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On Friday, September 1, 1939, Nazi Germany invaded Poland, and it was at that moment that World War II began. “The Poles were brave beyond belief.” 4 Unfortunately, they also were wedded to tradition beyond comprehension. In the words of military historian and author Sir Basil Henry Liddell Hart, the Polish army “still pinned their trust to the value of a large mass of horse cavalry, and cherished a pathetic belief in the possibility of carrying out cavalry charges in that respect . . . their ideas were eighty years out of date, since the futility of cavalry charges [against modern weapons] had been shown as far back as the American Civil War.” 5,6 One million gallant Poles charged on horseback with their sabers gleaming, and tens of thousands were massacred by Germans armed with Panzers, machine guns, and Stuka dive bombers.

This story illustrates how dangerous it is, in a technologically advancing world, to cling to outdated methods and tools. The Polish army’s failure to adopt new technology led it to fight a twentieth-century opponent with nineteenth-century weapons and tactics. The result was the loss of many brave men, and of the war.

The diag-nostic tools available to primary care physicians to support the bedside examination—the contents of the “black bag”—are today as out of date as the cavalry charge was in Poland in 1939. Although this analogy may seem anomalous to some, in our view the practice of medicine can reasonably be considered a war, one that pits patients and doctors, with all the skills and tools they can muster, against human disease. The stakes are equally high, and the failure to adopt new technologies could be as consequential for patients and primary care medicine as that failure was for Poland and the Polish army. It is time to introduce modern tools into the black bag; in the process, what a physician can accomplish at the bedside can be transformed.

The bedside examination today

The bedside examination supplements the medical history, providing reliable information about a patient’s health and disease status, and giving the physician enough personal and physical contact with the patient to help build trust and a positive therapeutic relationship. Unfortunately, many of the observations made at the bedside using traditional tools are inaccurate or imprecise, and either require exceptional skill to do well, or are based on unverified assertions about specific findings and their alleged clinical implications. 4,7 Faith T. Fitzgerald’s 1990 review of physical diagnosis identified some aspects of health and disease, such as nutritional status, hemoglobin level, and hepatomegaly, that can be assessed accurately by physical examination. Other important areas of the physical examination appear to elude accurate assessment, even in the hands of experienced and skilled practitioners. The hemodynamics of the heart, especially the right heart, is one example. 8 Others include the detection of a displaced trachea and of tactile fremitus, which have kappa statistics of 0.01. (A value of 1.0 indicates perfect agreement and 0 indicates no agreement.) 9

Nonetheless, many parts of the physical examination, such as the analysis of cardiac murmurs, require much instruction and experience to master. 2 This means that many clinicians will never acquire the skill level of an expert, and will therefore never obtain the depth of information of skilled experts. And some important areas of the physical examination appear to elude accurate assessment, even in the hands of experienced and skilled practitioners. The hemodynamics of the heart, especially the right heart, is one example. 8 Others include the detection of a displaced trachea and of tactile fremitus, which have kappa statistics of 0.01. (A value of 1.0 indicates perfect agreement and 0 indicates no agreement.) 9

Many of the deficiencies of the bedside examination arise from the use of instruments that have not changed in over a century: traditional tools cannot take advantage of modern technology. The stethoscope was invented by Laennec in 1819, and the ophthalmoscope by von Helmholtz in 1852. 9 The latest instrument added to the black bag of most primary care physicians was the sphygmomanometer, invented in the late nineteenth century, and first introduced in America by Harvey Cushing in 1901. 10 Imagine our society if surgical procedures, accounting devices, and modes of transportation and communication were entirely dependent on inventions from over 100 years ago! No lasers, plastics, computers, mobile telephones, printers, all but a few drugs, microprocessors, anesthesia as we know it, X-ray imaging (much less magnetic resonance, computerized axial tomography, or sonography), or new laboratory tests! But primary care physicians today conduct their bedside examinations armed only with nineteenth-century tools.

What can be done to improve accuracy in physical exams?

Some of the causes of inaccuracy and insensitivity of parts of the physical exam are currently inescapable. Some, how- ever, are not. The use of modern tools could make the clinical
examination far less dependent on extraordinary observer skill and experience. Bedside examinations could be extended to include observations that formerly required specialized laboratories. Today’s advances in microelectronics and miniaturization make possible portable diagnostic tools that go far beyond the stethoscope and blood pressure cuff, that might dramatically increase the information flow to the clinician at the bedside. Among the devices now available and under continuing development are portable ultrasound devices, oximeters, panoptic ophthalmoscopes, and digital cameras. The rapid pace of innovation raises the not-too-distant prospect of being able to perform at the bedside diagnostic tests based on gene chips or proteomics. Ultimately, decisions about adding new technologies to the conventional physical examination must be guided by judgments about the effects new technologies might have on the accuracy, financial costs, and convenience of the bedside examination, and on the therapeutic relationship with patients.

Handheld ultrasound— a tool for the black bag?

Because of its availability and its many potential uses, we believe that the portable ultrasound device should be the first addition to the new and enhanced black bag. Several companies have succeeded in miniaturizing ultrasound devices to about the size of a small textbook weighing about 1,400 grams and costing around $15,000.

Bedside ultrasound and Doppler technology will allow primary care physicians to accurately assess disease processes that currently are evaluated only inaccurately or imprecisely by the traditional physical examination. Primary care physicians would, for example, be able to detect pericardial fluid and to assess accurately the size of the left ventricle, the ejection fraction, and the functioning of the mitral and aortic valves. Other observations not easily or effectively made by physical examination could be better determined using handheld ultrasound devices. These include liver and spleen size, ascites, renal aneurysm, bladder obstruction, the presence of masses, detection of cysts of many types, and the location of central veins for catheter insertion.

The utility of hand-carried ultrasound units in the diagnosis of cardiac disease has now been evaluated in a number of studies. Surprisingly, the image quality of these units is similar to that of their top-of-the-line cousins, with a sensitivity of 97 percent and a specificity of 99 percent for detection of moderate-to-severe cardiac pathology.11,12 Cardiologists using handheld ultrasound devices in inpatient and outpatient settings consistently, make important, unanticipated findings,13 while missed findings are reduced by 31 percent.14 Handheld ultrasound devices improve the accuracy of diagnosis and lead to changes in therapy in patients hospitalized for acute cardiac care.15 In a group of 13 medical residents using the device, 10 improved their physical exam skills as a result of the feedback provided by the devices.16 Another study in academic emergency department demonstrated that 95 percent of emergency department already use portable ultrasound.17

Obviously, adequate training is important, both in the technical acquisition of images and their interpretation.15,16,18 The American Society of Echocardiography recommends level I training for the responsible performance of the focused echo-cardiographic examination,19 but the level of training required for primary care physicians to obtain general information—to determine whether a pericardial effusion is present or whether left ventricular function is normal or reduced, and, importantly, to determine when to order a specialist examination—is unknown. The utility of examinations may also depend on the patient population; concerns have been raised about the accuracy of the technology’s use with critically ill patients.20,21

Studies are needed on the use of portable ultrasound for primary care physicians: How valuable is ultrasound to physical examinations in primary care practice? Will its use enhance physical examination skills by providing an immediate visual reinforcement to the auscultated murmur or to the palpated pulsatile abdominal mass? Does ultrasound improve diagnosis or therapy, and if so, how? Will routine use of portable ultrasound during the bedside examination increase the net information flow to the decision making clinician?

Generating a change in generalist-to-cardiologist referrals . . . and in reimbursement policies

Are bedside ultrasound examinations by primary care physicians as good as those specialists perform? The studies with cardiologists cited above show that the technical quality of the devices is not the primary issue, but that the skill and training of the operator determines the quality of the data. Thus, primary care physicians are unlikely to do as well as specialists in controlling the probe extended over the patient. Conversation is possible, unlike what is appropriate during most parts of the physical exam, and the experience is surprisingly intimate and not at all unpleasant.

Will another “machine” harm physician-patient interactions?

Revolutionizing the doctor’s black bag

The future of portable ultrasound can also be anticipated by seeing what has happened to the stethoscope, reflex hammer, tuning fork, and all the other tools in the traditional black bag. It is substantially a question of reimbursement. On the one hand, we might have a single billable entity of “physical examination with ultrasound” which will make the clinician who uses the tool as needed during his examination, and on the other hand, we might have some physicians (probably specialists) becoming qualified in various uses of the portable ultrasound and charging separately for each examination done.

The battle lines are now being drawn, although not necessarily along rational lines. Insurance companies appear determined to resist reimbursement of any kind. National Heritage Insurance Company, for example, the Medicare carrier for California and several other states, recently denied payment for cardiac studies using handheld ultrasound devices.23 Other insurance carriers such as Cigna also decided to deny payment for handheld ultrasound studies. These carriers base their decisions on the concept that studies using handheld ultrasound are part of the physical examination of the vascular system, and are therefore not separately reimbursable.

Because of the broad utility of ultrasound, we believe it should ultimately become an integral part of the bedside examination. Reasonable compensation for the additional cost of the device, necessary training, and the time required to perform the study seems appropriate. In any case, the current reluctance of the payers to reimburse should not be allowed to determine the fate of an innovation that could turn out to effect a substantial increase in both the quality and efficiency of medical care.

A constituted black bag could improve the quality and efficiency of patient care, although this contention needs proof. And there are other reasons for redesigning the black bag. Interest in primary care internal medicine and family practice has steadily eroded for years.24 In 2004, only 186 graduating U.S. medical students sought training in primary care internal medicine programs.25 New tools to improve the accuracy and utility of bedside diagnosis could restore some of the luster and status to primary care physicians, and increase the appeal of the profession to medical students and residents. A recent study showed that both medical and nursing students rated ultrasound, emergency medicine, and obstetrics and gynecology are more likely to be “novelty seekers” than those choosing other specialties.26 Improving the accuracy and the ability to make discoveries at the bedside could help reverse the “eurotopenia” that now seems to plague residency training programs.27
It now seems certain that portable electronic diagnostic devices such as handheld ultrasound devices will be widely used at the bedside. The question is whether they will be an integral part of the primary care physician’s diagnostic toolkit—an enhanced black bag—or whether they will be just another billable service in the hands of specialists.

Acknowledgment
Dr. Ziegelstein is supported in part by the Miller Family Scholar Program.

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