

## Returning to (Electronic) Health Records That Guide and Teach



Over the last 2 decades, medical records in the United States have undergone rapid digitization. Unfortunately, electronic health records have not delivered on their promise of improving clinical workflow, or even information access, given the lack of system interoperability.<sup>1</sup> With the implementation of the Health Information Technology for Economic and Clinical Act in 2009, legislative mandates have added more layers of regulatory requirements to electronic health records.<sup>2</sup> Thus, it is no surprise that electronic health records are the single greatest driver of physician burnout.<sup>3</sup> As we observe the acceleration of innovations in artificial intelligence and a greater emphasis on patient feedback in modern health care, there is urgency for present-day electronic health records to evolve back to the core purpose of a medical record—to guide and teach physicians in their clinical decision-making.

In 1968, Larry Weed, MD (1923-2017) proposed a radical innovation in medicine that is now used universally. In his article, “Medical Records that Guide and Teach,” Dr. Weed first describes the problem-oriented medical record and the subjective-objective-assessment-plan note to provide structure to the medical record.<sup>4</sup> The problem-oriented medical record includes a database of information (eg, history, physical examination, laboratory data) followed by a problem list with an action plan and analysis for each. The subject-objective-assessment-plan note is similarly organized with a database of information (eg, patient-generated progress, laboratory or radiological data) followed by an updated problem list and a recalibration of the plan. The problem-oriented medical record was intended to encourage thinking about symptoms and complaints, until those complaints had a basis

for a diagnosis. Dr. Weed’s intention was that the problem list would include symptoms and complaints such as “unexplained headaches” or “recurring abdominal pain” until the clinician could rigorously defend the diagnosis.<sup>5</sup> He was concerned that simply listing suspected diagnoses would encourage anchoring and other cognitive mistakes. The subject-objective-assessment-plan note is also organized to enforce structure and reliability to our data collection and thinking.

Prior to Larry Weed, the written medical record was highly variable in comprehensibility, often solely containing a diagnosis and treatment, with no evidence of what problems were addressed, how diagnoses were made, and how treatments were decided upon. By adding structure to aid clinical thinking, physicians were more precise in their documentation, so reasoning and care could be easily reviewed and understood. Dr. Weed’s inventions are so universal that the vast majority of younger physicians are surprised to hear that a single individual invented the modern medical record.

Beyond a structured record, Dr. Weed was visionary in his belief that computers, and by extension, the electronic health record, would support clinical decision-making. He believed that training physicians to recall the hundreds of causes of a complaint was futile, and argued that clinicians should be aided in the questions they ask their patients so problems could be evaluated with thoroughness. Dr. Weed envisioned an information technology system where symptom complaints were paired with relevant questions and the related possible diagnoses based on the medical literature. He coined the term “Problem-Knowledge Couplers” and believed that this system would reduce bias, drive thoroughness, and increase diagnostic accuracy. His ideas on how the medical record and information technology can improve clinical care hold particular importance as we recognize the current limitations of the electronic health record.

While modern electronic health records have universally adopted the problem-oriented medical record and subjective-objective-assessment-plan note, the simple digitization of Dr. Weed’s paper record has not delivered meaningful improvements for clinical decision-making. Medical records within electronic health records, enabled by the copy/paste function, have become longer but not better. Inaccuracies and mistakes are simply pushed forward with documentation creep.

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Instead of supporting decision-making, the present electronic health record has evolved into a compliance system, billing tool, and medical-legal record. Rather than reducing cognitive burden, the electronic health record's constant documentation requests, checkboxes, and added alerts lead to alarm fatigue. There is an urgent need to reframe the role of electronic health records back to the fundamental principles espoused by Dr. Weed's original vision as a tool to improve physician communication, decision-making, and patient care.

As the problem-oriented medical record transformed the paper record, breakthroughs in artificial intelligence, machine learning, and data science hold similar promise. But these innovations will reach their full potential only if they can integrate into the electronic health record and support a framework that improves clinical thinking without de-skilling clinicians. The first applications for artificial intelligence will most likely center on computer vision embedded within the medical record. The ability for computers to process health care data (eg, dermatologic, endoscopic, pathologic, and radiologic images) is moving forward with startling speed, but should be seen as advanced tools, not a replacement for clinical reasoning.<sup>6</sup> Because the vast majority of artificial intelligence tools are trained using physician diagnosis as ground truth, feedback loops and recalibration processes within electronic health records are necessary to enable continuous improvement and mitigate inherent biases. While Health Level Seven Fast Healthcare Interoperability Resources is one set of international standards that enable some software interoperability among electronic health record systems and outside applications, these standards must be continually improved upon, supported, and adopted by electronic health record vendors so that third-party developers can integrate new solutions meaningfully into the medical record—software interoperability must extend beyond embedding hyperlinks within a dashboard.

Aside from computer vision, a patient's own health record data should be mined in real time to improve clinical decision-making. Real-time natural language processing of a patient's history would trigger additional contextualized questions for a more complete history and to identify diagnostic errors. These include more precisely identifying atypical presentations of common diagnoses and reducing heuristic errors such as premature closure. When considering diagnostic testing or a treatment plan, systems should suggest evidence-based recommendations and provide more prognostic information unique to the patient. Finally, we need more integrated data-visualization tools to combat the increasing volumes of available data.

In parallel with innovations in artificial intelligence, broader patient engagement and patient-reported outcomes is another important trend in health care.<sup>7</sup> The new electronic health record would be more open to patients, driving their engagement earlier in the care process prior to a physician appointment. Patients can do more than simply rehash their prior diagnoses, allergies, and medication list. Physician charting burdens could be offloaded by having the patient complete questionnaires relevant to their symptoms, with answers

populated directly into the electronic health record prior to a visit. Early experiences have shown that patient engagement with electronic health records (eg, OpenNotes) improves record accuracy without increasing physician workloads.<sup>8</sup> Patient-reported outcomes, a data source of enormous potential and value, require electronic health record integration with the information presented in a way that is actionable but not overburdening for physicians. Instead of online portals to simply make requests of physicians, future patient engagement with electronic health records should result in less administrative load on the physician.

In June 2017, Larry Weed, MD passed away in his Vermont home after a career where he tirelessly highlighted the limitations of the human mind, our collective imprecision, and the need for new tools. He unremittingly advocated for an information technology system to enhance patient care, reduce diagnostic errors, and successfully guide management and therapy. Although stated in 1968, his conclusion is still relevant today.<sup>4</sup>

“If we accept the limits of discipline and form as we keep data in the medical records the physician's task will be better defined, the role of paramedical personnel and the computer will be clarified, and the art of medicine will gain freedom at the level of interpretation and be released from the constraints that disorder and confusion always imposed.”

The solutions to misdiagnosis, which contributes to 10% of patient deaths according to the 2015 National Academy of Medicine's *Diagnostic Error in Health Care* report,<sup>9</sup> and the professional burnout epidemic, which now affects more than half of all physicians, rest on electronic health records returning to serve patients and physicians, not billing clerks and lawyers.

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