Learning Outcomes

After completing this chapter, you should be able to:

◆ Define electronic health records
◆ Understand the core functions of an electronic health record as defined by the Institute of Medicine
◆ Discuss social forces that are driving the adoption of electronic health records
◆ Describe federal government strategies to promote electronic health record adoption
◆ Explain why electronic health records are important
◆ Describe the flow of medical information into the chart
◆ Compare the workflow of an office using paper charts with an office using an electronic health record
◆ Contrast inpatient and outpatient charts
◆ Explain why patient visits should be documented at the point of care
◆ Compare various types of electronic health record computers such as workstation, laptop, and Tablet PC

Evolution of Electronic Health Records

The idea of computerizing patients’ medical records has been around for more than 30 years, but only in the past decade has it become widely adopted. Prior to the EHR, a patient’s medical records consisted of handwritten notes, typed reports, and test results stored in a paper file system. Although paper medical records are still used in many healthcare facilities, the transition to electronic health records is underway.
Beginning in 1991, the IOM (which stands for the Institute of Medicine of the National Academies) sponsored studies and created reports that led the way toward the concepts we have in place today for electronic health records. Originally, the IOM called them computer-based patient records.\(^1\) During their evolution, the EHR have had many other names, including electronic medical records, computerized medical records, longitudinal patient records, and electronic charts. All of these names referred to essentially the same thing, which in 2003, the IOM renamed as the electronic health records, or EHR.

**Institute of Medicine (IOM)**

The IOM report\(^2\) put forth a set of eight core functions that an EHR should be capable of performing:

**Health information and data** This function provides a defined data set that includes such items as medical and nursing diagnoses, a medication list, allergies, demographics, clinical narratives, and laboratory test results. Further, it provides improved access to information needed by care providers when they need it.

**Result management** Computerized results can be accessed more easily (than paper reports) by the provider at the time and place they are needed.

- Reduced lag time allows for quicker recognition and treatment of medical problems.
- The automated display of previous test results makes it possible to reduce redundant and additional testing.
- Having electronic results can allow for better interpretation and for easier detection of abnormalities, thereby ensuring appropriate follow-up.
- Access to electronic consults and patient consents can establish critical links and improve care coordination among multiple providers, as well as between provider and patient.

**Order management** Computerized provider order entry (CPOE) systems can improve workflow processes by eliminating lost orders and ambiguities caused by illegible handwriting, generating related orders automatically, monitoring for duplicate orders, and reducing the time required to fill orders.

- CPOE systems for medications reduce the number of errors in medication dose and frequency, drug allergies, and drug–drug interactions.
- The use of CPOE, in conjunction with an EHR, also improves clinician productivity.

**Decision Support** Computerized decision support systems include prevention, prescribing of drugs, diagnosis and management, and detection of adverse events and disease outbreaks.

- Computer reminders and prompts improve preventive practices in areas such as vaccinations, breast cancer screening, colorectal screening, and cardiovascular risk reduction.

**Electronic communication and connectivity** Electronic communication among care partners can enhance patient safety and quality of care, especially for patients who have multiple providers in multiple settings that must coordinate care plans.

- Electronic connectivity is essential in creating and populating EHR systems with data from laboratory, pharmacy, radiology, and other providers.

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\(^2\)Ibid.
Secure e-mail and web messaging have been shown to be effective in facilitating communication both among providers and with patients, thus allowing for greater continuity of care and more timely interventions.

Automatic alerts to providers regarding abnormal laboratory results reduce the time until an appropriate treatment is ordered.

Electronic communication is fundamental to the creation of an integrated health record, both within a setting and across settings and institutions.

**Patient support** Computer-based patient education has been found to be successful in improving control of chronic illnesses, such as diabetes, in primary care.

Examples of home monitoring by patients using electronic devices include self-testing by patients with asthma (spirometry), glucose monitors for patients with diabetes, and Holter monitors for patients with heart conditions. Data from monitoring devices can be merged into the EHR, as shown in Figure 1-1.

![Figure 1-1 Data from digital spirometer transfers to EHR.](image)

**Administrative processes and reporting** Electronic scheduling systems increase the efficiency of healthcare organizations and provide better, timelier service to patients.

Communication and content standards are important in the billing and claims management area.

Electronic authorization and prior approvals can eliminate delays and confusion; immediate validation of insurance eligibility results in more timely payments and less paperwork.
◆ EHR data can be analyzed to identify patients who are potentially eligible for clinical trials, as well as candidates for chronic disease management programs.

◆ Reporting tools support drug recalls.

**Reporting and population health** Public and private sector reporting requirements at the federal, state, and local levels for patient safety and quality, as well as for public health, are more easily met with computerized data.

◆ Eliminates the labor-intensive and time-consuming abstraction of data from paper records and the errors that often occur in a manual process.

◆ Facilitates the reporting of key quality indicators used for the internal quality improvement efforts of many healthcare organizations.

◆ Improves public health surveillance and timely reporting of adverse reactions and disease outbreaks.

Later in this chapter, we will discuss initiatives by the U.S. government to encourage the development of healthcare information technology. It will become apparent how the IOM definitions of core functions influenced and were adapted into the framework proposed by the government.

**Computer-based Patient Record Institute (CPRI)**

Another early contributor to the thinking on EHR systems was the Computer-based Patient Record Institute (CPRI), which identified three key criteria for an EHR:

◆ Capture data at the point of care

◆ Integrate data from multiple sources

◆ Provide decision support

**Health Insurance Portability and Accountability Act (HIPAA)**

The HIPAA Security Rule did not define an EHR, but perhaps it broadened the definition. The Security Rule established protection for all personally identifiable health information stored in electronic format. Thus, everything about a patient stored in a healthcare provider’s system is protected and treated as part of the patient’s EHR.

**EHR Defined**

In *Electronic Health Records: Changing the Vision*, authors Murphy, Waters, Hanken, and Pfeiffer define the EHR to include “any information relating to the past, present or future physical/mental health, or condition of an individual which resides in electronic system(s) used to capture, transmit, receive, store, retrieve, link and manipulate multimedia data for the primary purpose of providing healthcare and health-related services.”

The core functions defined by the IOM and CPRI suggest that the EHR is not just what data is stored, but what can be done with it. In the broadest sense, "Electronic Health Records are the portions of a patient’s medical records that..."
are stored in a computer system as well as the functional benefits derived from having an electronic health record.

**Social Forces Driving EHR Adoption**

Visionary leaders in medical informatics have been making the case for the EHR for a long time. However, the combination of several important reports caught the public’s attention and set in motion economic and political forces that are driving the transformation of our medical records systems.

**Health Safety**

The IOM published a report that stated the following: “Healthcare in the United States is not as safe as it should be—and can be. At least 44,000 people, and perhaps as many as 98,000 people, die in hospitals each year as a result of medical errors that could have been prevented, according to estimates from two major studies.

“Beyond their cost in human lives, preventable medical errors exact other significant tolls. They have been estimated to result in total costs (including the expense of additional care necessitated by the errors, lost income and household productivity, and disability) of between $17 billion and $29 billion per year in hospitals nationwide. Errors also are costly in terms of loss of trust in the healthcare system by patients and diminished satisfaction by both patients and health professionals.

“A variety of factors have contributed to the nation’s epidemic of medical errors. One oft-cited problem arises from the decentralized and fragmented nature of the healthcare delivery system—or ‘non-system,’ to some observers. When patients see multiple providers in different settings, none of whom has access to complete information, it becomes easier for things to go wrong.”

These statements got the attention of the press and public. They also got the attention of 150 of the nation’s largest employers.

**Health Costs**

Employers who sponsored employee health insurance programs had become frustrated by the increasing costs of health insurance benefits for which they had little or no say about the quality of care. Following the release of the IOM report, these employers formed the Leapfrog group.

A study by the Center for Information Technology Leadership found more than 130,000 life-threatening situations caused by adverse drug reactions alone. The study suggested that $44 billion could be saved annually by installing computerized physician order entry systems in ambulatory settings.

Leapfrog created a strategy that tied purchase of group health insurance benefits to quality care standards. It also promoted computerized provider order entry (CPOE) as a means of reducing errors.

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Changing Society

Changes in the way we live have also made paper medical records outdated. In an increasingly mobile society, patients relocate and change doctors more frequently, thus needing to transfer their medical records from previous doctors to new ones. Additionally, many patients no longer have a single general practitioner who provides their total care. Increased specialization and the development of new methods of diagnostic and preventive medicine require the ability to share exam records among different specialists and testing facilities.

The Internet, one of the strongest forces for social change in the past decade, also affects healthcare. Consumers are becoming accustomed to being able to access very sensitive information securely over the web. They are beginning to ask, “If I can write checks and use Internet banking securely; if I can trade stocks and see my brokerage account; if I can check in for my airline flight and print my boarding passes; why can’t I see my lab test result online?”

One solution is personal health records (PHR), secure web sites that allow patients to keep their own medical records online and enable them to control who has access. One advantage of an online PHR is that it is available everywhere. Wherever patients travel and need medical care, they can retrieve their own records using the Internet.

Another important aspect of the World Wide Web is patient accessibility to medical information and research. There are literally millions of health-related pieces of information on the web. Patients are arriving at their doctor’s office armed with questions and sometimes answers. Medical information previously unavailable to the average consumer is now as easy to access as searching Google™ or WebMD®.

A small but growing number of medical offices are creating interactive web sites that actually allow the patient to request an appointment time or a prescription renewal. In a number of states it is even possible for patients and doctors to conduct the medical visit via the Internet. These are called “E-visits” and will be discussed further in Chapter 11.

Critical Thinking Exercise 1: EHR News

1. The topic of EHR is frequently in the news. Describe something you have read or seen on television about EHR.

Government Response

The response to the IOM report was swift and positive, within both the government and private sectors. Almost immediately, President Bill Clinton’s administration issued an executive order instructing government agencies that conduct or oversee healthcare programs to implement proven techniques for reducing medical errors and creating a task force to find new strategies for reducing errors. Congress appropriated $50 million to the Agency for Healthcare Research and Quality (AHRQ) to support a variety of efforts targeted at reducing medical errors.

President George W. Bush followed through by establishing the Office of the National Coordinator for Health Information Technology (ONC), under the U.S. Department of Health and Human Services (HHS) to “develop, maintain, and
direct the implementation of a strategic plan to guide the nationwide implementation of interoperable health information technology in both the public and private healthcare sectors that will reduce medical errors, improve quality, and produce greater value for healthcare expenditures.\(^5\)

President Barack Obama identified the EHR as a priority for his administration and signed into law the Health Information Technology for Economic and Clinical Health (HITECH) Act. The act promotes the widespread adoption of EHR and authorizes Medicare incentive payments to doctors and hospitals using a certified EHR and eventually financial penalties for physicians and hospitals that do not.\(^6\) Note that the HITECH Act is contained within the American Recovery and Reinvestment Act (ARRA), therefore you may see reference to it by the ARRA designation as well.

**Office of National Coordinator for Health Information Technology**

David J. Brailer, M.D., Ph.D., the first National Coordinator, acted quickly. Ten weeks after his appointment, the ONC delivered a framework for strategic action outlining 4 goals and 12 strategies for national adoption of health information technology.\(^7\) The document outlined a vision for consumer-centric and information-rich healthcare derived from the widespread adoption of health information technology and set a 10-year time frame for that to happen.

**Strategic Framework**

The framework as first published listed four major goals and a corresponding set of strategies. These were:

**Goal 1: Inform Clinical Practice**  This goal centered largely on efforts to bring EHR directly into clinical practice. The goal was to reduce medical errors and duplicative work, and enable clinicians to focus their efforts more directly on improved patient care. Three strategies for realizing this goal are:

- Strategy 1. Incentivize EHR adoption.
- Strategy 2. Reduce risk of EHR investment for clinicians who purchase EHR to reduce risk, failure, and partial use of EHR.
- Strategy 3. Promote EHR diffusion in rural and underserved areas.

**Goal 2: Interconnect Clinicians**  Interconnecting clinicians allows information to be portable and to move with consumers from one point of care to another. This will require an interoperable infrastructure to help clinicians get access to critical healthcare information when their clinical or treatment decisions are being made. The three strategies for realizing this goal are:

- Strategy 1. Foster regional collaborations.
- Strategy 2. Develop a national health information network.
- Strategy 3. Coordinate federal health information systems.

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Goal 3: Personalize Care  Consumer-centric information helps individuals manage their own wellness and assists with their personal healthcare decisions. The three strategies for realizing this goal are:

◆ Strategy 1. Encourage use of PHR.
◆ Strategy 2. Enhance informed consumer choice to select clinicians and institutions based on what they value, including but not limited to the quality of care that providers deliver.
◆ Strategy 3. Promote use of telehealth systems.

Goal 4: Improve Population Health  Population health improvement by the collection of timely, accurate, and detailed clinical information to allow for the evaluation of healthcare delivery and the reporting of critical findings to public health officials, clinical trials and other research, and feedback to clinicians. Three strategies for realizing this goal are:

◆ Strategy 1. Unify public health surveillance architectures.
◆ Strategy 2. Streamline quality and health status monitoring.
◆ Strategy 3. Accelerate research and dissemination of evidence.

Federal Health IT Strategic Plan 2008–2012

In June of 2008, the ONC published an update to the strategic framework called the Federal Health IT Strategic Plan. The plan had two goals, patient-focused healthcare and population health, with four objectives under each goal. The themes of privacy and security, interoperability, IT adoption, and collaborative governance recur across the goals, but they apply in very different ways to healthcare and population health.

Goal 1: Patient-focused Healthcare  Enable the transformation to higher quality, more cost-efficient, patient-focused healthcare through electronic health information access and use by care providers, and by patients and their designees.

◆ Objective 1.1—Privacy and Security: Facilitate electronic exchange, access, and use of electronic health information while protecting the privacy and security of patients’ health information.
◆ Objective 1.2—Interoperability: Enable the movement of electronic health information to where and when it is needed to support individual health and care needs.
◆ Objective 1.3—Adoption: Promote nationwide deployment of EHR and PHR that put information to use in support of health and care.
◆ Objective 1.4—Collaborative Governance: Establish mechanisms for multi-stakeholder priority setting and decision making to guide development of the nation’s health IT infrastructure.

Goal 2: Population Health  Enable the appropriate, authorized, and timely access and use of electronic health information to benefit public health, biomedical research, quality improvement, and emergency preparedness.

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Objective 2.1—Privacy and Security: Advance privacy and security policies, principles, procedures, and protections for information access and use in population health.

Objective 2.2—Interoperability: Enable the mobility of health information to support population-oriented uses.

Objective 2.3—Adoption: Promote nationwide adoption of technologies and technical functions that will improve population and individual health.

Objective 2.4—Collaborative Governance: Establish coordinated organizational processes supporting information use for population health.

Achievement of the eight objectives was tied to measurable outcomes, describing 43 strategies that needed to be done to achieve the objectives. Each strategy was associated with a milestone against which progress could be assessed. The plan included a set of illustrative actions to implement each strategy.

The HITECH Act

In passing the HITECH Act,9 the federal government showed that it firmly believes in the benefits of using EHR. The act encourages the widespread adoption of EHR by authorizing Medicare to make incentive payments to doctors and hospitals that use a certified EHR. These incentives are intended to drive adoption of EHR in order to reach the goal of every American having a secure EHR. To achieve this vision of a transformed healthcare system that health information technology can facilitate, there are three critical short-term prerequisites:

Clinicians and hospitals must acquire and implement certified EHR in a way that fully integrates these tools into the care delivery process.

Technical, legal, and financial supports are needed to enable information to flow securely to wherever it is needed to support healthcare and population health.

A skilled workforce is needed that can facilitate the implementation and support of EHR, exchange of health information among healthcare providers and public health authorities, and the redesign of workflows within the healthcare settings.

Providers that implement and have a meaningful use of a certified EHR prior to 2015 are eligible for incentives. This means that a practice adopting an EHR actually gets paid more than a practice continuing to use paper charts.

After 2015, Medicare will begin to administer financial penalties for physicians and hospitals that do not use a EHR. These will involve reducing the provider’s payments by 1 percent per year for up to five years. By 2020, a provider still using paper charts will have payments reduced by 5 percent.

Critical Thinking Exercise 2: Compare ONC and HITECH

Compare the HITECH requirements with the goals and strategies of the original Strategic Framework discussed earlier.

Strategic Plan Update 2011–2015

The HITECH Act requires the ONC, in consultation with other appropriate federal agencies, to update the 2008–2012 Strategic Plan (discussed above). The 2008–2012 plan is intended “to guide the nationwide implementation of interoperable health information technology in both the public and private healthcare sectors that will reduce medical errors, improve quality, and produce greater value for healthcare expenditures.”

The HITECH Act requires that the update include specific objectives, milestones, and metrics with respect to the following:

1. The electronic exchange and use of health information and the enterprise integration of such information.
2. The use of an EHR for each person in the United States by 2014.
3. The incorporation of privacy and security protections for electronic exchange of an individual’s individually identifiable health information.
4. Establishing security methods to ensure appropriate authorization and electronic authentication of health information and specifying technologies or methodologies for rendering health information unusable, unreadable, or indecipherable.
5. Specifying a framework for coordination and flow of recommendations and policies under this subtitle among the Secretary, the National Coordinator, the HIT Policy Committee, the HIT Standards Committee, and other health information exchanges and other relevant entities.
6. Methods to foster the public understanding of health information technology.
7. Strategies to enhance the use of health information technology in improving the quality of healthcare, reducing medical errors, reducing health disparities, improving public health, increasing prevention and coordination with community resources, and improving the continuity of care among healthcare settings.
8. Specific plans for ensuring that populations with unique needs, such as children, are appropriately addressed in the technology design, as appropriate, which may include technology that automates enrollment and retention for eligible individuals.

Meaningful Use of a Certified EHR

The HITECH act specifies the following three components of Meaningful Use:

1. Use of certified EHR in a meaningful manner
2. Use of certified EHR technology for electronic exchange of health information to improve quality of healthcare
3. Use of certified EHR technology to submit clinical quality measures (CQM) and other such measures selected by the Secretary of Health and Human Services

The key terms here are *meaningful use* and *certified EHR*. What is meaningful use and what is a certified EHR?

**Meaningful Use**

CMS officially published the Electronic Health Record Incentive Program Final Rule July 28, 2010, which finalized the incentive program and defined the criteria for determining "meaningful use." 

Requirements for meaningful use incentive payments were implemented over a multiyear period, in three stages. Stage 1, spanning the years 2011 and 2012, set the baseline for electronic data capture and information sharing. Stage 2 (scheduled to begin in 2013) and Stage 3 (scheduled for 2015) will continue to expand on this baseline and be developed through future rule making.

The 2011–2012 meaningful use requirements include a “core” group of requirements that must be met, plus an additional five that providers choose from a list of ten. The requirements for hospital and eligible professionals differ.

**Eligible Professionals**

For Eligible Professionals (EPs), there are a total of 25 meaningful use objectives. Twenty of the objectives must be completed to qualify for an incentive payment. Fifteen are core objectives that are required, and the remaining 5 objectives may be chosen from the list on the right.

**EPs Core Requirements**

(all 15 must be met)

- Computerized physician order entry (CPOE)
- E-Prescribing
- Report ambulatory clinical quality measures
- Implement one clinical decision support rule
- Provide patients with an electronic copy of their health information, upon request
- Provide clinical summaries for patients for each office visit
- Drug–drug and drug–allergy interaction checks
- Record demographics
- Maintain an up-to-date problem list of current and active diagnoses

**Additional EPs Objectives (choose 5, at least one with asterisk*)**

- Drug-formulary checks
- Incorporate clinical lab test results as structured data
- Generate lists of patients by specific conditions
- Send reminders to patients per patient preference for preventive/follow-up care
- Provide patients with timely electronic access to their health information
- Use certified EHR technology to identify patient-specific education resources and provide to patient, if appropriate
- Medication reconciliation
- Summary of care record for each transition of care/referrals

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Maintain active medication list  
Maintain active medication allergy list  
Record and chart changes in vital signs  
Record smoking status for patients 13 years or older  
Capability to exchange key clinical information among providers of care and patient-authorized entities electronically  
Protect electronic health information  

**Eligible Hospitals**  
For Hospitals, there are a total of 24 meaningful use objectives. Fourteen are core objectives that are required, and the remaining 5 objectives may be chosen from the list on the right.

**Hospitals Core Requirements**

**Additional Hospital Objectives**

(choose 5, at least one with asterisk*)

- CPOE
- Drug–drug and drug–allergy interaction checks
- Record demographics
- Implement one clinical decision support rule
- Maintain up-to-date problem list of current and active diagnoses
- Maintain active medication list
- Maintain active medication allergy list
- Record and chart changes in vital signs
- Record smoking status for patients 13 years or older
- Report hospital clinical quality measures to CMS or states
- Provide patients with an electronic copy of their health information, upon request
- Provide patients with an electronic copy of their discharge instructions at time of discharge, upon request
- Capability to exchange key clinical information among providers of care and patient-authorized entities electronically
- Protect electronic health information.

- Capability to submit electronic data to immunization registries/systems*
- Capability to provide electronic syndromic surveillance data to public health agencies*
- Drug-formulary checks
- Record advanced directives for patients 65 years or older
- Incorporate clinical lab test results as structured data
- Generate lists of patients by specific conditions
- Use certified EHR technology to identify patient-specific education resources and provide to patient, if appropriate
- Medication reconciliation
- Summary of care record for each transition of care/referrals
- Capability to submit electronic data to immunization registries/systems*
- Capability to provide electronic submission of reportable lab results to public health agencies*
- Capability to provide electronic syndromic surveillance data to public health agencies*
Certified EHR

Under the CMS EHR incentive programs, eligible health care providers must adopt and meaningfully use a “certified EHR” that has been certified by an ONC Authorized Testing and Certification Body (ONC-ATCB). To synchronize the two regulations, the ONC published the Health Information Technology: Initial Set of Standards, Implementation Specifications, and Certification Criteria for Electronic Health Record Technology Final Rule\(^ {12}\) on the same date as the CMS Final Rule.

The ONC certification criteria represent the minimum capabilities an EHR needs to include and have properly implemented in order to achieve certification. They do not preclude developers from including additional capabilities that are not required for the purposes of certification.

Even before the HITECH Act, various leaders in health information technology recognized the need to create a credible authority for certification of EHR systems. Goal 1: Strategy 2 of the original Strategic Framework called for a mechanism to reduce the risk to providers adopting an EHR. The Certification Commission for Healthcare Information Technology (CCHIT\(^ {5}\)) was formed to do just that.

The history of CCHIT:

◆ 2004: organized by leading health information associations, the American Health Information Management Association (AHIMA), the Healthcare Information and Management Systems Society (HIMSS), and the National Alliance for Healthcare Information Technology, to examine and certify Health IT products.
◆ 2005: awarded a three-year contract by the HHS to develop certification criteria and an inspection process for EHR systems.
◆ 2006: began certifying ambulatory EHR systems.
◆ 2007: began certifying inpatient EHR systems.
◆ 2009: became an independent nonprofit organization.
◆ 2010: applied to become an ONC Authorized Testing and Certification Body.
◆ 2011: began usability testing for ambulatory EHR systems.

The CCHIT Certified\(^ {5}\) program is an independently developed certification that includes a rigorous inspection of an EHR’s integrated functionality, interoperability, and security using criteria developed by CCHIT’s broadly representative, expert work groups.

The CCHIT inspection process is based on real-life medical scenarios designed to test products rigorously against the complex needs of healthcare providers. As part of the process, successful use is verified at live sites.\(^ {13}\)


\(^{13}\)CCHIT Certified\(^ {5}\) 2011 Certification Handbook (Chicago, IL: Certification Commission for Health Information Technology, 2010).
The 2011 CCHIT certification criteria specifically align with those required to meet the ARRA/HITECH meaningful use criteria, with the intention that a provider using a CCHIT Certified EHR will be in compliance with eligibility requirements.

The ONC will recognize Authorized Testing and Certification Bodies in addition to CCHIT

**Clinical Quality Measures (CQM)**

CMS has specified a number of clinical quality measures for meaningful use. EPs must report on 3 required core or alternate core CQM and 3 additional CQM selected from a list of 38. Hospitals must report on 15 CQM.

To ensure EHR systems can support these CQM reporting requirements, ONC certification requires an EHR designed for an inpatient setting to be tested and certified to all of the clinical quality measures specified by CMS. An EHR designed for an ambulatory setting must be tested and certified as including at least 9 clinical quality measures specified by CMS—all six of the core (3 core and 3 alternate core) clinical quality measures specified, and at least 3 of the 38 additional measures. Of course EHR developers may include as many clinical quality measures above that requirement as they see fit.

**Why Electronic Health Records Are Important**

Historically, a patient’s medical records consisted of handwritten notes, typed reports, and test results stored in a paper file system. A separate file folder was created and stored at each location where the patient was examined or treated. X-ray films and other radiology records typically were stored separately from the chart, even when they were created at the same medical office.

These are some of the drawbacks to paper records: Handwritten records often are abbreviated, cryptic, or illegible. When information is to be used by another medical practice, the charts must be copied and faxed or mailed to the other office. Even in one practice with multiple locations, the chart must be transported from one office to another when a patient is seen at a different location than usual. Paper records are not easily searchable. For example, if a practice is notified that all patients on a particular drug need to be contacted, the only way of finding those patients is literally to open every chart and look at the medications list.

Certainly, improved legibility, the ability to find, share, and search patient records are strong points for an EHR. There are additional benefits from an EHR that take the practice of medicine to levels that cannot be achieved with paper records. Four examples of this are: health maintenance, trend analysis, alerts, and decision support. These will be covered in more detail in Chapter 2.

However, there are the additional criteria. The IOM report calls for *electronic communication and connectivity among care partners* and the second goal of the
A 63-year-old man went to his doctor’s office in Kentucky complaining of chest pains and tightness in his chest. He was immediately transferred to the local hospital, where a stress test and cardiac catheterization confirmed he had had a heart attack. He was hospitalized overnight.

Early retirement from his stressful job as well as a regimen of exercise, diet, beta blockers, aspirin therapy, and other medications proved successful. He moved from Kentucky to Florida and tried unsuccessfully to have his medical records concerning the previous heart attack transferred to his new doctor in Florida. The ECG and stress tests were repeated in Florida. Finally, after two years, the records from Kentucky arrived.

In subsequent years, he moved twice more but, wiser now, he took copies of his medical records with him. He continued a normal and active life until age 77, when he slipped in his workshop and broke his right knee. With his leg in a cast he was less active; a blood clot formed and broke free.

Three weeks after he broke his knee, he went to the doctor’s office with what he described as very severe flu symptoms, extreme fatigue, a bad cough, and sharp pains in his back when he moved or coughed. The doctor sent him to the emergency room, where he was diagnosed with a pulmonary embolism in the lower lobe of the right lung. He was hospitalized and put on a therapy of blood thinners.

At age 79, he was continuing to lead an active lifestyle, but he was experiencing occasional sharp brief chest pain and brief dizziness. His doctor scheduled a stress test and cardiac catheterization at a cardiac center connected to the hospital. A blockage was discovered and a double bypass surgery was performed at the same hospital. The patient tolerated the surgery well and recovered quickly.

However, one of the veins used in the bypass operation had been harvested from the leg that had the previous broken knee. Three weeks after he was discharged, he passed out and fell. He was taken by ambulance to the ER at the same hospital where he had had his surgery and where he had been hospitalized for the previous pulmonary embolism. Here is what happened:

- When the ambulance arrived at the hospital, the nurses and ER staff again took a medical history from the patient and patient’s family.
- The patient’s primary care physician had a complete medical history of the patient, including copies of his records dating back to his heart attack in Kentucky, but the hospital system was not connected with the physician’s office system.
- The patient reported that he had just had surgery at the same hospital only three weeks before. The hospital system surely had his medical history, but the ER was on a different system and the ER doctors did not have access to the records.
- Although the ER was in the same hospital as the cardiac lab, the ER doctors did not have access to those records, either.
- The patient told the ER staff he thought the symptoms felt similar to his previous experience with a pulmonary embolism, but even though the ER was in the same hospital where the patient was hospitalized for a pulmonary embolism two years before, the ER doctors did not have access to the records from his past condition.
- A CAT scan was ordered based on patient history of the embolism provided by a family member, not his medical record.
- After waiting in the ER for 14 hours, he was hospitalized with two pulmonary embolisms, one in each lung.

Seven days later, the patient was discharged from the hospital. He has fully recovered and is doing fine.

This is not the story of poor medical care or a bad hospital. The hospital is affiliated with a major teaching hospital and is as good as or better than most. This is a story of the unfortunate state of medical records. Paper records are not accessible and can take months to transfer. The lack of timely copies of existing records often causes tests to be reordered or the obvious conditions to be overlooked. Electronic records are better, more accessible, but even the most sophisticated systems do not necessarily have the infrastructure in place to communicate with other EHR systems even in the same community or, as in this case, not even in the same facility!
ONC strategic framework is to *interconnect clinicians*. The need for EHR and better connectivity between EHR systems is examined in the Real-Life Story: Where’s My Chart?

**Critical Thinking Exercise 3: When the Chart Is Lacking**

Read the Real-Life Story: Where’s My Chart?

1. What are the dangers to the patient of a provider not having access to paper charts?
2. What is the likelihood of the second incident of the pulmonary embolism being overlooked?
3. How would the patient care be improved if the various EHR systems had been able to exchange patient records electronically?

**Flow of Clinical Information into the Chart**

Whether medical records are paper or electronic, the clinician’s exam notes are usually documented in a defined structure organized into four components:

- Subjective
- Objective
- Assessment
- Plan

Charts in this format are referred to as SOAP notes; the acronym representing the first letter of the words *subjective, objective, assessment, and plan*. Guided Exercises throughout this book will follow the SOAP format.

However, the EHR requires not only computers and software, but also change in the way providers work. To understand this, let us compare the workflow in a medical office using paper charts with a medical office using an EHR system.

**Workflow of an Office Using Paper Charts**

Follow the arrows in Figure 1-2 as you read the following description of a workflow in a primary care medical practice using paper charts.

1. An established patient phones the doctor’s office and schedules an appointment.
2. The night before the appointment, the patient charts are pulled from the medical record filing system and organized for the next day’s patients.
3. On the day of the appointment, the patient arrives at the office and is asked to confirm that insurance and demographic information on file is correct.
   The patient is given a clipboard with a blank medical history form and asked to complete it. The form asks the reason for today’s visit and asks...
the patient to report any previous history, any changes to medications, new allergies, and so on.

4 Patient is moved to an exam room and is asked to wait.

**Subjective**—The patient is asked to describe in his or her own words what the problem is, what the symptoms are, and what he or she is experiencing.

A nurse reviews the form the patient completed, and may ask for more detail about the reason for the visit, which usually is called “the chief complaint.” The nurse writes the chief complaint on a form that is placed at the front of the chart along with the updated patient form. The nurse takes the vital signs and records them on the form. Vital signs are “objective” data.

5 The doctor or other healthcare provider enters the exam room and discusses the reason for the visit, reviews the symptoms and may add to the subjective portion of the note.

**Figure 1-2 Workflow in a medical office using paper charts.**
Objective—The clinician performs a physical exam and makes observations about what he or she finds.

Assessment—Applying his or her training to the subjective and objective findings, the clinician arrives at a decision of what might be the cause of the patient’s condition, or what further tests might be necessary.

Plan of Treatment—The clinician prescribes a treatment, medication, or orders further tests. Perhaps a follow-up visit at a later date is recommended. A note will be made in the chart of each element of the plan.

If medications have been ordered, a handwritten prescription will be given to the patient or phoned to the pharmacy. A note of the prescription will be written in the patient’s chart.

The doctor marks one or more billing codes and one or more diagnosis codes on the chart and leaves the exam room.

If lab work has been ordered, a nurse, medical assistant, or phlebotomist will obtain the necessary specimen and send the order to the lab.

At many practices, the physician creates the exam note from memory, either handwriting in the chart or dictating the subjective, objective, assessment, plan, and treatment information.

When the patient is dressed, the patient will be escorted to the check-out area. The nurse or staff may give the patient education material or medication instructions.

If x-rays or other diagnostic tests have been ordered at another facility, the office staff may call on behalf of the patient and schedule the tests.

If a follow-up visit has been indicated, the patient will be scheduled for the next appointment.

The dictated notes are later transcribed and returned to the doctor to review before being permanently stored in the chart.

If lab, x-ray, or other diagnostic tests have been ordered, the results and reports are subsequently sent to the practice either by fax or on paper a number of days later. When received, they are filed in the patient’s chart and the chart is sent to the clinician for review. They are reviewed by the physician, and then re-filed in the paper chart.

The paper chart is filed again. Note that the chart may have to be pulled and re-filed each time a new document, such as the transcription or lab report, was added, which required the doctor’s review.

One obvious downside to paper charts is accessibility. If the patient chart is needed for a follow-up visit or by another provider, it is possible that it has not been returned to the file room while it is pending dictation or while the provider is reviewing test results.

Workflow of an Office Fully Using an EHR

Follow the arrows in Figure 1-3 as you read the following description of a workflow of a patient visit to an office that fully uses the electronic capabilities that are available in EHR systems today, including patient participation in the process and the capabilities of the Internet.
An established patient phones the doctor’s office and schedules an appointment.

**Internet alternative**—Patients are increasingly able to request an appointment and receive a confirmation via the Internet.

The night before the appointment, the medical office computer electronically verifies insurance eligibility for patients scheduled the next day.

On the day of the appointment, the patient arrives at the office and is asked to confirm that the demographic information on file is still correct.

A receptionist, nurse, or medical assistant asks the patient to complete a medical history and reason for today’s visit using a computer in a private area of the waiting room. The patient completes a computer-guided questionnaire concerning his symptoms and medical history.

**Internet alternative**—Some medical practices allow patients to use the Internet to complete the history and symptom questionnaire before coming to the office.

When the patient has completed the questionnaire, the system alerts the nurse that the patient is ready to move to an exam room.

**Figure 1-3 Workflow in a medical office fully using an EHR.**
The nurse measures the patient’s height and weight and records it in the EHR. Using a modern device, vital signs for blood pressure, temperature, and pulse are recorded and wirelessly transferred into the EHR.

6 Subjective—The nurse and patient review the patient-entered symptoms and history. Where necessary, the nurse edits the record to add clarification or refinement.

The physician enters the exam room and discusses the reason for the visit and reviews with the patient the information already in the chart.

7 Objective—The physician performs the physical exam. The clinician typically makes a mental provisional diagnosis. This is used to select a list or template of findings to quickly record the physical exam in the EHR.

The EHR presents a list of problems the patient reported in past visits that have not been resolved. The physician reviews each, examining additional body systems as necessary, and marks the improvement, worsening, or resolution of each problem.

Assessment—Applying his or her training to the subjective and objective findings, the clinician arrives at a decision of one or more diagnoses, and decides if further tests might be warranted.

8 Plan of treatment—The clinician prescribes a treatment and/or medication; in addition, the clinician may order further tests using the EHR.

If medication is to be ordered, the physician writes the prescription electronically. The prescription is compared to the patient’s allergy records and current drugs. The physician is advised if there are any contraindications or potential problems. The prescription is compared to the formulary of drugs covered by the patient’s insurance plan and the physician is advised if an alternate drug is recommended (thereby avoiding a subsequent phone call from the pharmacist to revise the prescription). The prescription is then transmitted directly to the patient’s pharmacy.

A built-in function of the EHR accurately calculates the correct evaluation and management code used for billing. The billing code is confirmed by the physician and automatically transferred to the billing system.

When the visit is complete, so is the exam note. The physician signs the note electronically at the conclusion of the visit.

9 If lab work has been ordered, a nurse, medical assistant, or phlebotomist will obtain the necessary specimen and the order is sent electronically to the lab.

Patient education—Because of the efficiency of the EHR system, the physician has more personal time with the patient for counseling or patient education. In many systems the provider can display and annotate pictures of body areas for patient education, and print them so that the patient can take them home.

When the patient is dressed, he or she is given patient education material, medication instructions, and a copy of the exam notes from the current visit. Allowing the patient to take away a written record of the visit enables better compliance with the doctor’s plan of care and recommended treatments.

10 The patient is escorted to the checkout area.

If x-rays or other diagnostic tests have been ordered at another facility, the office staff may call on behalf of the patient and schedule the tests.
If a follow-up visit has been indicated, the patient will be scheduled for the next appointment.

If lab tests were ordered, the results are sent to the doctor electronically, are reviewed on screen, and automatically merged into the EHR.

If radiology or other diagnostic reports are sent to the practice electronically as text reports, they are imported into the EHR and can be reviewed by the physician.

Accessibility is not a problem in the EHR system because there is no chart to “re-file.” Multiple providers can access the patient’s chart, even simultaneously; for example, a physician could review the previous lab results before entering the exam room, even if the nurse was currently entering vital signs in the chart.

**Critical Thinking Exercise 4: Think About Workflow**

Having compared the two workflow scenarios, we see the immediate advantages of the EHR for the patient and clinician. Think about the workflow of the office that used paper charts (refer to Figure 1-2 if necessary.) Answer the following questions about the first workflow:

1. What was the nurse or physician doing at the time of the patient interaction?
2. Could they have recorded this data in a computer?
3. Could they have saved time later?
4. Could the data be entered by someone other than the person seeing the patient?
   The patient completed a form concerning any previous history, any changes to medications, new allergies, and so on.
5. Could the patient have used a computer, or could the form have been designed to be read by a computer?
6. Could the patient have completed the information before the visit?
   The nurse recorded various health measurements (vital signs) in the exam room.
7. Could the nurse have recorded the “chief complaint” or the vital signs in a computer instead of on a paper chart?
8. Were any of the instruments used capable of transferring their measurements to a computer system?
   During the physical exam, the physician made observations and an assessment. This was later dictated from memory, subsequently transcribed by a typist, and finally reviewed and signed by the physician.
9. Is the time it would take to record the observations and assessment in the exam comparable to the time it takes to dictate and review the transcribed notes later?
   The physician prescribed medications and ordered tests.
10. Would the time spent entering the prescriptions on a computer justify the benefits of electronic prescribing?
11. Are results available electronically from laboratories that the medical practice uses?
Would ordering a test electronically improve the matching of results to orders when the tests were completed?

**Inpatient Charts versus Outpatient Charts**

The previous figures illustrated the differences between two medical offices, one using a paper chart and another using an EHR. The differences between a hospital using a paper chart and a hospital fully using electronic records are even more significant. However, there are also differences in the type of chart each facility uses and overall workflow process. In this section we are going to compare both.

![Flow of an inpatient from admission through discharge.](image)

Although some patients are admitted to the hospital through the emergency department or by transfer from another facility, most patient admissions begin in the registration department. As depicted in Figure 1-4, the steps involved in an inpatient admission and discharge include the following:

1. When the patient arrives, patient demographic and insurance information is collected or updated, and an account is set up for the patient stay. Even if the patient has been an inpatient previously, a new account is created (although previous patients will use their existing medical record number).

2. An admitting and/or attending doctor is assigned to the patient. A physician is required to perform a complete history and physical on an inpatient.
within 24 hours of the admission. In an outpatient facility, no such time limit is imposed on when or what type of physical is performed.

3 The doctor orders tests, medications, and procedures.

4 The doctor reviews the results of tests and diagnostic procedures when they are ready.

5 Nurses provide most of the patient care, administer medications, take samples for tests, measure vital signs, perform nursing assessments and nursing interventions, and enter nursing notes into the chart.

6 When a patient leaves an inpatient facility, there is also a formal discharge process. Normally, the physician performs a final examination of the patient and writes a discharge order. Discharge does not necessarily mean the patient goes home. Patients may be discharged to a skilled nursing facility or a rehabilitation facility for further care. Patients who leave without a doctor’s order are discharged AMA (against medical advice).

7 Following discharge, the Health Information Management (HIM) department examines the patient’s chart to determine if it has any missing or unsigned documents (called chart deficiencies). When the chart is complete, it is sent to the billing department where the proper billing codes are assigned.

8 In a facility using paper charts, the last step is to file the chart.

There are also several significant differences in the content and purpose of a patient chart used in an acute care facility and that used by a medical office: the amount of information gathered about each patient and the number of individuals who will need access to it. Figure 1-5 highlights some of the differences between inpatient and outpatient charts.

Most physician offices have a single chart for the patient. Notes for each visit, test results, and any other reports are added to the chart.

Most hospitals start a new chart each time a patient is admitted. Information from previous stays in the hospital is linked to the patient ID, but the current chart contains only information related to the current stay.

The quantity of data in an outpatient chart is relatively low by comparison.

The quantity of data in an inpatient chart is likely to be much larger. Vital signs are taken and nurses’ notes are added numerous times per day; dietitians, respiratory therapists, and other providers add to the chart; there are typically many more orders for labs, medications, and so on.

The central element in the chart is the physician’s exam note.

Physician exams tend to be brief; the main focus of the chart is the physician orders and nurse’s notes indicating the patient’s response.

Figure 1-5 Contents typical of acute care versus ambulatory patient charts.
In an ambulatory setting such as a physician’s office, the patient visits the physician’s office a number of times over a period of months or years. Although items produced outside of each visit, such as lab results and consult reports, are also integrated into the patient’s chart, the most important element of the outpatient chart is the doctor’s notes about each visit. The clinician reviews previous notes on each subsequent visit using them to follow up on past ailments and to measure the patient’s progress in managing chronic problems.

The medical chart is primarily used by the physician and nurse, but is also used briefly by the administrative staff to prepare billings following each visit. The focus of the chart is the longitudinal care of the patient. As such, it usually contains all records of the patient’s visits and any reports or results received from other providers.

The inpatient chart, however, focuses on the treatment of a specific ailment or condition for which the patient was hospitalized. Data are gathered more frequently during the inpatient’s stay, resulting in a substantially large amount of information gathered during a short period of time. In most hospitals, a new chart or medical record is started for each hospital stay. Although records from previous hospitalizations are available for reference, they are not incorporated into the current chart, except as described in the admitting physician’s history and physical notes.

Because a large number of caregivers are involved with the patient’s stay in an acute care facility, there are a larger number of individuals with a legitimate need to access a patient’s record than in an ambulatory care setting. These caregivers include not only nurses and physicians, but other specialists that may consult on the case; radiologists, respiratory therapists, dietitians, and in many hospitals, even the hospital pharmacists have access to records when consulting with the ordering physicians about the medications being prescribed.

These differences between an acute care chart and a medical office chart are consistent whether the facility uses paper or electronic charts. However, another difference between the inpatient and outpatient EHR is the system itself. In most systems designed for physician’s offices, the data typically is received and stored by the EHR software in a single electronic medical record system. Most hospitals have a large number of departments using computer systems from many different vendors. The hospital EHR may not necessarily merge the data from these systems into a single EHR. Often the hospital EHR allows the clinician to view data in these other systems through an interface but does not necessarily store the data in a single EHR.

**Documenting at the Point of Care**

A goal of using an EHR system is to improve the accuracy and completeness of the patient record. One way to achieve this is to record the information in the EHR at the time it is happening. This is called *point-of-care documentation*. In a physician’s office, this means completing the SOAP note before the patient ever leaves the office. In an inpatient setting, this means that nurses enter vital signs and nursing notes at bedside, not at the end of their shift. Figure 1-6 shows a nurse entering notes while seeing the patient.
Using a point-of-care EHR, when the visit is complete, the note is complete. The clinician can then provide not only patient education materials for patients to take home, but also can actually print a copy of the finished note. Giving patients a copy of the notes from that day’s visit ensures that they will remember the key elements of their plan of treatment. They also will have a clearer understanding of their condition as well as information on any tests that may have been ordered or performed.

Leading physician experts on the EHR, Allen R. Wenner, an M.D. in Columbia, South Carolina, and John W. Bachman, an M.D., professor of Family Medicine at the Mayo Medical School in Rochester, Minnesota, wrote: “Documenting an encounter at the point of care is the most efficient method of practicing medicine because the physician completes the medical record at the time of a patient’s visit. Dictation time is saved and the need for personal dictation aides is eliminated. Thus, point-of-care documentation is less expensive than traditional dictation with its associated high cost of transcription. In addition, the physician can sign the note immediately.

Patient care is improved because the patient can leave with a complete copy of the medical record, a step that stimulates compliance. The delivery process is improved with point-of-care documentation because referrals can be accomplished with full information available at the time that the referral is needed. For these benefits to occur, the clinical workflow changes to improve efficiency, increase data accuracy, and lower the overall cost of healthcare delivery.”

Dr. John Bachman, M.D., has formulated what he refers to as Bachman’s Rule and Bachman’s Law:

Bachman’s Rule: “A patient who has a copy of a note is impressed by the fact that all the information they provided and were given is included for them to review. It also is useful in that it has immunizations prevention information and instructions. Outcome studies have shown it to be helpful in compliance and improvement of health; crossing the Quality Chasm.”

Bachman’s Law: “A clinician who gives a patient a copy of their note has all their work complete. Consequently there is no dictation, rework, signing, or any activity of maintaining the administrative workflow. This saves a great deal of money and means the workflow systems are extremely efficient.”

Underscoring doctors Bachman and Wenner are the CMS regulations for meaningful use\(^\text{15}\) which require eligible professionals to provide clinical summaries to patients each office visit.

The availability of information from the EHR during the patient visit is an invaluable tool in counseling and patient education. The clinician has access to graphs, medical images, test results, and anatomical drawings, all of which are useful in explaining something related to the patient’s condition or to illustrate an upcoming procedure. Using a Tablet PC, the doctor in Figure 1-7 is able to access the results of the patient’s most recent electrocardiogram wirelessly and explain them to the patient.

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As stated earlier, adopting an EHR may change the way doctors work. Experience has shown that patients react favorably to the use of a computer during the exam, especially when they are part of the process, able to see the screen, and able to participate in the review of their information. However, Wenner and Bachman describe three types of patient–physician relationships:

1. The doctor is paternalistic, telling the patient what to do.
2. The doctor gives the patient information and the patient decides what to do.
3. Patients and doctors share information to determine the best plan for given conditions.

Figure 1-8, provided by Dr. Wenner, lists the stages of change resulting from adoption of an EHR. Wenner and Bachman believe patients will help the physician when they are given some degree of control, as reflected in points 2 and 3.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Technology Adoption</th>
<th>Medical Records</th>
<th>Medical Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage I</td>
<td>Do it the old way</td>
<td>The paper chart used and viewed as an historical document by physicians</td>
<td>Health care providers are the center of health care</td>
</tr>
<tr>
<td>Stage II</td>
<td>Adopt technology but continue to do it the old way</td>
<td>Transcribing dictation onto paper, using the EHR for data storage only managed by staff</td>
<td>Providers continue to dominate medical decisions and maintain all health care data</td>
</tr>
<tr>
<td>Stage III</td>
<td>Change the workflow to leverage the technology Paperless medical office</td>
<td>Use EHR at the point-of-care with providers and patients participating to allow real-time continuity of care</td>
<td>Patients and providers will share decision making as health care information is available to both</td>
</tr>
</tbody>
</table>

Figure 1-8 Stages of change in EHR adoption.

The EHR system strives to improve patient healthcare by giving the provider and patient access to complete, up-to-date records of past and present conditions; it also enables the records to be used in ways that paper medical records could not. The sooner the data is entered, the sooner it is available for other providers and the patient. Chapters 2–12 will explore how data is entered in the EHR and focus on ways EHR systems speed up data entry, enabling clinicians to achieve point-of-care documentation in real time.

The Physical Clinic and Clinician Mobility

Let us examine how the office environment and the choice of computers, devices, and technologies can affect the successful adoption of an EHR. To quote Peter Gerloffs, Medical Director of Allscripts, a leading EHR vendor, “If physicians don’t use it, nothing else matters.” This means, of course, that the EHR has to be designed and deployed in a way that enables clinicians to make it a part of their workflow.

One consideration is how mobile the providers are when they are in the office.

1. Does a clinician have a preassigned set of exam rooms he or she always uses for patients or does the office have a number of rooms that are shared randomly by several providers throughout the day?

2. Is the clinician likely to complete the note and all orders when in the exam room, or do so on the way to the next room?

3. Where/when will the clinician review lab results, radiology reports, e-mail messages, prescription renewals, and so on: on the move throughout the day, at a desk in his or her office, or from home over the Internet?

The following discussion of various technologies and devices used in EHR solutions today will provide you with an idea of how these installations work in a medical office.

**EHR on Computer Workstations**

In most offices, you will find computer workstations in the billing, nursing, and lab areas, as shown in Figure 1-9. In some offices, you will find them in the exam room, and in a comparatively few offices you will find them in the waiting room or a subwaiting area for patients to use.

Computer workstations are cheap, reliable, dependable, and usually fixed in one location. You are probably working on one right now. They take up more space, requiring extra room for the keyboard and mouse. They are, however, easier for the IT department to manage and usually easier to upgrade when necessary.

Certainly workstations at fixed positions will be the right choice for some of the personnel who input data in your EHR. Whether they make sense at the point of care depends on how much free space you have in your exam rooms and if your providers want to finish up their exam notes before or after leaving the room. Most medical facilities were built long before anyone thought of putting computers in the exam rooms. Many exam rooms are already filled with supplies and equipment used for the exams and have only a small counter or writing area.

Although workstations can pose a security risk in the exam room when left unattended, that is easily handled through any number of biometric, or smart card, and auto sign-off solutions. With these solutions, the screen blanks or the EHR software is logged off whenever an authorized user is not present. An ID badge or other device has a computer chip imbedded in it that can be detected by the workstation. Biometric solutions usually involve a pad on the keyboard or mouse that reads and authenticates a user’s fingerprint. These will be discussed further in Chapter 10.

One final advantage of the workstation is that it can support a substantially higher screen resolution (finer picture) than any other device. This makes it the only viable choice for radiologists and others who “read” diagnostic quality images of x-rays, CAT scans, and so on.
Of course, the medical office EHR is actually on a network server somewhere else. Workstations and other devices are connected to the network. This can be done with cables that have been wired in the building walls or through “wireless” access points that connect to the network through high-frequency radio signals. One advantage of a workstation is that it is ideally suited to a wired network connection. These are usually much faster and less subject to failure.

**EHR on Laptop Computers**

A laptop computer, as shown in Figure 1-10, packages the screen, keyboard, mouse, and computer in one unit, about the size of an 8" × 11" notebook. In a medical office, these provide mobility for clinicians who want to stay connected and take their work from room to room.

Although laptops can be connected to a wired network fairly easily, it is usually bothersome to have to plug the computer in and log on to the network each time you enter a room. For this reason, most laptops use a wireless standard called “Wi-Fi,” which stands for “wireless fidelity,” to connect to the network. Wi-Fi capability is standard on many laptop computers.

Wireless networking, however, works only for very short distances; therefore, it requires infrastructure in the medical facility. Transmitters and receivers called “access points” must be installed throughout the building in close enough proximity that the laptop (or other wireless device) can always find the radio signal.

There are some concerns that wireless access points can be used by unauthorized computers to enter the network, or that wireless transmissions containing EPHI (protected health information in electronic form) can be intercepted. However, medical systems installed by qualified installers use secure authentication and encryption techniques (these will be explained in Chapter 10). These technical safeguards effectively protect the EHR and patient data.
The real risk with laptop computers is that providers and clinical users will save protected health information (PHI) data to the laptop computer’s hard drive. That data may then not be protected by the same safeguards used on the office network or built into the EHR system. Laptops also are more troublesome for the IT department to manage and update, and laptops eventually become obsolete because they have only limited capability for hardware upgrades.

Laptops have other issues as well. Typically they run on batteries. This means after 2 to 4 hours of use, the batteries need to be recharged. Although laptop computers have A/C adapters, most users do not like having to plug them in every time they come into a room. The small appearance of a laptop is deceptive. They typically weigh from 3.5 to 9 pounds; after carrying it all day, that weight feels quite heavy.

Being mobile, laptops also are more susceptible to being dropped, lost, or damaged. The keyboards are smaller and the built-in pointing devices that replace the mouse take some getting use to. However, laptops typically have high-resolution screens and will typically run any program that will run on a workstation.

One choice for facilities with limited counterspace in the exam rooms is to combine the laptop with a portable cart, as shown in Figure 1-11. The cart can be easily rolled from room to room and provides a stable and comfortable work area for the clinician. If the laptop has Wi-Fi connectivity, there is nothing to plug in. Also, if the batteries begin to run low, the A/C adapter-battery charger is usually right on the back of the cart. You also may have seen computer carts used on hospital floors where they are affectionately known as computers on wheels.

EHR on a Tablet PC

The Tablet PC offers the size and portability (and drawbacks) of a laptop computer. However, it offers one feature that many providers really like. Users can move and click the mouse by just touching the screen with a special stylus supplied with the Tablet PC. EHR systems that involve primarily opening lists and clicking findings with a mouse work well on a Tablet PC, as shown in Figure 1-12.

If 95 percent of the charting is done with a mouse, then a Tablet PC is ideal. However, a Tablet PC typically does not have a keyboard for touch typing. Most have a small area of the screen that can be used as a keyboard. Typing is done by clicking the mouse over each letter of the alphabet. This technique is serviceable for a word or two but painful for a clinician who uses a lot of free text.

To compensate for the lack of a keyboard, the Tablet PC has two other features. One is handwriting recognition, which allows you to hand print characters on the screen, and then a few seconds later it will convert them into typed characters. The other is speech recognition, which is built into the Tablet PC operating system. Spoken words are recorded and then processed with special software to produce a text note. Both of these features require you to train the computer
to recognize your handwriting or speech patterns. For some providers, these features work relatively well; others find that the error rate is too high.

**Speech Recognition**

Another useful computer tool for clinicians is speech recognition. Speech recognition software recognizes the patterns in your speech as words and turns them into text.

For specialties such as radiology and pathology, speech recognition is ideal as it allows providers to document their observations, while they use the mouse for a different application such as the manipulation of x-rays or diagnostic images. Modern voice recognition software can also recognize verbal commands to operate the software. This allows the radiologist or pathologist to select patients, open orders, save reports, zoom images, or change contrast without using his or her hands. Integration of speech recognition with an EHR can ensure the clinician’s report is automatically tied to the patient chart.

In other specialties speech recognition is sometimes used to add free-text comments to findings in the codified medical record. This is especially popular with providers who use a Tablet PC. Having clinical dictation instantly and automatically transcribed by a computer reduces turn-around time and eliminates the cost of a transcription service.

Most people speak at least 160 words per minute but type fewer than 40 words a minute, so speech recognition should be a lot faster. Speech recognition systems can achieve up to 99% accurate recognition, but most people seem to average about 95%. This means that a full-length dictation will have one or more errors that must be corrected. The time spent backing up and making corrections slows down the overall rate of efficiency. The good news is that
speech recognition systems improve as they are used. Each time the speaker makes a correction, the system learns a little more about the speaker’s voice patterns. Recognition is also improved by use of a special medical language model, which recognizes medical terms that might not be in a generic speech recognition product.

It has been the dream of many doctors to create a complete encounter note just by speaking about the patient visit, but historically that has produced a text note instead of a codified medical record. That problem has been overcome with the development of new applications that match the spoken text to Medicine nomenclature findings to produce a structured note. To learn how speech recognition works, read the technical explanation, *How Speech Recognition Software Works*, which is located on the Myhealthprofessionskit.com web site (access details provided on the inside cover).

**Chapter One Summary**

*Electronic Health Records are the portions of a patient’s medical records that are stored in a computer system as well as the functional benefits derived from having an electronic health record.*

The IOM set forth eight core functions that an EHR should be capable of performing:

- **Health information and data** Provide improved access to information needed by care providers, using a defined data set that includes medical and nursing diagnoses, a medication list, allergies, demographics, clinical narratives, laboratory test results, and more.

- **Result management** Electronic results for better interpretation, quicker recognition and treatment of medical problems; reduces redundant testing and improves care coordination among multiple providers.

- **Order management** CPOE systems improve workflow, eliminate lost orders and ambiguities caused by illegible handwriting, monitor for duplicate orders, and reduce the time required to fill orders.

- **Decision support** Includes prevention, prescribing of drugs, diagnosis and management, and detection of adverse events and disease outbreaks.

  Computer reminders and prompts improve preventive practices in areas such as vaccinations, breast cancer screening, colorectal screening, and cardiovascular risk reduction.

- **Electronic communication and connectivity** Among care partners, enhances patient safety and quality of care, especially for patients who have multiple providers.

- **Patient support** For example, patient education and home monitoring by patients using electronic devices.

- **Administrative processes and reporting** Increases the efficiency of healthcare organizations and provide better, timelier service to patients.

- **Reporting and population health** Facilitates the reporting of key quality indicators and timely reporting of adverse reactions and disease outbreaks.
The CPRI identified three key criteria for an EHR:

◆ Capture data at the point of care
◆ Integrate data from multiple sources
◆ Provide decision support

The ONC created a strategic framework for achieving widespread adoption of EHR within 10 years. The framework was revised for 2008–2012, and again for 2011–2015.

The HITECH Act provides CMS incentives for providers to use a certified EHR.

ONC seeks to reduce the risk of EHR investment by establishing Authorized Testing and Certification Bodies to certify EHR systems.

A patient encounter document is organized into four components:

◆ Subjective
◆ Objective
◆ Assessment
◆ Plan

EHR systems strive to improve patient healthcare by giving the provider and patient access to complete, up-to-date records of past and present conditions.

Documenting at the point of care means the providers (clinicians, nurses, and medical assistants) record findings at the time of the encounter, not after they have left the patient.

Implementing an EHR requires changes in the way providers work. The choice of computers, devices, and technology can affect the successful adoption of an EHR. One aspect, how much space is available, may determine the type of device to use. The second aspect is the mobility of the clinicians. The third aspect is what type of clinician–patient interaction the clinicians hope to achieve. These factors determine how and where to use computers to achieve point-of-care EHR.

Each of the devices we discussed had advantages and disadvantages:

◆ Computer workstations are cheap, reliable, dependable, easier for the IT department to manage, and can be upgraded when necessary. But they take up more space and may not fit in the exam rooms.

◆ A laptop computer packages everything in a unit about the size of a notebook. They provide mobility for clinicians who want to take their work from room to room. But they require a wireless network to gain that mobility and they have limited battery life.

◆ The Tablet PC offers the size and portability of a laptop computer and users can move and click the mouse by just touching the screen with a special stylus. However, in tablet mode, it does not have a keyboard, so it is less desirable when there is a lot of keyboard input. It works well for EHR systems that primarily involve opening lists and clicking findings with a mouse. Similar to laptops, it requires a wireless network and has a limited battery life.

◆ Speech Recognition software can interpret the sound waves of speech and match them to vocabulary words, converting speech to text.
Testing Your Knowledge of Chapter 1

1. What does the acronym EHR stand for?
2. What is the definition of an EHR?
3. Explain the benefits of EHR over paper charts.
4. Describe what points of the workflow are different between offices using a paper and an electronic chart.
5. Name at least three forces driving the change to EHR.
6. What are the four goals of the Strategic Framework created by the Office of the National Coordinator for Health Information Technology?
7. Describe at least three differences between inpatient and outpatient EHR systems.
8. Explain why documenting at the point of care improves patient healthcare.
9. What is the HITECH Act?
10. What is the name of an organization that certifies EHR systems?
11. List the 3 styles of the physician-patient relationships described by Wenner and Bachman.
12. List the eight core functions that an EHR should be capable of performing.
13. List the three criteria of an EHR defined by CPRI.
14. What are the four defined sections in a SOAP note?
15. What three benefits of electronic results identified by the IOM report?