

The background of the cover features a light blue network diagram with interconnected nodes and lines, creating a web-like structure. A dark blue horizontal band is positioned across the middle of the cover, containing the title and subtitle text.

HEALTH CARE INFORMATION SYSTEMS

A Practical Approach
for Health Care Management

FOURTH EDITION

Karen A. Wager | Frances W. Lee | John P. Glaser

WILEY

Health Care Information Systems

Health Care Information Systems

A Practical Approach for Health
Care Management

Fourth Edition

Karen A. Wager
Frances Wickham Lee
John P. Glaser

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In memory of our colleague Andy Pasternack

Preface

Health care delivery is in the early stages of a profound shift in its core strategies, organization, financing, and operational and care processes.

Reactive sick care is being replaced by proactive efforts to keep people well and out of the hospital. Fragmented care delivery capabilities are being supplanted by initiatives to create and manage cross-continuum systems of care. Providers that were rewarded for volume are increasingly being rewarded for quality and efficiency.

New forms of reimbursement, such as bundles and various types of capitation, are causing this shift. To thrive in the new era of health care delivery, providers are creating health systems, such as accountable care organizations, that include venues along the care spectrum.

In addition providers are introducing new processes to support the need to manage care between encounters, keep people healthy, and ensure that utilization is appropriate. Moreover, as reimbursement shifts to incentive-based provider performance these organizations will have a common need to optimize operational efficiency, improve financial management, and effectively engage consumers in managing their health and care.

These changes in business models and processes follow on the heels of the extraordinary increase in electronic health record adoption spurred by the Meaningful Use program of the US federal government.

On top of a foundation of electronic health records, the industry will add population health management applications, systems that support extensive patient engagement, broader interoperability, and more significant use of analytics. Providers involved in patient care will need immediate access to electronic decision-support tools, the latest relevant research findings on a given topic, and patient-specific reminders and alerts. Health care executives will need to be able to devise strategic initiatives that take advantage of access to real-time, relevant administrative and clinical information.

In parallel with the changes in health care, information technology (IT) innovation continues at a remarkable pace. The Internet of Things is creating a reality of intelligent homes, cars, and equipment, such as environmental sensors and devices attached to patients. Social media use continues to grow

and become more sophisticated and capable. Mobile personal devices have become the device of choice for personal and professional activities. Big data has exceptional potential to help identify new diagnostic and therapeutic algorithms, conduct most market surveillance, and assess the comparative effectiveness of treatments.

For providers to prosper in this new era they must be very effective in developing IT strategies, implementing the technology, and leveraging the technology to improve organizational performance. They must understand the nature of health care data and the challenges of privacy and security. Clinicians and managers must appreciate the breadth of health care IT and emerging health care IT trends.

The transformation of the health care industry means that IT is no longer a necessary back-office evil—it is an essential foundation if an organization is to survive. That has not been true in the past; provider organizations could do quite well in a fee-for-service world without computerized physician order entry and other advanced IT applications.

Having ready access to timely, complete, accurate, legible, and relevant information is critical to health care organizations, providers, and the patients they serve. Whether it is a nurse administering medication to a comatose patient, a physician advising a patient on the latest research findings for a specific cancer treatment, a billing clerk filing an electronic claim, a chief executive officer justifying to the board the need for building a new emergency department, or a health policy analyst reporting on the cost-effectiveness of a new prevention program to the state's Medicaid program, each individual needs access to high-quality information with which to effectively perform his or her job.

The need for quality information in health care, already strong, has never been greater, particularly as this sector of our society strives to provide quality care, contain costs, and ensure adequate access.

PURPOSE OF THIS BOOK

The purpose of this book is to prepare future health care executives with the knowledge and skills they need to manage information and information systems technology effectively in this new environment. We wrote this book with the graduate student (or upper-level undergraduate student) enrolled in a health care management program in mind.

Our definition of health care management is fairly broad and includes a range of academic programs from health administration, health information management, and public health programs to master of business

administration (MBA) programs with an emphasis in health to nursing administration and physician executive educational programs. This book may also serve as an introductory text in health informatics programs.

The first (2005), second (2009), and third (2013) editions have been widely used by a variety of health care management and health information systems programs throughout the United States and abroad. Although we have maintained the majority of the chapters from the third edition, this edition has gone through significant changes in composition and structure reflecting feedback from educators and students and the need to discuss topics such as population health and recent changes in payment reform initiatives. We have removed the section on the international perspective on health care information technology and updated the case studies of organizations experiencing management-related information system challenges. We also added a new chapter on the role of information systems in managing population health.

ORGANIZATION OF THIS BOOK

The chapters in this book are organized into four major parts:

- Part One: “Major Environmental Forces That Shape the National Health Information System Landscape” (Chapters One through Four)
- Part Two: “Selection, Implementation, Evaluation, and Management of Health Care Information Systems” (Chapters Five through Eight)
- Part Three: “Laws, Regulations, and Standards That Affect Health Care Information Systems” (Chapters Nine through Eleven)
- Part Four: “Senior-Level Management Issues Related to Health Care Information Systems Management” (Chapters Twelve through Fourteen)

In addition Appendix A provides an overview of the health care IT industry. Appendix B provides a compendium of a sample project charter, sample job descriptions, and a sample user satisfaction survey.

The purpose of Part One (“Major Environmental Forces That Shape the National Health Information System Landscape”) is to provide the reader with the foundation needed for the rest of the book. This foundation includes an overview of the major environmental forces that are shaping the national health IT landscape, such as Medicare’s alternative payment programs. The reader will gain insight into the different types of clinical, administrative, and external data used by health care provider

organizations. Additionally, the reader will gain an understanding of the adoption, use, and functionality of health care information systems with focus on electronic health records (EHRs), personal health records (PHRs), and systems need to support population health management (e.g., data analytics, telehealth).

Specifically Part One has four chapters:

- *Chapter One: National Health Information Technology Landscape.* This chapter discusses the various forces and activities that are shaping health information systems nationally. The chapter reviews the HITECH Act, the Affordable Care Act, HIPAA, and national efforts to advance interoperability.
- *Chapter Two: Health Care Data.* This chapter examines the range of health care data and issues with data quality and capture. This examination is conducted from a cross-continuum, health system perspective.
- *Chapter Three: Health Care Information Systems.* This chapter provides an overview of clinical and administrative information systems. The chapter focuses on the electronic health record and personal health record and describes in greater detail the major initiatives that have led to current adoption and use of EHRs by hospitals and physician practices (e.g., Meaningful Use and health information exchanges). The chapter also includes discussion on the state of EHRs in settings across the care continuum (e.g., behavioral health, community care, long-term care). It concludes with a discussion on important health care information system issues including interoperability, usability, and health IT safety.
- *Chapter Four: Information Systems to Support Population Health Management.* This is a new chapter. Its purpose is to focus on the key data and information needs of health systems to effectively manage population health. Key topics include population health, telehealth, patient engagement (including social media), data analytics, and health information exchange (HIE).

The purpose of Part Two (“Selection, Implementation, Evaluation, and Management of Health Care Information Systems”) is to provide the reader with an overview of what is needed to effectively select, implement, evaluate, and manage health care information systems. This section discusses issues mid- and senior-level managers are likely to encounter related to managing

change and managing projects. The reader will also gain insight into the role and functions of the IT organization or department.

Specifically Part Two has four chapters:

- *Chapter Five: System Acquisition.* This chapter discusses the processes that organizations use to select information systems. We have included a discussion on the importance of system architecture.
- *Chapter Six: System Implementation and Support.* This chapter reviews the processes and activities need to implement and support health care information systems. We have included an examination of change management and project management.
- *Chapter Seven: Assessing and Achieving Value in Health Care Information Systems.* This chapter discusses the nature of the value that can be obtained from health care information systems and the approaches to achieving that value.
- *Chapter Eight: Organizing Information Technology Services.* This chapter reviews the structure and responsibilities of the IT organization. This chapter discusses IT senior management roles such as the chief information officer and the chief medical information officer.

The purpose of Part Three (“Laws, Regulations, and Standards That Affect Health Care Information Systems”) is to provide the reader with an overview of the laws, regulations, and standards that affect health care information systems. Emphasis is given to system security.

Specifically Part Three has three chapters:

- *Chapter Nine: Privacy and Security.* This chapter examines privacy and security regulations and practices.
- *Chapter Ten: Performance Standards and Measures.* This chapter discusses the wide range of regulations that affect health care information systems, with an emphasis on new regulations related to the focus on the continuum of care.
- *Chapter Eleven: Health Care Information Systems Standards.* This chapter reviews the new and emerging standards that govern health care data, transactions, and quality measures.

The purpose of Part Four (“Senior-Level Management Issues Related to Health Care Information Systems Management”) is to provide the reader with

an understanding of senior-level management responsibilities and activities related to IT management.

Specifically Part Four has three chapters:

- *Chapter Twelve: IT Alignment and Strategic Planning.* This chapter discusses the processes used by organizations to develop an IT strategic plan. The chapter reviews the challenges faced in developing these plans.
- *Chapter Thirteen: IT Governance and Management.* This chapter discusses several topics that must be addressed by senior leadership if IT is to be leveraged effectively: establishing IT governance, developing the IT budget, and ensuring that projects are successful.
- *Chapter Fourteen: Health IT Leadership Case Studies.* This chapter comprises case studies that provide real-world situations that touch on the content of this textbook.

Each chapter in the book (except Chapter Fourteen) begins with a set of chapter learning objectives and an overview and concludes with a summary of the material presented and a set of learning activities. These activities are designed to give students an opportunity to explore more fully the concepts introduced in the chapter and to gain hands-on experience by visiting and talking with IT and management professionals in a variety of health care settings.

Two appendixes offer supplemental information. Appendix A presents an overview of the health care IT industry: the companies that provide IT hardware, software, and a wide range of services to health care organizations. Appendix B contains a sample project charter, sample job descriptions, and a sample user satisfaction survey: documents referenced throughout the book.

Depending on the nature and interests of the students, various chapters are worth emphasizing. Students and courses that are targeted for current or aspiring senior executive positions may want to emphasize Chapter One (National Health Care IT Landscape), Chapter Four (Population Health), Chapter Seven (IT Value), Chapter Twelve (IT Strategy), and Chapter Thirteen (IT Governance and Management). For classes focused on mid-level management, Chapter One (National Health Care IT Landscape), Chapter Five (System Selection), Chapter Six (System Implementation), and Chapter Seven (IT Value) will merit attention.

Regardless of role, Chapter Two (Health Care Data), Chapter Three (Health Care Information Systems), Chapter Eight (IT Organization), and Part Three (Laws, Regulations, and Standards) provide important foundational knowledge.

One final comment. Two terms, *health information technology (HIT)* and *health care information systems (HCIS)*, are frequently used throughout the text. Although it may seem that these terms are interchangeable, they are, in fact, related but different. As used in this text, HIT encompasses the technologies (hardware, software, networks, etc.) used in the management of health information. HCIS describes a broader concept that not only encompasses HIT but also the processes and people that the HIT must support. HCIS delivers value to individual health care organizations, patients, and providers, as well as across the continuum of care and for entire communities of individuals. HIT delivers little value on its own. Both HCIS and HIT must be managed, but the management of HCIS is significantly more difficult and diverse.

Health care and health care information technology are in the early stages of a profound transformation. We hope you find this textbook helpful as we prepare our students for the challenges that lie ahead.

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Finally, we wish to extend a very special thanks to Molly Shane Grasso for her many contributions to Chapter Four, “Information Systems to Support Population Health Management.”

The Authors

Karen A. Wager is professor and associate dean for student affairs in the College of Health Professions at the Medical University of South Carolina (MUSC), where she teaches management and health information systems courses to graduate students. She has more than thirty years of professional and academic experience in the health information management profession and has published numerous articles, case studies, and book chapters. Recognized for her excellence in interprofessional education and in bringing practical research to the classroom, Wager received the 2016 College Teacher of the Year award and the 2008 MUSC outstanding teaching award in the educator-lecturer category and the 2008 Governor's Distinguished Professor Award. She currently serves as the chair of the Accreditation Council for the Commission on Accreditation of Healthcare Management Education (CAHME), is a member of the CAHME board of directors, and is a past fellow of CAHME. Wager previously served as a member of the HIMSS-AUPHA-CAHME Task Force responsible for the development of a model curriculum in health information systems appropriate for educating graduate students in health administration programs. She is past president of the South Carolina chapter of the Healthcare Information and Management Systems Society (HIMSS) and past president of the South Carolina Health Information Management Association. Wager holds a doctor of business administration (DBA) degree with an emphasis in information systems from the University of Sarasota.

Frances Wickham Lee is professor and director of instructional operations for Healthcare Simulation South Carolina at the Medical University of South Carolina (MUSC). She recently joined the faculty at Walden University to teach in the Master of Healthcare Administration program. Lee has more than thirty years of professional and academic experience in the health information management, including publication of numerous articles and book chapters related to the field. She is past president of the North Carolina Health Information Management Association and South Carolina chapter of the Healthcare Information and Management Systems Society (HIMSS). Since 2007, Lee has broadened her expertise as a health care educator through her membership in a pioneering team charged with bringing health care

simulation to students and practicing professionals across the state of South Carolina. She holds a DBA degree with an emphasis in information systems from the University of Sarasota.

John P. Glaser currently serves as the senior vice president of population health for Cerner. He joined Cerner in 2015 as part of the Siemens Health Services acquisition, where he was CEO. Prior to Siemens, Glaser was vice president and CIO at Partners HealthCare. He also previously served as vice president of information systems at Brigham and Women's Hospital.

Glaser was the founding chair of the College of Healthcare Information Management Executives (CHIME) and the past president of the Healthcare Information and Management Systems Society (HIMSS). He has served on numerous boards including eHealth Initiative, the American Telemedicine Association (ATA), and the American Medical Informatics Association (AMIA). He is a fellow of CHIME, HIMSS, and the American College of Health Informatics. He is a former senior advisor to the Office of the National Coordinator for Health Information Technology (ONC).

Glaser has published more than two hundred articles, three books on the strategic application of information technology in health care. Glaser holds a PhD in health care information systems from the University of Minnesota.

Health Care Information Systems

PART ONE

Major Environmental Forces That Shape the National Health Information System Landscape

CHAPTER 1

The National Health Information Technology Landscape

LEARNING OBJECTIVES

- To be able to discuss some of the most significant influences shaping the current and future health information technology landscapes in the United States.
- To understand the roles national private sector and government initiatives have played in the advancement of health information technology in the United States.
- To be able to describe major events since the 1990s that have influenced the adoption of health information technologies and systems.

Since the early 1990s, the use of **health information technology (HIT)** across all aspects of the US health care delivery system has been increasing. **Electronic health records (EHRs)**, telehealth, social media, mobile applications, and so on are becoming the norm—even commonplace—today. Today’s health care providers and organizations across the continuum of care have come to depend on reliable HIT to aid in managing population health effectively while reducing costs and improving quality patient care. Chapter One will explore some of the most significant influences shaping the current and future HIT landscapes in the United States. Certainly, advances in information technology affect HIT development, but national private sector and government initiatives have played key roles in the adoption and application of the technologies in health care. This chapter will provide a chronological overview of the significant government and private sector actions that have directly or indirectly affected the adoption of HIT since the Institute of Medicine landmark report, *The Computer-Based Patient Record: An Essential Technology for Health Care*, authored by Dick and Steen and published in 1991. Knowledge of these initiatives and mandates shaping the current HIT national landscape provides the background for understanding the importance of the health information systems that are used to promote excellent, cost-effective patient care.

1990s: THE CALL FOR HIT

Institute of Medicine CPR Report

The Institute of Medicine (IOM) report *The Computer-Based Patient Record: An Essential Technology for Health Care* (Dick & Steen, 1991) brought international attention to the numerous problems inherent in paper-based medical records and called for the adoption of the **computer-based patient record (CPR)** as the standard by the year 2001. The IOM defined the CPR as “an electronic patient record that resides in a system specifically designed to support users by providing accessibility to complete and accurate data, alerts, reminders, clinical decision support systems, links to medical knowledge, and other aids” (Dick & Steen, 1991, p. 11). This vision of a patient’s record offered far more than an electronic version of existing paper records—the IOM report viewed the CPR as a tool to assist the clinician in caring for the patient by providing him or her with reminders, alerts, clinical decision-support capabilities, and access to the latest research findings on a particular diagnosis or treatment modality. CPR systems and related applications, such as EHRs, will be further discussed

in Chapter Three. At this point, it is important to understand the IOM report's impact on the vendor community and health care organizations. Leading vendors and health care organizations saw this report as an impetus toward radically changing the ways in which patient information would be managed and patient care delivered. During the 1990s, a number of vendors developed CPR systems. However, despite the fact that these systems were, for the most part, reliable and technically mature by the end of the decade, only 10 percent of hospitals and less than 15 percent of physician practices had implemented them (Goldsmith, 2003). Needless to say, the IOM goal of widespread CPR adoption by 2001 was not met. The report alone was not enough to entice organizations and individual providers to commit to the required investment of resources to make the switch from predominantly paper records.

Health Insurance Portability and Accountability Act (HIPAA)

Five years after the IOM report advocating CPRs was published, President Clinton signed into law the **Health Insurance Portability and Accountability Act (HIPAA)** of 1996 (which is discussed in detail in Chapter Nine). HIPAA was designed primarily to make health insurance more affordable and accessible, but it included important provisions to simplify administrative processes and to protect the security and confidentiality of personal health information. HIPAA was part of a larger health care reform effort and a federal interest in HIT for purposes beyond reimbursement. HIPAA also brought national attention to the issues surrounding the use of personal health information in electronic form. The Internet had revolutionized the way that consumers, providers, and health care organizations accessed health information, communicated with each other, and conducted business, creating new risks to patient privacy and security.

2000–2010: THE ARRIVAL OF HIT

IOM Patient Safety Reports

A second IOM report, *To Err Is Human: Building a Safer Health Care System* (Kohn, Corrigan, & Donaldson, 2000), brought national attention to research estimating that 44,000 to 98,000 patients die each year because of medical errors. A subsequent related report by the IOM Committee on Data Standards for Patient Safety, *Patient Safety: Achieving a New Standard for Care* (Aspden, 2004), called for health care organizations to adopt information

technology capable of collecting and sharing essential health information on patients and their care. This IOM committee examined the status of standards, including standards for health data interchange, terminologies, and medical knowledge representation. Here is an example of the committee's conclusions:

- As concerns about **patient safety** have grown, the health care sector has looked to other industries that have confronted similar challenges, in particular, the airline industry. This industry learned long ago that information and clear communications are critical to the safe navigation of an airplane. To perform their jobs well and guide their plane safely to its destination, pilots must communicate with the airport controller concerning their destination and current circumstances (e.g., mechanical or other problems), their flight plan, and environmental factors (e.g., weather conditions) that could necessitate a change in course. Information must also pass seamlessly from one controller to another to ensure a safe and smooth journey for planes flying long distances, provide notification of airport delays or closures because of weather conditions, and enable rapid alert and response to extenuating circumstance, such as a terrorist attack.
- Information is as critical to the provision of safe health care—which is free of errors of commission and omission—as it is to the safe operation of aircraft. To develop a treatment plan, a doctor must have access to complete patient information (e.g., diagnoses, medications, current test results, and available social supports) and to the most current science base (Aspden, 2004).

Whereas *To Err Is Human* focused primarily on errors that occur in hospitals, the 2004 report examined the incidence of serious safety issues in other settings as well, including ambulatory care facilities and nursing homes. Its authors point out that earlier research on patient safety focused on errors of commission, such as prescribing a medication that has a potentially fatal interaction with another medication the patient is taking, and they argue that errors of omission are equally important. An example of an error of omission is failing to prescribe a medication from which the patient would likely have benefited (Institute of Medicine, Committee on Data Standards for Patient Safety, 2003). A significant contributing factor to the unacceptably high rate of medical errors reported in these two reports and many others is poor information management practices. Illegible prescriptions, unconfirmed

verbal orders, unanswered telephone calls, and lost medical records could all place patients at risk.

Transparency and Patient Safety

The federal government also responded to quality of care concerns by promoting health care transparency (for example, making quality and price information available to consumers) and furthering the adoption of HIT. In 2003, the **Medicare Modernization Act** was passed, which expanded the program to include prescription drugs and mandated the use of electronic prescribing (**e-prescribing**) among health plans providing prescription drug coverage to Medicare beneficiaries. A year later (2004), President Bush called for the widespread adoption of EHR systems within the decade to improve efficiency, reduce medical errors, and improve quality of care. By 2006, he had issued an executive order directing federal agencies that administer or sponsor health insurance programs to make information about prices paid to health care providers for procedures and information on the quality of services provided by physicians, hospitals, and other health care providers publicly available. This executive order also encouraged adoption of HIT standards to facilitate the rapid exchange of health information (The White House, 2006).

During this period significant changes in reimbursement practices also materialized in an effort to address patient safety, health care quality, and cost concerns. Historically, health care providers and organizations had been paid for services rendered regardless of patient quality or outcome. Nearing the end of the decade, payment reform became a hot item. For example, **pay for performance (P4P)** or value-based purchasing pilot programs became more widespread. P4P reimburses providers based on meeting predefined quality measures and thus is intended to promote and reward quality. The **Centers for Medicare and Medicaid Services (CMS)** notified hospitals and physicians that future increases in payment would be linked to improvements in clinical performance. Medicare also announced it would no longer pay hospitals for the costs of treating certain conditions that could reasonably have been prevented—such as bedsores, injuries caused by falls, and infections resulting from the prolonged use of catheters in blood vessels or the bladder—or for treating “serious preventable” events—such as leaving a sponge or other object in a patient during surgery or providing the patient with incompatible blood or blood products. Private health plans also followed Medicare’s lead and began denying payment for such mishaps. Providers began to recognize the importance

of adopting improved HIT to collect and transmit the data needed under these payment reforms.

Office of the National Coordinator for Health Information Technology

In April 2004, President Bush signed Executive Order No. 13335, 3 C.F.R., establishing the **Office of the National Coordinator for Health Information Technology (ONC)** and charged the office with providing “leadership for the development and nationwide implementation of an interoperable health information technology infrastructure to improve the quality and efficiency of health care.” In 2009, the role of the ONC (organizationally located within the US Department of Health and Human Services) was strengthened when the **Health Information Technology for Economic and Clinical Health (HITECH) Act** legislatively mandated it to provide leadership and oversight of the national efforts to support the adoption of EHRs and **health information exchange (HIE)** (ONC, 2015).

In spite of the various national initiatives and changes to reimbursement during the first decade of the twenty-first century, by the end of the decade only 25 percent of physician practices (Hsiao, Hing, Socey, & Cai, 2011) and 12 percent of hospitals (Jha, 2010) had implemented “basic” EHR systems. The far majority of solo and small physician practices continued to use paper-based medical record systems. Studies show that the relatively low adoption rates among solo and small physician practices were because of the cost of HIT and the misalignment of incentives (Jha et al., 2009). Patients, payers, and purchasers had the most to gain from physician use of EHR systems, yet it was the physician who was expected to bear the total cost. To address this misalignment of incentives issue, to provide health care organizations and providers with some funding for the adoption and **Meaningful Use of EHRs**, and to promote a national agenda for HIE, the HITECH Act was passed as a part of the **American Recovery and Reinvestment Act** in 2009.

2010–PRESENT: HEALTH CARE REFORM AND THE GROWTH OF HIT

HITECH and Meaningful Use

An important component of HITECH was the establishment of the Medicare and Medicaid EHR Incentive Programs. Eligible professionals and hospitals that adopt, implement, or upgrade to a certified EHR received incentive payments. After the first year of adoption, the providers had to prove successfully

that they were “demonstrating Meaningful Use” of certified EHRs to receive additional incentive payments. The criteria, objectives, and measures for demonstrating Meaningful Use evolved over a five-year period from 2011 to 2016. The first stage of Meaningful Use criteria was implemented in 2011–2012 and focused on data capturing and sharing. Stage 2 (2014) criteria are intended to advance clinical processes, and Stage 3 (2016) criteria aim to show improved outcomes. Table 1.1 provides a broad overview of the Meaningful Use criteria by stage.

Through the Medicare EHR Incentive Program, each eligible professional who adopted and achieved meaningful EHR use in 2011 or 2012 was able to earn up to \$44,000 over a five-year period. The amount decreased over the period, creating incentives to providers to start sooner rather than later.

Table 1.1 Stages of Meaningful Use

Stage 1: Meaningful Use criteria focus	Stage 2: Meaningful Use criteria focus	Stage 3: Meaningful Use criteria focus
Electronically capturing health information in a standardized format	More rigorous HIE	Improving quality, safety, and efficiency leading to improved health outcomes
Using that information to track key clinical conditions	Increased requirements for e-prescribing and incorporating lab results	Decision support for national high-priority conditions
Communicating that information for care coordination processes	Electronic transmission of patient summaries across multiple settings	Patient access to self-management tools
Initiating the reporting of clinical quality measures and public health information	More patient-controlled data	Access to comprehensive patient data through patient-centered HIE
Using information to engage patients and their families in their care		Improving population health

Source: ONC (n.d.a.).