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**White Paper:  
The Future of Electronic  
Health Records**

# Introduction

Ten years ago, one doctor in 10 kept digital records on their patients. The other 90 percent made notes on paper and stored them in manila folders on shelves and in filing cabinets.

**Paper records had some obvious disadvantages. They took up space, they were difficult to share with other physicians, hospitals, and insurance companies.**

Patients switching doctors, hospitals, or places of residence could not easily bring their records with them.

In 2009, in the wake of the financial crisis, the federal government acted to remedy this situation. The Health Information Technology for Economic and Clinical Health (HITECH) Act set aside \$27 billion of federal funds to encourage health care providers to adopt electronic health record (EHR) systems, and more money was subsequently made available for training and assistance. All told, the federal government spent about \$35 billion on bringing the U.S. health care industry into the electronic age. The program was highly successful in that it made EHRs commonplace. Today, nine in 10 doctors have adopted them. “We have made a colossal transformation in a relatively

short period of time,” says Lloyd Minor, MD, Dean of Stanford Medicine. “But we have not realized the potential benefits of the data that exist in electronic health records.”

Indeed, many of the benefits of EHRs have been elusive. As implemented today, EHRs have too many of the drawbacks of paper records. The promise of being able to send them easily from one office to the next has been hampered by a lack of standards and perverse incentives in the health care marketplace to hoard information. Worse, EHRs, with their cumbersome user interfaces and onerous billing



requirements, have become a burden to doctors and nurses, contributing to burnout and information overload among physicians, and degrading patient care. “A clinician will make roughly 4,000 keyboard clicks during a busy 10-hour emergency-room shift,” writes Abraham Verghese, Professor for the Theory and Practice of Medicine at Stanford Medicine, in the *New York Times Magazine*.

**“In the process, our daily progress notes have become bloated cut-and-paste monsters that are inaccurate and hard to wade through.”**

Although EHRs have many problems, there are reasons to believe that they will eventually start living up to their promise. With some changes in technology, regulations, and attention to training, EHRs may soon serve as the backbone of an information revolution in health care, one that will transform health care the way digital

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**There are a lot of reasons to be optimistic that we will be able to have both high-tech and high-touch medicine.**

*-Lloyd B. Minor, MD  
Carl and Elizabeth  
Naumann Dean  
Stanford University School  
of Medicine*



**A clinician will make roughly 4,000 keyboard clicks during a busy 10-hour emergency room shift.**

*-Abraham Verghese, MD, MACP  
Linda R. Meier and Joan F. Lane  
Provostial Professor  
Stanford University School  
of Medicine*

technologies are changing banking, finance, transportation, navigation, Internet search, retail, and other industries. Regulations are being put in place that will put patients in control of their own health records and facilitate the sharing of data among health care organizations. Engineers are developing artificial intelligence technology that can “take notes” for physicians, summarize the important points from a patient’s record, and assist in medical decision making. Apple’s recent app for medical information, which gives third-party developers the ability to pull information from health records, is expected to be the first of many developments that brings health care data to patients’ fingertips. “There are a lot of reasons to be optimistic that we will be able to have both high-tech and high-touch medicine,” says Minor.

This white paper is intended to provide a roadmap for this transformation. We will explore the current state of the EHR, reporting the results of a survey by Stanford Medicine and The Harris Poll

of physicians and their experiences and attitudes with EHRs.

**Most important, we will offer some concrete suggestions for solving the problems that physicians confront today with regard to EHRs and how the medical profession can fully leverage the power of medical data over the next decade.**

We will distill the key ideas from a symposium of health care industry professionals, hosted by the Stanford University School of Medicine on June 4, 2018, including a vision of how EHRs could contribute positively to health care and medicine by 2028, how to exploit the best ideas from the tech industry to make it happen, and immediate and practical steps that health care professionals can take towards this vision.



# The Vision for 2028

## **What would a health care system with a fluid movement of information and state-of-the-art technology look like?**

In an ideal world, physicians, nurses, and other health care practitioners would simply take care of their patients without having to think much about health records at all. They would devote most of their time and attention to interacting with the patient. Whatever the outcome of the examination, relevant information would flow seamlessly to all parties necessary to handle the patient's progress through the health care system—to insurance companies, hospitals, other physicians, and the patient.

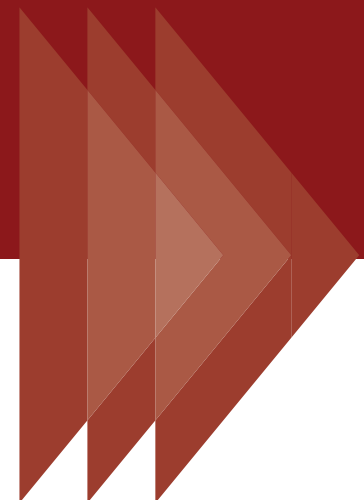
In terms of the electronic health record itself, this means that the EHR would be populated with little or no effort. When the nurse or doctor takes vital signs, these would be automatically uploaded. In the exam room, an automated

physician's assistant would listen to the interaction between doctor and patient, and, based on the communication in the room and verbal cues from the clinicians, record all relevant information in the physical exam.

The automated physician's assistant would also offer options for taking action. It would use artificial intelligence (AI) technology to synthesize medical literature, the patient's history, and relevant histories of other patients whose records would be available in anonymized, aggregated form. When the assistant hears a complaint from the patient, the EHR would populate different possible diagnoses for the clinician to investigate. It would also be sensitive to an individual patient's characteristics—lifestyle, medication history, genetic makeup—and bring all the relevant medical knowledge to bear on what would be best treatment options for a particular patient.

## **This kind of medical decision-making support would bring Precision Health into the doctor's practice, with the goal of keeping people healthy.**

Knowledge would flow not only to the clinician that is caring for a particular patient, but also to public health officials interested in the population at large. We can imagine a future where EHRs are part of a rich, seamless data stream that facilitates doctor-patient rapport even as it delivers real-time diagnostic support. Clinicians would be free to do what they do best: use their brains and interact with other human beings.



## 2018: The Current State of Electronic Health Care Records

The current reality of EHRs is less inspiring. As a starting point, The Harris Poll conducted a survey on behalf of Stanford Medicine that explores the attitudes physicians have about EHRs in their practices. The online survey took place between March 2 and March 27, 2018. Respondents were 521 primary care physicians in the United States, whose medical specialty was defined as Family Practice, General Practice or Internal Medicine, recruited through the American Medical Association lists. Results were weighted to bring gender, region, and medical specialty into line with actual proportions of doctors in the country. They were licensed to practice in the U.S. and had been using their current EHR system for at least one month.

**When EHRs were first introduced, the hope was that they would liberate patient health information and would lead to better insights and care.**

But primary care doctors are clear in the survey and in conversation that the opposite has happened: EHRs too often get in the way of better care. In the Stanford Medicine-Harris poll, doctors report that more than 60 percent of their time spent on behalf of patients is actually devoted to interacting with EHRs. Half of office-based primary care physicians think using an EHR actually detracts from their clinical effectiveness. Writes Verghese:

**“In America today, the patient in the hospital bed is just the icon, a placeholder for the real patient who is not in the bed but in the computer. That virtual entity gets all our attention.”**

Christine Sinsky, MD, Vice President of the American Medical Association in charge of professional satisfaction, says that these results accurately reflect her experience as a physician. “I’ve made site visits to over 50 practices. I’ve given

more than 200 presentations at society meetings, health system meetings, grand rounds at academic medical centers. The conversations I’ve had in those places align with findings of the Stanford Medicine survey,” she says. “If anything, they underestimate the degree of professional angst and moral distress that physicians have experienced as they deal with this tool.”

The angst comes when physicians have to make trade-offs between the amount of time they spend with their patients, the amount of time they spend creating documentation of their encounter with each patient, and the amount of time they have left for families and friends.

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*-Christine Sinsky, MD  
VP of Professional Satisfaction  
AMA*

### How Physicians Are Spending Their Time Per Patient



**11.8 minutes**

Interacting directly with a patient during a visit



**8.3 minutes**

Interacting with the EHR system during a patient visit



**10.6 minutes**

Interacting with the EHR system outside of a patient visit



**18.9**

Total time spent in EHR



**62%**

of time spent in the EHR per patient



**They actually get in the way of the patient-doctor interaction. We are taking our doctors and nurses and making them into data-entry clerks. It's not fun, it contributes to burnout, it's non-value-added time.**

*-Marc Harrison, MD  
President and CEO  
Intermountain Healthcare*

**Whereas previously a physician might dictate a brief medical note, they are now often responsible for the clerical work of formatting electronic notes, which increases the time spent on documentation.**

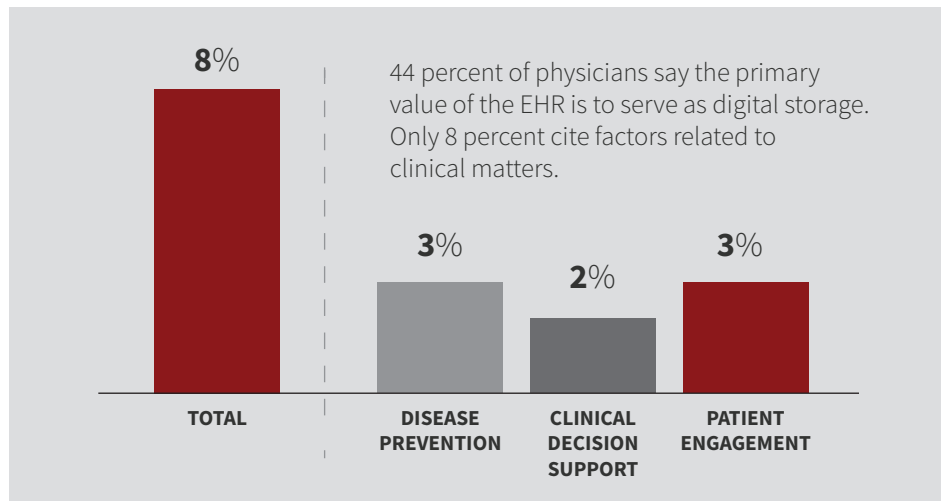
Medicare and Medicaid reporting requirements have made this problem worse by requiring physicians to document every action taken on behalf of the patient. "As good as the EHRs are as they exist right now, they're not nearly as intuitive as they should be," says Marc Harrison, MD, President and CEO of Intermountain Healthcare. "They actually can get in the way of the patient-doctor interaction. As a nation, we are taking our doctors and nurses and making them into data-entry clerks. It's not fun, it contributes to burnout, it's non-value-added time." Few physicians see any clinical value in their EHRs. Only 8 percent cite factors related to clinical

matters, such as disease prevention and management (3 percent), clinical decision support (3 percent), and patient engagement (2 percent). On the other hand, 44 percent of physicians say the primary value of EHRs is to serve as digital storage.

Where do we go from here? Nearly three-quarters of doctors in the poll say the first order of business should be improving the user interface of EHRs to enhance efficiency and reduce screen time. Half want to see data entry shifted to support staff and 38 percent would welcome a highly accurate voice recording technology that would act as a scribe during patient visits.

The poll also indicated some long-term concerns. More than 40 percent of doctors would like to see in the next decade EHRs transformed into a powerful tool that helps with clinical

Physicians in their practice have to synthesize a great deal of information, and EHRs often make this task more difficult, says Sinsky. EHRs are often designed with dropdown menus that increase the cognitive workload on the physician. Doctors report anecdotally being able to see fewer patients, having to spend more time working, and feeling dissatisfaction with the work they do.



Source: Stanford Medicine-The Harris Poll

care, predictive analysis to support disease diagnosis and prevention, and population health management. About a third would like to see financial information integrated into the system so that patients can weigh the costs of their care options.

The top area of interest among respondents was “interoperability”—the need to make patient data available easily and readily to professionals from all parts of the health care system for the benefit of the patient.



**While less than half of physicians feel that their EHR enables quality care, we’ve come across a half dozen organizations where over 75 percent of their physicians feel that their EHR enables high-quality care.**

*-Taylor Davis  
EVP, Analysis and Strategy  
KLAS*

**More than two-thirds of doctors listed this as the No. 1 issue to fix in the long term. To do that, we have to have a radically different health IT infrastructure—one that promotes data sharing and is open to developers.**

## The Importance of Managing Change

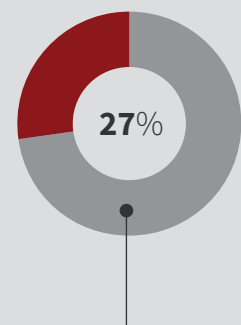
Changes in technology, regulation, and the business of health care could transform medicine in the next decade. In the short term, however, physicians can take some steps to alleviate the burden on their practices from EHRs. Following best practices for implementing EHRs can improve physician satisfaction and improve patient care. Judging from the experience of some of the best-run health care provider organizations, the most practical and significant step physicians can take is to better learn how to use their current EHR systems.

The amount of training physicians get in their EHRs has a big impact on their own levels of satisfaction. Although satisfaction is low on average among physicians, surveys by KLAS, a health care information-technology research firm, show wide variation in satisfaction levels among organizations, which suggests that some are managing their use of EHRs better than others. “While less than half of physicians feel that their

EHR enables quality care, we’ve come across a half dozen organizations where over 75 percent of their physicians feel that their EHR enables high-quality care,” Taylor Davis, Executive Vice President for Analysis and Strategy at KLAS Enterprises, told the Stanford Medicine symposium.

These organizations are not necessarily the ones that have been most aggressive at adopting the latest technology. Instead, they emphasize teamwork and training—and they’ve devoted higher than average amounts of time to training physicians to use EHRs. “Their physicians realize that it’s a myth that the EHR is going to be intuitive enough to use out of the box,” said Davis. “It’s not their technology, it’s their change management.”

### Short-Term EHR Fixes



1 of 4 PCPs believe there should be better training on how to maximize the value of their EHR

Source: Stanford Medicine-The Harris Poll

Some organizations are trying to limit physician training for using EHRs to an hour or two, while others put them through two-week programs. “What’s clear is that the organizations with the least physician burnout are the ones where physicians have had longer training sessions,” says C.T. Lin, MD, Chief Medical Officer at University of Colorado Health.

**“And it’s not about how to use the EHR. It’s about how we provide care, with the EHR as one of the main tools.”**

A few years ago, Lin and his colleagues at Colorado Health realized that many of the physicians and nurses at its 400 clinics were dissatisfied with their EHRs. They started an experiment, called Sprint, in which they sent an 11-person team to one clinic at a time to perform custom training and development. The goal of the Sprint team was to address physician burnout and help the clinic work better as a team. The team was composed of one physician informaticist, one nurse informaticist, one project manager, four analysts who can build things, and four trainers.

When the team would show up at a clinic, physicians and administrators would often insist that they needed nothing less than a complete overhaul of the systems they use for keeping

electronic patient records. Often, however, their current systems already provided much of the specific features and functionality they needed. “Typically, three-quarters of what they ask for the system already does,” says Lin. “We would say, ‘Oh, you know the 17 clicks you have to click to perform that task? Try that button instead.’ And they would say, ‘How long have we had one of those?’”

**“ People get this sort of empowered feeling of like, now that you’ve left, we can carry on the work because you’ve shown us a better way of working. That’s the surprising finding out of Sprint.**

*-CT Lin, MD  
Chief Medical Information Officer  
UCHealth*

**The reason clinicians didn’t know about features they needed is because they didn’t get adequate training at the outset, or they weren’t brought up to speed when new systems were rolled out or incremental changes were made.**





For this reason, each Sprint team comes with four trainers who bring physicians and other practitioners up to speed. In many cases, management failed to design the clinic's workflow to take advantage of the capabilities of the EHR. About 30 percent of a Sprint team's job is to build things that the clinic's current records system doesn't do. These can include making up a flow sheet or a new kind of synopsis report—anything that a physician needs for their specialty but for one reason or another never got. The team generally delivers these projects a day or two after a physician asks for them. “People feel like, at the end of those two weeks, someone cares,” says Lin.

The Sprint team also inculcates better habits of communication among members of clinical teams. For instance, they introduce the practice of holding team huddles every day. “People get this sort of empowered feeling of like, now that you've left, we can carry on the work because you've shown us a better way of working,” says Lin. “That's the surprising finding out of Sprint.”

Colorado Health assembled its first Sprint team by borrowing from its existing staff. Early on, executives considered disbanding the team, but its reputation had already spread to department heads, who were eager to know when they would be seeing a

Sprint team in their clinic. Two years after the experiment was started, Colorado Health put together a second team. The SWAT-team approach has its drawbacks. It takes resources and suffers from a lack of scalability. Even with two teams and a rapid-fire ethos, it will take 10 years for Colorado Health's two teams to work through 400 clinics. An alternative, says Lin, is to be strategic about which pain points to target. If an organization can't afford to create a SWAT team of 11 people for two-week stints, it may be possible to construct a team of, say, three people who can accomplish half as much. “If the *New York Times* publishes a béarnaise sauce recipe that's not in your fridge, you have to work with what you've got,” says Lin. “Can I get to 80 percent of the deliciousness using what I already have?”

**Other health care organizations have used up-front training to achieve better physician satisfaction.**

NorthShore University HealthSystem created an onboarding program for physicians that called for four to six hours of training on their Epic EHR systems. Within two weeks, physicians also completed three full days of one-on-one training by clinical trainers with backgrounds primarily in nursing. The amount of required training time is adjusted if physicians can show

proficiency with an EHR and completed their residency in an environment that uses Epic. Training time can also be extended as needed.

NorthShore's clinical trainers typically meet recently hired physicians at the physician's office one hour prior to the first scheduled patient. The trainers get the physicians set up in the system and answer questions. Trainers stay the entire day to provide one-on-one support. This process is repeated on the second day. The trainer returns the following week to ensure that there are no remaining concerns about how to use the EHR.

Greater Hudson Valley Health System, a community hospital, got good results by enlisting physicians to help them prioritize development tasks. This allowed them to reduce the time to implement changes requested by physicians to within two days. Greater Hudson Valley also established a governance process that gave the organization some nimbleness in responding to health crises, such as a measles outbreak in 2018. This idea was to allow for changes in workflows in response to a crisis without introducing confusion. Their solution was to have analysts meet regularly with clinicians to determine the top five issues they want action on. The hospital's information technology staff also began

to use Epic's analytics tools to measure productivity, to find the best workflow that increases the quality of patient care. During the measles outbreak, IT met with the hospital's lawyers, quality-control personnel, nurses, and infectious disease experts to determine how best to modify EHRs to make them more useful in managing the crisis. The changes took a matter of hours to implement.

Central to the success of Great Hudson Valley's program is making analytics data available to physicians. Since the clinicians helped narrow down the list of priorities, it is important that they are able to access data they need to make appropriate decisions.

**For physicians and health care organizations that handle Medicare and Medicaid patients, the federal government is beginning to move away from some of its more onerous requirements for documenting the patient-doctor interaction.**

Its recent "Patients Over Paperwork" initiative, announced in June 2018, would consolidate some Medicare fee structures for outpatient visits, reduce clerical tasks associated with coding and billing administration, and allow doctors and other practitioners to focus on documented changes since the patient's last visit

rather than re-documenting information. The Centers for Medicare and Medicaid Services (CMS) estimates that the new regulations would save nearly 30,000 hours spent on billing administration. If these changes are adopted, they might relieve some of the burden on physicians in the next few years.

## Inefficiencies in Billing and Reimbursement

Physicians and patients alike have their favorite anecdotes about the problems of the U.S. health care system. Many of these stories center on the process of billing and reimbursement. Terry Gilliland, MD, Senior Vice President and

Chief Health Officer at Blue Shield of California, told the Stanford Medicine symposium that overhead for billing transactions accounts for 6 percent of a payer's costs. One practice reported that it takes a trained registered nurse 45 minutes on average to get insurance pre-authorization for a CT scan. Another practice reported that, over the course of dealing with all of their different payers and care organizations, they are required to fill out 200 different forms. In general, health care billing in the U.S. is characterized by a pervasive fear of technology and inefficiency.

**"This is an extremely fragmented manual process that is not benefitting many people," says Gilliland.**

One problem is a lack of automation of manual processes. A physician's office might fill out a claims form on paper and fax it to the payer, who would pay someone to transcribe it into their system. Then the payer will identify information that is missing in the form but is needed to process a claim. The form then gets faxed back to the doctor's office, which adds it and faxes it back. The payer then has to pay someone to transcribe the information into the system. These kinds of inefficiencies drive up the cost of transactions.

### Inefficiencies In Billing and Reimbursement



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**Despite the rapid adoption of EHRs, there has not been a commensurate reduction in fragmentation and automation in the realm of billing.**

This is ironic considering that the conventional wisdom among physicians is that billing is the primary purpose of EHRs in the first place. Standards for Application Programming Interfaces (APIs), which allow software from different devices to exchange information securely and efficiently, may help alleviate some inefficiencies in billing. (We'll discuss APIs further below.) For instance, an API may give a payer access directly to the information it needs to process a claim, rather than having to exchange faxes with the doctor's office. The change in recent years from transaction-oriented reimbursement schemes, in which health care providers are paid for, and have to document, each act they perform, to those that emphasize the value of health care services to the patient, has lowered the volume of forms and documentation somewhat. Fewer practices are required to document things that they've done to get reimbursement.

**Gilliland identified some practical, short-term steps to help streamline billing:**



1. Physicians: Junk the fax machine. Every doctor's office ought to embrace electronic communications. "For the 30 to 40 percent of American practices that are unwilling to give up the fax machine and are unwilling to receive electronic payments, perhaps there has to be a culture shift," Gilliland told symposium attendees. Federal and private payers may be able to help in this regard by providing incentives. Even simple changes such as physician practices shifting to a payer's portal website, rather than insisting on using faxes and paper payments, would create significant efficiencies.



2. Physicians must start accepting electronic payments. Many doctors' offices are reluctant to allow payers to transfer funds electronically for fear that they would also be able to make withdrawals.



3. Payers need to support physician practices. Providing in-kind support to providers in exchange for sharing clinical and claims information would help practices adopt technology. For instance, payers could provide a dashboard back to providers so that they can get analytical insights about their utilization and costs. This would have the added benefit of helping them make the transition to value-based billing.



4. Create common standards across payers. If health care insurers and other payers agree on a common set of data and formats, they would greatly reduce the bureaucratic burden on small practices who now must fill out so many different forms.



5. Streamline pre-authorization. Decreasing the hassle and time to process claim pre-authorizations would reduce inefficiencies and

enhance patient care. Physician offices should get instant feedback on pre-authorizations. It should not take 45 minutes of a nurse’s time on the phone to get authorization.

## Artificial Intelligence Can Improve the Doctor-Patient Interaction

Artificial intelligence holds great promise for alleviating some of the burden on physicians of working with electronic health records and freeing the physician to focus on the patient during an examination rather than on filling out forms.

**AI can potentially help physicians get up to speed on a patient’s clinical history, take notes and document the visit with the patient, and support medical decisions about what to do next.**

A clinician, upon walking into an examination room, needs knowledge about the patient’s background and history. The EHR as currently implemented in many organizations is not designed to impart knowledge. It contains a great deal of information, but it can be difficult for physicians to locate specific information needed for informed decision-making. The quality of much of the information is poor—much of it is put there for non-clinical

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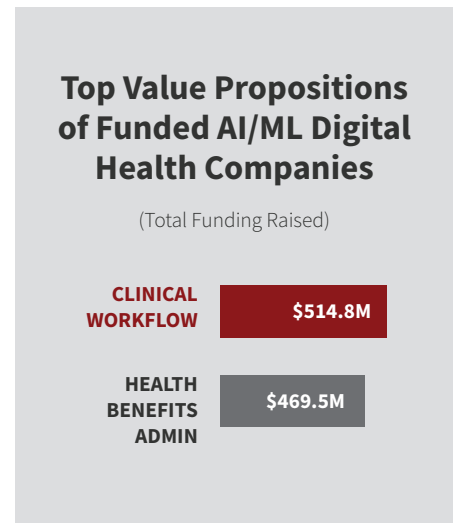
**If you could document just what you need to take care of the patient, the volume of notes in an EHR would shrink by 70 percent.**

*-Paul Tang, MD, MS  
Chief Health Transformation Officer  
IBM Watson Health*

purposes, such as documenting patient-doctor interactions with billing codes to satisfy regulators and insurers. “If you could document just what you need to take care of the patient, the volume of notes in an EHR would shrink by 70 percent,” says Paul Tang, Vice President and Chief Health Transformation Officer at IBM and a symposium participant. All that extra information obscures whatever useful information the EHR contains, and makes the doctor’s job harder.

Reading a patient’s record in the EHR and gleaning insight from it is a high-level cognitive task. “You wouldn’t ask

a medical student to do it or you’d get back a ton of stuff,” says Tang. He and others are working on natural language processing technologies that can read

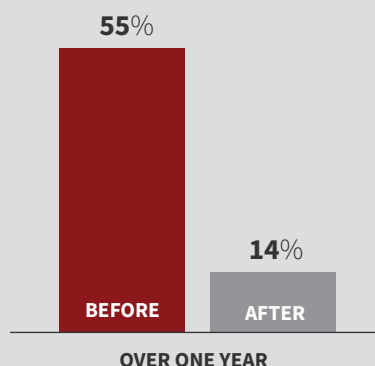


Source: Rock Health

the text and data on the record and use machine learning algorithms to choose what information is relevant. The act of writing a note is also a high-level cognitive task: it requires a synthesis of the clinician’s experience in the exam room, which includes not only the words that are spoken in conversation but also non-verbal cues and medical judgements in the physician’s head. Clinicians used to write succinct notes on paper records. Now they too often use the copy-and-paste function on their computers to add excessive amounts of information, which makes it that much harder to find what’s relevant.

## Physician Burnout

Over the course of one year there was a decrease in physician burnout at the University of Colorado Health due to the addition of more medical assistants to help physicians with note entry.



Studies show that physicians who use medical assistants to act as “digital scribes” and record the content of the patient-doctor interaction show far more satisfaction and lower rates of burnout. University of Colorado Health experimented with increasing the ratio of Medical Assistants (MAs) to physicians, from 0.4 MAs per physician to nearly two. Before the physician enters the room, an MA spends 20 minutes talking with the patient, updating the medical records and handling minor medical issues, such as vaccines and screenings. When the physician walks in, the MA stays in the room, acting as a scribe during the exam. They found that over the course of a year, this approach went a long way to relieving physician burnout: the metric they use to measure physician burnout declined from 55 percent to 14

percent. Assigning two people for each physician to act as scribe may not be a cost-effective solution, however.

**AI researchers are working on automating the job of scribe. Google and Stanford Medicine have been working for more than a year on a digital scribe project that would listen to the dialogue in a patient visit and take notes.**

The idea is not merely to take a transcription, but rather to knit the dialogue into a narrative. In the study, each doctor wears a microphone to capture conversations with patients, which are used to train machine-learning algorithms in getting the gist of a doctor-patient interaction. The goal is to train the algorithm to generate a pithy progress note.

**Google researchers say that its scribe can capture complex conversations typical of a patient-doctor conference even when family members and other practitioners are present in a noisy environment.**

AI can also potentially assist doctors in making medical decisions at the end of a patient visit. For instance, if a patient who is already on medication for hypertension comes into the doctor’s office with high blood pressure, what should the doctor do: increase the

dosage or try another drug altogether, and if so, which one? Doctors often have to make these kinds of decisions with incomplete information on the patient or on population studies of the drug’s efficacy. The physician then needs to do considerable research to determine the best medical course of action. An AI assistant that could take in relevant information about the patient in the EHR and combine it with a review of the medical literature could save the doctor a great deal of time.

In a study recently published in *Nature Digital Medicine*, researchers at the University of California, San Francisco, University of Chicago Medicine, Stanford Medicine, and Google used an advanced algorithm to predict unexpected readmissions, long hospital stays, and in-hospital deaths among 216,000 adult patients using data from their EHRs. The study suggests that machine-learning algorithms can make sense of messy electronic health record data, including unstructured clinical notes, errors in labels, and large numbers of input variables, to make predictions about patient health. Another study at Stanford Medicine uses algorithms to sift through large databases, including electronic health records, to detect patients who likely have a certain genetic condition that can lead to a fatal heart attack at a premature age. A combination of AI and information

from patient records could also advance the ball on Precision Health.

**Based on an individual's characteristics, AI could draw on sources of big data to offer personalized treatment recommendations, based on:**

1. The patient's past medical history
2. Genomic information
3. The way the patient metabolizes certain drugs
4. Relevant medical literature
5. Similar patients in the population
6. Environmental and social factors

Intermountain Healthcare, for instance, is studying the clinical and economic implications of using genomics in the treatment of behavioral health. It is currently using genomics in the care of people with depression—specifically to determine which antidepressants at which doses will be most effective for a patient based on their particular drug metabolism. The company is planning similar studies for anti-psychotic and bipolar patients. Combining genomics with machine learning could be a powerful predictive tool.

An AI-based decision support system

for individual doctors could serve as a window to data from many other sources, and could be a major tool in preventive and personalized health.

## An App-Based Ecosystem Can Put Patients at the Center

Perhaps the biggest disappointment of EHRs is that they are still to a large degree static. Although they store data electronically, that data is still trapped within the institutions that gather it. The next step in the digitization of health care, symposium participants agreed, is to free up this information in ways that enhance patient health while protecting privacy. The goal is to leverage data in the EHR to enhance patient care. This should happen in an information marketplace that empowers patients and health care providers to configure their own EHR experiences and workflows.

Harris Poll respondents overwhelmingly called for greater interoperability of data in EHRs. In other words, the information in EHRs should pass seamlessly among health care organizations and patients. This includes all the ways patient records are currently exchanged among providers and payers and patients, but also new ways that would enhance patient care. For instance, aggregate data from EHRs would help

in determining what medical resources should be deployed strategically across a population to help manage risks. “When predictive models are enriched by clinical data, they are richer and more accurate,” says Rishi Sikka, MD, President of System Enterprises, Sutter Health. If physicians can make more accurate predictions, they can intervene in meaningful ways to prevent illness.

Free movement of data would also improve patient health by eliminating unnecessary tests. Whenever a blood test is done because the records of a previous test were unavailable, or

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**When predictive models are enriched by clinical data, they are richer and more accurate.**

*-Rishi Sikka, MD  
President, System Enterprises  
Sutter Health*

whenever an x-ray is taken because a previous image was not readily available, patients are exposed to undue risk.

A lack of available information also

makes it more difficult to make good medical decisions. Physicians are often in the dark about what their patients do after they leave the examination room. A doctor may not know, for instance, whether a patient with diabetes has filled a prescription for insulin, even though this information is critical to the patient’s health. “Typically, information does not go back from pharmacy to doctor,” says Roy Beveridge, Chief Medical Officer of Humana. “There’s no feedback loop. This is simple to do if there’s connectivity,” says Beveridge. “It’s why interoperability is so important.” Even organizations that have a greater than usual need to exchange

information struggle with interoperability. A survey published in July 2018 in JAMIA of 68 hospitals found that even those organizations that frequently shared patients didn’t do very well at exchanging records. Of 63 pairs of hospitals studied, 23 percent reported worse information sharing between the hospitals with which they regularly share patients, with 17 percent reporting better sharing and 48 percent indicating no difference. “New policy efforts, particularly those emerging from the 21st Century Cures Act, need to explicitly pursue strategies that ensure that [highest shared patient] providers engage in exchange with each other,”

conclude authors Julia Adler-Milstein of University of California, San Francisco, who spoke at the Stanford Medicine symposium, and Jordan Everson of Vanderbilt.

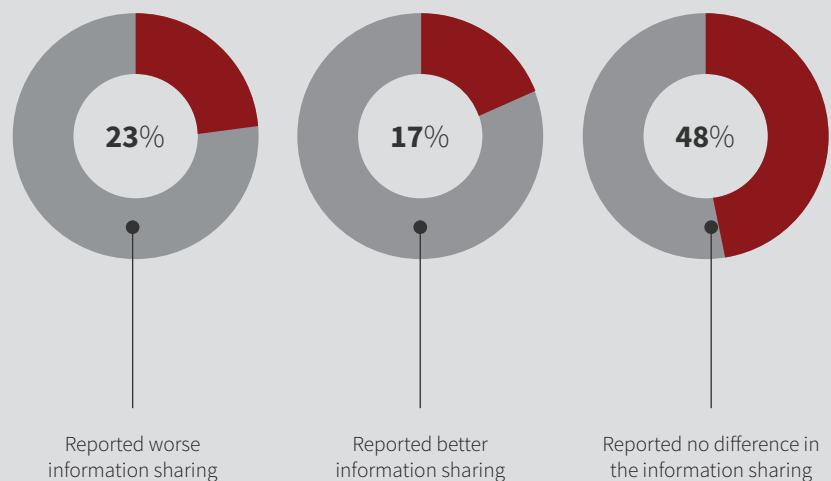
One obstacle to the free flow of information is perverse incentives in the businesses that deal with EHR systems. Health care organizations that gather data about patients have a proprietary interest in that data—they want it to flow only if they are compensated for it. “Unless there’s a free exchange of data, your hospital believes that its data is valuable to them, and they’re not releasing it to the



**This is simple to do if there’s connectivity, it’s why interoperability is so important.**

*-Roy Beveridge, MD  
Chief Medical Officer  
Humana*

### Out of 63 Pairs of Hospitals Studied That Regularly Share Patients



Source: Journal of the American Medical Informatics Association

ophthalmologist or the pharmacy,” says Beveridge.

**“If no one is sharing information, this simple feedback loop doesn’t occur, because everyone’s trying to maximize their little bit of money.”**

Congress acted in 2016, with the passage of the 21st Century Cures Act, to fix the lack of interoperability by authorizing HHS to investigate cases in which patient information is not shared and imposing penalties. “It didn’t escape Congress that some of this information wasn’t being shared for a variety of reasons and that people didn’t have health care on their smartphones,” says Don Rucker, MD, the National Coordinator for Health Information Technology at the Office of the National Coordinator for Health IT,

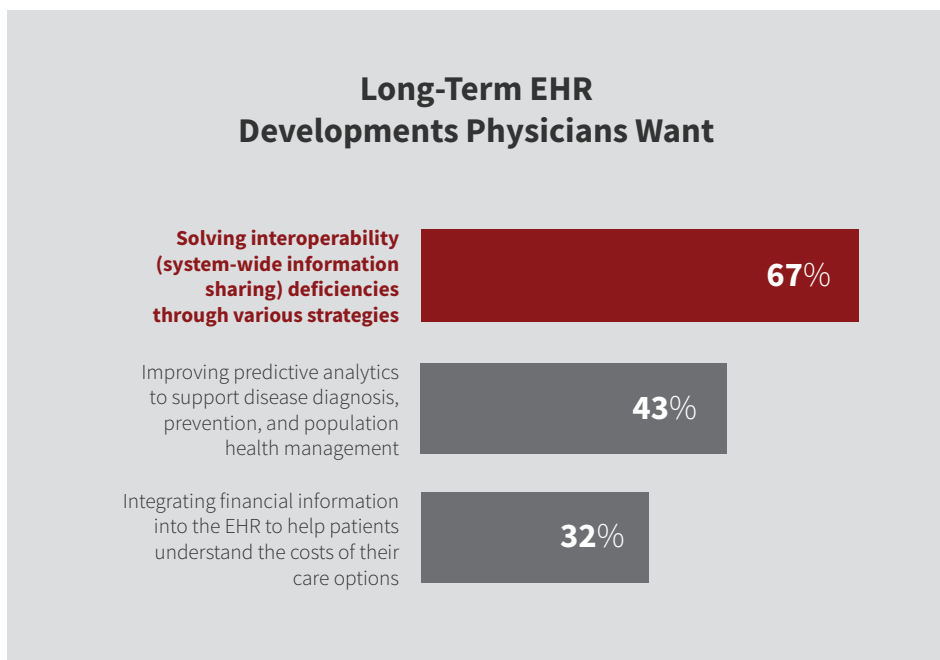
part of the U.S. Department of Health and Human Services (HHS). Rucker’s office is currently working to promulgate rules that flesh out the provisions of the Act by defining permissible types of information blocking—instances when a business can legally refrain from sharing information—and establishing rules for open APIs. “We believe those rules will be powerful,” says Rucker.

Another obstacle is concern over privacy. Currently the practice of handling patient medical records is governed by a combination of state rules and the Health Insurance Portability and Accountability Act of 1996, or HIPAA. Devised in the early days of the AIDS crisis to ensure the privacy of medical diagnoses, HIPAA forbids dissemination of patient data without the permission

of the patient except under specific exceptions, such as some circumstances in which health care providers need to exchange data about patients they have in common. Since some state laws are more restrictive, some people are hesitant to exchange data even when they are allowed to.

Health care organizations tend to have an overly-restrictive interpretation of HIPAA rules, says Lucia Savage, Chief Privacy and Regulatory Officer at Omada Health and a former Chief Privacy Officer at the Office of the National Coordinator

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Source: Stanford Medicine-The Harris Poll



for Health Information Technology, in HHS. Patients and executives are skittish about privacy in the wake of revelations about NSA surveillance and Facebook's sale of user data. An overly-restrictive view of patient privacy when it comes to medical records has hampered efforts to make the data available in useful ways. Participants at the Stanford Medicine symposium were overwhelmingly of the opinion that the risk of not sharing data outweigh the risks to privacy. Says Savage: "The best way to secure a health record is to print it out on paper, stick it in a box, and cover it with cement. But then it's of no use at all."

A lack of standards for EHRs has also held back progress in making data freely available. EHRs often contain a mixture of formatted data and free text, and standards vary widely from one IT provider to the next. And they are not interoperable with one another—sometimes even within the same health care organization.

In an effort to free up medical data, the non-profit group Health Level Seven International drafted a standard called FHIR, for Fast Healthcare Interoperability Resources, that specifies how health care apps can share data. HHS gave EHR developers until January 2017 to create FHIR-based open-specification APIs. The Centers for Medicare and Medicaid Services, a part of HHS, gave health

care organizations until January 2019 to provide data when a patient requests it via a FHIR-based app. This means, in effect, that data must be delivered when a patient's app requests it, so long as the app is authentic and secure.

A year and a half later, the app revolution hasn't yet arrived. Resistance from the medical community to new technology is one factor. Privacy concerns are another.

**"People were worried that the app would be a fraudulent app or that identity credentials presented by the app would be stolen," says Savage.**

"Tons of work has been done with the medical professional to try to get them used to this idea that in fact it's a completely legitimate exercise, legally and technologically, for an individual to give their credentials to an app that's acting on their behalf then for the app to do the work of fetching."

Many health care technology experts believe that app-based medicine will eventually break the logjam that is keeping medical data from flowing freely. Apple's recent upgrade to its Health app allows users to download information from participating health care providers onto their iPhones. At the moment, only three or four dozen institutions participate—a small fraction

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Omada Health, Inc.

of the more than 4,000 or so hospitals in the U.S. The hope is that this situation will improve once patients demand that their health data is readily available, and more institutions join the trend.

**Demand from the patient user is crucial to overcoming many of the barriers that now stand in the way of interoperability.**

The foundation of an app-based health care world would be the EHR. It would be the basic repository of data about the patient, and the patient would control that data by granting permissions,

through their acceptance of the terms and conditions of the app, in accordance with HIPAA and other regulations. In a way, the EHR itself is a collection of health care components, often integrated via APIs that standardize how each one communicates with the others. Thus, in the anticipated app-based economy, those APIs would be extended, using industry-accepted security protocols, to encompass information that patients, physicians, and care teams could repurpose in ways that are meaningful and useful. It would also go a long way to solving the interoperability problem, provided those protocols are openly and easily available, as is required in the Cures Act. The power of an open API is that it can be used to fetch information without having to have nurses calling insurance companies and assistants sending faxes. The app itself contains all the permissions and contractual agreements required to carry out a transaction, so there's no checking or double-checking involved. "It's the difference between a dumb pipe and a smart pipe," says Aneesh Chopra, who served as Chief Technology Officer in the Obama White House. "An API is a smart pipe. It's designed with all the agreements built into it. It gives an app developer the ability to get data quickly in accordance with certain rules." And the app/API interaction leaves an audit trail.

Patients, doctors, and health care industry professionals could glean insight from an ecosystem of health care apps that interprets data, combines data from different sources, and communicates it to relevant parties—patients, doctors, and health care industry professionals. Patients could use their smartphones to assemble their own ecosystem of apps that meet their own needs for health information, the same way they'd use apps for checking accounts or to apply for a mortgage or to call an Uber.

The Veterans Health Administration is trying to build such an ecosystem for its 9 million veterans and families. The VA, which provides care at 1,240 facilities globally, has made interoperability a priority in its \$10 billion plans to modernize its EHR system. It is partnering with vendors and other health systems to ensure that its EHR system will be 100-percent interoperable across vendor EHRs and would leverage APIs to create a developer-friendly environment to nurture app development.

**About a dozen groups have signed an industry pledge to support this effort.**

If each patient had a universe of health care apps to pick and choose from, it would help to democratize medical data,

the way ATMs democratized banking. From an information technology standpoint, the challenge to medicine is greater than it was for banking. Health care data is inherently more complicated than account balances and mortgage payments. Medicine has had barely a decade to wrestle with this particular information challenge. The next decade promises to be an eventful one.

# A Summary of Action Points

## For Medical Practices:

- Invest in adequate EHR training when onboarding physicians and bring them up to speed when incremental changes are made;
- Enlist physicians to help prioritize EHR development tasks and to design clinical workflows that take advantage of EHR capabilities (e.g., the Sprint team model);
- Tailor the size and makeup of physician development teams, taking into account the clinical resources available;
- Deliver EHR development projects soon after physicians ask for them;
- Establish an EHR governance process that gives the clinical organization nimbleness in responding to health emergencies and crisis scenarios;
- Make analytics data available to physicians—presented in a way that is intuitive at the point of care;
- Shift non-essential EHR data entry to ancillary staff. In the near term, consider increasing the number of medical assistants to act as “digital scribes” (though this option is expensive). In the long term, seek automated solutions to eliminate manual EHR documentation;

- Re-evaluate your organization’s interpretation of privacy rules;
- Create opportunities for patients to digitally maintain their records (providing family history, medical history, medications, health monitoring data, etc.);
- Junk the fax machine (if you still have one) and embrace electronic communications;
- Start accepting electronic payments, if you don’t already.

## For Payers:

- EHRs are a reflection of the current fee-for-service payment paradigm. Commit to value-based care and provide adequate support to physicians under this model, including greater reimbursement for preventive care services and the use of digital health to engage patients;
- Create common standards for billing and quality reporting across payers;
- Streamline pre-authorization procedures;
- Make claims data more accessible to physicians to enable a longitudinal view of their patients.

## For Regulators:

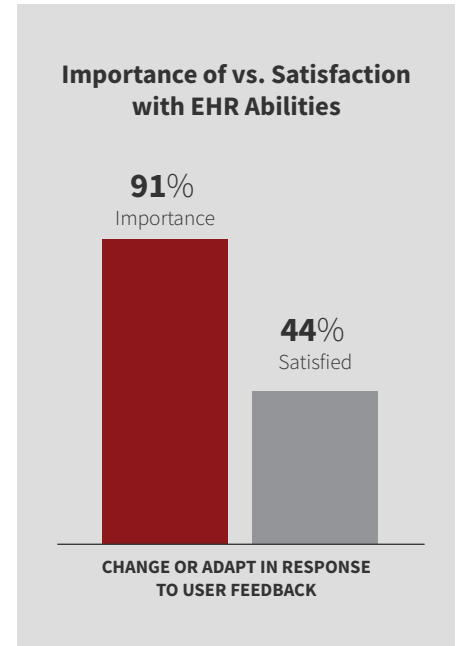
- Affirm commitment to value-based care and moving away from requiring literal documentation of patient-doctor interactions;
- Create more flexibility around who needs to enter data into the EHR, as many tasks do not require the expertise of a highly trained clinician;
- Clarify information-blocking rules to encourage open APIs and eliminate perverse incentives to hoard information.

## For Technologists:

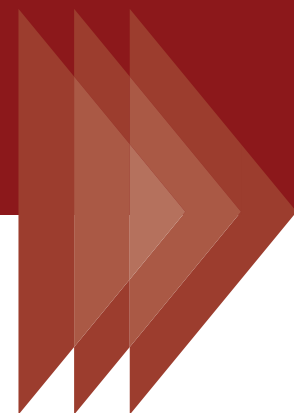
- Clarify definitions of interoperability—in collaboration with other stakeholder groups—and adopt common technical standards to support them;
- Develop systems and product updates in partnership with your end users—less than half of U.S. physicians believe EHR developers are responsive to their feedback;
- Embrace open APIs and nurture a community of developers to enable an app-based ecosystem that puts the patient in control;
- Develop and market an ecosystem of third-party apps that put patients in control of their own health data;
- Focus on eliminating the manual entry of data into the EHR by

recruiting AI, natural language processing, and other emerging technologies;

- Develop AI to increase the intelligence of clinical information systems, enabling them to:
  1. Synthesize relevant information in the EHR before each patient encounter and present the physician with a pithy summary;
  2. Combine patient complaint information with EHR databases and the latest medical literature to support medical decision making;
  3. Deliver current and contextualized information to each member of a patient care team (i.e., enable intelligent “care traffic control”).



Source: Stanford Medicine-The Harris Poll



[med.stanford.edu/ehr/whitepaper](https://med.stanford.edu/ehr/whitepaper)