

ized. But information and knowledge do not equal wisdom, and it is too easy for nonexperts to take at face value statements made confidently by voices of authority. Physicians are in the best position to weigh information and advise patients, drawing on their understanding of available evidence as well as

their training and experience. If anything, the wealth of information on the Internet will make such expertise and experience more essential. The doctor, in our view, will never be optional.

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

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Can Electronic Clinical Documentation Help Prevent Diagnostic Errors?

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The United States is about to invest nearly \$50 billion in health information technology (HIT) in an attempt to push the country to a tipping point with respect to the adoption of computerized records, which are expected to improve the quality and reduce the costs of care.¹ A fundamental question is how best to design electronic health records (EHRs) to enhance clinicians' workflow and the quality of care. Although clinical documentation plays a central role in EHRs and occupies a substantial proportion of physicians' time, documentation practices have largely been dictated by billing and legal requirements. Yet the primary role of documentation should be to clearly describe and communicate what is going on with the patient.

Electronic prescribing appears to reduce the rate of medication errors, but the other benefits of electronic records are less clear.² We must ensure that electronic clinical documentation works effectively to improve care if more benefits are to be achieved. Yet

many questions about it persist. For example, can it be leveraged to improve quality without adversely affecting clinicians' efficiency? Will the quality of electronic notes be better than that of paper notes, or will it be degraded by the widespread use of templates and copied-and-pasted information?

A fundamental part of delivering good medical care is getting the diagnosis right. Unfortunately, diagnostic errors are common, outnumbering medication and surgical errors as causes of outpatient malpractice claims and settlements.³ EHRs promise multiple benefits, but we believe that one key selling point is their potential for preventing, minimizing, or mitigating diagnostic errors. Admittedly, evidence to support the existence of such a benefit is currently lacking, and our hypothesis runs counter to the sentiments and claims of many physicians, who argue that electronic documentation in its current incarnation is time-consuming and can degrade diagnostic thinking — by distract-

ing physicians from the patient, discouraging independent data gathering and assessment, and perpetuating errors.⁴ But we envision a redesigned documentation function that anticipates new approaches to improving diagnosis, not one that relies on the putative “master diagnosticians” of past eras. The diagnostic process must be made reliable, not heroic, and electronic documentation will be key to this effort. Systems developers and clinicians will need to reconceptualize documentation workflow as part of the next generation of EHRs, and policymakers will need to lead by adopting a more rational approach than the current one, in which billing codes dictate evaluation and management and providers are forced to focus on ticking boxes rather than on thoughtfully documenting their clinical thinking.

There are numerous ways in which EHRs can diminish diagnostic errors (see table). The first lies in filtering, organizing, and providing access to information. Making accurate diagnoses has

Leveraging Electronic Clinical Documentation to Decrease Diagnostic Error Rates.	
Role for Electronic Documentation	Goals and Features of Redesigned Systems
Providing access to information	Ensure ease, speed, and selectivity of information searches; aid cognition through aggregation, trending, contextual relevance, and minimizing of superfluous data.
Recording and sharing assessments	Provide a space for recording thoughtful, succinct assessments, differential diagnoses, contingencies, and unanswered questions; facilitate sharing and review of assessments by both patient and other clinicians.
Maintaining dynamic patient history	Carry forward information for recall, avoiding repetitive patient querying and recording while minimizing copying and pasting.
Maintaining problem lists	Ensure that problem lists are integrated into workflow to allow for continuous updating.
Tracking medications	Record medications patient is actually taking, patient responses to medications, and adverse effects to avert misdiagnoses and ensure timely recognition of medication problems.
Tracking tests	Integrate management of diagnostic test results into note workflow to facilitate review, assessment, and responsive action as well as documentation of these steps.
Ensuring coordination and continuity	Aggregate and integrate data from all care episodes and fragmented encounters to permit thoughtful synthesis.
Enabling follow-up	Facilitate patient education about potential red-flag symptoms; track follow-up.
Providing feedback	Automatically provide feedback to clinicians upstream, facilitating learning from outcomes of diagnostic decisions.
Providing prompts	Provide checklists to minimize reliance on memory and directed questioning to aid in diagnostic thoroughness and problem solving.
Providing placeholder for resumption of work	Delineate clearly in the record where clinician should resume work after interruption, preventing lapses in data collection and thought process.
Calculating Bayesian probabilities	Embed calculator into notes to reduce errors and minimize biases in subjective estimation of diagnostic probabilities.
Providing access to information sources	Provide instant access to knowledge resources through context-specific "infobuttons" triggered by keywords in notes that link user to relevant textbooks and guidelines.
Offering second opinion or consultation	Integrate immediate online or telephone access to consultants to answer questions related to referral triage, testing strategies, or definitive diagnostic assessments.
Increasing efficiency	More thoughtful design, workflow integration, and distribution of documentation burden could speed up charting, freeing time for communication and cognition.

always depended on thoroughness in gathering the patient's history, findings from the physical examination, and other data. Because information from patients' previous clinical encounters and tests will be more readily available with electronic than paper records, shifting to electronic systems could substantially improve clinicians' knowledge about the patient. The problem of having too much information is now surpassing that of having too little, and it will become increasingly difficult to review all the patient information that is

electronically available. However, one virtue of computerized systems is that they can display recorded information in various formats. Designers will need to leverage the "visual affordance" capabilities of EHRs to facilitate the aggregation, trending (of a patient's weight or renal function, for instance), and selective emphasis or display of data so as to facilitate rapid judgments.

The second way in which EHRs can foster thoughtful assessment is by serving as a place where clinicians, together with patients, document succinct evaluations,

craft thoughtful differential diagnoses, and note unanswered questions. Free-text narrative will often be superior to point-and-click boilerplate in accurately capturing a patient's history and making assessments, and notes should be designed to include discussion of uncertainties. Documentation of clinicians' thinking must be facilitated by streamlined text-entry tools such as voice recognition. Exam-room layouts, screen placement, and workflow should be redesigned to enable patients and physicians to work together on the same side of the

screen. Follow-up questions should be documented in ways that facilitate tracking and sharing with future providers and consultants.

Third, EHR systems should facilitate the documentation of evolving history and ongoing assessment. Rather than requiring a record to start from scratch with each new physician or encounter, electronic notes should follow an evolutionary paradigm — especially for chronic conditions. Putting this strategy into effect will require us to go beyond reflex criticism of copy-and-paste methods to a search for creative approaches — based on functions such as annotation, tracking of changes, and threads — that not only enable information to be carried forward but also allow it to be continuously refined and updated.

Fourth, a better approach to managing problem lists is needed. The failure to effectively integrate the creation, updating, reorganization, and inactivation of items on problem lists into the clinician's workflow has been one of the great failures of clinical informatics. Although such lists are vital for ensuring that important problems are not overlooked, clinicians will not maintain them unless they are made more useful and easier to incorporate into clinical conversations and documentation. Tools for easily reordering these lists and allowing specific providers (for instance, specialists or nonphysician staff members) to work selectively with a subset of problems are necessary features that most current EHRs lack.

Fifth, EHRs should ensure fail-safe communication and action in the areas of ordering tests and

tracking the results. These steps are central to diagnosis, yet current systems often separate these functions from clinical note taking. Tracking tests is integral to documenting the acknowledgment and assessment of results and the subsequent actions taken and is vital to ensuring that important results don't fall through the cracks. Better tools are needed to efficiently weave results management into EHR documentation and workflow and to link

Systems developers and clinicians will need to reconceptualize documentation workflow as part of the next generation of EHRs, and policy-makers will need to adopt a more rational approach.

laboratory results to problem lists and medications.

Sixth, electronic systems should incorporate checklist prompts to make sure that key questions are asked and relevant diagnoses considered. Despite renewed interest in safety checklists, diagnostic checklists have so far been neither clinically helpful nor widely used. Yet human memory alone cannot guarantee that key questions will be asked and important diagnoses considered and accurately weighed. Decision-support software and predictive models have also had limited use to date, but both could become important if their design were more practical and evidence-based — if, for example, they automatically generated differential diagnoses that facilitated both documentation and decision making.

Finally, electronic systems

should do more to help with follow-up and the systematic oversight of feedback on diagnostic accuracy.⁵ Clinicians need a reliable, automatic follow-up system that goes beyond the provision of simple, one-size-fits-all instructions to “return in 4 months” or “call if not better.” For example, a button embedded in a note might activate automated follow-up calls after a physician-specified interval. Computerized documentation could also be used

to educate patients about symptoms to watch for. Automated feedback that spans patients and providers could convert our current “open-loop” system, in which feedback is often lacking, to one in which outcomes can be used to systematically learn from diagnostic decisions and errors.

Clinicians need to take back ownership of the medical record as a tool for improving patient care; such a move could have many benefits, including reducing the frequency of diagnostic errors. External requirements for EHRs should be minimized, and physicians, members of their support staff, and patients should be engaged in reengineering documentation, with the goal of building a more distributed, reliable, and content-rich yet succinct and efficient system. Diagnosing illness is one of our most

important professional responsibilities, and patients justifiably expect us to perform this difficult task well. Electronic documentation represents a pivotal tool that can help us to fulfill this responsibility.

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

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