, the usual approach is to think of possible solutions and test them."[5] He emphasizes, however, that diagnostic ideas of more or less specificity come to mind almost immediately in the physician-patient encounter, and experienced clinicians navigate their way through the histories, physicial examinations, and laboratory tests rather individualistically in solving problems rather than remaining tethered to a branching tree of diagnostic algorithms. They are not blank minds ritualistically collecting information, context-free, but rather more the holistic expertise emphasized by Benner. Algorithms do not represent the diagnosing mind.

Such considerations have major implications for education—as important as those that deal with what may be available as "patient material" to illustrate and teach the substance of medicine. Students should be faced with diagnostic problems soon after they begin the study of medicine, argues Campbell. Teachers should try to share with students the formulation of a hypothesis, the development of a map of the terrain under scrutiny, and the choice of routes. At each turn in the history, examination, and investigation, it is important to ask what are the implications of the findings to eliminate the pursuit of information that gets one no further and to focus on approaches that are problem solving rather than simply performing routines.

The editor of *The Lancet,* reflecting on these views, asks why the process of diagnosis is seldom found in conventional medical school curricula, even though it is the principal intellectual skill of medicine.[6] Medical schools continue to emphasize the rote learning of a myriad of facts felt to be fundamental to the subsequent diagnostic process, but they do not teach how to manipulate such information. Medical students must be taught to practice medical thinking, to understand what they are doing with the information they have and to learn to use that evidence to reject unacceptable diagnoses. We may argue whether diagnostic recognition per se is or is not hypothesis generation, and we may tilt toward the cognitive psychologist's position that diagnosis is primarily a "hypothetico-deductive" process or side with Benner in a more holistic view that only seems less sophisticated because we do not fully understand the process of moving from novice to expert. The important point is that as teachers of medical students and house officers, we must go beyond the considerations of what has changed in the "patient material" available to trainees and think equally hard about the processes by which clinicians use the information they acquire and how best to teach these as well. Our responsibilities as mentors thus broaden as our own perspectives enlarge on teaching and learning in medicine.

To summarize our discussion thus far, we have considered the changing content of illness displayed to trainees on inpatient units. We have considered the resulting change in the tasks that are the responsibilities of the trainees. From the truncation of the spectrum of illness seen and from the move of many of the cognitive and physical tasks of inpatient care to the ambulatory sector immediately before and after admission to hospital, it appears that the inpatient rotations have become far less able to provide the substance, the experience, and the perspective needed to gain mastery in clinical medicine. Because the eliminated segments—what yesterday helped make whole the inpatient experience—because these portions of illness have been moved into the ambulatory sphere, it is only natural that educators look to the clinic and the office as substitutes for what has been lost on the wards and floors. But it is not a one-to-one tradeoff, and our examination of the nature of expertise explains why. If the development of expertise is characterized by the shift from context-free rules with little differentiation of what is important from what is not to a garnering of experience that not only makes for such differentiation but integrates individual vignettes and scenarios of illness that allow clinicians ultimately to feel what is right and to articulate it in more formal, even algorithmic, terms, then educators must consider that the new ambulatory experiences must be integrated with the inpatient exposure in a way that is most meaningful to the educational process. We cannot create a proper sense of the organism by tacking the head of a duck onto the body of a horse and the tail of an armadillo.

We have moved, thus far, from the content of medicine to a consideration of its diagnostic process—the use of that content. The traditional framework for such considerations in medical education has been the examination of what *knowledge, skills,* and *attitudes* we want to engender in medical school graduates and in young physicians completing residency programs. Well and good. But while this triad is an important component of the objectives of medical education, it is not sufficient. Two additional imperatives enter the considerations of educating physicians: expanding this triad to a pentad. They are the gratification of being physicians and the reassurance of relative personal immunity in physicians' struggle with death and disease.

In the "old days," at the height of the Oslerian tradition, the inpatient unit served as an ideal arena for teaching and learning because, as we have pointed out, many of the inpatients then provided most of the entirety of an acute illness—a history with symptoms, physical findings on examination, the opportunity to go through a diagnostic process, develop therapeutic decisions, and to see firsthand the direction of outcome. But also the essence of a physician's role and knowledge and power could be exemplified in such admissions. Not only were they each a practicum of a chapter or two in a textbook of medicine, but working on each case foretold what it would be like to practice medicine fully fledged.

We all recognize that virtually every physician takes away from medical school and house-staff training vivid imprints of physician-mentors whose major lessons have been not merely the substance of medicine but also—and perhaps even primarily—the art and science of its practice, that is, lessons in intellectual integrity, empathy, sensitivity, and selflessness. While learning the material of medicine, physicians could see their persona and career being forged out of the direct examples of professors.

There was something, for example, in the classic ward routines of house-staff training. The arrival of the visiting physician, a person of stature, was a highlight of the day. The circuit made around the unit, even by the most self-effacing of these mentors, followed by a diligent troop ranging from medical students to senior residents, provided a certain measure of theater. By "theater" I mean not the histrionics of the more flamboyant of our colleagues but, rather, the drama inherent in the masterful performance of the expert physician

role and the resulting impression it makes. Consider two uses of such ritual that we cannot ignore, as we contemplate today's metamorphosis of the inpatient unit, the major clinical training site for the transition of student into physician. The first has to do with the gratification of being a physician. New responsibilities are being shouldered by students and even greater burdens, along with increasing accountability, by house officers. A growing and new effort is being demanded of them, and encouragement is important. With the classic rituals of the inpatient unit, of which the major rite, visit or attending rounds, is reinforced day after day, the high status of "doctoring" is affirmed daily. Through repeated affirming, the trying entry of the neophyte into the profession of medicine is nurtured repeatedly through the palpable promise of a future sense of professional self-confidence and even admiration from others. The trainee becomes inspired; he or she is doing something good, albeit difficult.

In the absence of apprentice relationships of students with senior physicians able and willing to teach, little of this sustenance appears at present in the ambulatory sector, to which we look more and more as a site for training. There the individual scheduling of patients and physicians necessarily eliminates most opportunity for such group reinforcement; as presently taught, there is little comparable "theater" in ambulatory care. The potential gratifications more often tend toward the purely cerebral, and the joys of outpatient practice pale in comparison with the hush that fell over an inpatient unit as the professor arrived for daily rounds and the gratification of taking part, once again, in a time-honored ritual.

A second aspect of our inpatient rites may be even more important. Not only are physicians given extraordinary responsibility along with extraordinary opportunity, as students they also begin an initiation into forbidden realms. Physicians become entitled to probe private parts of body and mind; they learn to hold a person's heart in their hands, stop it, and then set it going again—or not! Advancing into the realm of the forbidden, physicians take on death and dying as adversaries—a fearsome business. Recall that the role of healer—medicine man or woman, shaman, physician—existed long before those healers were actually able to do much about the maladies they were called to heal, beyond the promises implied to patients and family. But always there was a certain dramatic ritual that served not only to convince a patient of the shaman's power but perhaps also to reassure practitioners of their relative immunity from the horrors of the forbidden world with which they wrestled.

I suggest that this imputing of powers is needed by both patients and practitioners. If so, then it is not enough to argue that as the substantive basis—the so-called patient material that best presents the content of medicine for learning—moves from the inpatient unit to the ambulatory sector, so will trainees' psyches as readily make the same transition. It is not enough to conceptualize the knowledge, skills, and attitudes we want to develop in trainees. Academic medicine has taken several decades of learning to think of patients as whole persons, not simply clusters of symptoms and signs. We must also think of trainees as wholes, and that includes asking how we can support them as persons as they move into those disturbing realms of death and disorder, as they require and deserve the nurture, gratification, reassurance, and protection justly accorded healers. Intentionally or not, teaching hospitals shaped past inpatient unit routines to provide these necessities. Now, because the character of inpatient care and its role in teaching are changing so profoundly, our challenge expands to create comparable and realistic models for success in the teaching arena of ambulatory care, models that recognize not only the substantive requirements and their mastery, but also the psychological requirements for the "complete" physician.

In summary, we have examined the changing content of clinical material available to trainees and considered the impact of that change on medical education. We have gone further to probe the nature of the acquisition of that expertise we hope to inculcate. Finally, we have concluded that goals focused on knowledge, skills, and attitudes are not enough. That triad should be expanded to a pentad. As educators we must include both *gratification* as reward for assuming the responsibilities of the physician, and *reassurance*—the forging of a sense of relative immunity against God's wrath for probing the unconscious taboo of death, for jousting with it, and even, sometimes, for winning. How we contend with the burgeoning factual content of medicine, how we grow to understand the process of acquiring expertise, and how we create this theater of the psyche while hewing to the reality of today's science, economics, and ethics will be a major challenge to medical education for the 21st century.

REFERENCES

1. Rabkin MT: Occasional notes—The SAG index. N Engl J Med 1982; 307:1350-1351

2. Eddy DM: Medical decision making. Health Affairs 1986; 5:108-115

3. Benner P: From Novice to Expert—Excellence and Power in Clinical Nursing Practice. Menlo Park, Calif, Addison-Wesley, 1984

4. McCormick JS: Diagnosis: The need for demystification. Lancet 1986; 2:1434-1435

5. Campbell EJM: The diagnosing mind. Lancet 1987; 1:849-851

6. Diagnosis: Logic and psycho-logic (Editorial). Lancet 1987; 1:840-841