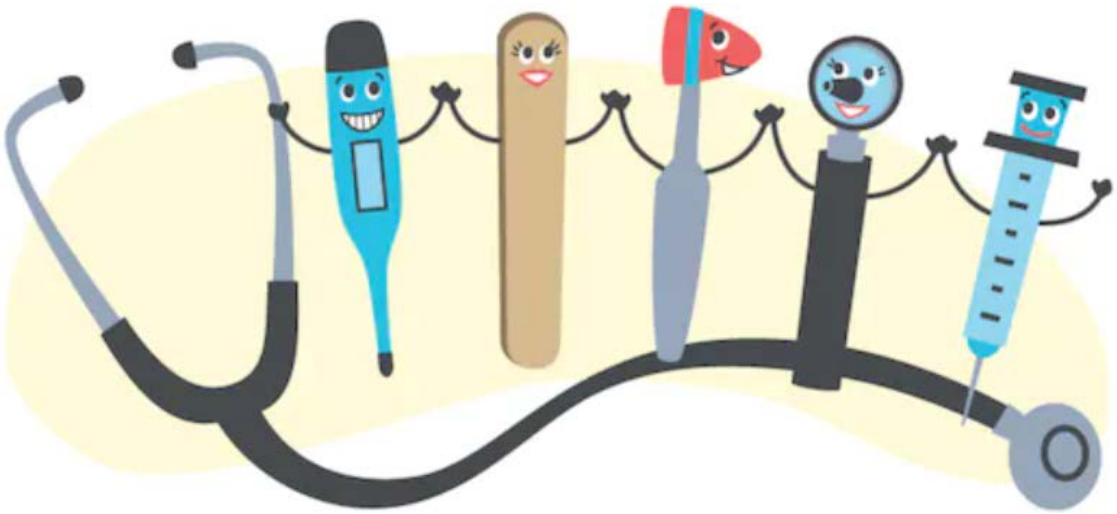
Physical exam:

Past, Present and Future



Sujata Bhushan, MD
Associate Professor of Internal Medicine
Division of General internal Medicine
Internal Medicine Grand Rounds
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University of Texas Southwestern Medical Center

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The bedside encounter between a patient and physician is central to the practice of medicine. This time-honored ritual provides the basis for trust and healing for the patient but is also an important source of fulfillment and satisfaction for the physician. It is fundamental to accurate diagnosis and high-quality patient-centered care[1].

The physical examination, once the cornerstone of diagnosis, has fallen on hard times. Advanced testing and imaging exams, readily available in most settings, often take precedence, as physicians are pressed to find enough time to do a thorough exam. The electronic medical record competes with the patient for attention and physicians note that the practice of medicine has become more technological and increasingly disembodied. These changes have devalued the physical exam in practice and medical education, in a vicious circle where clinical skills play second fiddle to technology and are likely to atrophy.

Quoting a recent satire from Dr. Glaucomflecken: AMA holds funeral service [2]:
The American Medical Association held a large funeral service today in honor of the Physical Exam, which passed away earlier this month after a decade long battle with obscurity. The funeral was well attended by nurses, medical doctors, and trainees from all over the country who wished to pay their respects. The service began with an hour-long tribute to the highlights of a centuries old career diagnosing illness, with special recognition given to the following: (these are all part of the physical exam, which is/or has previously been taught to every future doctor in medical school, but now it seems that the technology seems more important).

S3, S4, and "murmurs," whatever those are, palpating the point of maximal impact, percussing the lungs, percussing in general, measuring liver span, actually putting your own finger into the rectum to examine it, doing that thing where you have the patient swallow some water then feel their thyroid, femoral pulses, reflexes not involving the knee, 1st Cranial nerve, pinprick test, temperature sensation, any part of the exam where human contact is involved.

Following a display of the Physical Exam's most prized possessions, including a stethoscope, reflex hammer and a little vial filled with coffee beans, several health care providers gave moving eulogies in remembrance of an old friend.

Tim (60-year-old internist): *"I'll miss you dear friend. My intimate knowledge about you was my only defense against the onslaught of millennial EMRs and imaging studies. I could always count on you to show me findings that, although might not have any clinical significance whatsoever, could at least be used to humiliate a resident for missing it."*

Lucy (24-year-old resident): *"Dear Physical Exam, we never really knew each other. You were already pretty old and inconsequential by the time I started medical school. However, I still sometimes put on my stethoscope and listen to the strange thuds, beeps, and boops coming from inside the patient that used to be important. Hell, I'll even write about those crazy sounds in my progress notes like I'm a real 1950s primary care doctor. But then I look at the telemetry and think to myself, technology is pretty awesome. Lolz!"*

History of Physical exam:

Let's take a look at the evolution of physical exam and techniques over time [3].

Table 1
Key developments in the history of the physical examination

Date	Person	Development
ca. 400 BC	Hippocrates	Medicine as a profession; disease natural, not divine
ca. AD 1300		Dissection of human bodies increased
1543	Vesalius	*Fabrica* published; first accurate anatomy text
ca. 1670	Sydenham	Classification of disease
1761	Morgagni	*De Sedibus* published. Pathology begins
1761	Auenbrugger	Percussion discovered
1808	Corvisart	Popularization of percussion
1816	Laennec	Stethoscope invented, distributed with each copy of his book
1800–1850	Louis	French School establishes systematic approach to clinical case, still in use to this day
1830–1900	Mueller	German School adds insight from mechanisms of disease, studied by experimental methods
1889	Osler	Medical clinic opens at the Johns Hopkins Hospital

Adapted from Walker HK. The origins of the history and physical examination. In: Walker HK, Hall WD, Hurst JW, editors. Clinical methods: the history, physical, and laboratory examinations. 3rd edition. Boston: Butterworths; 1990. p. 6; with permission.

The dawn of the modern physical examination was in 1761, when Leopold Auenbrugger first described the technique of percussion. Tradition holds that Auenbrugger called on the memory of his father, an innkeeper, tapping on casks of wine to establish how much wine was left and when to reorder. In1808, Corvisart republished the treatise in French with extensive commentary. Rene Laennec, a student of Corvisart, who in a moment of inspiration, rolled a sheet of paper into a cone and placed the point in his ear and the base to a patient's chest. Astounded by what he heard, Laennec went on to create the first stethoscopes out of wood. In 1819, Laennec published *On Mediate Auscultation*, a manual on stethoscope use that coined terms still used today, such as "rales," "egophony," and "pectoriloquy" [4].

The age of the instrument began in 1850, when Hermann von Helmholtz, invented the world's first ophthalmoscope. In 1875, Wilhelm Heinrich Erb and Carl Friedrich Otto Westphal described the use of a hammer to test deep tendon reflexes. In 1871, Carl August Wunderlich, published *Medical Thermometry and Human Temperature*, which described both the normal human body temperature and temperature patterns typical of diseases such as typhoid fever. In 1896, Riva-Rocci invented a usable sphygmomanometer and so added the last of the quantitative physical signs to the physical examination [4].

The predominant mode of 19th century clinical advancement was the discovery of physical signs.

At the beginning of the 20th century, the physical sign was reaching an apex of clinical importance. For more than a century, physicians had impressed the public with their perception of parts of the body that most never knew existed: heart murmurs, deep tendon reflexes, blood pressure, retinal vasculature, etc. Patients could come to only one conclusion: “The doctor will be able to feel, hear, and see more of my body than I can.”

The latter half of the 20th century saw the rise of textbooks that focused solely on the act of physical examination. These included books by Hutchinson, Cabot, Chamberlain, DeGowin, Sapira and Bates to name a few. These are universally used in most medical schools for teaching physical exam skills during the first two years of medical school.

Core bedside skills of history taking and physical examination—still vital to comprehensive assessment, diagnostic accuracy [5], and truly patient-focused care—are taught and assessed in the first two years of medical school but largely ignored once the student reaches the clinical years. During residency, development of these skills is assumed when in fact they wither further [6]. Combining instruction in the technique and value of physical diagnosis in all stages of medical training (not only in the first 2 years of medical school) could greatly improve bedside diagnostic skills and make it easier for the trainee to integrate those skills into clinical practice.

The bedside visit ritual, inspires confidence in the physician. It strengthens the patient–physician relationship. We, in academia, have managed to ignore the loss of bedside skills [7]. Our patients see the deficiency easily. Patients recognize how the perfunctory bedside visit, the stethoscope placement, through clothing, differs from a skilled, hands-on exam [8].

Dr. Varghese coined the term “the iPatient”. He talks about the two approaches to the patient: in one, the patient is an icon, clad in a binary garment: the iPatient. Often, emergency room personnel have already scanned, tested, and diagnosed, so that interns meet a fully formed iPatient long before seeing the real patient. iPatients are “card-flipped” in the bunker. In the second way, the “traditional way”, the body is the text, one that is changing and must be frequently inspected, palpated, percussed, and auscultated. The scent in the room, a family member’s statement contradicting what the patient says, the knobby liver, clonus, the absent nasolabial fold, the hoarse voice: these help us understand the patient, and on this foundation, data from the chart can be selectively applied.

What is tragic about tending to the iPatient is that it can’t begin to compare with the joy, excitement, intellectual pleasure, pride, disappointment, and lessons in humility that trainees might experience by learning from the real patient’s body examined at the bedside [8].

Little is known about the effects of excellent teachers on student performance in clerkships. The first studies to examine the effect of teaching quality on third-year medical student performance were conducted by Griffith and colleagues [9]. Teaching quality was based on overall student evaluations; the best teachers were those who received the top 20% of student evaluations, whereas the worst teachers received the lowest 20%. Students exposed to the best faculty and residents performed better on the end-of-

clerkship board shelf examination and the National Board of Medical Examiners (NBME) step II subject examination in internal medicine. The best teachers increased student skill performance as measured by an objective structured clinical examination. The worst teachers (faculty, residents, and interns) lowered student performance on all these measures. During the clerkship, the resident had the greatest effect on students' cognitive growth. This makes intuitive sense, as the resident is present with the student more than the attending physician and creates the climate for learning on the wards.

Crumlish, et, al, in another prospective observational study, investigated the rounding behavior of members of Brigham and Women's Hospitalist Service [10]. For 5 weeks from December 2007 to January 2008, interns and residents rotating on the hospitalist service reported in a daily e-mail (1) total time spent with their attending during attending rounds, (2) time spent inside patient rooms during attending rounds, and (3) whether or not a physical examination finding or technique was demonstrated by their hospitalist attending. A total of 61 observations were reported (66% response). Hospitalists spent an average of 101 minutes on teaching rounds and an average of 17 minutes inside patient rooms or 17% of their teaching time at the bedside. Bedside teaching occurred during 61% of teaching sessions and physical examination teaching occurred during 38% of teaching sessions. Rounds that included time spent at the bedside were longer on average than rounds that did not include time spent at the bedside (122 vs. 69 minutes, $P < 0.001$). Bedside teaching makes up approximately 17% of the time that hospitalists at this medical center spend on teaching rounds.

A multidisciplinary group of musculoskeletal specialists at the University of Michigan led by Stansfield et al, developed and gathered validity evidence for a three station OSCE focusing on the HDPE (Hypothesis Driven Physical Exam) of the shoulder, back and knee, emphasizing the ability to anticipate (identify pre-encounter) expected physical exam findings, and subsequently perform discriminatory physical examination maneuvers [11].The Objective Structured Clinical Exam (OSCE) was administered to 45 final year medical students. Trained faculty observed and scored students' ability to anticipate exam findings and perform diagnostic examination maneuvers on simulated patients.

Results showed that Interclass correlation coefficient (ICC) was good (between .69 and .87) for six exam maneuvers. Maneuver performance was overall poor, with no discriminatory maneuver performed correctly by more than two thirds of students, and one maneuver only performed correctly by 4 % of students.

For the shoulder and knee stations, students were able to anticipate necessary discriminatory exam findings better than they could actually perform relevant exam maneuvers. The ability to anticipate a discriminatory finding correlated with the ability to perform the associated maneuver correctly, with the exception of the ability to perform maneuvers needed to diagnose a torn anterior cruciate ligament of the knee. Neither the ability to anticipate or perform was predictive of identifying correct diagnoses for the different cases.

Descriptive statistics of performance ratings for each discriminatory maneuver

From: Assessing musculoskeletal examination skills and diagnostic reasoning of 4th year medical students using a novel objective structured clinical exam

Table 2 Descriptive statistics of performance ratings for each discriminatory maneuver

Region	Diagnosis: discriminatory maneuver	Inter-rater reliability (ICC)	Mean (sd) performance	Percent perfect score
Back	L5 radiculopathy (Radic): Straight leg raise	.81	1.62 (.64)	64 %
	Sacroiliac dysfunction (SI): FAbER maneuver	.85	0.84 (.86)	24 %
	Lumbar stenosis (LS): No maneuver	–	–	–
Shoulder	Rotator cuff impingement (Impingement): Jobe test OR Neer test OR Hawkin test	.69	1.58 (.56)	53 %
	Glenohumeral arthritis (GH arthritis): Assessment for crepitation and pain reproduction with glenohumeral grind	.76	0.26 (.57)	4 %
	Adhesive capsulitis (Ad Cap): Comparison of active versus passive range of motion	–	–	–
Knee	ACL tear (ACL): anterior drawer OR Lachman maneuver	.87	1.60 (.51)	56 %
	Osteoarthritis (Knee OA) (palpation for compartmental crepitus)	.87	0.82 (.86)	29 %
	Patellofemoral syndrome (PF) (patellar grind maneuver or observation for abnormal patellar tracking)	–	–	–

In another study, incoming internal medicine PGY-1 residents at Boston University School of Medicine in June 2006, completed a written multiple-choice question (MCQ) test on clinical signs and completed a physical exam assessment during their residency orientation. The written test consisted of 25 MCQs designed to evaluate the ability of the residents to interpret and diagnose physical exam findings. The 5 major systems, cardiovascular, neurologic, pulmonary, gastrointestinal, and musculoskeletal, were represented. The OSCE used volunteer patients with abnormal physical findings recruited from the medical wards and clinics. The 5 stations included cardiac, pulmonary, abdominal, neurologic, and musculoskeletal systems [12].

Analysis of variance showed significant differences in the OSCE scores for individual systems (P .05) with the cardiovascular and musculoskeletal examination scores being significantly lower than the pulmonary, neurology, and abdominal examinations scores. The overall MCQ, OSCE, and individual system scores are shown in the TABLE below:

Mean test scores:

Test	N	Mean	Median	SD	Score Range
MCQ (all PGY-1)	45	58.4	56.0	11.5	36.0–80.0
MCQ (PGY-1 w/OSCE)	20	61.0	60.0	11.9	36.0–80.0
OSCE total	20	54.7	61.3	11.0	39.7–84.5
Cardiology	20	30.0	30.0	21.3	0–100
Pulmonary	20	69.2	66.6	18.2	41.7–100
Abdominal	20	61.6	58.3	16.6	33.3–91.7
Neurologic	20	67.0	66.6	14.8	33.3–100
Musculoskeletal	20	41.7	37.5	17.1	25–100

Abbreviations: MCQ, multiple choice question; OSCE, objective structured clinical examination; PGY-1, postgraduate year 1.

Examples of errors observed in residents' physical exam
Included:
1. **Faulty exam technique**
a. Not using bell and diaphragm of stethoscope
b. Not eliciting shifting dullness correctly
2. **Lack of systematic exam**
a. Skipping inspection or palpation completely
b. Not following a stepwise exam such as motor strength, tone, reflexes, gait, and so forth
3. **Failure to identify findings**
a. Identification of diastolic murmur
b. Identification of bronchial breath sounds
4. **Failure to interpret findings and make a diagnosis**
a. Differentiating between upper and lower motor neuron signs
5. **Difficulty formulating differential diagnosis for a given finding**
a. Causes of ascites
b. Causes of knee effusions

Cardiac Examination (CE) :
Ideally, CE involves integration of patient history with inspection, palpation, auscultation, and, when appropriate, maneuvers to bring out the pathophysiological findings. For instance, diminished femoral arterial pulses noted in a young patient with aortic regurgitation, most likely indicate the presence of unsuspected aortic coarctation.

The consequence of cursory CEs that miss important findings is delay in proper diagnosis and appropriate treatment. These ‘‘objective findings’’ in the medical record can and do affect subsequent workup and therapy. It is especially true when the initial workup in a patient's chart contains the statement ‘‘S1, S2, no MRG’’ (first heart sound; second heart sound; no murmurs, rubs, or gallops). This terse entry too often becomes a ‘‘rubber stamp’’ entry on all subsequent history and physical entries in the chart.

Vukanovic-Criley et al tested whether cardiologists outperformed other physicians in cardiac examination skills, and whether years in practice correlated with test performance [13].

The preliminary section of the test was designed to reacquaint the participants with the expected auscultatory findings produced by these lesions: the loud first heart sound, opening snap and diastolic rumble of mitral stenosis, and the ejection sound, mid-systolic murmur, and delayed carotid upstroke of congenital aortic stenosis. Other preliminary questions reviewed the effects of respiration on heart sounds, the differentiation of carotid from jugular venous pressure waves, and the use of carotid pulsation for timing auscultatory events. The remaining 22 questions related to virtual patient examinations (VPEs): video scenes of actual patients who had pathological heart sounds and murmurs recorded through the stethoscope. Although VPEs were accompanied by a brief medical history, the test questions did not request specific cardiac diagnoses, but rather identification of carotid vs venous pulsations, presence and timing of heart sounds, and systolic and/or diastolic timing of murmurs.

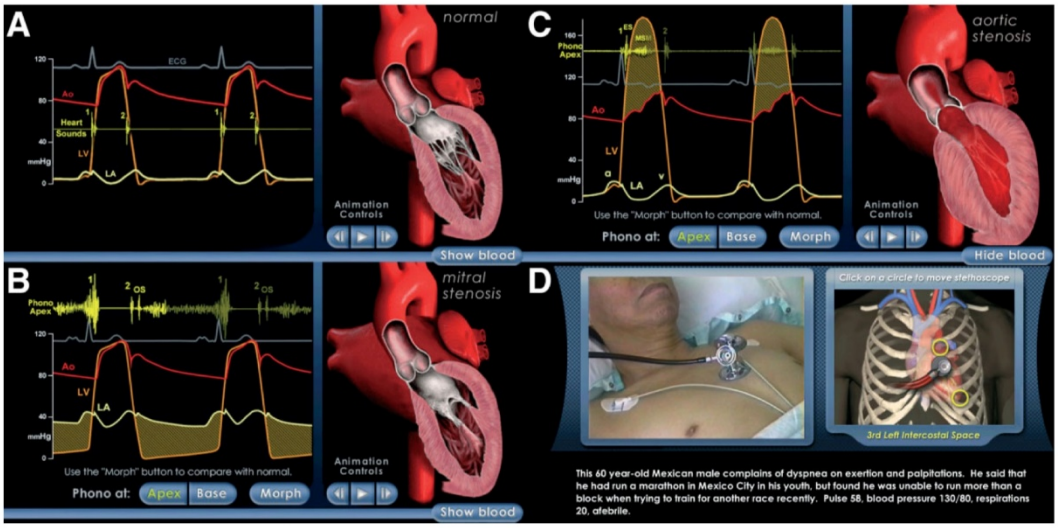


Figure 1. Screenshots from the introductory portion of the CE test (A–C) show intracardiac pressures, ECG, phonocardiograms, and animations representing normal, mitral stenosis, and aortic stenosis. Animation controls permit real-time, stop-frame, or slow motion. Heart sounds recorded from the base or apex can be selected. The Morph button permitted a comparison with the normal example. Multiple-choice and true/false questions (not shown) addressed principal findings. (D) Virtual cardiac patient. A patient with a recording stethoscope at the base is shown in the left panel and the choice of listening positions can be selected from the right panel. Multiple-choice questions (not shown) addressed principal findings. Abbreviations: CE, cardiac examination; ECG, electrocardiogram.

Results showed that academic and volunteer cardiologists outperformed other medical faculty, as did cardiology fellows. Lower scores were observed in more recently trained faculty.

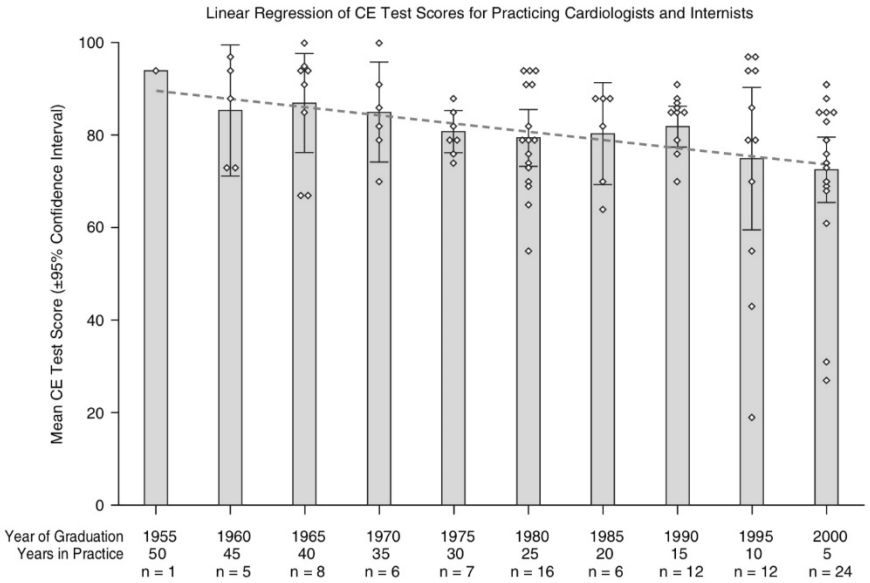


Figure 3. Linear regression of CE test scores achieved by faculty members. Mean CE test scores for cardiologists and internists are plotted against 5-year increments since completion of their training. Scores decrease linearly the more recently the physician was trained. Abbreviations: CE, cardiac examination.

Cardiac examination (CE) begins with acquisition of basic knowledge of cardiac physiology and pathophysiology in the first 3 years of medical school. Supervised exposure to patients with cardiac findings is principally confined to the third year in most medical schools. ‘‘Critical reinforcement’’ implies a commitment to confirming or refuting one’s bedside diagnostic impressions by critical review and correlation with available imaging and/or hemodynamic studies performed on that patient. Cardiology fellows indeed benefit from exposure to patients with a wider spectrum of cardiac findings than trainees would be expected to encounter in family and internal medicine. Moreover, fellows have ready access to special studies that provide the necessary critical reinforcement to improve their examination skills. This mode of exposure is the means by which cardiology fellows obtained better CE test scores, and why cardiologists continue to improve over time. On the other hand, patient exposure without critical reinforcement seems to be the norm for the average medical resident, explaining their lack of advancement in scores despite clinical encounters with hundreds of patients. Thus, some form of critical reinforcement is needed for all trainees to improve their cardiac examination skills. For any training level, a minimum of 5 hours of practice appears to be necessary to create any significant improvement in CE skills.

Despite documented deficiencies in clinical skills, medical school and residency curricula do not emphasize clinical skills teaching or assessment. Reported barriers to teaching clinical exam skills include a scarcity of good teaching patients, lack of time for teaching at the bedside, an over-reliance on technology, and a shortage of skilled faculty to impart this knowledge.

JAMA series of “The Rational clinical exam” includes reviews of the precision and accuracy of specific elements of the clinical examination as they are employed in identifying and solving common clinical problems [14]. The articles in this series have been

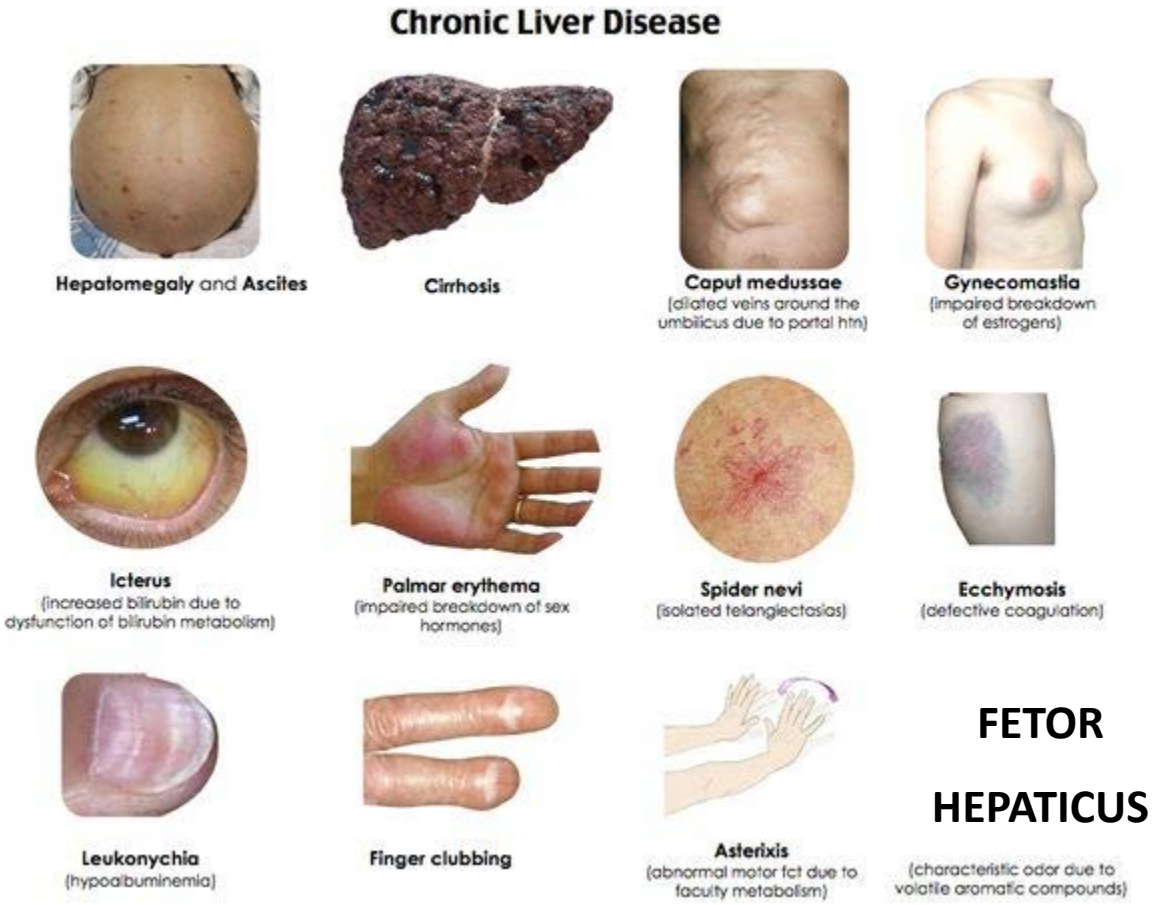
written by frontline clinicians. Each article follows a common format, beginning with a brief clinical scenario of a common clinical presentation. Next, detailed instructions are provided on how to elicit the symptoms and signs that are relevant to the clinical problem, followed by a summary of their precision and accuracy. Each article concludes with a "bottom line," recommending the most effective and efficient clinical examination for this problem given the current state of knowledge. Wherever applicable, advice on how to develop, test, and improve the relevant clinical skills is included.

For example, examination of the liver starts with a case scenario and discusses the palpation and percussion of the liver borders [15]. Determination of vertical liver span in the MCL can be done two ways. They recommend gentle percussion for locating the upper liver border and palpation or gentle percussion to locate the lower border. An MCL span of less than 12 to 13 cm with gentle percussion alone or gentle percussion combined with palpation makes hepatomegaly very unlikely.

The auscultatory means of assessing liver span is by using the “scratch test”. The scratch test is performed by placing the diaphragm of the stethoscope at the xiphisternum. Starting low in the abdomen, in the right lower quadrant, a finger is moved up the abdomen scratching gently. The intensity becomes greatly enhanced once the finger is over the lower border of the liver [16]. Continue scratching upwards until the sound becomes softer again, that corresponds roughly to the upper edge of the liver. This is because of the difference in sound transmission through the abdominal cavity over solid and hollow organs. Recent research comparing the scratch test to liver ultrasound for locating the liver edge has found very good reproducibility between performers of scratch test, as well as sufficient validity compared to Ultrasound to make it a useful tool in the physical exam armamentarium.

Patients with end stage liver disease especially alcoholic cirrhosis usually have a constellation of characteristic peripheral signs that should be looked for when examining these patients. Some of these include:
-Temporal wasting
- Scleral and subungual icterus
- Parotid enlargement
- Lacrimal gland enlargement
- Fetor hepaticus
- Constructional apraxia
- Spider angioma
- Gynecomastia
- Ascites
- Splenomegaly
- Distended veins
- Caput medusae
- Umbilical hernia
- Testicular atrophy, scrotal edema
- Hemorrhoids
- LE edema
- Hands: palmar erythema, asterixis, clubbing, Dupuytren’s contracture
- Nails: Terry’s nails, Muehrcke’s nails

Images of stigmata of liver disease:



Sir William Osler stated that “Medicine is learned by the bedside and not in the classroom.” However, this tenet is being challenged in the modern hospital. The time that residents spend in direct contact with patients has decreased from over 20% of their workday in the 1990’s to less than to 10% in recent years . Physicians spend less time at the bedside in the modern hospital setting which has contributed to a decline in physical diagnosis, and in particular, cardiopulmonary examination skills. This trend may be a source of diagnostic error and threatens to erode the patient-physician relationship.

Dr. Garibaldi, et al, at Hopkins created a new bedside cardiopulmonary physical diagnosis curriculum and assessed its effects on post-graduate year-1 (PGY-1; interns) attitudes, confidence and skill.

105 internal medicine interns in a large U.S. internal medicine residency program participated in the Advancing Bedside Cardiopulmonary Examination Skills (ACE) curriculum while rotating on a general medicine inpatient service between 2015 and 2017 [17]. Teaching sessions included exam demonstrations using healthy volunteers and real patients, imaging didactics, computer learning/high-fidelity simulation, and bedside teaching with experienced clinicians. Primary outcomes were attitudes, confidence and skill in the cardiopulmonary physical exam as determined by a self-assessment survey,

and a validated online cardiovascular examination (CE). Interns who participated in ACE (ACE interns) by mid-year more strongly agreed they had received adequate training in the cardiopulmonary exam compared with non-ACE interns. ACE interns were more confident than non-ACE interns in performing a cardiac exam, assessing the jugular venous pressure, distinguishing ‘a’ from ‘v’ waves, and classifying systolic murmurs as crescendo-decrescendo or holosystolic. Only ACE interns had a significant improvement in score on the mid-year CE. They concluded that a comprehensive bedside cardiopulmonary physical diagnosis curriculum improved trainee attitudes, confidence and skill in the cardiopulmonary examination. These results provide an opportunity to re-examine the way physical examination is taught and assessed in residency training programs.

Hopkins and some other institutions have now adapted the UK based PACES (Practical Assessment of Clinical Exam Skills) for assessing and improving the clinical exam skills of their resident trainees.

Dr. Abraham Verghese and his group at Stanford developed the “Stanford 25,” which consists of 25 hands-on sessions and online content to teach the bedside physical exam to students, residents and faculty and promote the culture of bedside medicine [18]. They started with 25 but have added on many more. They believe that too often, a diagnosis is missed and care is delayed not because the answer was too hard to find, it simply wasn't looked for! Interestingly, their logo is an apple tree because they want to make sure **to never miss the low hanging fruit.**

- Ankle Brachial Index
- Ankle and Foot Exam Stanford Medicine 25 Stanford Medicine
- Aortic Regurgitation Exam
- Ascites & Venous Patterns
- Bedside Ultrasound
- Breast Exam
- Cardiac Second Sounds
- Cerebellar Exam
- Deep Tendon Reflexes
- Dermatology Exam: Acne vs. Rosacea
- Dermatology Exam: Learning the Language
- Dermatology Exam: Nevi (Mole) Exam
- Diastolic Murmurs Exam
- Fundoscopic Exam (Ophthalmoscopy)
- Gait Abnormalities
- Hand Exam
- Hip Region Exam
- Internal Capsule Stroke
- Involuntary Movements and Tremor Diagnosis: Types, Causes, and Examples
- Knee Exam
- Liver Disease: Head to Foot
- Liver Exam
- Low Back Exam

- Lymph Node Exam
- Neck Veins & Wave Forms
- Parkinson's Disease Exam
- Pelvic Exam
- Precordial Movements in the Cardiac Exam
- Pulmonary Exam: Percussion & Inspection
- Pulsus Paradoxus and Blood Pressure Measurement Techniques
- Pupillary Responses
- Rectal Exam
- Shoulder Exam
- Spleen Exam
- Thyroid Exam
- Tongue Exam

Clinical Skills in the Outpatient setting:

It can be equally, if not more, challenging to do bedside teaching during a clinic visit, the challenge being to provide effective, concise and relevant instruction in an efficient manner.

5 minute moment:

The Five Minute Moment (5M2) is a technique pioneered by the Stanford Medicine 25, which enables bedside educators to provide important information about physical exam techniques and findings in a memorable and engaging way. The 5 Minute Moment can be modified for inpatient and outpatient setting as needed. 5M2's can be 5 minute sessions or serve as building blocks for longer bedside encounters depending on the needs of the instructor and learners.

The 5-minute bedside moment consists of the following 2 elements:
(1) A narrative to explain the context and the usefulness of the maneuver (often, a case vignette or a historical anecdote will help the learner remember the technique more easily); and
(2) The demonstration of the physical examination finding. This demonstration also should include the interpretation of the finding and cover common errors in the technique.

The 5-minute bedside moment is a simple model that can be easily learned, practiced, and taught [19].

This can be adapted to Morning reports, bedside rounds and "Chief's" rounds for the medical students. The faculty can be encouraged to develop their own unique repertoire of 5M2 moments on the basis of their own clinical experience and interests, a repertoire they can draw on during appropriate opportunities at the bedside.

Here is an example of a 5 Minute Moment [20] :

Ankle Reflexes[1],[2]

Narrative Section

Historical Vignette - Did you know that the reflex hammer's history is rooted in wine? The story of the reflex hammer dates back to 1761 when Josef Leopold Auenbrugger first described the art of percussion adapted from his father's method of tapping wine casks to measure the level of remaining wine. Percussion was initially performed with a hammer, but it fell out of use when the fingers were used as pleximeter and hammer. The hammer would later be adapted by physicians for the deep tendon reflexes when Erb and Westhal described the diagnostic utility of the knee-jerk reflex, about 1875.

Clinical Vignette and Usefulness - Mr. Jones presented with progressive weakness in both legs and arms. The examination showed bilateral weakness in all 4 extremities. There was normal sensation below the clavicle, normal cranial nerves, and normal mentation. Deep tendon reflexes were very brisk, and there was ankle and patellar clonus. The Babinski and Hoffman reflexes were present with 3+ reflexes in all 4 extremities. The distinct constellation of findings suggested a transverse cord lesion. The differential would have been different had the reflexes been normal or absent.

[1] Chi J *et. al.* "The Five Minute Moment." *Am J Med.* **2016 Aug;** 129 (8): 792-795.

[2] Lanska, DJ. "The History of Reflex Hammers." *Neurology.* **1989 Nov;** 39: 1542-1549.

Society of Bedside Medicine

Model Proper Technique - two techniques can help elicit the ankle reflex in a bed bound patient. The first involves both legs fully extended and the examiner placing two fingers across the plantar surface of the metatarsal heads. With the foot cocked up, strike the hammer against the two fingers, looking for the brisk ankle contraction. Alternatively, the patient can outwardly rotate the hip, flex the knee. The examiner positions two fingers on the metatarsal heads. This time, though, strike the Achilles tendon directly to observe the contraction. Finally, in a patient who is unable to relax their lower extremities, cross the foot being examined over the lower part of the other leg and strike the Achilles tendon as before.

In a seated patient, have the patient relax the ankle while the examiner applies slight tension to the Achilles tendon by lifting the under the foot. Strike over the Achilles tendon to see the tendon contraction (S1 level) and the resulting plantar flexion of the foot.

Interpretation - An explanation of reflex grading: 0 absent, 1+ slight but clear response, 2+ brisk and normal response, 3+ very brisk exaggerated response, 4+ clonus.

Caveat and Common Errors - When first using the reflex hammer, many learners tend to hold the hammer too high. This lowers the torque and can lead to a reflex that is falsely absent because adequate pressure is not applied quickly. Holding the hammer in too tight a fashion impairs the stroke.

Society of Bedside Medicine

Point of Care Ultrasound (POCUS):

Inspection, palpation, percussion, and auscultation have been the 4 pillars of clinical bedside medicine. Incorporating appropriate technology at the bedside might improve its performance. Selective use of bedside ultrasound (or ***insonation***) can be one such strategy that could be incorporated as the fifth component of the physical examination [21].

Point-of-care ultrasonography (POCUS) is a safe and rapidly evolving diagnostic modality that is now utilized by health care professionals from nearly all specialties. Technological advances have improved the portability of equipment, enabling ultrasound imaging to be executed at the bedside and thereby allowing internists to make timely diagnoses and perform ultrasound-guided procedures.

Some examples of use of POCUS [22] :

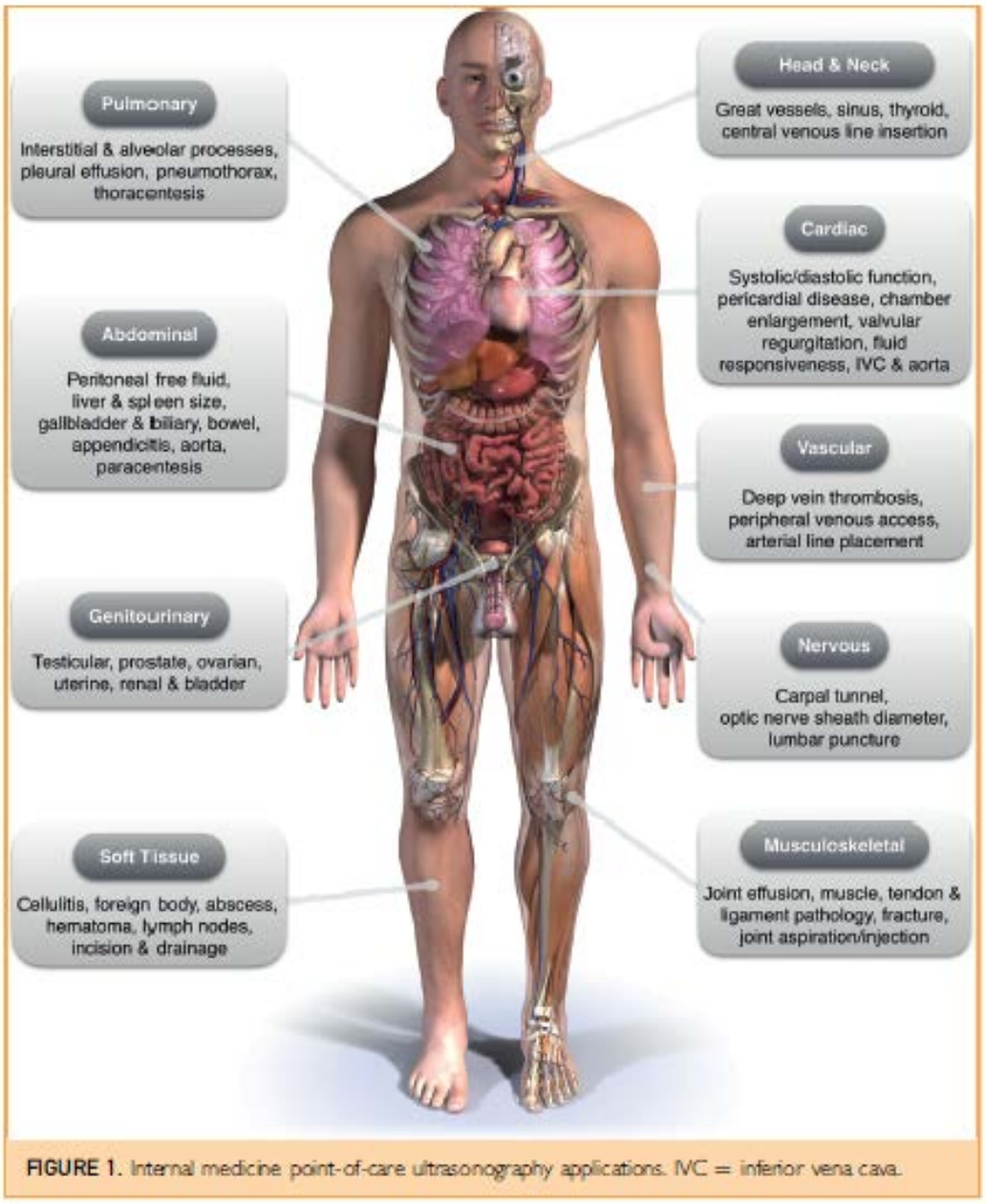


FIGURE 1. Internal medicine point-of-care ultrasonography applications. IVC = inferior vena cava.

Abdomen

- Detection of ascites (as little as 100ml). US guided paracentesis reduces bleeding complications.
- FAST exam (**F**ocused **A**ssessment with **S**onography for **T**rauma)
- Kidneys: can detect hydronephrosis, stones, renal cysts, Foley location, and estimate bladder volume.

Heart

- Left Ventricular Systolic Dysfunction detection.
- Moderate or large pericardial effusion
- Moderate or severe left atrial enlargement
- Moderate or severe left ventricular hypertrophy
- Cardiomegaly
- POCUS echocardiography changed hospitalist management 37% of the time, and reduced length of stay 15%

Lungs

- Pneumonia: Meta-analysis of 9 studies showed pooled sensitivity of 97% (95% CI: 93%-99%) with specificity of 94% (95% CI: 85%-98%).
- Pleural effusion: POCUS can accurately differentiate consolidated lung from pleural effusion and is more sensitive than chest X-ray for detecting small pleural fluid volumes (100% vs. 71%). Pleural effusion size and character can be serially monitored. Drainage with ultrasound guidance is associated with lower rate of post-procedure PTX and lower hospital costs.
- Pneumothorax: POCUS can accurately and rapidly detect PTX. Sensitivity of lung ultrasound 79%-95% compared to 40%-52% of X-ray.
- Pulmonary Edema: sensitivity of 86% to 100% and specificity of 92% to 98%

Veins

- In patients with acute dyspnea, a dilated, noncollapsing IVC may differentiate acute decompensated heart failure (ADHF) from primary pulmonary disease.
- IVC measurements may guide fluid removal in hemodialysis and heart failure patients.
- Central Venous Volume: In 2 studies of patients hospitalized with ADHF, lack of improvement of IVC collapsibility index at the time of discharge was associated with higher rates of readmission. A follow-up study comparing diuresis guided by IVC collapsibility to usual care in patients hospitalized with ADHF showed a reduction in hospital readmission rates (4% vs 30%, P50.03) without an increase in hospital length of stay or renal dysfunction. Patients with small, collapsed IVCs can be administered intravenous fluids safely, particularly in the setting of hypovolemic or septic shock, and the response to this fluid resuscitation can be assessed by serially measuring the change in IVC diameter 23.

Despite the several undisputed advantages of utilizing POCUS, there are several barriers and pitfalls to consider. First, there are challenges relating to equipment and technology. POCUS can be performed with a variety of available equipment: full-sized traditional machines, laptop-sized devices, and pocket-sized devices. Concerns have been raised about small handheld systems with regard to their narrow sector, smaller field of view, lower resolution, and simplified transducer technology. The utility of a POCUS examination also depends on the experience and skills of the operator [25].

Barriers to POCUS adoption include insufficient faculty training, high cost of ultrasonography machines, and time required to train physicians. Most importantly,

POCUS findings must be interpreted and integrated with other clinical data to effectively guide clinical decision making.

Despite a general consensus that ultrasound is an important skill to teach in medical school, the integration of ultrasound education in U.S. schools is highly variable. There seems to be a need for national standards to guide the integration of ultrasound education into U.S. medical school curriculum [24].

Meanwhile, practicing internists are feeling growing pressures to acquire basic POCUS skills because their trainees may have more advanced POCUS skills than they do! Both novice trainees and attending physicians showed similar improvement in point-of-care ultrasound image interpretation skills and confidence after a brief training course.

In conclusion, in teaching at the bedside, the teacher is reenacting medical history and living the Osler adage, that a student who "studies medicine without books sails an uncharted sea, but (s)he who studies medicine without patients does not go to sea at all." There remain compelling reasons to be at the bedside and to teach at the bedside, the most important one being that **the bedside is where the patient is.**

The road back ***to*** the bedside will, start ***at*** the bedside.

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