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CHAPTER 2

HIS Scope, Definition, and Conceptual Model

Learning Objectives

By the end of this chapter, the student will be able to:

- Describe the purpose, definition, and scope of health information systems (HIS) using a conceptual model.
- Define the components of HIS according to the conceptual model, including systems and their management, health informatics, data and analytics, research, policy, and public health.
- Explain the progression and maturation of HIS, beginning with the foundation of core HIS and their management; the use of HIS embodied in the discipline of informatics in key functions such as medicine, nursing, and public health; the use of HIS to learn and create information and knowledge through data analytics and research; and the use of HIS to improve health outcomes and the way healthcare work is done through research, policy, and public health.
- Describe organizational and community settings in which HIS and informatics can be used.

INTRODUCTION

Before delving into the depths of health information systems (HIS), it is important to lock in some key concepts regarding the scope of HIS and take the mystery out of computer systems by reviewing the overall structure of how systems and their uses fit together. The conceptual model adopted in this text provides an understanding of the relationships among the major elements of HIS—not just the "systems" of HIS, but also the art and science of making use of systems and information (informatics), the data created and captured in these systems, and the variety of uses that the data can be put to work to do, such as research, policy, and public health. Each of these uses of data depends on the foundational HIS that create and capture data through the applied use of systems to do clinical and administrative work in healthcare organizations of all types, shapes, and sizes. This chapter describes and builds the layers that comprise the entire HIS model.

Definition of Health Information Systems

In this text, we will define the scope of HIS as including all computer systems (including hardware, software, operating systems, and end-user devices connecting people to the systems), networks (the electronic connectivity between systems, people, and organizations), and the data those systems create and capture through the use of software. Each key layer of this progression through the totality of HIS relies on the foundation of core systems, and requires professionals who specialize in that layer's work. Next, we look at the various layers of HIS one at a time—systems; health informatics; data and analytics; and research, policy, and public health.

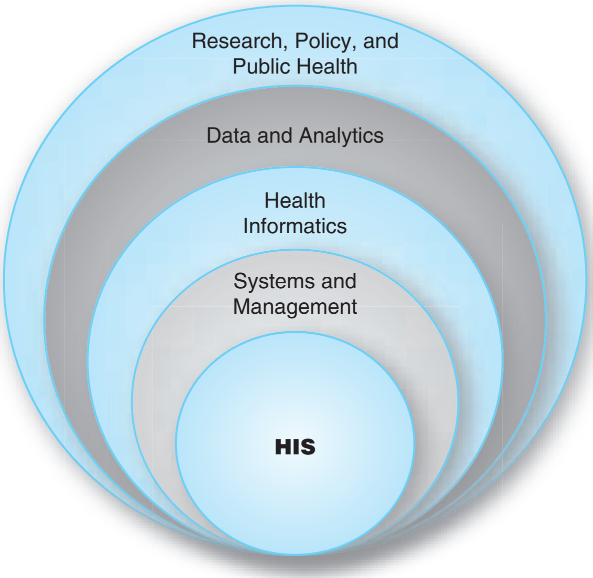
Systems and Their Management

Well-architected, properly managed computer systems are the foundation of the ability to create, transmit, and use information. As obvious as this sounds, with availability of the Internet, development of cool new devices such as iPhones and Androids, and advertisements everywhere from vendors touting the ease of "cloud computing," it is sometimes tempting to think that access to high-quality, useful systems and information is as easy as 1-2-3—that all that is necessary is to "plug into" one of these devices or some other easily accessible computing modality. The hard truth is that the myth of "plug-and-play" simply delays the realization that meaningful health information and data—whether available via the Internet, over a secure internal network, or through the use of an iPad or another innovative device—are only as good as the HIS platform that serves as the data source. In other words, the access devices and networks do not actually create data; instead, **data** are created and captured by painstakingly and properly implemented HIS that provide features and functions to support the workflow (sequence of common tasks) and processes (end-to-end methods) of healthcare providers and organizations, patients, and public health professionals.

These HIS that create and capture data (which can then be coalesced into meaningful information) serve as the *foundation* upon which all other information- and data-related capabilities depend. It might seem old-fashioned, but the source systems and devices that support the work of providers and healthcare organizations remain the essential building blocks of all other advanced uses of data and information and computerized workflow support modalities such as health informatics, data analytics and outcomes analysis, research and public health data surveillance, and predictive modeling techniques.[1] We will talk more about these source systems and their management in the *HIS Strategic Planning*, *HIS Application Systems and Technology*, and *Managing HIS and Technology Services* chapters.

The HIS model in **Figure 2.1** depicts this relationship: HIS and their management form the footing for health informatics, data and analytics, and research, policy, and public health uses of HIS. These components of the total scope of HIS, in turn, rely on the fundamental HIS for the capabilities and data the HIS create and capture so that these spheres can exist. For example, without the foundational HIS, informatics would have no systems capabilities and features and functions to work with in redesigning workflows and calculating rules and alerts, or clinical decision support and artificial intelligence aids to help in the advancement of the practice of medical, nursing, or other health-related professions.

FIGURE 2.1 HIS Scope Model



Likewise, without well-managed HIS used to support key work processes such as clinical care and administrative functions (e.g., billing and payroll), no data would be created and captured for use in databases for analytical and business intelligence purposes. In addition, without these HIS, no data would be created and captured for research, policy, and population-based public health purposes.[2] Data to be used for research, policy analysis, and public health surveillance need to come from somewhere—they need to be *real* data values, emanating from *real* healthcare processes and patients, which are then made available for these secondary purposes on any large scale.

Health Informatics

Informatics is the use of information systems and technology to redesign, improve, and recreate the way work is done in disciplines such as the practice of medicine, nursing, medical imaging, and public health. In most cases, informatics focuses on certain quality or process improvement objectives, but this varies based on the setting in which the informatics activities take place. Informatics comprises the "use" of the computer capabilities that HIS provide to end users. In health care, this includes the activities of physicians, nurses, and other clinicians in the various settings in which they do their work, as well as professionals working in public health in its various environs, such as community settings, public health clinics, and other public health organizations. HIS are expected to enable improvements in the efficient delivery of health care, the quality of services provided, and health outcomes across the U.S. population.

Data and Analytics

Much of the value of systems is locked up in their data—a resource created only as systems are used and data captured in those systems' databases. Creating this resource can yield additional value, the rewards of which are reaped at an exponential scale through secondary uses of this data treasure trove. While primary uses of data involve the transactions that support day-to-day activities of professionals and organizations, the only way to create *information* is through the **aggregation** and compilation of these data to create something greater than the single units of data—in other words, to create meaningful information that is relevant to someone who is doing the work of health and health care. Thus the creation of information and the ability to conduct analysis and gain knowledge are completely dependent upon the creation and capture of the data in the first place.

If someone attempts to create information out of proxied, extrapolated, or estimated data for a certain purpose, the only fruit of those data will be educated guesses. With real data, emanating from real activities conducted in real organizations through real processes, real analysis and research drawing real inferences, associations, outcomes, and evidence can be accomplished. Data created and captured in systems represent a treasure trove to be carefully stewarded and valued every step of the way. Everything else in the conceptual model displaying the progression of information from HIS relies on these data.

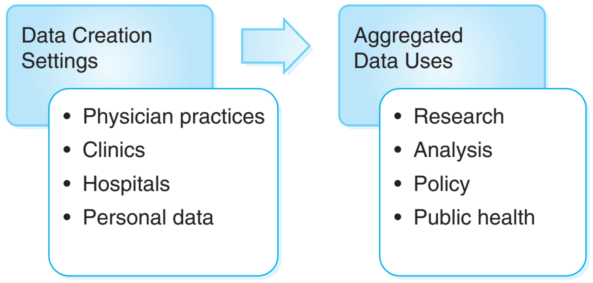
The importance assigned to real data is not unique to the healthcare field. "Business intelligence" is a popular term for the value realized by flexibly analyzing comprehensive stores of data representing the totality of an organization or provider's scope of activity. In other words, data from various systems that support clinical and financial transactions can be combined to enable analysis that reveals insights into the entirety of the activities within the scope of that entity. In health care, this concept leads to the notion of "clinical intelligence."

Research, Policy, and Public Health

At the pinnacle, data created and captured in HIS become available for research. These data fuel the work of university researchers—with their inherent expertise, curiosity, and desire for insight—and they enable analysts to measure the health of patient populations and provide evidence for improving efficiency and effectiveness of healthcare processes and outcomes. Policy makers rely on research that predicts the long-term implications of steps taken in the delivery of health care and implementation of healthcare laws and regulations; that is, they rely on researchers' findings, such as studies carried out in university settings, or analyses performed by governmental agencies and organizations dedicated to health care and public health.[3–5] The simple data captured, one patient at a time, in EHRs designed to support individual workflows at separate organizations are ultimately aggregated into databases that can be made available to researchers and analysts. These aggregated data for research and analysis—the proverbial acorn—ultimately guide the work of policy makers and public health professionals responsible for governmental, political, and legal decisions about healthcare directions, policies, programs, and investments—the mighty oak tree (see **Figure 2.2**).

Public health officials are in a position to harvest the bounty of the entire HIS data chain, as the scope of their work expands from the purview of a person, an organization, or group of patients, to the entire country, ultimately reflecting an international scope. As data are aggregated from systems that support clinical care or business activities across organizations and geographies, they can be analyzed according to many dimensions, such as demographic characteristics (e.g., female versus male, age groups, or race or ethnicity), pathogen (e.g., tuberculosis or anthrax), disease (e.g., cancer, heart disease, or acute illnesses), providers (e.g., hospitals, primary care physicians, or specialists), payment mechanisms (e.g., fee-for-service, health maintenance organization [HMO], preferred provider organization [PPO], Medicare, Medicaid, or uninsured), or other characteristics to better understand trends across an entire population. Such analysis of population-wide characteristics and activities is not confined to the boundaries of an organization (e.g., a hospital) or a segment of the population (e.g., patients insured by a certain carrier or analyses pre- and post-healthcare reform). Rather, inquiries and reports of interest to public health officials reflect the full expanse of their responsibility or perspective, such as a county, region, nation, or the world, as opposed to a subset consisting of those persons who are covered by insurance, are cared for at a particular institution, or live in certain geographies that may be over-represented by the available data. The options or variations available for a particular scope are completely determined by the data available for such analyses and the generalizability of those data to an appropriate population. Elsewhere in this text, we consider the types and sources of data that can be used for these analyses.

FIGURE 2.2 Data Creation/Data Aggregation



Progression and Maturation of HIS Through the HIS Conceptual Model

We can outline the steps in the progression of the use of HIS and HIS data according to the HIS conceptual model.

1. Foundation (HIS)

The progression begins with core HIS and their effective and proper management. None of the subsequent layers of HIS can exist without the foundational, core systems and infrastructure.

2. Use (Informatics)

HIS software system capabilities support clinical and business transactions, and enable redesign and improvement of healthcare workflow and processes, a discipline referred to as health informatics. The automated support of daily activities carried out in a healthcare organization—and use of HIS by the professions of medicine, nursing, and public health to develop new, streamlined, and more effective workflows in the care of patients, with the intention of improving health care—is the unique discipline of informatics. The term "informaticist" has emerged as our world has become automated; this role is found at the intersection of computers and the work of professionals using those systems, such as physicians, nurses, and public health officers, and the work of IT professionals designing, building, and implementing those systems, such as computer systems engineers, systems analysts, programmers, trainers, and testers.

3. Learning/Knowledge (Business/Clinical Intelligence, Data, and Analytics)

The use of data for learning and gaining new knowledge begins when transactional data are created and captured in HIS through the use of HIS software, then coalesced into databases and **analytics** platforms. Subsequently, these data are used for analysis and creation of information, including clinical decision support (CDS), business intelligence (BI), and clinical intelligence (CI), ultimately leading to enhanced knowledge about health care and public health. This newly gained knowledge and the analytical capabilities represent secondary uses of data, which can reveal ways to improve healthcare processes, health outcomes, population health, and overall efficiency and effectiveness in health care.[6]

4. Change

Eventually the progression and maturation of the use of HIS and the data they produce will improve our ability to conduct research, create effective policy, and improve the public's health through change. The path to change for the better is illuminated by evidence produced through use of systems, analytics, and research using data created and captured in HIS.

HIS USES IN ORGANIZATIONAL AND COMMUNITY SETTINGS

With so many different types of organizations and players using health data, the answer to the question "What does this organization or entity use HIS for?" will differ for each type of organization or entity. Likewise, the mission, vision, and goals of each organization will drive the types of systems that are "core" to its purpose. In each instance, one must answer the question "What is the fundamental reason for using HIS?". This requires thinking through the types of systems that different kinds of providers will need to deliver care to their patients and measure outcomes of that care, as well as the types of HIS needed by different types of payers, patients/consumers, public health agencies, or research organizations.

Inpatient, Outpatient, and Ambulatory Healthcare Provider Organizations

Provider organizations are found in any setting in which healthcare services are delivered by healthcare professionals, including hospitals (e.g., free-standing community hospitals, academic medical centers, specialty hospitals, rural hospitals, and multihospital systems), integrated delivery networks, physician offices, physician groups and multispecialty practices, home health agencies, and outpatient clinics of all types (e.g., free-standing surgical centers, community clinics, imaging centers, and urgent care clinics, to name a few). Anywhere care is delivered, HIS are playing an increasingly essential role.

Hospitals began gradual, widespread development of HIS many years ago. The first systems implemented by these organizations supported financial accounting and patient billing functions, with occasional specialized niche clinical or research applications being developed by innovative clinicians with a special knack for technology and access to technical professionals such as programmers. In the 1970s, hospitals began rolling out HIS supporting processes in clinical settings, with the nascent systems including features such as order entry or results reporting. Generally speaking, these early HIS in the clinical areas of hospitals were geared more toward capturing charges for purposes of providing data to patient accounting systems, which then used these data to populate claims to insurers and bills to patients. Most of these systems were developed in hospital data processing departments, where the early HIS innovators invested in hardware platforms, operating systems, and programming packages, and hired programmers and systems analysts to define HIS requirements for various areas in the hospitals and create the programs and systems based on those requirements. Those in-house systems would then be implemented gradually throughout the sponsoring hospital with the support of in-house development teams. Team members collaborated with end users, who helped define the requirements based on their own ideas for uses of computers; they also took advantage of ideas generated in collaboration with colleagues from other hospitals who might also be working on in-house computer systems for their areas.

In the 1970s, early HIS software vendors emerged. Some of these vendors acquired software from the hospitals, doing in-house development, and then commercialized this software into products for which hospitals could purchase licenses to use in their organizations. Others developed their own software, which was then commercialized and licensed to hospitals on a multiyear basis. Thus the HIS software industry was born. These early HIS software products initially focused on financial and patient accounting/billing functions; later, during the 1980s, clinical systems supporting the automation of specific departmental areas in hospitals (e.g., laboratory, radiology, and pharmacy) began to emerge, as did order communications and results reporting systems for use in hospitals and a few large multispecialty physician practices.

The market for commercial HIS products, along with consulting services to help an increasing number of hospitals, clinics, and physician practices implement them, grew steadily throughout the 1990s, with sales of these products and services totaling hundreds of millions of dollars. Also in the 1990s, with the work of a few forward-thinking, pioneering organizations serving as examples, and the presence of a few software vendors that were able to make the leap and develop commercial software products to support a broad range of integrated clinical functions, electronic health records (EHRs) emerged. The introduction of EHRs spurred a massive wave of automation of hospitals that continues today. The current norm in U.S. health care is for hospital and clinical processes in all areas of financial, administrative, and clinical activity to be automated. The HIS products and services supporting the entire highly diverse collection of organizations providing health care and patient health services are the basis of a multibillion-dollar industry.

Patients'/Consumers' Homes

Consistent with the spread of mobile computing throughout our society and world, patients being cared for by providers and people in their homes or places of work can increasingly access their patient records and providers, as well as monitor their personalized health data. Additionally, vast sources of health-related information are accessible through the Internet, from mobile devices, and via electronic sources to consumers of healthcare services or those interested in learning about various health or medical conditions, services, and products. The age of patient engagement is upon us—increasingly CEOs of healthcare institutions and providers working in healthcare organizations have realized that they can achieve the best outcomes in organizational performance and clinical care by enlisting patients in the process. Likewise, many people now expect to be part of their own healthcare process, consistent with how they drive participation in other types of commerce and consumption of goods and services.

While this sounds quite logical, it is a far stretch from the not-too-distant era of the "passive patient," a time in which physicians were seen as almost god-like figures and providers were reluctant to share the contents of a patient's medical record with the patient or family. In fact, part of the author's education in medical records science in the 1970s consisted of learning how to carefully manage the situation in which patients asked to see the contents of their medical records: Legally patients have always had a right to that information, but providers actively avoided showing them the information for fear they would not understand it or could not handle knowing what was going on inside their own bodies. The language and values of health care reflect this traditional expectation of the obedient patient as being either "compliant" or "not compliant" with the instructions or prescriptions of the expert, superior clinician. Patients who do not "follow doctor's orders" are seen as deviant or irrational, and are blamed for poor outcomes.[7] In fact, the term "patient" linguistically derives from the passive voice in the English language and implies the entity receiving something, in an inferior position, from someone or something (in this case, the clinician or physician who prescribes a regimen of treatment and therapy) from a superior, dominant position.[8]

Modern-day patients and people (meaning individuals before they become sick or injured and who are in the mode of maintaining their health) are playing an increasing role in their care by taking advantage of the connectivity and empowerment of access to information—a role inherent to the information age. Just as we use computers to research and obtain services and products in retail, food, and entertainment, so we now *expect* to be able to access our personal health information from providers and interact electronically in the care process from our homes or places of work. A growing body of evidence is now emerging in the literature showing that clinical outcomes, patient satisfaction, and cost performance improve when patients are engaged and activated in the processes of their care. HIS is a powerful facilitator of such engagement.[9,10] Plus, as the tipping point is within our collective sight vis-à-vis the adoption of EHRs in most hospitals and physician practices, innovators are enthusiastically embracing new means of personal connectivity and engagement in the healthcare arena using IT tools widely applied in other industries.[11,12]

Payers, Insurance Companies, and Government Programs and Agencies

The mechanism by which hospitals, physicians, clinics, and all other healthcare providers are paid for the healthcare services provided to their patients involves insurance companies or payers of one type or another. Several types of payers are found in the United States: private insurance companies, government programs that pay for healthcare services for various groups of citizens based on age or income, military programs that pay for these services for military personnel and their families, and other special insurance programs. Private payers or health insurance companies include companies such as United Health, Aetna, Blue Cross/Blue Shield, Cigna, and others. Government-funded health coverage programs include Medicare (health insurance for people age 65 or older or with certain illnesses such as permanent kidney failure and those with certain disabilities), Medicaid/MediCal (state-specific health insurance for people and families with low incomes), State Children's Health Insurance Plan (SCHIP; state-administered programs using federal money for uninsured children younger than 19 years of age from low-income families), TriCare (health insurance for active and retired members of the military and their families), and Department of Veterans Affairs (government-sponsored programs for military veterans, covering the care they receive from doctors, hospitals, emergency rooms, and immunizations).[13,14]

Military Healthcare Organizations

TriCare is a program that provides for health insurance and coverage of healthcare services, available to all active and retired members of the military and their families (referred to as "dependents" in military vernacular). The Department of Veterans Affairs (VA) offers additional medical care to retired military personnel when needed, which is either fully covered if the veteran is totally disabled, or partially covered if the veteran is partially disabled as a result of military service. CHAMPVA (Civilian Health and Medical Program of the Department of Veterans Affairs) is a health benefits program that helps retired military and their families.[15]

In the 1980s and 1990s, some of the pioneering work that led to the development of EHRs was done in military healthcare settings. For example, the Veterans Health Information Systems and Technology Architecture, commonly referred to as the VistA system, provided an early and shining example of the benefit and power of a comprehensive, integrated EHR. The VistA system was enormously important to the development of EHRs because it supports not only care delivered in inpatient hospital settings, but care for ambulatory patients as well. A predecessor of the VistA system was developed in the early 1980s in a joint venture between the giant government contractor Science Applications International Corporation (SAIC) and the VA, and was a more basic form of a clinical information system that was used extensively throughout the system of VA hospitals and clinics. The VA ultimately replaced this earlier, simpler version of a core clinical system with the more comprehensive, sophisticated VistA system. Not only was great progress made in the evolution of HIS through these efforts, but over the years the thousands of VA hospitals and clinics have served as training grounds in which numerous medical students and clinicians learned to care for patients using computers to support the care and administrative processes. In fact, this system is so widespread that nearly 70% of all physicians practicing medicine in the United States today have used it as part of their medical training.

Public Health Organizations

Public health organizations are entities that exist to protect and enhance the public's health. Among other roles, they serve as a "safety net" by providing health care for patients who are uninsured or underinsured (e.g., through county hospitals and community clinics). In addition, public health services include preventive programs operated by municipal or county Departments of Public Health, such as free clinics, school-based immunizations, health-related and nutrition educational programs, birth control education, distribution of condoms, inspection and safety ratings of restaurants, violence prevention programs, environmental health alerts, and a host of other services aimed at maintaining and preserving the health of a population of people within a certain region, state, or locale. Put simply, the role of these public health organizations and initiatives is to attend to the "public's health." In other words, public health organizations always think in terms of the populations whom they serve; they are *not* invested in the for-profit or medical care business of health care. Such organizations are typically funded by government programs at the federal, state, county, or local level, and they exist to keep the entire community of people in their jurisdiction or community protected from environmental risks and able to maintain their health to the degree feasible. A public health organization measures its target population's health by collecting and examining statistics such as infant mortality; mortality and morbidity rates; biological surveillance; immunization rates; rates of communicable diseases such as tuberculosis, HIV/AIDS, and meningitis; deaths and injuries due to violence; air quality; and a variety of other metrics that tell public health officials about the status of and threats to the population's health.[16]

Public health organizations whose primary goal is to measure, monitor, and report key public health statistics nationally are another type of entity whose mission it is to maintain, monitor, and improve the public's health. These organizations depend on a variety of data sources to create such public health information:

- Data from hospitals, clinics, and physician practices gathered through the claims administration processes for Medicare, Medicaid, SCHIP, and other government-sponsored health insurance programs
- Data from laboratories across the nation set up specifically for bio-surveillance and homeland security
- Data voluntarily provided to federal or research organizations that are committed to the study and evaluation of healthcare quality and cost issues

Examples of national organizations of this type include the following[17]:

- Centers for Disease Control and Prevention (CDC): Provides online resources for dependable health information
- Public Health Institute: Promotes health, well-being, and quality of life for people across the nation and around the world
- Rural Assistance Center: Provides health services-related information for rural America

Health Information Exchanges and Regional Health Information Organizations

Since the early 2000s, provider organizations in some regions have been entering into collaborative arrangements of varying scopes and business models with the goal of sharing patient-related health information, securely, between providers organized into not-for-profit, collaborative "data sharing" organizations in that region. Examples of regional organizations that might participate in these consortia include hospitals and hospital systems, clinics, physician practices, emergency responders such as paramedics, tumor registries, imaging centers, community clinics, public health institutions, and others. The idea is that these providers seek to make patient data that they have in their own systems available to other providers if needed to support care for the same patient. The aim is to improve the timeliness of data availability, support clinicians in emergency situations when patients need care at an organization where they typically do not receive care, make existing data available in an emergency to help speed diagnosis and treatment, reduce the need to repeat tests that have been performed at another clinical setting for which the results are stored and readily available within that organization's EHR, save the patient the discomfort and inconvenience of repeated care and testing, facilitate cross-continuum care models such as accountable care organizations (ACOs) and medical homes, and reduce costs and waste when possible.

These pioneering cooperative, collaborative efforts have met with mixed success, but have sprouted (such as the Rhode Island statewide information network) and in some cases taken root (such as the Michiana Health Information Network) across the United States. Many of these initiatives have struggled mightily and then failed due to lack of a sustainable business model, unworkable technical models, lack of cooperation on the part of member organizations, difficulties extracting data from member organizations' systems, or lack of cooperation between competitor providers and vendors. Despite these challenges to forerunners in health information exchange (HIE), progress continues and is beginning to show signs of sustainability. As EHRs become more commonplace, integrative technologies that enable extraction and sharing of data securely have also become more robust: EHR vendors are now enhancing their products' capabilities and providing the technology and software capabilities necessary to share patient data securely as a standard part of their software. Each of these factors may facilitate sharing this information among regional providers.

In addition to today's rapid advancement of ubiquitous technological capabilities in the private sector, a federal mandate related to HIE, included as part of the American Recovery and Reinvestment Act (ARRA) of 2009, is contained in the Health Information Technology for Economic and Clinical Health (HITECH) Act. This act has allocated funding of $27 billion in incentives for hospital and physician providers to adopt EHRs and achieve meaningful use criteria (**Exhibit 2.1**), including, among many types of EHR capabilities, electronic HIE.[18] Thus organizations designed to accomplish HIE—often called **regional health information organizations (RHIOs)**—have gained significant momentum as a result of the HITECH Act; RHIOs enable participating provider organizations to securely exchange patient care-related data and achieve

Meaningful Use criteria in their quest to reap the rewards of HITECH's financial incentives. By sharing patient data securely according to the requirements set out by HITECH and Meaningful Use criteria, RHIOs and other forms of HIE move us slowly but surely closer to a more integrated, less wasteful U.S. health system. Examples of successful RHIOs include Rhode Island Health Network, Michiana Regional Health Information Network, Delaware Health Information Network, and others. Examples of failed RHIOs include Santa Barbara RHIO, early iterations of California Health Information Network, and others. Thus far, smaller regions have achieved the best early results. Owing to their more cohesive, less competitive provider environment and smaller scale, these less complex regions have improved chances of connecting a more manageable scope of organizations, data, and patients for whom data are exchanged.[19,20] Providers participating in these HIEs and taking advantage of their interoperability capabilities vary widely, and widespread use of such capabilities will likely take many years to realize.

EXHIBIT 2.1 HIE-Related Meaningful Use Criteria

Meaningful Use Stage 2 and Health Information Exchange (HIE) Highlights

- **Common Standards and Implementation Specifications for Electronic Exchange of Information:** The Meaningful Use Stage 2 final rules define a common data set for all summary of care records, including an impressive array of structured and coded data to be formatted uniformly and sent securely during transitions of care and, upon discharge, and to be shared with the patient themselves. These include:
  - Patient name and demographic information
  - Vital signs
  - Diagnosis
  - Procedures
  - Medications and allergies
  - Laboratory test results
  - Immunizations
  - Functional status, including activities of daily living and cognitive and disability status
  - Care plan field, including goals and instructions
  - Care team, including primary care provider of record
  - Reason for referral
  - Discharge instructions

Modified from healthit.gov. (n.d.). EHR incentives & certification: How to attain meaningful use. http://www.healthit.gov/providers-professionals/how-attain-meaningful-use

External Regulatory, Reporting, Research, and Public Health Organizations

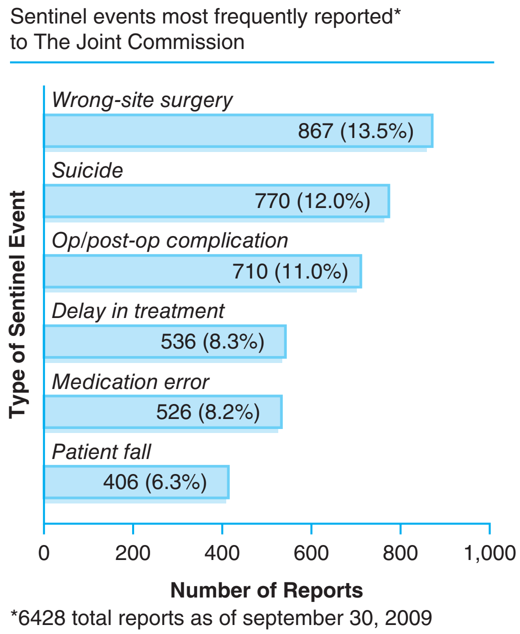
The primary purpose of HIS is to support patient care and administrative processes of healthcare providers and organizations devoted to patient care and the provision of health-related activities and public health services. Each type of organization engaged in such efforts is accountable to its community and board constituents as well as to regulatory oversight bodies, and each collaborates with myriad third-party organizations ("third party" means an organization or agency external to the provider organization). Some third-party or external organizations set standards (metrics) for healthcare providers to use when measuring the quality and cost of the services they provide. The third-party organizations then collect the reported measures from participating health providers and create statistical benchmarks from the aggregate data for those providers to use when evaluating their performance against the performance of other like organizations and implementing quality-improvement and cost-control initiatives. Examples of such third-party or external organizations include The Leapfrog Group, whose mission is to promote improvements in the safety of health care by giving consumers data to make more informed hospitals choices, and state organizations such as the California Health Care Foundation's report cards on hospitals and long-term care facilities, among others. These external organizations may also be state or federal regulatory agencies given the responsibility of monitoring the safety and compliance of provider organizations serving certain constituents (e.g., state or county populations, cardiology patients, children, or aged patients); their responsibilities are typically outlined by governmental regulations that are often funded by a governmental agency.

A third-party external reporting agency may also monitor key metrics regarding quality of care for a particular state or the country as a whole. For instance, the Department of Health Services (DHS) and Office of Statewide Health Planning and Development of the California Health and Human Services Agency (OSHPOD) are state-based agencies charged with ensuring safety in hospitals and other healthcare settings. Provider organizations are required to report data to those state agencies on a regular basis about all services provided to their patients and communities, as well as any untoward events, such as wrong-site surgeries or hospital-acquired infections, that occur to patients. The *Health Informatics* chapter discusses external reporting organizations in more detail.

Other examples of external organizations to which healthcare providers submit vast amounts of data and reports reflecting services provided, safety practices, costs, and outcomes of care include **The Joint Commission**, a quasi-regulatory organization that inspects and accredits hospitals based on their ability to meet a rigorous set of scored criteria (**Figure 2.3**), and the Cardiac Reporting Organization, which was established to monitor cardiac mortality rates nationally.[21,22] Regulatory requirements are mandatory and failure to provide required data and reports—or submission of data reflecting poor performance such as too many medical or patient care errors that could harm patients—may result in the hospital or provider being reprimanded and monitored, fined, subjected to a temporarily suspended or revoked license, or closed. Other, more voluntary third-party reporting relationships may have to do with a provider organization voluntarily providing data and reports to an external reporting group so that it can be compared to similar organizations regionally or nationally in an effort to continually improve participants' cost performance, clinical quality of care, and transparency to their communities. Examples of these types of relationships include the Institute for Health Care Improvement (IHI), The Advisory Board, The Leapfrog Group, and the California Hospital Assessment and Reporting Taskforce (CHART).[23–25] CHART, for example, is a voluntary program in which 86% of California hospitals are participating; it provides report-card–type evaluation and peer-comparative data that hospitals can use to assess, benchmark, and improve their quality and cost performance.

FIGURE 2.3 Sentinel Events Most Frequently Reported to The Joint Commission*

**A sentinel event is an unexpected occurrence involving death or serious physical or psychological injury, or the risk thereof. Such events are called "sentinel" because they signal the need for immediate investigation and response.*



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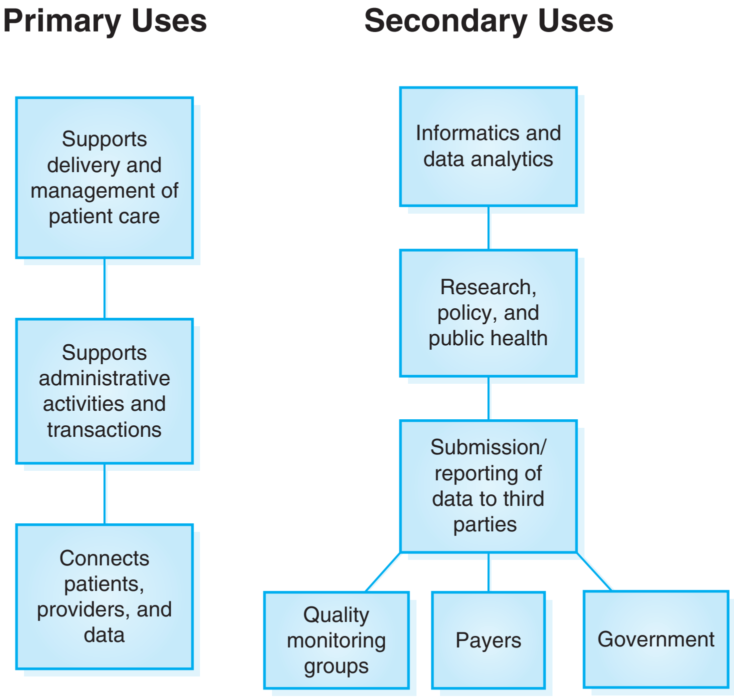
To support this kind of reporting, the third-party organization's reporting databases must be able to create a compilation of clinical and cost-related data from hospitals, clinics, and physician practices—that is, data originating in these providers' own smaller-scale HIS that support their clinical and business processes and activities. Data submitted to the third-party organizations come directly from the multiple HIS supporting patient care and reporting capabilities at the provider organizations; none of these external organizations is the original source of the data. Rather, these external entities review, report, aggregate, and consolidate data from many provider organizations; then benchmarks or report cards on the provider organizations' performance can be compared to the benchmarks or report cards for all other organizations that submit data and reports to that same third-party reporting organization. Whether such reporting is voluntary or mandatory, it is the job of all provider organizations to responsibly, promptly, and transparently report the numbers, types, mishaps, costs, and quality associated with the services they provide to interested parties, such as quality monitoring groups, payers, government, communities, and patient populations. Such reporting relationships represent **secondary uses of data** that originate in provider organizations as a direct result of patient care and business support activities, data originally created and captured in the clinical and administrative transaction systems of health provider organizations. In contrast, the original patient care and administrative transactions represent the **primary use of data** created and housed in these providers' HIS. **Figure 2.4** is an overview of the primary and secondary uses of HIS data and systems by providers of care and others in the healthcare ecosystem.[26]

FIGURE 2.4 Primary and Secondary Uses of HIS Data



Data from the Institute of Medicine. (2003). *Key capabilities of an electronic health record system: Letter report*. Washington, DC: The National Academies Press.

Public Health Reporting Systems

Local, county, state, and national public health organizations and reporting agencies exist to monitor and protect the public's health for the citizens living within their purview. Just as healthcare provider organizations must automate their clinical and administrative processes using HIS, so public health organizations must design, implement, and use computer systems to collect and analyze data reflecting the health of a population. This paves the way for implementation of effective programs to support that population's health status and create initiatives for the management of chronic disease.[27] Examples of such HIS reporting systems for public health purposes include systems for detection and monitoring of public health problems; analysis of public health–related data; and public health knowledge management, alerting, and response. The Public Health Information Network (PHIN) initiative of the federal government works in conjunction with the National Health Information Infrastructure to establish standards (Consolidated Health Information) for automation of clinical health data for public health reporting purposes. Timely access to such clinical data and connectivity between laboratories to facilitate sharing results data will improve the opportunities for responding to public health issues such as outbreaks of disease, disaster, or terrorism.[28]

SUMMARY

The scope of HIS includes a universe of data-related systems, activities, and new knowledge developed from using those systems. The ability to maximize the depth and breadth of HIS utility for achieving the ultimate goals of improving outcomes and developing knowledge depends on the progressive development and maturation of systems and their use as reflected in the HIS conceptual model. The layers of this model provide a comprehensive view of the total scope of HIS activity:

- *HIS:* Building the foundation of HIS and their management.
- *Health Informatics*: Enhancing the use of those systems to improve how work is done and meaning can be derived from data.
- *Business Intelligence/Clinical Intelligence*: Using data and creating information from which to learn and build knowledge, which leads to further creation of relevant information and new uses of data for analytics, including clinical decision support, business intelligence, and clinical intelligence.
- *Research, Policy, and Public Health*: Eventually improving the health of populations through evidence-based change driven by well-informed research, policy, and public health.

HIS supporting clinical, administrative, and research/reporting activities are used extensively in a wide variety of organizational and community settings, including inpatient and outpatient healthcare provider organizations; patients' and consumers' homes and places of work or livelihood; payers, insurance companies, and government programs and agencies; public health organizations; health information exchanges and regional health information organizations; and regulatory, reporting, and research organizations.

KEY TERMS

Aggregation	**15**
Analytics	**16**
Data	**14**
Informatics	**14**
Primary uses of data	**21**
Public health	**18**
Regional health information organization (RHIO)	**19**
Secondary uses of data	**21**
The Joint Commission	**21**

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Discussion Questions

1. What are the key steps in the progression of HIS according to the HIS conceptual model? What is the relationship between the various layers?
2. Why do you think it is necessary to be attentive in entering data elements that may not have a clear relationship to the work you are doing? How does the information use or data collection of a laboratory technician in a hospital differ from that of a public health administrator at a county agency or a specialist physician at an outpatient facility?
3. As more healthcare provider organizations adopt EHRs, what do you think will be the effect on healthcare-related research? On public health issues?
4. Why are healthcare organizations just in the beginning stages of engaging patients in their care? Do you think HIS has anything to do with this change? Do you think this will have a beneficial effect for the organizations? For the patients? Explain.
5. Insurance companies use a lot of data from provider organizations' HIS to process claims and calculate reimbursement. How important is this practice to the overall healthcare process? Given that this process involves money for the provider organizations, which is more important: HIS for patient care or HIS for gaining reimbursement for that care?
6. Military personnel and veterans often get their care from military or VA healthcare providers, but some of their care is received in non-military settings. How might clinical data from one setting be sent to another for purposes of caring for these military patients?
7. What are *primary* uses of HIS? What are *secondary* uses of HIS? Which of these can best help the U.S. healthcare system improve?
8. Public health reporting and surveillance systems have gotten much more attention since the terrorist attacks on the United States on September 11, 2001. Do you think this is justified? Who do you think should be responsible for surveillance locally or nationally—healthcare providers like hospitals and physician offices or the government?

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