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8 The Value of the Physical Examination in Modern Medicine

Abraham Verghese, Steven McGee

Medicine is experiencing unprecedented progress in understanding the biology of disease and developing new therapies; concurrently, artificial intelligence (AI), with its ability to train on and interpret large medical data sets, is transforming many aspects of clinical medicine. Meanwhile, the rising costs of health care in the United States and many other nations have led to the merging of health care systems and the decline of individual physician practices. For the patient, the profoundly personal and often isolating nature of the illness experience remains largely unchanged since antiquity: individuals who are ill want to feel they are in the hands of a caring and attentive physician, and they will judge the quality of their care based on that interaction. It is not uncommon to hear patient dissatisfaction expressed as "my doctor never touched me" or "never laid a hand on me."

HISTORICAL EVOLUTION OF THE PHYSICAL EXAMINATION

A student of ancient medical texts finds few good descriptions of physical findings of disease; longstanding proscriptions against dissecting the dead meant that for centuries physicians had a poor understanding of normal anatomy or physiology. One exception is in the writings of Hippocrates (460–370 BCE), who described clubbing in the setting of empyema and the "succussion splash" (heard without a stethoscope) in a patient with hydropneumothorax. Only in 1543, with the publication of Vesalius's *De Humani Corporis Fabrica Libri Septem* (*On the fabric of the human body in seven books*) did things begin to change.

The Dawn of Physical Diagnosis In 1761, the Viennese physician Leopold Auenbrugger published his treatise, *Inventum Novum ex Percussione Thoracis Humani Interni Pectoris Morbos Detegendi* (*A new discovery that enables the physician from the percussion of the human thorax to detect the diseases hidden within the chest*). He recalled his father, an innkeeper, tapping the sides of casks of wine and listening for where the sound changed in character, thereby revealing the position of the fluid meniscus and how much wine remained. Auenbrugger could similarly, by tapping on his patients' chests, detect cardiomegaly as well as the presence of fluid in the pleural space. He confirmed the validity of his findings in a few autopsies. His discovery was revolutionary because it was the first means of "looking" into the living body; it was the ultrasound of its day. Auenbrugger's text was so complete that little new has been added to the art of percussion since, with the exception of "Skodaic resonance" (an arc of hyperresonance above a pleural effusion) and "Kronig's isthmus" (a narrow band of resonance in the supraclavicular area connecting the resonance of the front and back of the chest, an isthmus that is narrowed on one side in the presence of apical lobe diseases such as tuberculosis).

New Bedside Instruments Soon after percussion came the invention of the stethoscope by Laënnec in 1816, the ophthalmoscope by Helmholtz in 1850, the clinical thermometer by Wunderlich in 1868, the reflex hammer to elicit the muscle stretch reflexes described by Erb and Westphal in 1875, and the blood pressure cuff by Riva-Rocci in 1896. In the 1800s, Paris was the place to learn clinical skills under individuals such as Corvisart, Laënnec, Dupuytren, Bichat, and Pierre Louis. By the 1850s, the "German School" epitomized by Johannes Müller emerged, with its emphasis on experimental medicine and laboratory skills. For many North American physicians, including William Osler (1849–1919), who shaped medical education in America, a sojourn in Europe was obligatory. The use of tuning forks, oximeters, electronic stethoscopes, and Dopplers (for pulse detection and for ankle brachial index) and other ultrasound devices brings us to the present. Just as modern physicians are adopting point-of-care ultrasound and even pocket ultrasounds, the addition of new instruments has always been part of the evolution of physical diagnosis.

An Illustration of Clinical Examination Excellence Almost all diseases in the latter part of the nineteenth century and the early twentieth century were defined by their bedside findings, as clinical imaging had not yet developed. Physicians therefore prioritized careful bedside examination by means of inspection, palpation, percussion, and auscultation. Professor Joseph Bell (1837–1911) at the University of Edinburgh was legendary for his inferential skills. Among his medical students was the future physician and writer, Arthur Conan Doyle, who based his famous sleuth, Sherlock Holmes, on Professor Bell. The following anecdote in *Lancet* (by another one of Bell's students) illustrates Bell's skill in inspection before he begins palpation, percussion, and auscultation.

> *A woman with a small child was shown in. Joe Bell said good morning to her and she said good morning in reply. "What sort of a crossing di' ye have fra' Burntisland?"*
> *"It was guid."*
>
> *"And had ye a guid walk up Inverleith Row?"*
> *"Yes."*
>
> *"And what did ye do with th' other wain (child)?"*
> *"I left him with my sister in Leith."*
>
> *"And would ye still be working at the linoleum factory?"*
> *"Yes I am."*
>
> *Dr. Bell then explains to the students: "You see gentlemen, when she said good morning I noted her Fife accent, and, as you know, the nearest town in Fife is Burntisland. You noticed the red clay on the edges of the soles of her shoes, and the only such clay within 20 miles of Edinburgh is in the Botanical Gardens. Inverleith Row borders the gardens and is her nearest way here from Leith. You observed that the coat she carried over her arm is too big for the child who is with her, and therefore she set out from home with two children. Finally she has a dermatitis on the fingers of the right hand which is peculiar to workers in the linoleum factory at Burntisland."*

With the ascendance of diagnostic technology and laboratory testing, bedside examination skills declined, a trend that began in the 1970s and has accelerated. "Assessment drives learning" is an axiom of education; in medicine, the use of multiple-choice exams without a clinical assessment by direct observation of trainees as they examine patients with known physical findings diminishes the trainee's incentive to develop these skills.

FIVE REASONS THE PHYSICAL EXAMINATION REMAINS VERY RELEVANT

The bedside examination remains important and necessary for at least the following five reasons:

1. For a host of disorders, there are no laboratory or imaging studies that make the diagnosis, and thus the bedside findings *are* the gold standard; Parkinson's disease is an example.
2. Focused evidence-based physical examination maneuvers allow the physician to assign a greater or smaller value to the probability of a particular disease than prior to the examination and can thus direct and complement imaging and laboratory testing.
3. The physical examination frequently uncovers clues to other disease states that are asymptomatic or unrelated to the patient's presenting complaint but that are potentially treatable.
4. Missing critical findings in the examination can lead to errors that delay diagnosis and treatment; subject the patient to unnecessary contrast, radiation, or even surgery; and at times lead to significant morbidity and death. Such errors are embarrassing to the physician and can lead to malpractice claims.
5. The physical examination, when viewed through an anthropologic lens, has all the classic markers of a ritual. When performed well, the ritual elicits the patient's confidence and trust, while at the same time symbolically validating and localizing their disease or

symptom on the canvas of their body and in an organ, as opposed to on an image or biopsy report.

It is also worth noting that the physical examination is safe, immediately accessible, has no added cost, and uses no technology beyond the instruments carried by the clinician or available in the room. Its pedagogic value with trainees is in the opportunity to teach proper examination techniques as well as clinical reasoning. It allows the clinician to model empathy, consideration for the patient's comfort, and the establishment of a connection that builds trust and reduces anxiety.

The five themes are elaborated below, with particular attention to the second theme above.

When the Physical Examination Is the Sole Means of Making a Diagnosis For numerous medical disorders, the physical examination findings *are* the gold standard, the *only* means of making a diagnosis. This is the case for many diseases of the skin and of the eye (a reason why internists should be well versed in examining both organs and be familiar with common disorders associated with these). Amyotrophic lateral sclerosis is diagnosed principally by the clinical examination—there are no diagnostic blood tests or imaging findings. Table 8-1 lists other examples.

Evidence-Based Physical Examination Improves Diagnosis and Complements Imaging and Laboratory Testing Trainees often assume that evidence-based medicine (EBM) is properly focused on "external" data such as from laboratory tests or diagnostic images; these are perceived as more "objective." However, as the late clinical epidemiologist Alvan Feinstein (often thought of as one of the fathers of EBM and whose book *Clinical Judgment* remains a seminal work) took pains to emphasize, the *clinical* evidence base is of great importance. He wrote, "clinicians can bring science to clinical judgment by better exercise of the very human capacities that appear to impair it, and by giving increased attention not to laboratory substances and inanimate technology, but to sick people and the human methods of evaluating sick people." Rather than devaluing the objective data to be found on the clinical examination, physicians should take pride in its careful collection. These data include not just the physical findings but also the physician's unique understanding of the patient's history, background, social situation, work environment, aspirations, beliefs, family structure, and local trends in disease.

BEYOND THE STUDENT'S FIRST PHYSICAL DIAGNOSIS TEXTBOOK Medical students typically learn their patient examination skills in preclinical courses that utilize one of several excellent physical diagnosis textbooks. In later years, however, few students revisit these texts to remind themselves of the rationale for each test or the correct technique. This might be because when the student enters the hospital in their clinical years, they often find that the workflow revolves more around the virtual patient in the computer, the ordering and retrieving of tests, and data entry, with less emphasis on examining the embodied patient. The introductory physical examination texts remain an important and fundamental base from which to build skills. The trainee in internal medicine should progress to more advanced texts that embody Feinstein's philosophy of "bringing science to clinical judgment," such as *Evidence-Based Physical Diagnosis* by Steven McGee and the *JAMA Rational Clinical Exam* series begun in 1998 by David Simel and Drummond Rennie.

Trainees may falsely believe that physical examination findings are unreliable because clinicians can disagree about the presence or absence of a finding. Also, trainees may incorrectly assume that chest radiograph, computed tomography (CT) scan, or tissue biopsy reports are "gold standards," while physical examination findings are inaccurate.

RELIABILITY Whether it is the interpretation of a bedside finding or of a CT scan, human observations are accompanied by a certain degree of interobserver disagreement. In clinical studies, *interobserver agreement* is captured by the test statistic *kappa* or κ, which is a normalized measure of the increase in observed agreement over what would be expected by chance. Its value ranges from 0 (for agreement by chance) to 1 (for perfect agreement); 0.2–0.4 is considered fair agreement,

TABLE 8-1 Selected Examples of Conditions in Which the Physical Exam Is the Diagnostic Standard or the Primary Method of Diagnosis

DISEASE CONDITIONS	NOTES
Dermatology (selected list) Cellulitis, psoriasis, rosacea, acne vulgaris, eczema, urticaria, pityriasis rosea, cutaneous lichen planus, erythema multiforme, hereditary hemorrhagic telangiectasia, rubella, measles, herpes zoster, erythema nodosum	• Many dermatologic conditions are diagnosed by observation, even if confirmatory tests may exist • Skin biopsy not needed for the selected examples unless there is diagnostic uncertainty
Neurology Amyotrophic lateral sclerosis, Parkinson's disease (tremor, bradykinesia, rigidity; absence of atypical features), Bell's palsy	• Only the neurologic exam can determine the functional deficit, if any, of an abnormality on computed tomography scan or magnetic resonance imaging • Peripheral neuropathy is common; diagnosis is by symptoms and signs (decreased sensation, decreased or absent reflexes, and motor weakness); electromyography and nerve conduction studies are painful and must be ordered for specific reasons • Sensory testing for pain and temperature (carried by small unmyelinated fibers) may be more sensitive than conventional nerve conduction tests, which test larger myelinated nerves fibers • Patterns of sensory loss help localization: glove and stocking (peripheral neuropathy); radicular (root); Brown-Sequard type (spinal cord); "crossed" signs (cranial nerve deficits on one side and motor deficit on the other with brainstem lesions)
Rheumatology Rheumatoid arthritis, lupus erythematosus, scleroderma, relapsing polychondritis, patterns suggesting vasculitis (acute mononeuritis, palpable purpura)	• The clinical exam is essential for diagnosis and follow-up • In rheumatoid arthritis or lupus, serology alone does not make the diagnosis. A positive rheumatoid factor *without* multiple joint involvement, constitutional symptoms, rheumatoid nodules, morning stiffness, palpable synovitis, etc., is likely falsely positive. Seronegative rheumatoid arthritis is a clinical diagnosis
Cardiology Pericarditis	• Diagnosis depends on combinations of characteristic chest pain, pericardial friction rub, and characteristic electrocardiogram; 34–50% have normal echocardiograms
Ophthalmology Diabetic retinopathy, conjunctivitis, suspicion of keratitis, iritis, scleritis, acute angle glaucoma, retinal infarction	• "Red eye": the internist must recognize symptoms and signs that require immediate ophthalmology referral, including peri-limbic erythema (ciliary flush), photophobia, acute progressive pain, vision loss, foreign body sensation, anisocoria, fluid in the anterior chamber (hypopyon) • With conjunctivitis, the redness is most intense on the palpebral and peripheral bulbar conjunctiva • Bacterial versus viral versus allergic causes of conjunctivitis: bacterial discharge is purulent, sticky; eyes are stuck shut and crusted. Viral and allergic conjunctivitis can have mucoid, watery discharge. History of hay fever, itching, and previous episodes suggests allergic

0.4–0.6 is moderate agreement, and 0.6–0.8 is substantial agreement. It might surprise the trainee to learn, for example, that there is only fair to moderate agreement (κ of 0.38–0.58) in recognizing the presence of an infiltrate on chest radiograph, while there is better agreement (κ of 0.83) for recognizing interstitial edema. The interobserver agreement for the classification of coronary artery lesions on angiogram is only fair (κ of 0.33); it is slightly better for determining the severity of valvular regurgitation on echocardiogram (κ of 0.32–0.55). Pathologists interpreting liver biopsies show fair agreement in noting cholestasis (κ of 0.4) and moderate agreement on the existence of cirrhosis (κ of 0.59).

In the same manner, physical signs have varying degrees of interobserver agreement. Some signs, such as percussing for liver span or the use of auscultatory percussion, have notoriously low interobserver agreement and should be abandoned, while other signs have high agreement. A wide range in κ for a physical examination maneuver often reflects studies of varying rigor, different levels of training and experience, the transient nature of a sign, and other factors. Determining whether neck veins are normal or elevated shows a κ ranging from 0.08 to 0.71. Nevertheless, when the method of examination is agreed upon and the technique performed correctly, the interobserver agreement for many physical signs is good. The clock-drawing test (Wolf-Klein method) for dementia has a κ of 0.73; eliciting a positive abdominojugular test has a κ of 0.92, or almost perfect agreement.

DIAGNOSTIC ACCURACY: PRETEST PROBABILITY, LIKELIHOOD RATIO, AND POSTTEST PROBABILITY From the patient's history, the experienced clinician formulates hypotheses that are then accepted or rejected, or new ones are added as data are obtained by the physical examination (iterative hypothesis testing). For example, in a patient with cough and fever, the clinician might suspect pneumonia, and with those symptoms, the *pretest probability* of pneumonia is between 15 and 35%. It is useful for the clinician to have handy or memorize the pretest probabilities for common diagnoses, given particular clinical settings (Table 8-2). In a patient with cirrhosis, for example, the pretest probability of their having hepatopulmonary syndrome (HPS), which considerably alters their prognosis, is in the range from 14 to 37%. The finding of clubbing in this patient has a high specificity of 64–96% for HPS, but a variable sensitivity of 12–91%.

Of more utility than sensitivity and specificity is the likelihood ratio (LR), a measure that allows the clinician to rapidly estimate *posttest probability*. The LR is calculated as the ratio of the probability of a particular finding in patients *with* disease (i.e., the sensitivity) divided by the probability of the identical finding in patients with mimicking conditions but *without* disease (i.e., the false-positive probability, which is 1 minus the specificity). LRs serve as diagnostic weights: values >1 increase probability from pretest to posttest (and the greater the LR, the more the probability increases); LRs with values <1 decrease probability (and the closer the value is to zero, the more probability decreases). McGee has popularized a useful rule of thumb in interpreting LRs: LRs of 2, 5, and 10 translate to increased probability of disease of 15, 30, and 45%, respectively, whereas LRs of 0.5, 0.2, and 0.1 reduce the probability of disease by 15, 30, and 45%, respectively. These estimates are accurate to within 5–10% of the actual calculated posttest probability and serve well for bedside decisions.

In the previous example of the patient with cirrhosis, the finding of finger clubbing in detecting HPS has an LR of 4.3 (Table 8-3). Suppose the clinician's estimate of pretest probability of HPS is about 30%: the

TABLE 8-3 Physical Signs and Their Likelihood Ratios

DIAGNOSIS AND FINDING	LIKELIHOOD RATIO IF FINDING IS: PRESENT	ABSENT
Diagnosing ascites in patients with abdominal distension		
Edema	3.8	0.2
Flank dullness	NS	0.3
Fluid wave	5.0	0.5
Shifting dullness	2.3	0.4
Diagnosing hepatopulmonary syndrome in patients with chronic liver disease		
Clubbing	4.3	0.6
Cyanosis	4.4	0.7
Ascites	NS	NS
Jaundice	NS	NS
Diagnosing pneumonia in patients with cough and fever		
Percussion dullness	3.6	NS
Egophony	4.1	NS
Crackles	2.8	0.8
Bronchial breath sounds	3.3	0.9
Diagnosing elevated left heart filling pressures in patients with chest pain and dyspnea		
Heart rate >100 beats/min	5.5	NS
Crackles	NS	NS
Displaced apical impulse	5.8	NS
Positive abdominojugular test	8.0	0.3
S3 gallop	3.9	0.8

Abbreviation: NS, not significant (i.e., the likelihood ratio of the finding is statistically no different from the value of 1.0 and therefore useless to the clinician when considering this diagnosis).

Source: Adapted from SR McGee: *Evidence-Based Physical Diagnosis*, 5th ed. Philadelphia, Elsevier, 2022.

TABLE 8-2 Pretest Probability of Selected Conditions[a]

CLINICAL SETTING	DIAGNOSIS	PRETEST PROBABILITY (%) MEDIAN	RANGE
Hospitalized with fever	Bacteremia	18	7–37
Cough and fever	Pneumonia	22	15–35
Pleuritic chest pain, dyspnea, or hemoptysis	Pulmonary embolism	25	9–43
Murmur of aortic regurgitation	Moderate-to-severe aortic regurgitation	42	24–56
Chronic liver disease	Hepatopulmonary syndrome	25	14–37
Abdominal distension	Ascites	29	24–33
Ankle injury	Ankle fracture	12	10–14
Lymphadenopathy persisting several weeks	Serious disease (mostly cancer)	26	14–41
Diabetic foot ulcer	Osteomyelitis	65	52–68
Acute calf pain or swelling	Deep venous thrombosis	25	6–43

[a]These pretest probabilities derive from published studies of physical findings. Clinicians can further refine them by considering their own clinical experience. For example, the pretest probability of hepatopulmonary syndrome (range, 14–37%) is probably closer to 14% in primary care patients with liver disease and closer to 37% in hepatology patients.

Source: Adapted from SR McGee: *Evidence-Based Physical Diagnosis*, 5th ed. Philadelphia, Elsevier, 2022.

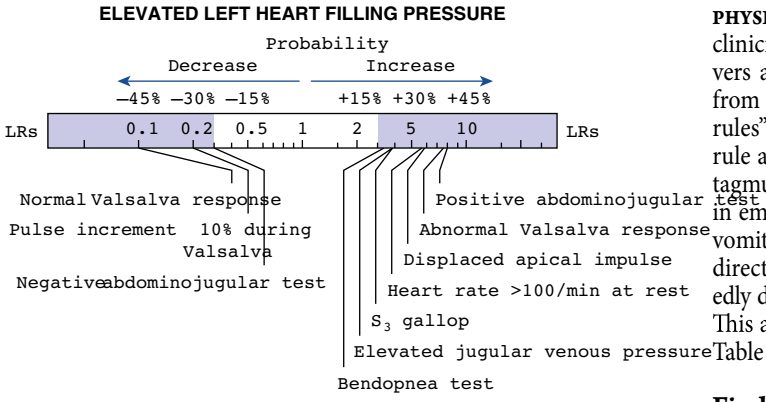

FIGURE 8-1 With just a glance, the clinician can immediately identify those few findings that significantly increase probability of heart failure (*right* side of ruler, likelihood ratio [LR] = 3 or more) and those that significantly decrease it (*left* side of ruler, LR = 0.3 or less). For example, the figure shows that the *presence* of S_3 gallop (LR = 3.9) and *presence* of displaced apical impulse (LR = 5.8) significantly increase probability of heart failure. On the other hand, the *absence* of either finding does not appear on the ruler because these LRs lie between 0.3 and 3.0 (Table 8-3) and therefore are diagnostically unhelpful. *(Reproduced with permission from SR McGee: Evidence-Based Physical Diagnosis, 4th ed. Philadelphia, Elsevier, 2022.)*

LR of 4.3 raises the probability of HPS by about 25–30%; adding this to the pretest probability results in a posttest probability of HPS of about 55–60%. One can also combine findings, if they have different pathogenesis (i.e., are independent). If the same patient with cirrhosis and clubbing also has cyanosis, which has an LR of 4.4 (increasing probability another 25–30%), the posttest probability of HPS (combining the two findings and their probabilities with the pretest probability) is now about 80–90%.

LRs allow the clinician to compare all traditional physical findings for a given diagnosis and quickly identify those few findings that accurately increase or decrease probability, a practice that improves the clinician's accuracy, efficiency, and confidence. Table 8-3 provides selected findings for four different conditions. If contemplating the diagnosis of ascites, for example, the clinician consults the table and focuses only on those findings with large LR values (3.0 or more, which increase probability) and those findings with LRs close to zero (0.3 or less, which decrease probability), disregarding those findings with values close to 1 (i.e., 0.3–3.0) because these latter values change probability minimally or not at all. In the example of abdominal distension, only the presence of the fluid wave (LR = 5) and edema (LR = 3.8) increase probability sufficiently, and only the absence of edema (LR = 0.2) and absence of flank dullness (which is the same as presence of flank tympany, LR = 0.3) decrease probability. These are the only findings the clinician applies at the bedside. LRs for a variety of conditions can be easily looked up in the two sources mentioned above. In *Evidence-Based Physical Diagnosis,* McGee has created an original and easily remembered graphic representation of physical signs related to a host of conditions (Fig. 8-1).

PHYSICAL SIGNS AS DECISION POINTS IN PATIENT MANAGEMENT The clinician should also master some common physical diagnosis maneuvers and "rules" that are helpful in distinguishing serious conditions from more benign ones (Table 8-4). These are sometimes called "stop rules" because the workup can safely end if all the conditions of the rule are met. One example is the HINTS battery (Head Impulse, Nystagmus, Skew Deviation Test) in evaluating the patient with dizziness: in emergency room patients with acute sustained vertigo, nausea, and vomiting, the combination of positive head impulse test, absence of direction-changing nystagmus, and absence of skew deviation markedly decreases the probability of posterior circulation stroke (LR = 0.02). This and a few other useful maneuvers and clinical rules are shown in Table 8-4.

Finding Clues to Unsuspected and Asymptomatic Disorders

The attentive physician often picks up clues to diseases that the patient may be unaware of but that could be consequential. Noting diffuse enlargement of the thyroid (in goiter or in Grave's disease), or xanthelasma (hypercholesterolemia), or acanthosis nigricans (in insulin resistance) presents the opportunity to intervene. Such clues abound, as an observant physician in busy public places such as airports cannot help but notice. A common observation is the coxalgic gait: the patient's trunk leans dramatically to the side (the "lateral lurch") when bearing weight on a painful hip. On the other hand, if the patient's lateral lean over the hip is less dramatic and accompanied by a drop in the contralateral pelvis, the opposing sways of the shoulder and pelvis give the impression of a hinge between sacrum and lumbar spine. This is the Trendelenburg gait, a sign of weakness of the hip abductor, the gluteus medius. At one time, the Trendelenburg gait was commonly seen after polio or other neuromuscular diseases, or with congenital hip dislocation; more recently, it can be seen after damage to the gluteus medius or the superior gluteal nerve after hip arthroplasty by the lateral approach. Another commonly observed gait abnormality is "circumduction" of the foot (which swings in a small semicircle with each step instead of moving forward directly), along with a reduced arm swing on the same side, suggesting past hemiplegia. Table 8-5 lists some other such observations that are meaningful to the clinical eye. Developing this type of clinical gaze requires conscious practice and alertness. Too narrow an examination based on the presenting symptom can miss important clues and be a disservice to the patient. Conversely, detecting such findings is satisfying because it might present the opportunity to intervene earlier in the course of a disease.

Medical Error from Oversights in the Physical Examination

Failure to do the examination, or an incomplete examination, can lead to diagnostic delay, inappropriate or delayed treatment, unnecessary exposure of the patient to radiation, surgical misadventure, or even death. Examples abound: the febrile patient whose petechiae or ecchymosis is missed because clothing is not completely removed, delaying the consideration of and empiric treatment for suspected Rocky Mountain spotted fever or meningococcemia; the patient with wrist and ankle pain seen by the primary care physician and referred

TABLE 8-4 Bedside Rules That Decrease Probability of Serious Conditions ("Stop Rules")

CONDITION	DIAGNOSIS	BEDSIDE RULE[a]	LIKELIHOOD RATIO IF BEDSIDE RULE SATISFIED
Ankle injury	Ankle fracture	Negative Ottawa ankle rule	0.1
Acute calf pain and swelling	Deep venous thrombosis	Original Wells score 0 or less[b]	0.2
Acute sustained vertigo, nausea, and vomiting	Posterior circulation stroke	HINTS peripheral	0.02
Acute abdominal pain	Acute appendicitis	Alvarado score 4 or less	0.1
Acute cough and fever	Pneumonia	Heckerling score 0 or 1	0.3
Diabetic foot ulcer	Osteomyelitis	Negative probe-to-bone test	0.2

[a]Definition of rules: for "Ottawa ankle rule," "Original Wells rule," and "Alvarado score," see reference (McGee); for "HINTS peripheral" see text; for "Heckerling score," the clinician scores 1 point for each of the following findings if present: temperature >37.8°C, heart rate >100 beats/min, crackles, diminished breath sounds, and *absence* of asthma; for "probe-to-bone" test, the clinician gently probes the foot ulcer with a blunt metal probe and identifies a rock-hard, gritty base without intervening soft tissue (positive test) or fails to observe this (negative test). [b]Clinicians combine a Wells score 0 with negative quantitative D-dimer before stopping workup.

Source: Adapted from SR McGee: *Evidence-Based Physical Diagnosis*, 5th ed. Philadelphia, Elsevier, 2022.

TABLE 8-5 Important Clues to Disorders That May Not Be Related to the Patient's Presenting Symptoms

TYPE OF OBSERVATION, WITH SELECTED EXAMPLES	NOTES
Faces and expression Acromegaly, Parkinson's disease, Cushing's syndrome, myxedema, hyperthyroidism, myasthenia gravis, Hippocratic facies, amiodarone facies, myotonic dystrophy, multiple endocrine neoplasia 2b (MEN2b), Down's syndrome, congenital syphilis, facial lipodystrophy with antiretroviral therapy in HIV, scleroderma	• Blue pigmentation around malar region with amiodarone • Myotonic dystrophy: "hatchet face" from temporal and facial muscle wasting, baldness in males, cataracts. • MEN2b: mucosal neuromas on lips, tongue, marfanoid habitus
Gait Coxalgic gait, Trendelenburg gait, high-stepping gait, Parkinson's gait, hemiplegic gait, diplegic gait or spastic gait, ataxic gait, sensory ataxic gait	• Parkinson's features are short, shuffling steps, forward flexion, appearance of hurrying up ("festination"), hesitancy in turning, absent arm swing, tremor • Peripheral neuropathy or posterior column disease cause sensory ataxia with broad-based "stamping" gait—striking foot down hard; worse at night when visual cues are diminished • Both hemiplegic and diplegic or "spastic" gait have hypertonia in upper limb flexors and lower limb extensors and adductors, with ankles extended and toes pointed in, circumduction with each step, "scissor gait" with diplegia (cerebral palsy)
Hands (Selected examples in the right column.) There are many eponymous *nail changes* (Beau's line, Terry's nails, Mee's line, Muehrcke's lines, half-and-half nails, etc.); they are frequently seen but not diagnostically helpful as they are associated with multiple conditions, including renal failure, liver failure, past or current severe illness, and hypoproteinemia. Koilonychia is associated with iron deficiency anemia but not exclusively. Pitting is seen in psoriasis and many other conditions.	• *Cardiac conditions:* splinter hemorrhages, Osler's nodes, Janeway lesions in endocarditis; "fingerization of the thumb" in Holt-Oram syndrome (with atrial septal defect); Marfan syndrome with arachnodactyly, thumb and wrist sign; Ehlers-Danlos syndrome with joint hypermobility, lax thin skin • *Liver dysfunction:* palmar erythema, spider angioma, white nails, asterixis • *Endocrine:* moist, warm, tremulous extremities, onycholysis in hyperthyroidism • *Neurologic:* myotonic grip with myotonic dystrophy; wrist drop of radial palsy; claw hand of ulnar nerve palsy • *Rheumatology:* nail fold and capillary changes in vasculitis; Heberden's and Bouchard's nodes in osteoarthritis; swan neck deformity, subluxation and ulnar deviation of fingers in rheumatoid arthritis and other chronic inflammatory arthritis; telescoping hand in destructive psoriatic or rheumatoid arthritis • *Pulmonary:* nicotine staining; clubbing; cyanosis • *Congenital/developmental changes:* Single transverse palmar crease in Down's syndrome
Odors	• Odor of tobacco on clothing • Grapelike odor of *Pseudomonas* wound infection • Fetid breath of anerobic lung abscess • Uriniferous odor in renal failure • Ammoniacal mousy odor in hepatic failure • Acetone-like fruity odor in diabetic ketoacidosis • Fish odor in trimethylaminuria • Bitter almond scent with cyanide poisoning • Alcohol metabolites with intoxication or alcohol-induced delirium
Clothing	• Inappropriate clothing for the ambient weather in hypothyroidism and hyperthyroidism • Neglect of clothing or color mismatch in dementia or delirium • Untied shoelaces in edema, toe of shoe cut out in chronic gout
Stature	• Short stature (growth hormone deficiency, Turner's syndrome) • Tall stature in Marfan syndrome and those with a Marfanoid habitus. In one study, the phenotypic features that favor Marfan syndrome are pectus carinatum, reduced elbow extension, high-arched or "gothic" palate, arm span–to–height ratio (ASHR) >1.05, hindfoot deformity, downslanting palpebral fissures, the thumb sign, lens subluxation, myopia, dental crowding, joint laxity, and micrognation

Source: Adapted from multiple sources including SL Berk, A Verghese: General Appearance, in *Clinical Methods: The History, Physical, and Laboratory Examinations*, 3rd ed. Walker HK et al (eds). Boston, Butterworths, 1990.

to consultants in rheumatology or orthopedics, and serologic tests for lupus, vasculitis, and other conditions ordered, until at some point the presence of clubbing (and even Horner's syndrome) is noted, suggesting pulmonary hypertrophic osteoarthropathy caused by a malignancy in the lung; or the patient with chest pain taken to the cardiac catheterization lab where contrast is injected before a rash looking like "dew drops on rose petals" involving a dermatome on the left chest is noted (herpes zoster). Studies show that when patients with "cellulitis" are first routed through a dermatology clinic, about a third will have an alternative diagnosis such as eczema or lymphedema, avoiding hospitalization and antibiotics.

RADIOLOGISTS REPORTING WHAT SHOULD HAVE BEEN OBVIOUS ON THE EXAMINATION It is unfortunately commonplace in hospital practice for the physician to be notified by the radiologist on the day after admission that the admission plain films of the abdomen show the patient labeled "gastroenteritis" has strangulated bowel in a hernial orifice or has gas in the scrotal tissue (Fournier's gangrene). These represent surgical emergencies that should be diagnosed by physical examination. Radiologists often report breast masses on CT scan of the chest, gynecomastia in a male, or thyroid masses, all of which should have been palpable. Such errors are consequential to the patient and an embarrassment to the clinician. Conversely (and less frequently), a careful physical examination might raise doubt on a radiologic interpretation. For example, even though all patients with acute atraumatic third cranial nerve palsy should undergo urgent neuroimaging, the "rule of the pupil" still applies: a dilated pupil suggests a compressive etiology such as an aneurysm, whereas a normal pupil suggests an ischemic cause. One particular study described two patients whose pupillary findings challenged the radiologic report. One patient's image showed a cavernous meningioma, which was suggested as causal, yet the pupil was spared; the clinicians elected to follow the patient, who made a full recovery, suggesting ischemia was the cause. A second patient had an abnormal pupil but a normal CT angiogram; noting

this discrepancy, the clinicians discussed the dilated pupil with the radiologist, and on restudying the image, a posterior communicating aneurysm was noted.

THE CAUSE OF OVERSIGHTS IN THE PHYSICAL EXAMINATION This variety of medical error usually goes unnoted and is difficult to study. In one paper based on physician-reported anecdotes of such oversights (either their own or those of others), it was because the physical examination was cursory or had not been done, although the patient's chart suggested a complete exam. The electronic medical record with its templates, dropdown boxes, and cut-and-paste functions makes it easy to suggest (and bill for) a complete examination. These errors of omission and commission are magnified by rapid patient turnover; frequent "handoffs" from the emergency room to the night team and then to the morning admitting team, with overreliance placed on the initial diagnosis; and insufficient continuity of care for any particular physician to be fully invested in the patient. Pride in their profession and a desire to avoid egregious mistakes that harm the patient should give clinicians a healthy skepticism for diagnostic labels given to new patients handed over for continuing care.

The Physical Examination as a Ritual Meaningful to Patient and Physician Busy physicians may not appreciate that what may be routine for them—seeing a patient in the clinic or the hospital—is far from routine for the patient. An ethnographer observing a new patient–physician encounter sees one stranger presenting themselves to another stranger and revealing personal and sensitive information that they may not admit to their spouse or their spiritual advisor; the setting is a room that has unique furnishings not to be found in either individual's home. One of the two participants might be wearing a white shamanistic garment with specialized tools in the pockets, while the other is asked to don a cloth or paper gown for the occasion. Then, at some point, one participant disrobes and allows the other to touch and manipulate their limbs and body; peer into their eyes, ears, and throat; probe their hernial orifices; and at times, examine the genitalia and rectum. These actions are far from the norm in society and could even be construed as assault. The great privilege of being a physician is that the physical examination is part of the contractual agreement to provide care for the patient, and it therefore comes with great fiduciary responsibility. To the ethnographer, the patient–physician encounter has all the trappings of a ritual.

CHARACTERISTICS OF RITUALS All rituals (such as weddings, baptisms, funerals, inaugurations, or graduations) are characterized by the crossing of a threshold, by a commitment, and by some type of transformation. The physical examination ritual can signal the patient's transition from self-sufficiency to seeking help, or from illness to wellness; it also signals the placement of trust in the physician. The willingness to disrobe and allow touch—markers of vulnerability—indicates the patient's acceptance that this ritual is important for the transfer of knowledge.

PATIENTS ARE EXPERT JUDGES OF RITUAL Patients of different ethnicities and cultural backgrounds, and with differing beliefs about illness, nevertheless recognize and appreciate ritual, even when the physician fails to see it. Patients are also good judges of the skills of other professionals such as automobile mechanics, hairdressers, or cooks, and they can tell if the work is being done well and with pride. In studies where lay subjects assess videos of surgeons operating (crowdsourced assessment), the subjects' assessments when compared to that of experienced surgeons rating the same videos showed moderate to strong correlation. Patients can feel let down when a physical examination feels perfunctory, such as when it consists only of a prodding of the belly and the placing of the stethoscope on the clothing instead of on the skin. To quote William Osler, "Remember, however, that every patient upon whom you wait will examine you critically and form an estimate of you by the way in which you conduct yourself at the bedside. Skill and nicety in manipulation, whether in the simple act of feeling the pulse or in the performance of any minor operation, will do more towards establishing confidence in you than a string of Diplomas, or the reputation of extensive hospital experience." When well executed, the physical examination preserves the patient's sense of identity and affirms their humanity and personhood. It validates the presenting symptoms by localizing them on their soma, on and in their body, rather than on a distant radiologic report or a lab test. Imaging and laboratory tests strip away the markers of individuality and personhood. Patients who chance to see their own imaging studies see little that is recognizable to them as self.

PASSING ON THE SKILLS Skilled rituals are typically learned by a lengthy apprenticeship. The gradual erosion of bedside rounds in teaching hospitals, replaced by rounds in a conference room where the patient's data on the computer are discussed, is detrimental to trainees. Bedside skills can only be passed on by role models who, by repeated demonstration, by observing the trainees' technique, and by giving appropriate feedback, keep this useful and essential skill alive.

PLACEBO, NOCEBO, AND THE PHYSICAL EXAMINATION The physical examination can be dehumanizing when done poorly, but when done well, it can have a salutary effect. Research on the placebo effect shows that a placebo can be something other than an inert tablet. One can have a "placebo without a placebo," meaning that the context, the ritual and its manner of execution, the setting, and the tone of voice of the examiner induce measurable change in levels of neurotransmitters and can produce a psychobiological effect. Trainees must appreciate their role in bringing about this effect. When patient expectations of the physical examination rituals are fulfilled, there is a positive effect; conversely, a clumsy and indifferent examination could have a nocebo (unpleasant or harmful) effect that impairs subsequent interactions.

CONCLUSION

The physical examination of the patient remains a critical element in diagnosis as well as in the ongoing assessment of the patient. The history generates hypotheses that are subsequently confirmed by useful evidence-based physical examination maneuvers, which then allow judicious ordering of further diagnostic tests. The ritual epitomizes the art and science of medicine and is itself an important means of satisfying the patient's need to feel cared for in a uniquely human and personal way. Physicians who over a lifetime cultivate skill in "reading the body" will find their practice more rewarding, will excite those apprenticing with them, and will pass on this important aspect of medicine to another generation.

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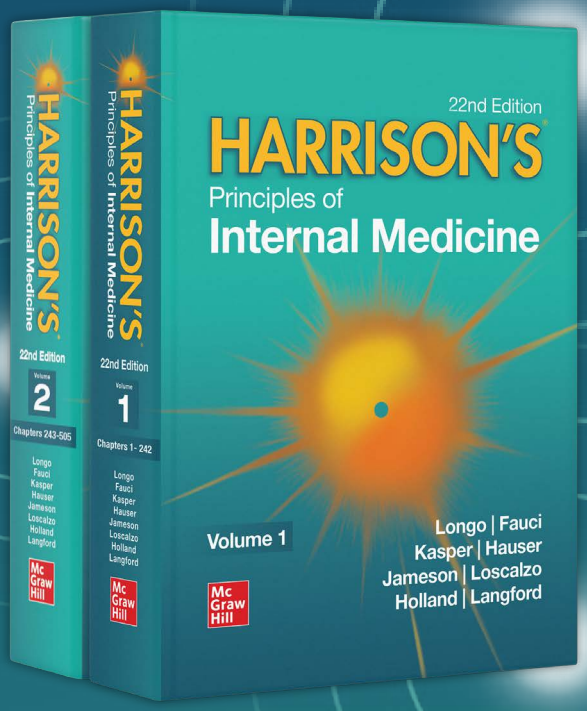

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