Chapter 2

Information Systems

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Learning Objectives

- Understand the electronic health record (EHR) as indispensable to high quality, coordinated, and efficient care
- Understand that many types of information systems (IS) are needed to manage an integrated health system
- Appreciate how information systems are tightly integrated with the business and clinical functions of the health system
- Be aware of the leadership, personnel roles, and services commonly found in the IS function
- Be very familiar with how Information and data are key to management and clinical decision making
- Appreciate the role and relationship of analytics systems and their business and clinical functions
- Recognize how technology changes due to environmental forces such as policies and emerging payment models impact health care

INTRODUCTION

The **electronic health record (EHR)** is indispensable to provide high-quality, coordinated, efficient care and is mandated through federal policy. However, many more types of **information systems (IS)** are needed

for an integrated health system to support its mission and remain competitive in the market. These information systems are tightly integrated with the business and clinical functions of the health system and are managed and supported by skilled professionals within the IS function of the organization.

This chapter discusses the EHR in detail as well as other significant clinical and administrative information technology (IT) found in integrated health systems. The leadership, personnel roles, and services commonly found in the IS function are explored as well. Information and data are key to management and clinical decision making; thus the role and relationship of analytics systems and their business and clinical functions are examined as important developments in healthcare IT. Finally, technology changes due to environmental forces such as policies and emerging payment models are discussed.

KEY INFORMATION SYSTEMS

Information system is a broad term used to describe both the technology (e.g., hardware and software) and the way that individuals use a system to perform their roles within the organization. Data also play an important role in information systems, making up the information component that is transferred between systems of computers and human users. For example, an EHR system consists of hardware (e.g., computers), software (e.g., the EHR application or program), and data (e.g., orders, lab results). The EHR system also consists of templates (structured guides) that are tightly integrated with clinical pathways (the step-by-step process that providers follow when giving care). Therefore, when thinking about the EHR, one must think about the technology as well as the way it is used.

The justification for understanding information systems as they pertain to managing integrated delivery systems is simple: Most, if not all aspects of a health system have been transformed by information systems. Indeed, first the revenue cycle, then operations, and now clinical delivery have not just been automated but truly transformed through the value-added capabilities of these systems. Therefore, a competitive advantage may be gained by managing the information technology function to its full capacity, and integrating this new information across all decision makers within the organization. In this section, we discuss important health information technology (HIT) systems used by clinical staff as well as healthcare administrators.

Electronic Health Record

All of a patient's medical information is documented within his or her health record. It is important to appreciate the breadth and depth of the information contained within the health record to better understand the challenges of keeping these data electronically and repurposing them later (**Figure 2–1**). Medical providers use the health record to document the health state of the patient as well as the care they provide. Providers also use it to communicate to one another. The health record is used as the source of billing codes, establishing what will be charged on the medical bill. In most cases, the health record is also a legal record of the patient's status, the provider's decision making, and exactly which procedures were performed. These very different usages are very important to consider when repurposing health records for research and analysis (**Table 2–1**).

Ideally, the health record has the following characteristics:

- *Longitudinal*, spanning medical encounters over the years
- *Comprehensive*, including all of the various types of health information (e.g., labs, procedures, images) in one place
- *Complete*, containing all of the encounters available regardless of hospital, setting, and geographic location

Currently, this ideal is rarely, if ever, achieved.

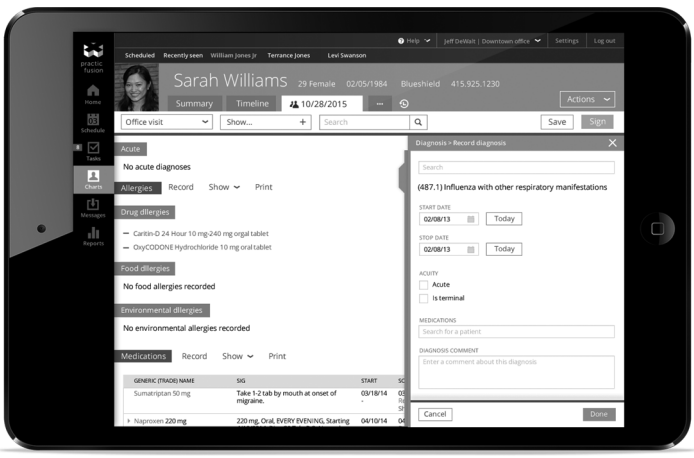

Figure 2–1 Screenshot of Practice Fusion EHR
Courtesy of Practice Fusion, Inc.

Table 2–1 Typical EHR functions and data elements

EHR Functions	EHR Data
Health information and data management*	Patient demographics
Structured templates	Vitals
Result management*	Allergies
Order management*	Diagnosis and problems
ePrescribing	Progress/nursing notes
Order sets	Physician notes
Formularies	History and physical examination
Decision support*	Care setting
Alerting	Medication
Additional information	Procedures
Electronic communication and connectivity*	Laboratory order and results
Health information exchange (HIE)	Microbiology
Remote radiology	Radiology images
Provider messaging	Consent and advance directives
Telehealth	Patient-reported outcomes
Patient support*	Chief complaint
Patient education	
Administrative processes and reporting*	
Reporting and population health*	
Disease registries	

* Denotes key functions as reported by Institute of Medicine (2003).

Many EHR products are designed to support general medicine practices and/or a large number of specialty services. However, some EHR software may be unique and tailored to a specific medical specialty. For example, ophthalmology practices may require special charting and drawing capabilities as well as the ability to communicate to special equipment. Moreover, EHRs are frequently designed to meet the needs of specific segments, such as ambulatory or acute care. To see other examples of EHR products and market segments, visit www.klasresearch.com, which is a rating service (think *Consumer Reports*) for EHRs and other health information technology.

The diversity of EHR needs across clinical settings represents a challenge to the integrated delivery system. Only the most expensive EHR vendors support large systems that incorporate high-quality inpatient and outpatient

capabilities in the same product. Frequently, an integrated delivery system will support different EHR products across the enterprise due to cost requirements, the various needs of providers, or legacy situations. This proliferation of products (and standards) places an additional burden on system and user integration plans and maintenance across systems.

Patient health records have existed since the beginnings of medical practice. However, the transition from handwritten records to computerized records remains one of the great challenges of our era. There is strong evidence that EHRs are a requirement (but not sufficient themselves) to improve health outcomes. Such records can foster better clinical outcomes through improved documentation, error checking, and other decision support (Kern, Barrón, Dhopeshwarkar, Edwards, & Kaushal, 2013; Wu et al., 2006). Productivity and financial improvements may also be possible (Poissant, Pereira, Tambly, & Kawasumi, 2005).

Despite the relatively rapid computerization of other industries, EHR adoption has been slow (**Figure 2–2**). The slow pace of adoption of EHRs by hospitals and providers has been attributed to financial misalignment (Johnston et al., 2003), immature technology, and workflow interference (Ash & Bates, 2005). Conversely, improvements in these areas as well as new policies to incentivize EHR adoption are increasing adoption.

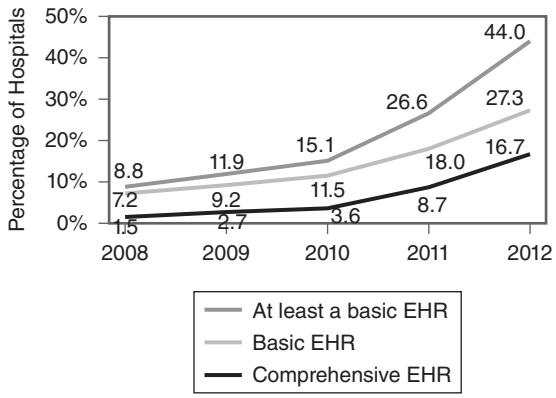

Figure 2–2 Adoption of Electronic Health Records by Hospitals, 2008–2012

Consumer-Oriented Technologies and mHealth

This is the decade of **mobile health applications (mHealth)** and other consumer-oriented health technologies. Whereas the EHR may revolutionize medical practice, mHealth holds the potential to bridge the "last mile" of health care and connect clinical information systems to consumers in their homes and other nonclinical environments.

Patient portals and **personal health records (PHRs)** are consumer-oriented technologies that help individuals and caregivers manage healthcare information. Patient portals and PHRs can have similar capabilities, but PHRs are consumer controlled and independent of the provider organizations (**Figure 2–3**), whereas portals are the "online apps" available to patients of an integrated delivery system. Patients can log into the portal and perform a variety of value-added tasks. Common capabilities include the following:

- Schedule appointments
- View test results
- Patient–clinician messaging
- View current medications
- Problem lists
- View/update allergies
- Immunizations
- Prescription renewals/refill requests

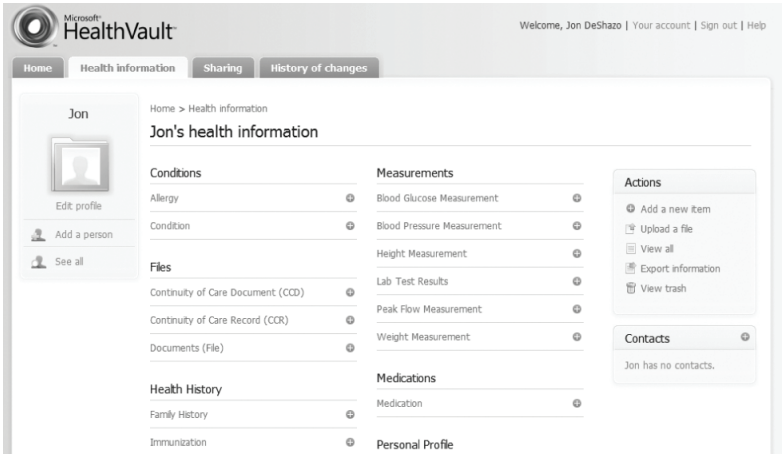

Figure 2–3 Screenshot of Personal Health Record
Used with permission from Microsoft.

- Online billing services
- eVisits
- Save/export EMR data
- Education material
- Satisfaction surveys

For integrated delivery networks, patient portals are becoming instrumental communication channels through which to connect with patient and their caregivers across care settings and at home. For example, use of the online medication refill function in patient portals has been shown to improve patient medication adherence and key lab markers in diabetic patients (Sarkar et al., 2013). In addition, a growing body of evidence indicates that patient portals can improve use of preventive services, missed visits and care transitions, chronic disease management, and other aspects important to integrated care delivery systems. However, more research is needed, particularly on portal use among older and socioeconomically disadvantaged patients (Goldzweig et al., 2013).

The use of remote sensors and mobile devices is also growing in health care. Mobile devices (e.g., mobile phones and tablets) have the potential to reach large numbers of individuals in geographically dispersed places through a convenient and low-cost delivery mechanism. Mobile-based technologies have been used in chronic disease management, sexual health, general well-being, weight loss, tobacco cessation, and many other programs (Fiordelli, Diviani, & Schulz, 2013). Text messaging has been used to reduce missed visits, ensure medication compliance, and even make quicker diagnoses (Car, Gurol-Urganci, de Jongh, Vodopivec-Jamsek, & Atun, 2012; Krishna, Boren, & Balas, 2009).

The significant interest in mHealth is partly due to payment models and recent legislation that require healthcare provider organizations to be accountable for the health of their patients. In this environment, information technologies that support smoother transitions between care settings, improve communication between the patient and the provider outside of the traditional care setting, and go where the patient goes are growing in popularity.

Other Clinical Information Systems

An integrated delivery system typically includes a large number of clinical information systems in addition to the EHR. Many of these systems are tightly integrated with the EHR. The three ancillary systems that are the foundations of the EHR are the pharmacy, radiology, and laboratory systems. To fully capitalize on their promise, these ancillary systems should

be integrated (or even centralized) across an integrated delivery system. Many providers choose ancillary systems offered by their existing EHR vendor to avoid the need for potentially complex and costly interfaces.

Although integrated delivery systems can have very diverse facility makeup (e.g., imaging centers, multiple outpatient clinics), it is typically beneficial for core information systems to be less geographically distributed. Ideally, the ancillary systems, like the EHR, should be centralized within and available across all care settings.

A number of lists identifying and defining clinical systems have been published by industry as well as researchers. The Health Information Management System Society's (HIMSS) EMR adoption model, known as EMRAM, is often used to describe the clinical information systems in an organization (**Figure 2–4**). The EMRAM is a score-based ranking from stage 0 (no clinical information technology) to stage 7 (the most capable information technology). It is cumulative, in that an organization must have all of the capabilities in Stage 1 before it should adopt Stage 2 capabilities. EMRAM contains information systems (e.g., data warehousing, pharmacy system) as well as capabilities that may be found within other clinical information systems (e.g., clinical decision support system, clinical documentation).

EMR Adoption Model[SM]

Stage	Cumulative Capabilities
Stage 7	Complete EMR; CCD transactions to share data; Data warehousing; Data continuity with ED and ambulatory
Stage 6	Physician documentation (structured templates), full CDSS (variance & compliance), full R-PACS
Stage 5	Closed loop medication administration
Stage 4	CPOE, CDSS (clinical protocols)
Stage 3	Nursing/clinical documentation (flow sheets), CDSS (error checking), PACS available outside Radiology
Stage 2	CDR, Controlled Medical Vacabulary, CDS, may have Document Imaging, HIE capable
Stage 1	Ancillaries – lab, rad, pharmacy - all installed
Stage 0	All three ancillaries not installed

Figure 2–4 EMR Adoption ModelSM

The following is a breakdown of the most important elements in the EMRAM:[1]

- *Laboratory:* An application that streamlines the process management of the laboratory for basic clinical services such as hematology and chemistry.
- *Radiology:* An automated Radiology Information System that manages the operations and services of the radiology department. The functionality includes scheduling, patient and image tracking, and rapid retrieval of diagnostic reports.
- *Pharmacy:* An application that provides complete support for the pharmacy department from an operational, clinical, and management perspective, helping to optimize patient safety, streamline workflow, and reduce operational costs. It also allows the pharmacist to enter and fill physician orders and, as a by-product, performs all of the related functions of patient charging, general ledger updating, resupply scheduling, and inventory reduction/statistics maintenance.
- *Clinical data repository (CDR):* A central database in which to store and report on clinical data from various applications.
- *Health information exchange (HIE):* Provides the capability to access clinical data from external clinical information systems. Can be peer-to-peer or centralized through a health information exchange organization.
- *Clinical decision support system (CDSS):* An application that uses rules and guidelines based on clinical data to generate alerts and treatment suggestions. CDSS is key, but not necessarily sufficient, to encourage provider behavior changes.
- *Computerized provider order entry (CPOE):* The capability for providers to enter orders (e.g., medications, labs), typically using a structured format, into the computer system. It is frequently coupled with CDSS to provider drug-error alerts.
- *Closed loop medication administration:* The capability for a system to record and reconcile a prescription order with dispensary and administration details.

Administrative Information Systems

As with clinical systems, a great number and variety of information systems are available that support the administrative, operational, and strategic functions of the healthcare organization. In fact, administrative systems can generate a significant return on investment. A review of 57 articles on all types of health IT found that most of the positive financial effects of health information technology stem from administrative benefits. These benefits

include savings on administrative goods, personnel, and pharmaceutical choice, and well as revenue gains from improved billing (Low et al., 2013).

Of the various types of administrative systems, billing systems have the longest history and most profound impact on healthcare organizations. A computerized billing system electronically documents information describing services provided and submits a claim to an insurance provider. Health system billing systems typically accommodate complex service and fee schedules, as well as other capabilities such as research billing and patient registration. Because billing systems play such a critical role in revenue generation, they are frequently the first IT system adopted; because of their primacy, they may then become a driver of analytic systems.

Enterprise resource planning (ERP) systems are becoming an indispensable management tool to integrated health systems. ERPs combine human capital and supply chain management with other available data to help organizations streamline equipment, supplies, personnel, and end-to-end fiscal control.

IS FUNCTION AND INTEGRATED HEALTH SYSTEMS

The information systems function within a health system is made up of people, technologies, and processes working together to support the mission and business goals of the organization. In health care, the IS function must support the operational needs of almost every type of end user, including healthcare providers, administrators and clerical workers, facilities and plant workers, scientific staff, and even patients. This diversity creates a challenging array of diverse information technology for the IS function to support.

To satisfy these diverse end-user requirements, health system IS functions must support systems such as the following:

- Clinical information systems
- Research information systems
- Business intelligence and performance/quality improvement systems
- Clerical and administrative systems
- Operations and financial systems
- Networking, interfaces, and telephony systems
- Billing systems

These systems perform a variety of service functions:

- System and software management
- Server/hardware management
- User provisioning and helpdesk support
- Health information management
- Backups and business continuity planning

Following business convention, the IS function of a health system is led by the **chief information officer (CIO)**. The CIO is the administrator responsible for IS technology, services, and personnel in a health system. A CIO's responsibility may include a single hospital, a large integrated delivery system, or an organization with a larger footprint. National- or regional-level CIOs may be supported by local CIOs at a smaller local level. For example, a large integrated delivery system may have a corporate level CIO, as well as CIOs for specific hospitals and ambulatory. CIOs typically report to the chief executive officer, but they may also report to other "C"-suite officers or directly to the board of directors (**Figure 2–5**).

In health care, the IS function is also led by the unique roles of **chief medical informatics officer (CMIO)** and **chief nursing informatics officer (CNIO)**. These two roles represent a structural coupling of clinical expertise with IS function experience. CMIOs are medically trained individuals responsible for the physician needs of clinical systems. Likewise, CNIOs are nurses responsible for the nursing needs of clinical systems. CMIOs and CNIOs will also likely lead a cadre of **physician and nurse informaticists**—providers who have frequently received training in clinical information systems and function as superusers and champions of clinical systems. The CMIO and CNIO may report to the CIO, and/or to the chief medical officer or chief nursing officer, respectively.

The **chief technology officer (CTO)** reports to the CIO and is responsible for enterprise-level strategy and issues related to information systems technology. The CTO should have a good command of current and emerging technologies and understand how they can be best applied operationally or used to further the organizational mission.

The **chief security officer (CSO)** is responsible for the development and enforcement of policies and technologies for information security as well as

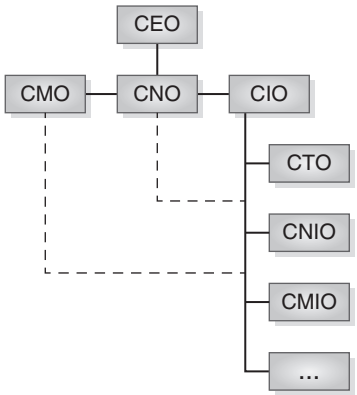

Figure 2–5 Organization chart of IS leadership

business continuity and disaster recovery planning. This is quickly becoming a complex and critical role as health care grows more dependent on information technology. Sometimes the CSO may also be responsible for compliance with the Health Insurance Portability and Accountability Act (HIPAA) and other privacy policies.

The **chief data officer**, who is also sometimes known as the chief health information officer, is an emerging role in health care. At one time a CIO may have had the appropriate level of knowledge regarding health data, but the recent explosive growth of data in health care is forcing organizations to develop leaders who specialize in data-centered roles (Versel, 2014). Data are now considered to be among a health system's most valuable assets, and how data are used will be the source of significant competitive advantage in the future (Aiken & Gorman, 2013).

Aside from senior leadership and reporting structure, how the IS function is organized within (or throughout) the integrated health system matters. Currently, most integrated delivery systems are moving toward a **centralized IS configuration** rather than a **decentralized** one. In a centralized IS configuration, most if not all, of the IS personnel work in a central headquarters or regional-based support center, rather than at each of the facilities. While a centralized approach has many benefits, including economies of scale, human resources/training, oversight/control, and ease of delivering a consistent service or product, it does have some drawbacks. For example, in a decentralized model, the IS personnel can develop closer relationships with their customers and have better insight into the end users' needs. Also, end users appreciate the proximity of IS support.

IS organizations can also be function based (e.g., where the emergency department has its own IS team), application based (e.g., where the billing system and EHR have their own teams), or organization process based (e.g., where all clinical systems fall under one team, and all revenue cycle systems fall under another team). Each of these configurations has unique advantages and disadvantages and performs differently depending on whether information systems are centralized or decentralized. An integrated health system will likely be a matrix organization including several of these arrangements. For example, in a semi-centralized arrangement, all IS teams may be process based except the clinical systems, which are subdivided by application-based teams.

IS process improvement is critical within integrated delivery systems. As organizations experience rapid changes (particularly within IS), there is a need to know which functions are currently operating well and which are outdated or even unnecessary. Process improvement frameworks are a structured method of assessing the performance of IS and making process improvement recommendations. A large number of process improvement

Table 2–2 Examples of Process Improvement Frameworks

	Website	IT Relevance	Healthcare Relevance	Level of Detail	Weaknesses	Strengths
IT infrastructure Library (ITIL)	www.itil.org	Yes	No	Detailed	Highly dependent on interpretation	Service and operations oriented
Six Sigma	www.isixsigma.com	No	No	Abstract	Difficult to apply in uncertain processes	Data driven, takes costs into account
Lean	www.Lean.org	No	No	Detailed	Just-in-time processes work best in stable systems	Oriented toward production-cycle improvement
CMMI	www.sei.cmu.edu/cmmi/?	Yes	No	Detailed	Does not address operations	Geared towered software development
Institute of Healthcare Improvement	www.ihi.org	No	Yes	Detailed	Slow, incremental progress	Good for addressing specific problems
Malcolm Baldrige	www.nist.gov/baldrige/?	No	Yes	Abstract	Holistic approach	Holistic approach

frameworks are available to adopt and follow, and an organization can certainly create its own from scratch or based on existing frameworks. The critical point is that the framework be consistently applied, measure important outcomes, and directly or indirectly lead to improvements. **Table 2–2** provides four examples of commonly used frameworks: IT infrastructure Library (ITIL), Six Sigma, Lean, and the Capability Maturity Model.

ANALYTICS AND BUSINESS INTELLIGENCE

The future of health care is data driven, and advanced analysis and business intelligence will be at the heart of it. **Business intelligence (BI) and analytics** is a collection of methods to extract and analyze data for better decision making. It can be applied for various purposes at almost any level from clinician, to department administrator, to corporate strategist. In health care, the move toward analytics is driven by need as well as the emerging sources of data produced by rapid EHR adoption.

Typically an integrated health system will employ BI to address the following areas:

- *Research and translational improvements:* A movement toward personalized medicine, genomic medicine, and comparative effectiveness analytics is driving business intelligence in this area.
- *Value-based care:* New reimbursement models are forcing integrated delivery systems to consider cost and value, as well as the effectiveness of their clinical processes. This new approach requires the clinical outcome data to be merged with operations and cost data.
- *Clinical and operational improvements:* Business intelligence may help improve clinical processes and operational processes, and identify opportunities for growth and savings that may lower costs.

The IS function of an organization plays a critical role in the success of BI systems. In addition to hosting and supporting the BI computer systems themselves, the IS function is largely responsible for the quality of the data represented. It is crucial for the primary information systems to capture clean, well-defined data. To ensure this demand is met, the computer systems capturing the data that flow into the BI systems may use front- and back-end data integrity checks, as well as routine end-user training. Coupled with data definitions lineage and good security, this effort will improve the data quality. The IS function (or preferably a chief information officer) then performs the following key functions to support business intelligence:

- *Data governance:* Governance focuses on managing data and data concepts from initial capture through aggregation and/or transformation to use. Types of data used in data governance include controlled terminologies and reference data.
- *Data integration:* This process includes the mapping of source data to target data, as well as a plan to load data from one system to another. Frequently, it includes data cleansing and quality control steps.
- *Data storage:* Data must be stored in a manner appropriate to the level of access and use needed. Data availability and disaster recovery are also considerations at this stage.

In 2009, the Health Information Technology for Economic and Clinical Health (HITECH) Act was enacted as part of the American Recovery and Reinvestment Act. This policy authorized the U.S. Department of Health and Human Services to spend $25 billion on healthcare IT adoption and research. The policy comprised an economic stimulus package as well as an EHR adoption incentive program. The HITECH Act expanded the Office of the National Controller for Health Care IT and created two new national

committees: the HIT Policy Committee and the HIT Standards Committee. Several provisions of the act funded regional and state programs to encourage HIT adoption by providers as well as adoption- and effectiveness-oriented EHR research. However, the most impactful aspects of the law are the Meaningful Use program and the EHR adoption incentive program.

In the three-stage Meaningful Use program, hospitals and eligible providers are incentivized to adopt certified EHRs and to use these records in their practices. The complexity and capability of the systems used increase from one stage to the next. At the end of the five-year program, if hospitals and eligible providers are not "meaningful use compliant," incentives are replaced by penalties.

Due in large part to the drivers of the HITECH Act and Meaningful Use, more than half of all providers in the United States are currently using EHRs and another 25% are actively on their way to using EHRs in their practice. Time will reveal if meaningful use has been achieved and positive outcomes delivered by the policy.

Under another impactful policy, codified in the Patient Protection and Affordable Care Act, providers can take on more risk for their patients and be rewarded for achieving cost savings for their patient populations. Accountable care organizations, therefore, profit most when they demonstrate they are practicing evidence-based medicine and encouraging patient engagement, thereby avoiding unnecessary hospitalizations and healthcare costs.

Accountable care is a set of policies and processes, but IT can greatly impact the model used to implement it. The Certification Commission for Healthcare Information Technology (CCHITO recommends the following processes be closely supported by HIT: care coordination, cohort management, clinician engagement, financial management, reporting, and knowledge management.

CHAPTER SUMMARY

The Electronic Health Record, or EHR, is indispensable in providing high quality, coordinated, efficient care and is mandated through federal policy. However, there are many more types of information systems that are needed for an Integrated Health System to support its mission and remain competitive in the market. These information systems are tightly integrated with the business and clinical function of the Health System and are managed and supported by skilled professionals within the IS function of the organization.

This chapter discussed the EHR in detail as well as other significant clinical and administrative information technology found in integrated health systems. The leadership, personnel roles, and services commonly

found in the IS function were reviewed then explored. Information and data are key to management and clinical decision-making and the business and clinical functions were discussed. Finally, technology changes due to environmental forces such as policies and emerging payment models were discussed.

Key Terms and Concepts

Business intelligence and analytics: A collection of methods to extract and analyze data for better decision making.

Centralized configuration: An information systems configuration in which most, if not all, of the IS personnel work in a central headquarters or regional-based support center, rather than at each of the facilities.

Chief data officer: Also known as the chief health information officer; an emerging data-centered role in health care.

Chief information officer (CIO): The administrator responsible for information systems technology, services, and personnel in a health system.

Chief medical informatics officer (CMIO): A medically trained individual who is responsible for the physician needs of clinical systems.

Chief nursing informatics officer (CNIO): A nurse who is responsible for the nursing needs of clinical systems.

Chief security officer (CSO): The administrator responsible for the development and enforcement of policies and technologies for information security as well as business continuity and disaster recovery planning.

Chief technology officer (CTO): The administrator responsible for enterprise-level strategy and issues related to information systems technology.

Decentralized configuration: An information systems configuration in which at least some of the IS personnel work at each of the facilities, rather than in a central headquarters or regional-based support center.

Electronic health record (EHR): A record that stores all of a patient's medical information. Medical providers use the health record to document the health state of the patient as well as the care they provide.

Enterprise resource planning (ERP) system: A system that combines human capital and supply chain management with other available data to help organizations streamline equipment, supplies, personnel, and end-to-end fiscal control.

Information system: A broad term describing both the technology (e.g., hardware and software) and the way that individuals use a system to perform their roles within the organization.

Mobile health applications (mHealth): Applications that connect clinical information systems to consumers in their homes and other nonclinical environments.

Patient portal: An "online app" available to patients of an integrated delivery system.

Personal health record (PHR): A consumer-controlled record of an individual's medical information that is independent of the provider organization.

Physician and nurse informaticist: A provider who may have received training in clinical information systems and functions as a superuser and champion of clinical systems.

Questions to Consider

1. How is the IS function organized? What are the leadership roles in IS function? Which services are provided by IS function?
2. What are the primary functions of the EHR? How is an EHR within an IDS different?
3. What are the consumer-oriented systems in an IDS?
4. What are the primary administrative systems in the IDS and which functions do they provide?
5. What is the role of IT in defining and measuring quality?
6. How does IT support analytics and business intelligence?
7. What role does IT play in supporting population-based care and value-based payment models?

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