Viewpoint: **Suggestions for a Shift in Teaching Clinical Skills to Medical Students: The Reflective Clinical Examination**

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Abstract

How medical students are taught physical examination (PE) skills appears to have changed little since the 1950s. Textbooks are organized according to organ systems and describe methods of eliciting and recording history and PE data using a routine format. In many medical schools, the preclinical teaching programs for clinical examination skills similarly emphasize an orderly collection of data. Teaching students to use diagnostic reasoning is postponed until students have learned history-taking and PE skills.

The authors propose three modifications to this educational approach. First, rather than performing the clinical examination using a routine format, students should be encouraged to form diagnostic hypotheses early on while listening to the patient's narrative, and conduct the subsequent search for history and PE data in a reflective way in order to confirm or refute these hypotheses. Second, the authors propose that interviewing patients and conducting the PE be taught by one-on-one tutoring until students achieve mastery. Last, they suggest that the PE be guided not only by students' diagnostic hypotheses, but also by patients' expectations.

These modifications are consistent with current trends in medical education that encourage a reflective practice and problem-based learning (PBL), and they also introduce medical students to the precepts of clinical reasoning. The authors suggest that challenging students to seek specific physical findings may increase the likelihood of detecting findings when they are present, and may transform patient interviewing and conducting the PE from routine activities into intellectually exciting experiences.

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During the past decades, studies have repeatedly reported that doctors have deficient patient interviewing[1,2] and physical examination (PE)[3,4] skills. The ensuing efforts to improve medical students' examination skills have led to major changes in how patient interviewing is taught.[5–7] However, the PE and the recording of the patient's clinical database, as described in textbooks of physical diagnosis, have remained unchanged since the 1950s,[8] through the 1970s[9] until today.[10] The approach to teaching the clinical examination continues to emphasize an orderly collection and recording of patient data along the sequence of history taking, complete system review, and routine PE. The latter begins with a physician or student observing the patient's appearance and vital signs, and moves on to an examination from head to toe.

The advantages of this approach are that it is relatively easy to teach and it satisfies both doctors and patients to know that a complete examination has been performed. Furthermore, every doctor can recall instances of serendipitous diagnoses, which were made because of adherence to a complete system review and a routine PE. This teaching approach is also consistent with three implicit premises or beliefs about students' abilities. The first is that medical students cannot use expert diagnostic strategies; therefore, the students' tasks should be initially restricted to collecting patient history and PE data. The second is that after being initiated into how to take histories and conduct PEs during the preclinical program, students will improve their examination skills and will be introduced to diagnostic reasoning during their clerkships. The third is that all patients expect and consent to a routine collection of history and PE data.

Tradition, inflexibility, and the perceived advantages of this teaching approach likely explain its endurance during past decades. However, this approach is inconsistent with how we expect physicians to ultimately perform because it divorces collecting data from the process of clinical reasoning. Our objective is therefore to question the premises of the traditional approach to teaching clinical examination skills and to propose some modifications that emphasize a problem-oriented history-taking and PE. We argue that, rather than using a routine data gathering format, students should be taught to conduct the history and PE in a thoughtful and purposeful way *from the beginning of their training.* The changes we advocate have not yet been implemented in a formal program, but we believe students would be better served by our approach.

Premises of the Traditional Approach to the Clinical Examination

Our assessment of the traditional teaching methods of the clinical

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examination is based on our review of textbooks, the traditional patient database in clinical settings, and reports on teaching programs in the United States, as well as our own observations at our institutions. It appears to us that these methods are based upon the following implicit premises.

Premise 1: Medical students cannot use expert reasoning strategies

To resolve diagnostic problems, an experienced physician employs two strategies.[11] The first is "pattern recognition," i.e., retrieval from memory of familiar disease manifestations, such as skin lesions and Grave's disease.[12] The second is "hypothetico-deductive" reasoning (also referred to as "iterative hypothesis testing")[13], whereby a physician generates about three diagnostic hypotheses while listening to her or his patient's story. Each hypothesis then guides a search for additional symptoms and signs that ought to be present if the hypothesis were true. Confirmation of a hypothesis leads to a diagnosis; its rejection leads to the consideration of alternative hypotheses. A physician's choice of strategy depends on the complexity of the problem. "Easy" cases are solved by pattern recognition; "difficult" cases require testing of hypotheses and, frequently, consultation with colleagues and reliance on other sources of information such as textbooks and data stores. Whether a problem is perceived as easy or difficult depends on a given doctor's knowledge and experience.[11]

Experience certainly adds to the store of disease manifestations in a physician's memory[12] and to the quality of his or her diagnostic hypotheses.[14] However, contrary to the belief that the use of problem-solving strategies is contingent on experience, it has been repeatedly found that students faced with clinical problems can advance diagnostic hypotheses[15–17] and that teaching interventions that promote expert reasoning strategies are feasible at all stages of medical training.[18,19] Therefore, it has been suggested that, since experienced physicians use the hypothetico-deductive approach for solving difficult problems, and since most clinical situations will present difficult problems for inexperienced students, medical students should practice this deductive approach through PBL.[19]

Indeed, after its development at McMaster University,[20] PBL has gained acceptance at medical schools and in textbooks.[21,22] Therefore, the premise that medical students cannot use expert reasoning strategies is inconsistent both with evidence and with contemporary approaches to medical education.

Premise 2: Students' examination and reasoning skills improve during their clerkships

Doubts about the validity of this second premise arose while three of the authors (JB, SNH, MB) participated in the preclinical teaching programs of examination skills and tutored students during their clerkships in medicine at the medical schools of the Hebrew University-Hadassah in Jerusalem (HUH) and the Ben-Gurion University in Beer Sheva (BGU). The instructors of the preclinical programs were medical staff and residents who were often overworked. It was our impression that many of them did not provide students with the necessary supervision to ascertain students' mastery of the PE. Moreover, the expectation that students' examination skills would be reinforced and improved at a later time was not always met. During the clerkships, patient interviewing and PE skills were only rarely the subject of a planned teaching program. Emphasis on examination skills varied among the clerkship preceptors, and some of them appeared to think that it was not their responsibility to supervise students as they examined patients.

During their clerkships, the students we observed became aware of the difference between the routine examination that they were required to perform and record, and the reflective one that they observed during rounds. A "routine" (or "complete") examination is the one described in textbooks of physical diagnosis.[8–10] The term "reflective" examination, as we use it, refers to an examination that consists of three parts. The first part is the patient's narrative. By listening to it, students or doctors form a set of diagnostic hypotheses. The second is the patient's answers to open-ended and closed questions aimed at testing these hypotheses. The third is a search for physical findings. A reflective PE may also be referred to as "selective" or "focused" on the organ systems that may be involved in the patient's disease; as "purpose-driven" by diagnostic hypotheses; or as "detailed," to the extent that the organ system that may be involved is examined in greater detail than in a routine PE. For example, during a reflective PE of a patient with rheumatic pain, the physician or student examines the patient's joints with more scrutiny than during a routine PE.

The differences our students observed between the routine and reflective examinations appeared to convey to some the feeling that the routine examination was not important for patient care, but was rather a time-honored ritual merely to be carried out "for the record." This may have prompted them to perform a hasty examination that was characterized by shortcuts, a technique that may even have deteriorated with practice. Furthermore, the expectation that students would acquire diagnostic reasoning skills during the clerkships was not always met. Students at HUH and BGU were rarely the first to examine a patient after his or her admission to hospital. Instead, students usually met their patients after the initial data acquisition, hypothesis generation, and diagnostic reasoning had been completed by other physicians. In addition, clerkship preceptors varied in the degree of autonomy they granted to their students during the follow-up of hospitalized patients: some preceptors expected students to only report the patient's findings, while others challenged their students to synthesize these data and suggest a plan for further evaluation and treatment. Therefore, students were often deprived of the opportunity to exercise their reasoning skills, both at patients' admission and during follow-up.

All of these shortcomings in students' training during their clinical clerkships have also been observed in U.S. medical schools. U.S. authors have reported that clerkship activities did not enhance students' PE skills.[23,24] For example, students' breast examination skills actually *declined* over the course of their training.[25] Studies have also shown that U.S. students on clinical clerkship rotations also met their patients late after their admission to the hospital.[26] A review of the methods of student evaluation in U.S. medical schools concluded that "too many medical schools still fail to employ evaluation

methods that specifically assess students' achievement of the skills and behaviors they need to learn to practice medicine."[27, p. 842]

Therefore, the premise that after initially learning the PE during their preclinical training students improve their examination and clinical reasoning skills during their clerkships is unjustified. A poor examination is unlikely to detect a finding; and a student who has rarely detected a significant finding is unlikely to view the clinical examination as a valuable experience. This may partly explain students' and residents' reliance on "hard" laboratory and imaging data, rather than on clinical assessment of their patients.[28]

Premise 3: Patients expect to have a routine physical examination

In the past, it has been assumed that a patient who consulted a doctor implicitly agreed to have a routine PE. However, the shift from physician's paternalism to respect for patient autonomy has led to the realization that patients may disagree with their doctors about the value of some diagnostic and treatment options. A survey in the United Kingdom has indicated that not all patients expect to have a complete PE, and some do not expect to be examined at all when they consult a doctor.[29] These findings make sense: a patient may need only a prescription or the results of a laboratory test, or a woman with sore throat may not understand why a doctor not only examines her throat, but also attempts to detect undiagnosed hypertension, breast cancer, or cancer of the uterine cervix.

It seems that the supposition that all patients who consult a doctor expect a routine PE is inconsistent with common sense and the available evidence. The extensiveness of the PE is contingent upon a patient's agreement, and his or her willingness to submit to a routine PE without an explanation should not be taken for granted.

Possible Methods for Improving How Students Learn the Clinical Examination

We suggest three modifications to how examination skills have traditionally been taught before and during students' clerkships: generation of diagnostic hypotheses, learning for mastery, and consideration of patients' preferences.

Generation of diagnostic hypotheses

We concur with Kassirer's call to "preach what we practice"[13] and train students to approach patients by hypothetico-deductive reasoning. Rather than being taught to perform the routine PE "for the sake of completeness," students should be encouraged to adopt the reflective approach to the examination.

The reflective examination is driven by one or more of five clinical purposes: to detect conditions requiring immediate treatment, to test diagnostic hypotheses in patients with focal complaints, to search for a diagnostic cue in patients without focal complaints, to monitor a known disease, or to promote health (see Table 1). A reflective examination is guided by diagnostic hypotheses even when its purpose is to detect a cue for diagnosis in patients with nonspecific complaints; in these cases, the differential diagnosis is wider and may require an examination of several organ systems. The fewer the diagnostic cues derived from the patient's history, the more extended the PE should be. A reflective PE is also purpose-driven when it attempts to promote the patient's health by early diagnosis of diseases: in such cases the PE should focus on those diseases wherein early treatment has been shown to reduce mortality.[30]

Clearly, one cannot expect a similarly efficient performance of the examination from seasoned physicians and students. However, we believe that the gaps between them will be narrowed more effectively by encouraging novices to adopt expert problem-solving strategies than by requiring them to perform routine examinations. Therefore, we recommend that students be taught to approach a clinical problem in the same way that experienced physicians approach any unfamiliar problem: by raising diagnostic hypotheses and searching for information from colleagues and data stores. Students' diagnostic hypotheses may be nonspecific (e.g., "Shortness of breath may be caused by a disease of heart or the lungs"). However, even nonspecific hypotheses stimulate further probing for information ("What findings may suggest a disease of the heart?") and performing a reflective PE. Although more efficient, the reasoning strategies of expert physicians who cope with unfamiliar problems are not inherently different from students' reasoning.

Textbooks of physical diagnosis and the teaching programs that we envision in the future would be organized into sections for each of the various clinical purposes and contexts (see Table 1), rather than by anatomic organ systems, as they are today. Each section would consist of the diagnostic hypotheses to be tested (e.g., "Does this patient have ascites?"), and would provide answers based on selected physical signs that have been shown to be reproducible, sensitive, and specific enough to change the probability of a diagnosis in a given patient context.[31]

Teaching diagnostic reasoning offers an opportunity for introducing students to notions of quality assurance, medical error, and tolerance of uncertainty.[32] Students should become familiar not only with expert reasoning strategies, but also with the instances when these strategies may fail and result in avoidable medical errors.[33] For example, physicians or students may fail to estimate the probability of alternative diagnoses, miss or misinterpret evidence by failing to assign the appropriate weight to data from various sources, or commit themselves prematurely to a particular hypothesis, thereby failing to restructure the problem when new information becomes available.

Learning for mastery

It is an unwarranted assumption that students will become proficient with the PE by practicing on their own. Instead, we propose that teaching examination skills be based on the principle of "learning for mastery,"[34] with individual tutoring and practice, until the instructor is satisfied that the student has mastered the skill. Such a teaching approach would consist of rigorously supervised programs for *each* of the clinical contexts (see Table 1). These programs would be implemented during students' clerkships in the relevant clinical departments, e.g., primary care, medicine, emergency medicine, pediatrics, geriatrics, obstetrics-gynecology, and neurology. The responsibility for teaching the PE should be assumed by clerkship preceptors, who should not take it for granted that students mastered the

Table 1

Examples of Symptoms and Signs to be Sought in Specific Patient Contexts in Order to Test Diagnostic Hypotheses, by Purpose of the Reflective Examination and by Patient Population

Purpose of the examination*	Patient populations and sample contexts†					
	Pediatric	Adolescent	Young adult	Adult	Geriatric	Pregnant
To detect conditions that require immediate treatment	**Neck rigidity** *in a 2-year-old patient with fever and vomiting* (bacterial meningitis)	**Mood disorder** (depression)	**Orthostatic hypotension and smell of acetone** *in a patient with abdominal pain and polyuria* (diabetic acidosis)	**Tracheal deviation and hyperresonance on chest percussion** *in a patient with respiratory distress* (tension pneumothorax)	**Pallor and pulselessness** *in a patient with sudden limb pain* (arterial occlusion)	**High blood pressure** *in a patient with seizures* (eclampsia)
To test diagnostic hypotheses in patients with focal complaints (e.g., chest pain, dysuria)	**Tonsillar exudates and cervical adenopathy** *in a 10-year-old patient with fever, sore throat but no cough* (strep tonsillitis)	**Blurred sinus trans-illumination** *in a patient with colored nasal discharge* (sinusitis)	**Tenderness at the costovertebral angle** *in a patient with fever and dysuria* (pyelonephritis)	**Muscle weakness and ptosis** *in a patient with diplopia and difficulty in swallowing* (myasthenia gravis)	**Reduced diaphragmatic motion, barrel chest and absent cardiac dullness** *in a patient with chronic shortness of breath* (emphysema)	**Leg muscle weakness, reduced patellar reflex, and pain on leg elevation** *in a patient with back pain* (sciatic nerve compression)
To search for a cue for diagnosis in patients with nonspecific complaints (e.g., fatigue, confusion, loss of weight, fever) without focal symptoms.	**Bulging tympanic membranes** *in a 1-year-old patient with fever* (otitis media)	**Dilated pupils, tachycardia, and hypertension** *in a confused patient* (sympathomimetic toxidrome)	**Goiter and exophthalmus** *in a patient with weight loss* (hyperthyroidism)	**Splenomegaly and splinter hemorrhages** *in a patient with fever and a heart murmur* (bacterial endocarditis)	**Dullness on percussion and bronchial breathing** *in a patient with sudden confusion* (lobar pneumonia)	**Jaundice and petechiae** *in a patient with vomiting* (acute fatty liver)
To monitor a known disease and detection of complications	**Loss of weight** *in a patient with gluten sensitivity*	**Changes in weight** *in an obese patient*	**Retinopathy** *in a diabetic patient*	**High blood pressure** *in a hypertensive patient*	**Shortness of breath on exertion, hepatomegaly and abdominal jugular reflux** *in a patient with chronic left ventricular failure*	**Fetal growth, premature labor and abruptio placentae** *in a diabetic patient*
To promote health and case finding in asymptomatic patients	**Failure to gain weight** (malnutrition)	**Alcohol abuse** (alcoholism)	**Smoking** (tobacco dependence)	**High blood pressure** (hypertension)	**Loss of hearing** (otosclerosis)	**Leg edema and high blood pressure** (preeclampsia)

* The exam may be directed toward one or more of these aims.
† Symptoms and signs are presented in bold text; specific patient contexts are given in italics. Diagnostic hypotheses are enclosed in parentheses.

relevant skills during a previous clinical rotation or during their preclinical course.

Such an approach may not only improve students' examination skills; by providing explicit learning objectives, it may also standardize teaching in the various clerkship rotations and shift didactic priorities from today's emphasis on the interpretation of ancillary tests in *rare* disorders to the symptoms and signs of *common* disorders. For example, students completing clerkships in primary care will be expected to know that a combination of tonsillar exudates, cervical lymphadenitis, and fever in an adult patient complaining of sore throat without cough increases the probability of streptococcal tonsillitis from 2.5% to 56%.[35] Knowing how the absence or presence of clinical findings reduces or increases the probability of a diagnostic hypothesis may also help students to select more appropriate ancillary tests.[28]

Students should also be taught to monitor the progression of common chronic diseases, and to combine this monitoring with patient empowerment (e.g., self-examination of the feet for patients with diabetes). Finally, we feel that health promotion and case-finding should also be included in the clinical examination. Students should be taught to inquire for and record habits, such as sedentary lifestyle and tobacco use, and then to provide advice and assistance for

changes when needed. While such interventions are recognized as the physician's task,[36] a recent survey of a random sample of adults in the United States revealed that they had received only about half of the recommended preventive care.[37]

Consideration of patients' expectations

We propose encouraging students to ask themselves, at the end of the patient interview and before performing the PE, the question: "What are this patient's main concerns and what does he or she expect from my examination?" In other words, a reflective PE should be guided not only by the doctor's diagnostic hypotheses, but also by the patient's expectations, which may be elicited by questions such as "I am very interested in what you think should be done about your illness" or "What do you think the problem is?"

Students should communicate with patients throughout the PE, and, if appropriate, explain the purpose of and ask for patients' consent for any part of the PE that may not seem to them to be related to their complaints.

The Reflective Examination: Strengths and Weaknesses

The reflective examination that we describe and advocate is an extension of the philosophy of medical education developed at McMaster[20] into the clinical clerkships. It also builds on the ongoing attempts to transform the PE into a rational quest for physical findings.[38] Our suggested approach is compatible with current trends in education that encourage PBL[19] and a reflective practice.[39] It divides teaching the clinical examination among multiple programs, thereby reducing the knowledge and skills to be mastered by the learners to manageable amounts, and it introduces students to clinical reasoning. Another possible advantage of the reflective examination is that, by challenging students to seek relevant physical findings, it will increase the likelihood of detecting them when they are present and will transform the PE from a routine activity into an intellectually exciting experience. Furthermore, our proposed approach may increase students' reliance on the clinical assessment of patients and reduce their dependence on ancillary studies. This, in turn, may reduce health care costs, patients' discomfort or experience of side effects, delay in treatment, and physicians' "chasing" false-positive results.

The main weakness of the reflective examination is that, by focusing on the five clinical purposes we have outlined, it may miss an unexpected finding that would have been detected by the performance of a complete system review during the history and a routine PE. Several studies have shown that performing a complete system review has led to new diagnoses in 5%, 7%, and 10.5% of patients, [40–42] while a routine PE has been reported to detect unsuspected findings in as many as 5% of patients.[41] Furthermore, academic medical centers may find the cost of one-on-one teaching prohibitive; yet we feel that the importance of basic examination skills would justify the expense. Teaching the reflective examination may also require teacher training in order to provide students with role-models who value the clinical assessment and do not rush to perform ancillary tests.

We know of no attempts to implement the reflective examination in its entirety in medical schools. However, the limitations of the traditional history and PE in promoting students' development as clinicians have been recognized in the literature.[43] Moreover, our viewpoint is consistent with the reports of novel teaching programs that are structured according to the ways in which patients may present to a physician,[44] that teach clinical problem solving to preclinical medical students by encouraging them to perform a focused PE,[45,46] and that combine teaching clinical skills with practicing critical thinking and reflection.[44] If our approach is implemented, future research may compare the efficiency of the reflective examination with that of the routine examination in order to determine whether the expected benefits of the reflective examination, in terms of students' improved diagnostic reasoning and reduced reliance on ancillary testing, justifies the risk of missing the diagnoses that might have been detected by performing the complete system review and the routine PE. Future research may also identify an optimal combination of the routine and reflective examinations. For example, we can envision a recommendation to supplement the reflective examination with selected parts of the routine PE and by a patient self-administered questionnaire.[42] We feel that an important goal of clinical training is to promote teamwork. From the perspective of cost and efficacy, much of the collection of routine history and PE data can be carried out by physician assistants, and such prescreenings may reduce the probability of missing an unsuspected diagnosis.

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