

## REVIEW ARTICLE

## MEDICAL EDUCATION

## Strategies to Reinvigorate the Bedside Clinical Encounter

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This article was published on November 12, 2025, at NEJM.org.

N Engl J Med 2025;393:2142-50.

DOI: 10.1056/NEJMra2500226

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**M**EDICAL TRAINEES TODAY SPEND AS LITTLE AS 13% OF THEIR TIME IN direct contact with patients.<sup>1</sup> As physicians spend less time with patients, fundamental bedside skills decline.<sup>2</sup> This decline contributes to diagnostic error, poor clinical outcomes, and increased health care costs.<sup>3</sup> More than half of outpatient diagnostic errors have been attributed to poor history taking and mistakes in the physical examination.<sup>4</sup> An overreliance on technology, due in part to declining clinical skills, leads to overinvestigation and rising costs.<sup>5</sup> The drift away from direct contact with patients contributes to a decrease in empathy on the part of medical students and residents and an increase in stress and burnout among practicing physicians. It also leads to a weakening of the doctor–patient relationship.<sup>6,7</sup> Lack of time at the bedside disproportionately affects marginalized groups and propagates health care disparities.<sup>8</sup> As bedside skills have declined, so too has the number of faculty members who are comfortable teaching those skills, which further contributes to their decay.<sup>9</sup> To help reverse these trends, we provide practical suggestions for clinical educators to reinvigorate the teaching and practice of bedside clinical skills in the modern health care environment.

### HOW DID WE GET HERE?

Early American medical education relied on a tiered system, from individual preceptorships in the beginning of the 19th century to didactic, degree-granting medical schools by midcentury. Few physicians could afford the education provided in Europe, where trainees learned at the bedside with clinical masters and then correlated clinical signs and symptoms observed in live patients with findings from autopsies and pathological examinations. This situation began to change around the beginning of the 20th century, as an increasing number of American medical schools followed the example set by master clinical educators such as Sir William Osler at The Johns Hopkins Hospital, whose students “examined patients, made diagnoses, heard the crepitant rales of a diseased lung, felt the alien and inhuman marble texture of a tumor.”<sup>10</sup>

This scientifically based method of combining bedside observation with pathological study reflected an endeavor to prepare doctors for teaching and learning at the bedside. But those aspirations have not endured for modern learners. Technology-based tests have moved the diagnostic process toward the laboratory and radiology suite, creating a false impression that what physicians see, feel, hear, and smell is no longer accurate or reliable.<sup>11</sup> The electronic health record (EHR) creates workflows that force physicians to spend more time with the digital representation of a patient (the “iPatient”) than with the actual person.<sup>12</sup> With changes in duty hours and economic pressures, throughput is prioritized over bedside evaluation and education.<sup>13</sup> The limited time that physicians do spend with patients is increasingly fragmented.<sup>14</sup>

## KEY POINTS

## STRATEGIES TO REINVIGORATE THE BEDSIDE CLINICAL ENCOUNTER

- Medical learners in the 21st century spend less time with patients during training than their counterparts did in the 20th century, which decreases the knowledge and practice of bedside clinical skills.
- Decreased bedside clinical skills lead to diagnostic error, poor clinical outcomes, increased health care costs, and physician burnout.
- Taking learners to the bedside facilitates clinical observation skills, creates opportunities to practice skills, and allows for evidence-based demonstrations of examination skills.
- Integration of point-of-care technology and artificial intelligence in the clinical encounter complements human observation, human clinical decision making, and human communication.
- Seeking opportunities to provide feedback on clinical skills in a context-specific way improves the technique at the bedside, as well as the interpretation of information obtained from the encounter.
- Beyond the diagnostic data obtained in the bedside clinical encounter, the physical examination helps learners navigate clinical uncertainty, helps teachers model interactions with patients, improves physician–patient communication, increases professional fulfillment, and helps address health care disparities.

Some physicians and trainees falsely believe that going to the bedside is inefficient.<sup>15</sup> Some worry that discussing the complexities of care in the presence of patients leads to discomfort or confusion on their part.<sup>16</sup> The uncertainty that comes with going to the bedside can be intimidating for educators and learners alike.<sup>17</sup> Although personal protective equipment protects physicians and patients from the spread of infectious diseases (René Laënnec, the inventor of the stethoscope, died from tuberculosis<sup>18</sup>), physical barriers can prolong rounds; decrease the accuracy of activities such as communication, palpation, and auscultation; and limit overall time spent in contact with patients.<sup>17</sup> As a result of these barriers, morning rounds, traditionally a bastion of bedside teaching, have migrated to the hallway, with less than 20% of rounding time spent with actual patients.<sup>1</sup> This creates a cycle in which bedside clinical skills are undervalued, undtaught, and underused, which further contributes to their erosion among practicing physicians and trainees.

Recent data support the enduring value of the bedside encounter. In a study of emergency room visits that resulted in hospital admission, history taking and physical examination led to the diagnosis in almost 40% of cases, with another 33% of diagnoses made by adding simple investigations.<sup>19</sup> An appropriate physical examination can obviate the need for additional diagnostic testing, yet the most commonly reported error with respect to the physical examination is simply not performing it.<sup>20</sup> One study showed that among patients who were admitted overnight, an attending physician uncovered a pivotal diagnosis in

26% of cases after performing a physical examination the following morning.<sup>21</sup> When teams go to the bedside after a handoff of care, the differential diagnosis changes substantially 20% of the time.<sup>22</sup> In addition to the diagnostic importance of bedside rounds, patients often prefer them and feel that their teams care more about them as individuals when rounds are conducted at the bedside.<sup>15,23,24</sup>

## HOW TO REINVIGORATE A CULTURE OF BEDSIDE MEDICINE

The interactive graphic describes a common scenario encountered by clinical educators. Using this scenario as a starting point, we offer six strategies to help reinvigorate a culture of bedside medicine and respond to the needs of patients, physicians, and learners (Table 1).

## GO TO THE BEDSIDE AND OBSERVE

The notorious criminal Willie Sutton supposedly once said, “I rob banks because that’s where the money is.”<sup>25</sup> Applied to medicine, Sutton’s law has traditionally meant “proceeding immediately to the diagnostic test most likely to provide a diagnosis.”<sup>26</sup> A revised Sutton’s law might state that in order to improve bedside clinical skills, you need to go where the patients are: the bedside.<sup>27</sup> The modern-day “bedside” includes not only a hospital room or outpatient office but also a telemedicine encounter or home health visit.

No matter where the encounter takes place, observation is one of the most important and underused clinical skills that can aid in estab-



An interactive graphic is available at [NEJM.org](https://NEJM.org)



**Table 1.** Strategies to Reinvigorate the Bedside Encounter.

Strategy	Justification
Go to the bedside and observe (both patient and trainee)	Observation forms the basis of much of the physical examination and can provide valuable clues to the diagnosis of many diseases, as well as the prognosis. Direct observation of the trainee's clinical skills is critical for providing actionable and specific feedback. Observational skills can be improved through practice in nonmedical contexts.
Practice and teach an evidence-based approach to the physical examination	The physical examination should be used in a hypothesis-driven approach, just like any other diagnostic test. In many cases, the physical examination remains the reference-standard diagnostic test. In other cases, likelihood ratios can help in selecting the appropriate physical examination maneuver, by comparison of that maneuver with a technology-based test.
Create opportunities for intentional practice	Time at the bedside is limited, so educators need to create opportunities for intentional practice of bedside skills. Traditional morning rounds remain the best opportunity for teaching bedside clinical skills. Other teaching sessions, such as morning report, noon conference, or dedicated physical examination sessions, can provide opportunities for practice.
Use technology to teach and reinforce clinical examination skills	Point-of-care technology (e.g., use of digital stethoscopes and ultrasonography) is part of the bedside examination. It enhances diagnosis, allows learners to calibrate physical examination skills, and brings educators, learners, and patients together. Telemedicine improves access to care and allows clinicians to visit with patients in their home environment. Artificial intelligence can reduce the administrative burden, assist in the clinical reasoning process, and help in the acquisition of data. Awareness of the possibility of bias is important when existing or new technologies are used at the bedside.
Seek and provide feedback on clinical skills	Direct observation and feedback on clinical skills with real patients are rare in the United States. Assessment can drive learning. Formative assessments with real patients can inform individual learning plans.
Acknowledge the power of the bedside encounter beyond diagnosis	Approaching each encounter with curiosity can help physicians navigate uncertainty. Performing an appropriate history taking and physical examination helps patients feel cared for and can have a healing effect. Using evidence-based approaches to being fully present with patients improves the patient-physician relationship and increases professional fulfillment. Spending time at the bedside can help address health care inequities.

lishment of a diagnosis, as well as in clinical teaching. James Parkinson's description of the "shaking palsy" relied almost exclusively on his direct observation of patients.<sup>28</sup> Observing a patient from the foot of the bed, or even from the hallway, reveals clues that are critical for understanding the diagnosis, the prognosis, and the patient's personal circumstances.<sup>29</sup> Intentional practice can improve observational skills. In the preclinical years, practicing observation in a nonmedical context (e.g., by looking at art) improves observation in the clinical realm.<sup>30</sup> Observing learners engaging in a clinical encounter provides rich opportunities for assessment of and feedback on their clinical skills. Faculty members' competence and confidence in directly observing clinical skills can be improved with practice.<sup>31</sup>

#### PRACTICE AND TEACH AN EVIDENCE-BASED APPROACH TO THE PHYSICAL EXAMINATION

In medical school, the physical examination is often taught in a head-to-toe fashion rather than as part of a threshold-based approach to clinical decision making.<sup>32</sup> This strategy could lead some physicians to prioritize technology-based tests above the physical examination. One way to overcome this tendency is to teach and practice a hypothesis-driven physical examination,<sup>33</sup> in which a physical examination maneuver is considered in the same way that other diagnostic tests are considered.

The first step in this approach is to estimate a pretest probability of diagnostic hypotheses, with the use of clues derived from the patient's history and knowledge of the prevalence of disease in a particular context. Sometimes the diag-

nosis is apparent from the history alone, but if additional data gathering is warranted, the clinician can select an appropriate physical examination maneuver targeted toward a suspected diagnosis. Some physical examination findings are pathognomonic of the disease in question (e.g., the rash of herpes zoster or the appearance and warmth of cellulitis). However, in many cases, the accuracy and reliability of findings from the physical examination are established by comparing the findings with those from a technology-based test (e.g., a laterally displaced apical impulse and a third heart sound are compared with an echocardiogram in diagnosing heart failure with reduced ejection fraction).

Using the information derived from the history and a hypothesis-driven physical examination, clinicians can decide whether additional testing is warranted or enough information is available to make a diagnosis and offer a treatment recommendation.<sup>11</sup> But this approach requires seeking out opportunities to demonstrate and practice such an examination. The interactive graphic shows a hypothesis-driven physical examination of a patient with exertional dyspnea.

#### CREATE OPPORTUNITIES FOR INTENTIONAL PRACTICE

Intentional practice as part of a dedicated clinical skills curriculum improves physical examination skills.<sup>34</sup> Being with patients teaches the value of bedside skills and how data acquisition (i.e., history taking and physical examination) immediately affects patient care.<sup>17</sup> But intentional practice starts with empowering teachers and learners to overcome barriers and get back to the bedside.

Patient-centered medical education conducted with learners and teachers at the bedside during rounds can increase efficiency and enhance physician satisfaction.<sup>35</sup> Rounding in the patient's room identifies immediate issues to be addressed, helps to frame a shared medical agenda, and expedites the ordering of tests, treatments, and consultations. Teachers should prepare both patients and learners for what to expect during bedside rounds. One way to do this is to choreograph the bedside interaction by assigning tasks to members of the medical team, such as order entry or data retrieval from the EHR. Assigning roles to the participants helps to focus clinical presentations, carve out time to clarify important historical data, and integrate details of the physical examination into the

case presentation. Structuring time with the patient also provides opportunities for teaching.<sup>36</sup>

Several tools are available to aid in efficient bedside teaching, such as the One-Minute Preceptor<sup>37</sup> and the Five-Minute Moment.<sup>38</sup> The Five-Minute Moment combines a memorable vignette related to a finding from a physical examination with information on how to properly perform a maneuver during the examination and data on the relevance of the finding (see Fig. S1 in the Supplementary Appendix, available with the full text of this article at NEJM.org). If time allows, multiple scripted teaching tools can be combined to create a more comprehensive approach to a patient's chief concern.

Seeing every patient with the entire team during morning rounds is often not possible. Clinical educators can prioritize which patients to see with learners by selecting circumstances in which the history or physical examination is likely to be helpful in elucidating a diagnosis. For example, a focused cardiopulmonary examination can help distinguish chronic obstructive pulmonary disease from heart failure in a patient with chronic dyspnea.<sup>39</sup> Since a substantial proportion of inpatient admissions are due to cardiopulmonary disease,<sup>40</sup> learning how to perform a targeted cardiopulmonary examination is useful for most clinicians. Educators can also select patients to see on the basis of particular presentations that would provide an opportunity for both the educators and their learners to improve their clinical skills. Given that "neurophobia" is a commonly described phenomenon in medical training,<sup>41</sup> seeing patients with neurologic symptoms is often a high-yield endeavor for both diagnosis and teaching.

Taking learners to the bedside apart from traditional rounds can also be valuable. For example, examining a patient with a new or worsening clinical condition can demonstrate in real time the value of the bedside encounter in diagnosis and clinical decision making. This type of "reactive learning" is an important part of informal learning in the workplace.<sup>42</sup>

Dedicated physical examination and observation sessions outside of routine patient care can also build clinical skills. One of the authors leads regular sessions in which trainees provide the chief concern or symptom they would like to explore for a patient unknown to the faculty and

other learners. The team goes to the bedside to conduct a physical examination (including ultrasonography, if appropriate), agrees on the findings that are present, discusses the potential clinical significance of the findings, and compares them with available results from imaging studies and other diagnostic tests. These educational sessions demonstrate the value of bedside clinical findings and calibrate examination technique with imaging results. The sessions also provide an opportunity to celebrate discoveries made by trainees and acknowledge the limitations of the bedside examination (e.g., when the findings from the examination and ultrasonography do not uncover the diagnosis).

Teachers can take advantage of traditional educational sessions to teach and practice clinical skills. For example, after a morning report presentation, the team goes to the bedside to conduct a focused history taking and physical examination. When this strategy is used, bedside findings can lead to substantial changes in the differential diagnosis (e.g., a patient with renal failure from suspected dehydration is discovered to have decompensated heart failure).<sup>43</sup> Traditional morning report or other conferences can also be used to demonstrate and practice specific physical examination maneuvers with the use of standardized patients (persons trained to simulate the symptoms of a condition) or healthy volunteers.<sup>44</sup>

Bedside sessions should start early on in medical school, since habits form early and influence clinical practice throughout physicians' careers. Preclinical students who participate in observed bedside clinical encounters with both real and standardized patients have better clinical skills at the end of their third-year clerkships than preclinical students who have not participated in such sessions.<sup>45</sup> However, when preclinical students move on to their clinical rotations and do not see physicians using the history and physical examination in the everyday care of patients, they quickly shift their focus toward the EHR and technology-based tests.<sup>12</sup>

#### USE TECHNOLOGY TO TEACH AND REINFORCE CLINICAL EXAMINATION SKILLS

Laënnec's invention of the stethoscope two centuries ago remains one of the most important technological advances in medicine.<sup>18</sup> New technology has broadened the diagnostic capabilities

of the stethoscope. Digital stethoscopes allow simultaneous auscultation with real-time visualization of spectrograms and electrocardiograms (see the interactive graphic). Artificial intelligence (AI) algorithms aid in the diagnosis of arrhythmias and valvular heart disease.<sup>46,47</sup> Point-of-care ultrasonography (POCUS) can establish diagnoses that elude the traditional physical examination. POCUS allows learners to calibrate their physical examination skills by linking examination findings with real-time visualization of pathophysiological features.<sup>48</sup> AI algorithms can assist learners with image acquisition and interpretation.<sup>49</sup> But perhaps the true power of POCUS is that it brings patients, physicians, and trainees together at the bedside. To become proficient at POCUS, physicians need to be present with patients, strike up a conversation, and appropriately uncover the part of the body to be examined. In the process, important historical clues and physical examination findings become apparent (e.g., a sternotomy scar or a pacemaker).<sup>50</sup> Physicians can also build a connection with patients and engage them in shared decision making by showing real-time images of pathophysiological features.<sup>51</sup>

Technology can help overcome physical barriers to the clinical examination (e.g., personal protective equipment, which limits touch and hearing) and provide real-time diagnostics when transporting a patient to a scanner is not feasible (e.g., because of clinical instability or the need for infection prevention).<sup>52</sup> Technology has also reframed the concept of the bedside to include telehealth, which allows the patient to engage in a physician-assisted, patient-led physical examination while offering the physician insight into the patient's home environment.<sup>53</sup>

Emerging technologies have the potential to further modify the bedside clinical encounter. For example, multimodal AI systems might one day be able to assist with observation and visual inspection of patients.<sup>54</sup> Large language models have shown promise in clinical reasoning tasks.<sup>55</sup> Perhaps the more immediate and useful impact of AI will be to offload the administrative burden imposed by the EHR, freeing up time for direct contact with patients.<sup>56</sup> No matter how the role of AI at the bedside takes shape, the results from AI interactions should always inform rather than replace human observation, human clinical decision making, and human communication at

the bedside.<sup>57</sup> Bedside clinical skills will be even more important in an AI-enabled clinical workplace, which highlights the need for a stronger emphasis on direct observation and feedback on those skills.

#### SEEK AND PROVIDE FEEDBACK ON CLINICAL SKILLS

Delivering feedback to learners in the presence of patients is a complex skill, particularly if the feedback involves correcting a mistake in physical examination technique or modifying the differential diagnosis or treatment plan. Poorly delivered feedback could undermine the relationship between trainees and patients. If delivered in a context-specific and thoughtful way, however, bedside feedback can reassure patients that the entire team is invested in their care (see the interactive graphic). It is critical to set expectations with patients and learners before delivering bedside feedback; this process may involve alerting both the patient and the team beforehand that feedback is going to be provided and seeking specific areas of need for the learner. Avoiding medical jargon, when possible, can improve communication and education. A short debriefing with the learner after the bedside encounter can reinforce key points and identify ways to improve future experiences.<sup>36,58</sup>

Despite the importance of bedside feedback, direct observation and assessment of clinical skills with real patients are rare in the United States.<sup>59</sup> U.S. medical education instead relies on summative assessments of medical knowledge with the use of multiple-choice examinations to determine learners' developing competence. In many other countries, graduating residents in internal medicine are required to pass examinations in which they encounter real patients with real findings while being assessed by faculty observers. A high-stakes assessment can drive learning.<sup>60</sup> Non-U.S.-trained physicians who have gone through this experience are usually more fluent in their clinical examination skills and have a broader appreciation for the value of the bedside encounter in patient care than U.S.-trained physicians.<sup>61</sup> This experience may translate into better outcomes for patients.<sup>62</sup>

Although there is no appetite for a high-stakes, summative clinical skills examination in the United States, there is a need to incorporate more direct observation into training. The Assessment

of Physical Examination and Communication Skills (APECS) is a formative experience for internal medicine residents that includes integrated, physical examination-only, telemedicine, and POCUS encounters with real patients. Residents are assessed across seven clinical domains and receive individualized, hands-on feedback from experienced faculty.<sup>63</sup>

The APECS underscores the enduring value of the physical examination. A study that used the APECS to assess the physical examination skills of interns showed that good technique is significantly associated with identification of the correct physical findings, and both good technique and identification of physical findings are significantly associated with formulation of a correct differential diagnosis.<sup>63</sup> Direct observation of trainees also provides an opportunity for feedback. In another study that incorporated the APECS, only half the interns who participated in the examination of a patient with severe aortic regurgitation (the scenario in the interactive graphic) appreciated the characteristic diastolic murmur.<sup>64</sup> Two commonly observed errors (which the learner in the scenario in the interactive graphic also made) are auscultating through the gown or clothing and listening to the heart while feeling the radial pulse (instead of the apical impulse or carotid pulse).<sup>64</sup> These are simple errors in technique that can be easily corrected. The APECS also provides an opportunity for faculty development, since physicians from different specialties and with varying degrees of experience are paired as preceptors with learners.<sup>63</sup>

The APECS is resource-intensive and happens outside the delivery of routine care. Recognizing this limitation, the Society of Bedside Medicine created the Ten-Minute Moment for use in the daily workflow,<sup>65</sup> in which faculty observe a learner performing a focused physical examination and provide real-time feedback with the help of a skills-based worksheet. The Mini-Clinical Evaluation Exercise (Mini-CEX) is another commonly used tool to guide workplace-based observations and subsequent feedback.<sup>66</sup>

#### ACKNOWLEDGE THE POWER OF THE BEDSIDE ENCOUNTER BEYOND DIAGNOSIS

Clinical medicine is practiced against a background of uncertainty. Whether the task at hand is establishing a diagnosis, making treatment

decisions, or providing clinical follow-up, uncertainty is a part of bedside patient care. Acknowledging this fact allows patients, clinicians, and trainees to negotiate the uncertainty together, which can strengthen the patient–physician relationship.<sup>67</sup> One attribute educators can demonstrate to mitigate uncertainty is curiosity. Curiosity, as defined in a 1999 essay by Fitzgerald, “is the urge to investigate, to discover,” and when applied to clinical medicine, curiosity allows the patient to be viewed as a person, with signs and symptoms as set pieces in a story.<sup>68</sup> Approaching the bedside encounter with curiosity allows clinicians to effectively partner with patients and learners.

Using evidence-based practices to be fully present during interactions with patients, such as preparing with intention, listening intently, and agreeing on what matters, allows time spent at the bedside to yield more than just clinical clues. It allows for connection with a patient’s story and engenders trust.<sup>69</sup> Time spent being fully present helps clinicians find meaning in their work, which can be a powerful buttress against stress and burnout.<sup>7,27</sup> A physical examination done well conveys caring and can have a placebo effect beyond diagnostic findings.<sup>7</sup> Celebrating moments when time spent with a patient yields important clinical information builds excitement in the clinical encounter and is an antidote to “eurekaphenia” (i.e., the paucity of “eureka” moments when the learner recognizes the link between a clinical finding and the pathobiologic basis of a disease). Many learners and practicing physicians experience eurekaphenia, since they spend little time at the bedside.<sup>70</sup>

The bedside encounter can also address health care disparities. Among teenagers who are members of underrepresented racial and ethnic groups, the percentage who report having never had a physical examination during routine checkups is

higher than that among their White peers.<sup>71</sup> Even when those examinations occur, systemic inequities (e.g., the paucity of dermatologic textbooks that include darker skin tones<sup>72</sup> or bias in devices such as pulse oximeters<sup>73</sup>) can worsen outcomes for patients of color. Patients with low English language proficiency can also receive inadequate care.<sup>74</sup> When educators take teams to the bedside, they are able to acknowledge and address these inequities in a context-specific way.

## CONCLUSIONS

Against a backdrop of technological advances, limited time with patients, and clinical uncertainty, there is an urgent need to reinvigorate the bedside encounter in order to meet the needs of patients, trainees, and clinical educators in the 21st century. By using six strategies, clinical educators can help trainees appreciate the value of the bedside encounter in diagnostic reasoning, strengthen the patient–physician relationship, combat health care inequities, improve professional fulfillment, and avoid burnout. The words of Osler ring true more than a century later: “Medicine is learned by the bedside and not in the classroom. Let not your conceptions of the manifestations of disease come from words heard in the lecture room or read from the book. See, and then reason and compare and control. But see first.”<sup>75</sup>

Disclosure forms provided by the authors are available with the full text of this article at NEJM.org.

We thank Dr. Andrew Elder, Royal College of Physicians of Edinburgh, for his thoughtful comments on an earlier version of the manuscript and for his mentorship in bedside medicine.

Jeffrey M. Drazen, M.D., Raja-Elie Abdulnour, M.D., and Judith L. Bowen, M.D., Ph.D., are the editors of the Medical Education series.

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## REFERENCES

- Rosen MA, Bertram AK, Tung M, Desai SV, Garibaldi BT. Use of a real-time locating system to assess internal medicine resident location and movement in the hospital. *JAMA Netw Open* 2022;5(6):e2215885.
- Vukanovic-Criley JM, Hovanesyan A, Criley SR, et al. Confidential testing of cardiac examination competency in cardiology and noncardiology faculty and trainees: a multicenter study. *Clin Cardiol* 2010;33:738-45.
- Newman-Toker DE, McDonald KM, Meltzer DO. How much diagnostic safety can we afford, and how should we decide? A health economics perspective. *BMJ Qual Saf* 2013;22:Suppl 2:ii11-ii20.
- Singh H, Giardina TD, Meyer AND, Forjuoh SN, Reis MD, Thomas EJ. Types and origins of diagnostic errors in primary care settings. *JAMA Intern Med* 2013;173:418-25.
- Garibaldi BT, Elder A. Seven reasons why the physical examination remains important. *J R Coll Physicians Edinb* 2021;51:211-4.
- Neumann M, Edelhäuser F, Tauschel D,

- et al. Empathy decline and its reasons: a systematic review of studies with medical students and residents. *Acad Med* 2011; 86:996-1009.
7. Costanzo C, Verghese A. The physical examination as ritual: social sciences and embodiment in the context of the physical examination. *Med Clin North Am* 2018; 102:425-31.
8. Cooper LA, Roter DL. Patient-provider communication: the effect of race and ethnicity on process and outcomes of health care. In: Smedley BD, Stith AY, Nelson, AR, eds. *Unequal treatment: confronting racial and ethnic disparities in health care*. Washington, DC: National Academies Press, 2004:552-93.
9. Wu EH, Fagan MJ, Reinert SE, Diaz JA. Self-confidence in and perceived utility of the physical examination: a comparison of medical students, residents, and faculty internists. *J Gen Intern Med* 2007;22: 1725-30.
10. Barry JM. The great influenza: the story of the deadliest pandemic in history. New York: Penguin Books, 2004.
11. McGee S. Evidence-based physical diagnosis. 5th ed. Philadelphia: Elsevier, 2022.
12. Verghese A. Culture shock — patient as icon, icon as patient. *N Engl J Med* 2008;359:2748-51.
13. Block L, Habicht R, Wu AW, et al. In the wake of the 2003 and 2011 duty hours regulations, how do internal medicine interns spend their time? *J Gen Intern Med* 2013;28:1042-7.
14. Baratta LR, Harford D, Sinsky CA, Kannampallil T, Lou SS. Characterizing the patterns of electronic health record-integrated secure messaging use: cross-sectional study. *J Med Internet Res* 2023; 25:e48583.
15. Gonzalo JD, Chuang CH, Huang G, Smith C. The return of bedside rounds: an educational intervention. *J Gen Intern Med* 2010;25:792-8.
16. Wang-Cheng RM, Barnas GP, Sigmann P, Riendl PA, Young MJ. Bedside case presentations: why patients like them but learners don't. *J Gen Intern Med* 1989; 4:284-7.
17. Garibaldi BT, Russell SW. Strategies to improve bedside clinical skills teaching. *Chest* 2021;160:2187-95.
18. Tomos I, Karakatsani A, Manali ED, Papiris SA. Celebrating two centuries since the invention of the stethoscope: René Théophile Hyacinthe Laënnec (1781-1826). *Ann Am Thorac Soc* 2016;13:1667-70.
19. Paley L, Zornitzki T, Cohen J, Friedman J, Kozak N, Schattner A. Utility of clinical examination in the diagnosis of emergency department patients admitted to the department of medicine of an academic hospital. *Arch Intern Med* 2011; 171:1394-6.
20. Verghese A, Charlton B, Kassirer JP, Ramsey M, Ioannidis JPA. Inadequacies of physical examination as a cause of medical errors and adverse events: a collection of vignettes. *Am J Med* 2015;128(12):1322-1324.e3.
21. Reilly BM. Physical examination in the care of medical inpatients: an observational study. *Lancet* 2003;362:1100-5.
22. Choi JJ, Osterberg LG, Record JD. Exploring ward team handoffs of overnight admissions: key lessons from field observations. *J Gen Intern Med* 2024;39:808-14.
23. Majdan JF, Berg KT, Schultz KL, Schaeffer A, Berg D. Patient perceptions of bedside teaching rounds. *Med Educ* 2013;47:1124-5.
24. Lehmann LS, Brancati FL, Chen MC, Roter D, Dobs AS. The effect of bedside case presentations on patients' perceptions of their medical care. *N Engl J Med* 1997;336:1150-5.
25. Sullivan F. The talk of the town: notes and comment. *The New Yorker*. February 23, 1952.
26. Petersdorf RG, Beeson PB. Fever of unexplained origin: report on 100 cases. *Medicine (Baltimore)* 1961;40:1-30.
27. Garibaldi BT, Zaman J, Artandi MK, Elder AT, Russell SW. Reinvigorating the clinical examination for the 21st century. *Pol Arch Intern Med* 2019;129:907-12.
28. Parkinson J. An essay on the shaking palsy. *J Neuropsychiatry Clin Neurosci* 2002;14:223-36.
29. Berk SL, Verghese A. General appearance. In: Walker HK, Hall WD, Hurst JW, eds. *Clinical methods: the history, physical and laboratory examinations*. 3rd ed. Oxford, United Kingdom: Butterworth-Heinemann, 1990:987-9.
30. Russell SW. Improving observational skills to enhance the clinical examination. *Med Clin North Am* 2018;102:495-507.
31. Holmboe ES, Hawkins RE, Huot SJ. Effects of training in direct observation of medical residents' clinical competence: a randomized trial. *Ann Intern Med* 2004; 140:874-81.
32. Pauker SG, Kassirer JP. The threshold approach to clinical decision making. *N Engl J Med* 1980;302:1109-17.
33. Garibaldi BT, Olson AJ. The hypothesis-driven physical examination. *Med Clin North Am* 2018;102:433-42.
34. Garibaldi BT, Niessen T, Gelber AC, et al. A novel bedside cardiopulmonary physical diagnosis curriculum for internal medicine postgraduate training. *BMC Med Educ* 2017;17:182.
35. Cao V, Tan LD, Horn F, et al. Patient-centered structured interdisciplinary bedside rounds in the medical ICU. *Crit Care Med* 2018;46:85-92.
36. Lichstein PR, Atkinson HH. Patient-centered bedside rounds and the clinical examination. *Med Clin North Am* 2018; 102:509-19.
37. Neher JO, Gordon KC, Meyer B, Stevens N. A five-step "microskills" model of clinical teaching. *J Am Board Fam Pract* 1992;5:419-24.
38. Chi J, Artandi M, Kugler J, et al. The five-minute moment. *Am J Med* 2016;129: 792-5.
39. McGee S. *Evidence-based physical diagnosis*. 5th ed. Philadelphia: Elsevier, 2022.
40. McDermott KW, Roemer M. Most frequent principal diagnoses for inpatient stays in U.S. hospitals, 2018. HCUP statistical brief #277. July 2021 (<https://hcup-us.ahrq.gov/reports/statbriefs/sb277-Top-Reasons-Hospital-Stays-2018.jsp>).
41. Jozefowicz RF. Neurophobia: the fear of neurology among medical students. *Arch Neurol* 1994;51:328-9.
42. Eraud M. Informal learning in the workplace. *Stud Contin Educ* 2004;26: 247-73.
43. Goyal A, Garibaldi B, Liu G, Desai S, Manesh R. Morning report innovation: case oriented report and exam skills. *Diagnosis (Berl)* 2019;6:79-83.
44. Stanford medicine 25 (<http://stanfordmedicine25.stanford.edu/>).
45. Jackson MB, Keen M, Wenrich MD, Schaad DC, Robins L, Goldstein EA. Impact of a pre-clinical clinical skills curriculum on student performance in third-year clerkships. *J Gen Intern Med* 2009; 24:929-33.
46. Waaler PN, Melbye H, Schirmer H, et al. Algorithm for predicting valvular heart disease from heart sounds in an unselected cohort. *Front Cardiovasc Med* 2024;10: 1170804.
47. Ford O. Eko's new algorithm helps digital stethoscope give insight on heart conditions. *Medical Device and Diagnostic Industry*, January 28, 2020.
48. Kumar A, Liu G, Chi J, Kugler J. The role of technology in the bedside encounter. *Med Clin North Am* 2018;102:443-51.
49. Cheema BS, Walter J, Narang A, Thomas JD. Artificial intelligence-enabled POCUS in the COVID-19 ICU: a new spin on cardiac ultrasound. *JACC Case Rep* 2021;3:258-63.
50. Garibaldi BT, Russell SW. Teaching the physical examination at the bedside. In: Aronowitz PB, Keenan CR, eds. *Teaching and coaching in the hospital*. Philadelphia: American College of Physicians, 2025:157-78.
51. Howard ZD, Noble VE, Marill KA, et al. Bedside ultrasound maximizes patient satisfaction. *J Emerg Med* 2014;46:46-53.
52. Lewiss RE, Liu RB, Strony R. Point-of-care ultrasound is having its moment. *POCUS J* 2020;5:2-3.
53. Zulman DM, Verghese A. Virtual care, telemedicine visits, and real connection in the era of COVID-19: unforeseen opportunity in the face of adversity. *JAMA* 2021;325:437-8.

- 54.** Oikonomou EK, Khera R. Artificial intelligence-enhanced patient evaluation: bridging art and science. *Eur Heart J* 2024; 45:3204-18.
- 55.** Cabral S, Restrepo D, Kanjee Z, et al. Clinical reasoning of a generative artificial intelligence model compared with physicians. *JAMA Intern Med* 2024;184: 581-3.
- 56.** Spear J, Ehrenfeld JM, Miller BJ. Applications of artificial intelligence in health care delivery. *J Med Syst* 2023;47:121.
- 57.** Verghese A, Shah NH, Harrington RA. What this computer needs is a physician: humanism and artificial intelligence. *JAMA* 2018;319:19-20.
- 58.** Gonzalo JD, Heist BS, Duffy BL, et al. Content and timing of feedback and reflection: a multi-center qualitative study of experienced bedside teachers. *BMC Med Educ* 2014;14:212.
- 59.** Holmboe ES. Faculty and the observation of trainees' clinical skills: problems and opportunities. *Acad Med* 2004;79:16-22.
- 60.** Elder A. Clinical skills assessment in the twenty-first century. *Med Clin North Am* 2018;102:545-58.
- 61.** Jacobsen AP, Khiew YC, Murphy SP, Lane CM, Garibaldi BT. The modern physical exam — a transatlantic perspective from the resident level. *Teach Learn Med* 2020;32:442-8.
- 62.** Norcini JJ, Boulet JR, Dauphinee WD, Opalek A, Krantz ID, Anderson ST. Evaluating the quality of care provided by graduates of international medical schools. *Health Aff (Millwood)* 2010;29:1461-8.
- 63.** Clark BW, Niessen T, Apfel A, et al. Relationship of physical examination technique to associated clinical skills: results from a direct observation assessment. *Am J Med* 2022;135(6):775-782.e10.
- 64.** Lang K, Chew C, De La Rosa M, et al. Performance of cardiovascular physical exam skills by internal medicine residents. *Am J Med* 2024;137:1001-7.
- 65.** Artandi M, Norcini J, Garibaldi B, et al. Improving the physical exam: a new assessment and evaluation tool for physical examination skills. *Diagnosis (Berl)* 2022;9:393-7.
- 66.** Norcini JJ, Blank LL, Arnold GK, Kimball HR. The mini-CEX (clinical evaluation exercise): a preliminary investigation. *Ann Intern Med* 1995;123:795-9.
- 67.** Scott IA, Doust JA, Keijzers GB, Wallis KA. Coping with uncertainty in clinical practice: a narrative review. *Med J Aust* 2023;218:418-25.
- 68.** Fitzgerald FT. Curiosity. *Ann Intern Med* 1999;130:70-2.
- 69.** Zulman DM, Haverfield MC, Shaw JG, et al. Practices to foster physician presence and connection with patients in the clinical encounter. *JAMA* 2020;323:70-81.
- 70.** Hellmann DB. Eurekopenia: a disease of medical residency training programs? *Pharos Alpha Omega Alpha Honor Med Soc* 2003;66:24-6.
- 71.** Nitardy CM, Duke NN, Pettingell SL, Borowsky IW. Racial and ethnic disparities in preventive care: an analysis of routine physical examination among adolescents, 1998-2010. *Clin Pediatr (Phila)* 2016;55:1338-45.
- 72.** Narla S, Heath CR, Alexis A, Silverberg JI. Racial disparities in dermatology. *Arch Dermatol Res* 2023;315:1215-23.
- 73.** Fawzy A, Wu TD, Wang K, et al. Clinical outcomes associated with overestimation of oxygen saturation by pulse oximetry in patients hospitalized with COVID-19. *JAMA Netw Open* 2023;6(8):e2330856.
- 74.** Green AR, Nze C. Language-based inequity in health care: who is the "poor historian"? *AMA J Ethics* 2017;19:263-71.
- 75.** Thayer WS. Osler, the teacher. *Bull Johns Hopkins Hosp* 1919;30:198.

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