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Chapter 1 : Introduction to Health Science Technology - Louise M Simmers - Google Books

The American Reinvestment & Recovery Act (ARRA) was enacted on February 17, ARRA includes many measures to modernize our nation's infrastructure, one of which is the "Health Information Technology for Economic and Clinical Health (HITECH) Act".

The Internet represents a particularly profound change that will enable or force significant changes in organizational form and processesâ€”a transformation as profound as any that have gone before. The changes will have such far-reaching implications that health care organizations need to start preparing now to adopt the advanced Internet applications that are expected to appear in the near future. Organizations need to evaluate the potential and implications of new Internet technologies, adapt them to local needs and conditions, minimize the risks associated with new product and service deployment, and plan to demonstrate the value of their efforts. This chapter examines challenges to the adoption of Internet-based technologies by health care organizations. It attempts to identity fundamental impediments to greater use of the Internet that may be expected to persist for some time. The first section of the chapter provides a context for the analysis by reviewing the experiences of other industries that have achieved some success in changing business practices by adopting Internet technologies. The second section discusses in general terms why more health care organizations should be interested in adopting the Internet: The third section deals with organizational barriers that hinder Internet use. The discussion there addresses internal and external factors, such as policy and technical barriers, that influence and constrain the form and extent of Internet use, as well as the range of uncertainties that inhibit decision making regarding the Internet. The last section addresses the importance of organizational leadership. The chapter focuses primarily on Internet adoption by care provider organizations. To be sure, Internet technologies will need to be adopted by a number of different players in the health care arena, including consumers, physicians, and administrators. But because they are likely to bear many of the implementation costs and will have to address issues of acceptance by consumers and care providers, health care organizations are a suitable focus for this analysis. The specific factors that facilitate or impede Internet applications will differ from one organization to the other, but the discussion that follows is broadly applicable because it identifies common challenges faced by a variety of health care organizations as they attempt to implement a range of applications serving different types of end users. Lessons from Other Industries Internet technologies offer a range of potentially useful applications to organizations in many different industries. Simple Internet applications such as electronic mail e-mail can facilitate communication within distributed multinational corporations. Related networked applications can simplify flows of information among elements of a single organization and among multiple organizations. Real-time teleconferencing technologies can support meetings involving individuals located in different cities. Direct capture of sales information can enable retailers to streamline the delivery of inventory and forecast purchasing patterns. New automation systems can allow for distributed management of supply chains, support of human resource functions, and exchange of contact and other sales information. Although the deployment of these systems is still in an early stage, Internet technologies appear to have enhanced organizational performance by lowering costs, increasing efficiency, differentiating products and services, or creating broader markets. Leading users of these technologies have found that the value of the Internet lies not simply in automating existing business processes but in creating new means of interaction between suppliers and consumers of products and service, often with significant implications for industry structure. Industries differ in many respects, and their degree of success achieved in applying the Internet varies as well, 2 but the experiences of leading companies in different industries in which Internet use is common suggest a number of general trends. The Internet clearly is transforming the retail marketplace. Online retailers such as Amazon. Online auction sites, such as eBay, have pioneered new ways to link buyers and sellers in a virtual marketplace, with some companies expanding on the auction concept to exploit spot markets for last-minute airline tickets, car rentals, hotel rooms, and other

services. Internally, the effective use of information technology IT , including Internet technologies, can have a profound impact on organizational structure and function. As information is distributed efficiently to those who need it when they need it, lines of control and influence become clearer, and individual units often self-organize in new and more effective ways. The impact may be multifaceted, not only flattening organizational structures but also changing the skill mix of employees. Early evidence suggests that online sales of automobiles reduce the set of skills needed by salespeople McGarvey, In contrast, some stock brokerage firms report that online trading requires brokers to have a broader set of skills, although the total number of brokers needed may decline because much of the effort of executing a stock transaction can be passed on to the consumer. Online interactions boost consumer expectations. Many traditional storefront industriesâ€"from retail to manufacturing to newsâ€"are now open around the clock, competing in a highly visible and competitive environment. Consumers conduct many transactions at night or on holidays, when many traditional merchants shut their doors, and buyers often compare the prices of many Internet vendors before making purchases. In fact, many Internet companies encourage consumers to discuss topics or items of particular interest. Internet book merchants, for example, allow readers to contribute reviews and rate the quality of an offering. Internet-based vendors of financial information sometimes support client-generated discussion groups on specific equities or investing techniques. These techniques are intended to assist consumers in making educated decisions and, simultaneously, attract them to particular sites. Internet technologies also allow merchants to develop a deeper understanding of consumers. By automatically recording consumer choices and preferences, merchants can offer both goods and advertising that have a high likelihood of reaching a desired consumer audience. If applied successfully, these technologies enable merchants to develop a sense of one-on-one personalized service for thousands or even millions of customersâ€"a process sometimes called mass customization. Vendors can also allow consumers to preview, or experiment with, products prior to purchase. The film industry now routinely provides previews of upcoming movies on company sites on the Web. The music industry also distributes promotional material online in the hopes of generating traditional sales. Online mortgage vendors allow consumers to simulate the cash-flow implications of various mortgage packages. Most importantly, the customer relationships established by successful Internet companies are not static. During this period of rapid Internet evolution, companies are literally reinventing their online demeanor on a weekly basis in response to changing perceptions developed through experimentation with the Internet. In essence, merchants and consumers are engaged in a consensual exploration of the means by which this technology can more effectively satisfy perceived mutual needs. Advancing the Strategic Interests of Health Care Just as it is transforming other industries, the Internet could enable profound changes in the nature and structure of the health care industry and, ultimately, the delivery of health care services. The health care industry isâ€"and will continue to beâ€"diverse, with individual organizations facing different environmental pressures, pursuing different missions, and cultivating different cultures, but the Internet appears capable of supporting at least a handful of common strategic interests. It could, for example, help organizations to do the following: Improve the efficiency and effectiveness of processes that customers use to judge organizational performance e. The Internet already is empowering consumers to become more involved in and take greater control of their own health and care. They may soon be able to access information on the quality of care delivered by different health care providers or facilities in their geographic region. The relationship between health care organizations and consumers could change even further when an organization uses networks effectively to expand its customer base beyond a specific geographic region. The assumption that just because a patient lives near a particular hospital he or she will opt to be treated at that hospital is challenged by the ease with which networks afford patients access to clinical specialists worldwide. The Internet also offers institutions the capacity to separate their business operations from the operations of the physical plant. The effective use of computer networks could change the fundamental nature of a health care organization: For example, physician practice groups could use the Internet to acquire necessary expertise on demand and deliver health care from a

distance or to gain access to distributed decision-support systems and high-end applications offered by application service providers, contracting for specific medical services from remote practice groups rather than investing in an expensive, but seldom used, on-site resource. The Internet also allows the integration of clinical data from affiliated organizations such as two hospitals that contract with the same MCO , enabling the assembly of a medical record that is more complete than before and ensuring greater continuity and documentation of care. This is a useful feature because the increased specialization of clinical treatment has contributed to a differentiation of health care services. Specialization has led patients to acquire health services from different organizations e. Other opportunities exist for hospitals to use the Internet to improve internal operations. They could communicate, in a just-in-time fashion, with distributors of suppliesâ€”perhaps diminishing the need for an inventory management departmentâ€”and with each other to share patient records. They could reduce their reliance on local specialists by centralizing specialty services and offering them remotely via teleconsultations. Care providers and payers could link together to consolidate utilization review activities. The Internet also could affect the nature of health care research. Private research institutes, either free-standing or organized as research and development arms of pharmaceutical companies, could enhance their scientific collaborations with academic medical centers. The Internet also would enable schools and universities to educate not only the students who arrive on their campuses but also authorized learners anywhere in the world who have access to computers and Internet connections. The contours of such change are beginning to emerge. Health care organizations are beginning to experiment with Internet-based systems to serve a variety of functions. Many MCOs, for example, are developing Web sites to provide consumers with health-related information, the ability to select physicians or schedule appointments, and the tools to evaluate their immediate health care needs. They also offer specific programs for monitoring personal health status and can support e-mail exchanges between patients and designated providers. Still other firms focus on the administrative side of health care, using secure communications channels to deliver a broad array of services required in a managed care environment, with an emphasis on linking different types of health care organizations. Offering include products for enrolling in and managing personal health care plans; information services and portals designed for consumers, providers, and physicians; systems for viewing laboratory and other clinical data; and methods for referring patients to specialists, ordering medications, and performing other clinical tasks. The returns to health care organizations on investments in Internet-based applications are not yet clear, but the early evidence is encouraging. The result was not only significant cost savings for the organization but also improved consumer perceptions of Kaiser-Permanente and better understanding of health concerns. Partners Healthcare System, an integrated delivery organization based in Boston, reports that Internet-based systems reduced the time needed to return a radiology report to a health center from 72 hours to 4 hours. The organization expects to realize a 20 percent reduction in the cost of specialist dermatology by using telemedicine. More study is required to fully evaluate the benefits of Internet-based applications in health care, but the evidence cited above offers hope for improvements in customer satisfaction and reductions in cost. Given the potential of the Internet and the economic and other pressures facing the health care industry, it would be reasonable to expect significant investment in Internet technologies and applications by more health care organizations. Impediments to Adopting Internet Applications Despite the promise of many Internet-based applications, health care organizations can be expected to encounter many obstacles as they attempt to apply these technologies to realize their strategic visions. They will face barriers to, and constraints on, organizational change, as well as uncertainty about the efficacy and effects of Internet-based applications. A resistance to change might come from denial of the need to change, the inability to manage change, uncertainties about the types of changes needed and how best to make them, mistaken assessments of optimal changes, and failures in executing changes. These issues are not unique to the adoption of the Internet and could arise in many other areas of organizational change, including those driven by other types of information technology. Organizations that have difficulty making the necessary investments in, and managing, information technology in general will have even more difficulty adapting to the Internet. Barriers to Change

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Barriers to change can assume many forms, from characteristics of the marketplace to organizational capabilities. The discussion below classifies barriers into two broad categories: External factors are often difficult for an individual organization to address directly because they demand collective action. Internal barriers are easier to overcome but in many cases still present significant difficulties, even if the need for change is recognized as urgent. External Barriers External factors define the environment in which health care organizations operate and shape their ability to capitalize on the Internet. The barriers here assume many forms, including market forces, policies and standards, finances, and technology. Changes in the health care marketplaceâ€”such as an aging population, escalating health care costs, and changes in consumer preferencesâ€”can have positive and negative effects on health care organizations and the viability of different Internet-based applications. Often the effects cannot be anticipated. For example, an aging population can be expected to create a growing demand for health services, a trend that could benefit local hospitals but could raise costs for MCOs, which would need to provide more care on a per capita basis. An aging population also could boost demand for Internet-mediated care, but at the same time as this would allow the patients to avoid travel, it would raise challenging interface considerations. To the extent that changes in the marketplace signify to organizations a need to change, they can be considered stimuli for transformation; to the extent that they work against organizations, they can be considered barriers. Other market forces also affect the ability of health care organizations to adopt Internet technologies. Many health care organizations have seen shrinking operating margins over the last several years, along with a marked increase in regulatory compliance requirements such as those related to the Health Insurance Portability and Accountability Act of â€”see Chapter 5 and in competing programmatic needs Glaser and Hsu,

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Chapter 2 : 7 Biggest Innovations in Health Care Technology in [INFOGRAPHIC]

Updated with current information technology (IT) content that reflects the healthcare environment, Introduction to Information Systems explains the growing wealth of health data and information available to HIM practitioners and what it can do for patients and society while also explaining the responsibility to secure these assets.

The healthcare industry was no exception to the rise in disruptive technology changing the way people are impacted. Read the version: Want to be featured as a top health IT company? Without a doubt the pace at which new technology is impacting our everyday lives is increasing at lightning speeds. These technologies are starting to allow healthcare practitioners to offer cheaper, faster and more efficient patient care than ever before, which is certainly a step in the right direction. The healthcare industry has long been overburdened by a slow moving innovation due to the complexity of the medical ecosystem, but due to this technology the industry has finally seen some far reaching changes. Everything from new artificial hearts to electronic aspirin , the healthcare industry is slowly but surely becoming more agile, effective and cost-effective for patients looking for care. Of the many disruptions reaching the masses this year, here are the some of the biggest innovations in healthcare technology with far reaching impacts: Microchips Modeling Clinical Trials The potential to streamline, improve, and perhaps transform the current healthcare system is huge. Microchip modeling clinical trials aim to replace the use of animals in clinical trials to more accurately test the safety and efficacy of treatment for human patients and spare the lives of countless animals typically used in testing. These microchips are smaller than a human thumb, can reconstruct the complicated interface between organs and capillaries, which is similar to the idea of microfabrication, the process of making structures on a micrometer scale. By eliminating animal models in certain circumstances, scientists and doctors have been able to reconstruct organs like the human lungs by focusing on the use of complicated systems of microchips to emulate these bodily systems. Microchips more closely resemble live tissue, cell types and realistic three-dimensional interactions occurring in the human body than do other forms of clinical testing to date. Wearable Technology like Google Glass Wearable technology is still in its infancy but has already started to have widespread influence across many industries. Rafael Grossmann was the very first surgeon to use Google Glass or wearable technology in general while performing a surgery. As wearable technology continues to improve to better meet the needs of its users, healthcare providers continue to hope that its use will impact both the experience of patients and practitioners to better receive and administer care. He sees this new technology as allowing a doctor to someday interact with a patient, while simultaneously pulling up their medical history using Google Glass. The surgery performed using Google Glass could serve as an example of real-time education for medical students and other professionals alike. There are even telemedicine opportunities with Google Glass as well, allowing doctors and other medical professionals to provide clinical care in certain capacities from a distance. He argues that with the continued adoption of wearable tech like Google Glass, more lives will be saved since communication between medical professionals and patients will continue to improve to the next level. Here are seven applications of 3D printers in healthcare that could have an important impact in the future: These cells have already been successfully printed in a lab and could be one-day use to create tissue that could help test drugs and assist in the growth of new organs. There have been many advances in the areas of developing skin to help burn victims and skin disease patients, 3D printers can help further jumpstart these advances with the addition of laser-printed skin cells. Organovo is a company that has already successfully printed blood vessels and sheets of cardiac tissue that actually beat along just like a real heart. Printing cancer cells is a way of growing these cells on tissue in a lab to study, test drugs on and to eventually find a cure for. Printing cells with a 3D printer proves useful in a recent study of rats that had previously suffered heart attacks and were given these patches of cells to help slowly help improve their heart function overtime. Printing new part for organs or entire organs all together will help solve an ongoing medical need and help save hundred of thousands of people every year waiting for an organ donation to come

thru. Optogenetics A new technology has jump-started the technique in neuroscience known as optogenetics where neuroscientists target a single neuron in the brain of a mouse merely by turning on a light. This is done by using a light activated gene and inserting it into the genome of a mouse to be able to easily identify when the particular neuron is firing in the brain. Optogenetics is a hot topic amongst the medical community today, surrounded by both praise and criticism. This could have far reaching benefits with humans to help better understand the complex network of neurons that make up the brain. A stronger understanding could help humans better grasp how we create thoughts, emotions and behaviors. By controlling the activity of specific neurons, neuroscientists will begin to learn how each type of neuron contributes to the overall functions of the brain. The firing of a neuron through lighting may someday be a technique to finding the answers to some of the many open questions mankind has wondered about themselves both medically and physiologically since the dawn of time or this technique may not be able to work with humans due to its invasive nature in its current applications with rats. Time will tell as to whether this approach is effective, but nevertheless, the study of the human brain using light will help neuroscientists on the path to better understanding the neurons and how they work across this complex organ. This is a difficult task for healthcare professionals due to the complexities of the systems, technologies and operations currently in place at all healthcare facilities, hence why this industry is often the slowest moving when it comes to impactful change. A hybrid operation room is a new innovation where a traditional OR is outfitted with advanced medical technology to improve the care delivered to patients and enhances the skill-sets of medical practitioners when it comes to administering treatment. The Lakeland Regional Media Center is an example of a hybrid operating room, one of the first in its area, but definitely an indicator of more widespread changes to come to operating rooms around the country innovating on existing processes and technologies with traditional surgical procedures and treatment options. Technologies used in hybrid operating rooms have typically helped reduce trauma, scarring, spurred faster rehabilitation and has helped decrease hospital stays. Digestible Sensors Approved in , digestible sensors will continue to provide healthcare professionals with more information about the human body and how various treatment solutions affect each system of organs. A digestible sensor is a sensor that transmits information about a patient to medical professionals to help them customize the care to the individual as well as the care provided to other individuals experiencing similar health conditions or ailments. This technology would eventually allow an individual to swallow a pill provided by their doctor and skip their physical because the digestible sensors, that look like regular pills, could perform all the same functions a doctor typically handles in a standard physical and then some. An innovation of this nature could have far reaching effects for healthcare by helping detect diseases and conditions at earlier stages in people digesting these sensors that are in turn, constantly monitored wirelessly. From referrals, progress updates, and insurance authorizations; these types of communications result in huge amounts of money and time being wasted and a liability to every healthcare provider. Patients are stuck in the middle as doctors still communicate with antiquated systems ex. As many as 50 percent of referrals are not received by the specialty care provider causing patients to miss treatment and healthcare providers to lose money.

Chapter 3 : Animal Care and Management Technology - Health and Public Services Health and Public Ser

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AHRQ is responding to this mandate by utilizing the full spectrum of funding mechanisms to support projects that will generate knowledge and evidence on the use of IT in health care. Accordingly, the Agency developed a series of research solicitations RFAs to: Design and test best practices for reducing errors in multiple health care settings; Develop the science base to inform these efforts; Improve provider education to reduce errors; Capitalize on IT advances to translate effective strategies into widespread practice; and Build capacity to further reduce errors. This represents the single largest investment the federal government has ever made to address the problem of medical errors. The CLIPS RFA generated enthusiasm among patient safety and informatics researchers and resulted in a large number of competitive proposals from a wide range of public and private sector organizations. Many proposals involved research using handheld wireless devices, electronic medical record systems, computerized decision support tools, or electronic prescribing applications. Other areas of proposed research included simulation models for education and training, automated error alerting mechanisms, structured electronic data sets, digital eye technology, database applications, computerized patient self-monitoring and communication tools, wearable mini computers, biometric technology, Internet and intranet applications, cognitive science and human factors engineering, data mining, and barriers to electronic prescribing. Examples of currently funded projects are summarized in Table 2. This project examines the acceptance, benefits, and barriers in the use of stand-alone, handheld decision support systems DSSs in an ambulatory setting, and the clinical impact and cost-effectiveness of point-of-care, handheld ambulatory DSSs on medical errors. This research project will determine whether preventable adverse outcomes for the frail elderly population in long-term care settings can be avoided by using computers that alert nursing and other staff to the likelihood of problems such as falls, pressure ulcers, and urinary tract infections. This project explores the relationship between human, machine, and environmental factors associated with the operation of infusion devices in clinical settings. The project will identify and characterize properties of infusion devices, environmental conditions, and operator cognition that promote user errors. For example, one group of investigators developed a web-based communication and disease management system that provides clinical information and facilitates communication between patients with asthma and their providers. They are currently assessing the impact of their program on compliance with asthma management guidelines and overall quality of care. Another group of researchers is developing a prototype information exchange system that provides immediate access to patient information and facilitates communication during emergency response situations by integrating Internet resources, fingerprint technology, and smart cards. Finally, a third group of investigators is developing a computerized medical monitoring device that is enabled with a Bluetooth wireless network. The device automatically collects, analyzes and transmits patient data, and also alerts patients and providers to potential problems. The group is currently developing working prototypes of a weight scale, glucose monitor, and thermometer. The network includes nine partners that encompass a wide variety of organizational care settings and provide health care services to more than 55 million people. For example, two network partners are studying how automated electronic reminders affect compliance with recommended guidelines for the management of patients with diabetes. Another network partner is studying how different integrated delivery systems in California, Washington, Oregon, Alaska, North Carolina, Utah, and Idaho transfer medication information within each system. Another partner is studying the use of automated computerized reminders that utilize the Centers for Disease Control and Prevention CDC guidelines to improve screening and detection of patients at increased risk for tuberculosis. Finally, two partners are studying how electronic communication can be used by patients and providers to improve quality of care. The PBRNs are made up of community-based, primary care clinicians working together with

experienced health services researchers to address clinically relevant health care issues and translate research findings into practice to improve quality of care. The PBRNs were established in September , when 19 networks from across the country were funded with planning grants. The PBRNs represent a wide variety of practice settings located in 50 states and the District of Columbia, providing access to more than 5, primary care providers and almost seven million patients. For example, one PBRN is testing the feasibility of clinicians using handheld devices with computerized algorithms for assessing and counseling patients who smoke. Another network is testing an Internet-based communication, surveillance, and data management system to enhance linkages between community practices, state health departments, and the State Epidemiological and Bioterrorism Surveillance System. A third network is testing the use of a computerized automated reminder system for lipid management within an electronic medical record. Finally, three PBRNs are developing interactive surveillance systems to recognize bioterrorism events. Sometimes this occurs because evidence from well conducted, randomized controlled trials is not available. However, even when good evidence is available and there is strong consensus regarding the effects of an intervention, there is often inappropriate utilization of the intervention, resulting in suboptimal care. Studies suggest that it takes an average of 17 years for research evidence to be incorporated into standard clinical practice. The use of IT can help overcome this gap in knowledge management and application through tools to enhance the translation, implementation, and dissemination of important research findings in clinical practice. With this in mind, AHRQ launched its Translating Research into Practice TRIP-I program in , funding 14 projects to generate new knowledge about facilitating the use of rigorously derived evidence to improve patient care. Building on the success of TRIP-I, AHRQ launched TRIP-II in September , funding 13 projects that focused on implementation issues, such as organizational and clinical characteristics, that are associated with successfully translating research findings into clinical practice in diverse settings. One group of investigators is using an interactive, multi-media computer program to improve diabetes-related knowledge, attitudes, self-efficacy, and compliance with self-care recommendations in clinics serving predominantly African American and Hispanic patients. Another group of investigators is assessing a computerized decision support system that provides automated reminders, alerts, and guidelines in the outpatient setting. A third group of investigators is evaluating Internet-based learning modules designed to increase screening of female patients who are at risk for chlamydia infection and to decrease the incidence of pelvic inflammatory disease in primary care practices. Finally, investigators are evaluating the impact of a quality improvement model using electronic medical records and academic detailing on adherence to clinical practice guidelines for prevention of cardiovascular disease and stroke in 22 primary care settings across the United States. Strategic Partnerships The Agency is developing strategic partnerships to generate and disseminate research findings, facilitate use of its resources, and promote evidence-based medicine at the point of care among large and diverse audiences. AHRQ is spearheading a federal initiative to integrate and simplify the collection and reporting of patient safety data from the Department of Health and Human Services. Over the next two years, AHRQ will develop and pilot-test a Web-based reporting system featuring a common user interface. The Agency is also working with the National Committee on Vital and Health Statistics, the eHealth initiative, the Markle Foundation, and other federal, state, local, and private sector partners to improve health care quality and public health through the use of IT, including the development and adoption of national standards and the development of a national electronic health information infrastructure. Emergency preparedness of hospitals and health care systems for bioterrorism and rare public health events; Technologies and methods to improve the linkages between clinical health care systems, emergency response networks, and public health agencies; and Training and information needed to prepare community clinicians to recognize the manifestations of bioterrorism and manage patients appropriately. Conclusion Health care has lagged far behind many other industries in harnessing the capabilities of IT to improve services, knowledge, communication, outcomes, quality, and efficiency. Given the complexity of modern medicine, it is inevitable that IT will play an ever increasing role in improving health care quality. Research is needed to: Evaluate the role of IT in improving clinical decision making,

information management, communication, costs, and access to care; Assess barriers to successful implementation of proven IT, as well as strategies to overcome these barriers so that all patients and providers have access to technologies that can improve safety and quality of care; Generate solutions to eliminate the digital divide; Document the costs and resources associated with adopting and maintaining proven IT applications; and Evaluate transferability of IT solutions to other health care settings. Agency for Healthcare Research and Quality. Press Release, February Agency for Healthcare Research and Quality Available at http: Agency for Healthcare Research and Quality U. Preventive Services Task Force. Yearbook of Medical Informatics. Crossing the Quality Chasm: A New Health System for the 21st Century. National Academy Press;

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It affects, in some way, virtually everyone associated with providing, receiving, or reimbursing health care services. Despite the many technological advances in health care over the past few decades, the typical patient record of today is remarkably similar to the patient record of 50 years ago. This failure of patient records to evolve is now creating additional stress within the already burdened U. As described by Ellwood Patient record improvement could make major contributions to improving the health care system of this nation. A General Accounting Office GAO report on automated medical records identified three major ways in which improved patient records could benefit health care GAO, 1 The committee uses the term practitioners to refer to all health care professionals who provide clinical services to patients. These professionals include, but are not limited to, physicians, nurses, dentists, and therapists. Page 53 Share Cite Suggested Citation: The Computer-Based Patient Record: The National Academies Press. First, automated patient records can improve health care delivery by providing medical personnel with better data access, faster data retrieval, higher quality data, and more versatility in data display. Automated patient records can also support decision making and quality assurance activities and provide clinical reminders to assist in patient care. Second, automated patient records can enhance outcomes research programs by electronically capturing clinical information for evaluation. Third, automated patient records can increase hospital efficiency by reducing costs and improving staff productivity. Several sources support these conclusions. Reductions in the length of inpatient stays were also found in other studies of computerized medical records and medical record summaries Rogers and Haring, Other investigators found enhanced care and improved outcome of care for clinic patients Rogers et al. The first step toward patient record improvement is a close examination of the users of the patient record, the technologies available to create and maintain it, and the barriers to enhancing it. To that end, the Institute of Medicine IOM of the National Academy of Sciences undertook a study to recommend improvements to patient records in response to expanding functional requirements and technological advances. The NIH staff were involved in patient care, teaching, and research and were motivated by the need to make patient records more useful for all of these purposes. Thus, this report generally will refer to what are commonly called medical records as "patient records. Thus, the participants at a June IOM program development workshop recommended that the institute conduct a study of the patient record in light of new technologies. Efforts to enlist adequate financial support occurred over the ensuing two years. The IOM appointed a study committee in March , and the committee began its deliberations the following September. Among its membership were experts in community and academic medicine, health information services, health services research, hospital services, medical information systems, regulatory functions, and third-party payment. Specifically, the committee was asked to: In addition to addressing the technological issues in its charge, the committee sought to produce a report that would increase the interest of all health care practitioners in improving patient records and health care information management. Involvement of these practitioners in the development of future patient records is required if record improvement efforts are to meet with success. Committee Activities The committee met five times between September and December The subcommittees, each with approximately 15 members, met at least twice and solicited information from more than 70 advisers, including physicians in both private practice and academic medicine , nurses, dentists, medical record professionals, hospital administrators, researchers, and congressional staff. Also among these advisers were representatives of patient groups, computer software and hardware vendors, third-party payers, government agencies, and professional organizations. Each subcommittee prepared a report that was considered, along with the results of a special workshop and several background papers, by the full committee in its deliberations. Definitions During its work, the committee used the following specific definitions: A patient record is the repository of information

about a single patient. This information is generated by health care professionals as a direct result of interaction with a patient or with individuals who have personal knowledge of the patient or with both. Traditionally, patient records have been paper and have been used to store patient care data. A computer-based patient record CPR is 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, 3 links to medical knowledge, and other aids. A primary patient record is used by health care professionals while providing patient care services to review patient data or document their own observations, actions, or instructions. A secondary patient record is derived from the primary record and contains selected data elements to aid nonclinical users i. They identify three types of decision support functions: Throughout this report, clinical decision support systems refer to clinical consultation systems that use population statistics or encode expert knowledge to assist practitioners in diagnosis or in formulating treatment plans Shortliffe et al. Westin identified three "zones" through which information flows: This report does not address social uses of patient care data that lie outside health care e. Page 56 Share Cite Suggested Citation: Patient care evaluation refers to quality assurance, utilization review, and medical or legal audits. Patient care advancement refers to research. These records are often combined to form what the committee terms a secondary database e. A patient record system is the set of components that form the mechanism by which patient records are created, used, stored, and retrieved. A patient record system is usually located within a health care provider setting. It includes people, data, rules and procedures, processing and storage devices e. A patient record system can be part of a hospital information system , which typically handles both administrative and clinical functions, or a medical information system, which has been defined as "the set of formal arrangements by which the facts concerning the health or health care of individual patients are stored and processed in computer" Lindberg, A patient record system is a type of clinical information system, which is dedicated to collecting, storing, manipulating, and making available clinical information important to the delivery of patient care. The central focus of such systems is clinical data and not financial or billing information. Such systems may be limited in their scope to a single area of clinical information e. Report Organization The remainder of this chapter discusses the current state of patient record systems, including their strengths and weaknesses, and the environment of opportunity that exists for implementing computer-based patient records. Chapter 2 delineates the needs of patient record users and describes how future patient record systems can meet user needs. Chapter 3 identifies technologies essential to future systems and assesses how well existing systems meet future requirements. Chapter 4 describes nontechnological barriers to improving patient records and presents a strategic plan for overcoming them. The Patient Record Virtually every person in the United States who has received health care since has a patient record MacEachern, Patient records have proliferated to the extent that some medical centers in large metropolitan areas may now each have more than 4 million paper patient records Kurland and Molgaard, Although at any one time these records are not all active, they must be stored for up to 25 years, depending on state laws Waller, in this volume. Moreover, a given patient may have more than one record even within a particular institution. They are created and used most frequently in health care provider settings such as physician or dentist offices, hospitals, nursing homes, and public health clinics; but other institutions such as correctional institutions, the armed forces, occupational health programs of employers, and colleges and universities also maintain patient health care records Westin, Yet recent years have seen a trend toward automation of components of patient records e. This result may be 5 Health care professionals might maintain a separate patient record to protect sensitive data e. Because the committee focused more closely on traditional patient care records, this report does not address issues related to pharmacy records. Page 58 Share Cite Suggested Citation: Given the prevalence of paper patient records, the committee noted that support by practitioners for this kind of record keeping should not be underestimated. Time and resource constraints did not permit the committee to survey user attitudes toward paper records; however, committee members identified at least five strengths of such records from the perspective of record users: Paper records are familiar to users who consequently do not need to acquire new skills or behaviors to

use them. Paper records are portable and can be carried to the point of care. Once in hand, paper records do not experience downtime as computer systems do. Paper records allow flexibility in recording data and are able to record "soft" i. This feature allows users to organize data in various ways and to look for patterns or trends that are not explicitly stated. Criticism of current patient records is sometimes sharp. Pories believes that this situation has not improved and that it is not isolated. He is not alone in his view that patient records often lack the features needed for their most beneficial use. In a recent survey of internists in academic and private practice, 63 percent of the respondents agreed with the statement that patient records are becoming increasingly burdensome without improving the quality of patient care Hershey et al. The weaknesses of patient records, as described in the literature and in the work of the committee, can be subsumed under four main headings: Page 59 Share Cite Suggested Citation:

Chapter 5 : The Role of Public Health Informatics in Enhancing Public Health Surveillance

Health technology assessment is a structured analysis of a health technology, a set of related technologies, or a technology-related issue that is performed for the purpose of providing input to a policy decision (US Congress, Office of Technology Assessment).

Persons using assistive technology might not be able to fully access information in this file. For assistance, please send e-mail to: Type Accommodation and the title of the report in the subject line of e-mail. Public health surveillance has benefitted from, and has often pioneered, informatics analyses and solutions. However, the field of informatics also serves other facets of public health including emergency response, environmental health, nursing, and administration. Public health informatics has been defined as the systematic application of information and computer science and technology to public health practice, research, and learning 1. It is an interdisciplinary profession that applies mathematics, engineering, information science, and related social sciences e. Public health informatics is a subdomain of the larger field known as biomedical or health informatics. Health informatics is not synonymous with the term health information technology IT. Although the concept of health IT encompasses the use of technology in the field of health care, one can think of health informatics as defining the science, the how and why, behind health IT. For example, health IT professionals should be able to resolve infrastructure problems with a network connection, whereas trained public health informaticians should be able to support public health decisions by facilitating the availability of timely, relevant, and high-quality information. In other words, they should always be able to provide advice on methods for achieving a public health goal faster, better, or at a lower cost by leveraging computer science, information science, or technology. This report proposes a vision for informatics in enhancing public health surveillance, identifies challenges and opportunities, and suggests approaches to attain the vision. This topic was identified by CDC leadership as one of six major concerns that must be addressed by the public health community to advance public health surveillance in the 21st century. The six topics were discussed by CDC workgroups that were convened as part of the Surveillance Consultation to advance public health surveillance to meet continuing and new challenges 2. Although this report is not based on workgroup discussions, it is intended to continue the conversations with the public health community for a shared vision for public health surveillance in the 21st century. The work of public health informatics can be divided into three categories. First is the study and description of complex systems e. Second is the identification of opportunities to improve the efficiency and effectiveness of public health systems through innovative data collection or use of information. Third is the implementation and maintenance of processes and systems to achieve such improvements. The informatics perspective can provide insights and opportunities to improve each of the seven ongoing elements of any public health surveillance system 3. Examples include the following: Planning and system design â€" Identifying information and sources that best address a surveillance goal; identifying who will access information, by what methods and under what conditions; and improving analysis or action by improving the surveillance system interaction with other information systems. Data collection â€" Identifying potential bias associated with different collection methods e. Analysis â€" Identifying appropriate statistical and visualization applications; generating algorithms to alert users to aberrations in health events; and leveraging high-performance computational resources for large data sets or complex analyses. Interpretation â€" Determining usefulness of comparing information from one surveillance program with other data sets related by time, place, person, or condition for new perspectives and combining data of other sources and quality to provide a context for interpretation. Dissemination â€" Recommending appropriate displays of information for users and the best methods to reach the intended audience; facilitating information finding; and identifying benefits for data providers. Application to public health programs â€" Assessing the utility of having surveillance data directly flow into information systems that support public health interventions and information elements or standards that facilitate this linkage of surveillance to action and improving access to

and use of information produced by a surveillance system for workers in the field and health-care providers. The evolving field of surveillance informatics presents both challenges and opportunities. The challenges include finding efficient and effective ways of combining multiple sources of complex data and information into meaningful and actionable knowledge e. As these challenges are met, opportunities will arise for faster, better, and lower cost surveillance and interpretation of health events and trends. The domain of public health informatics designs and evaluates methods appropriate for this complex environment. Challenges Realizing this vision for 21st century public health surveillance requires attention to technology and process and to the specific needs i. The technology challenges for public health surveillance are daunting. Public health surveillance systems manage data that are high volume, heterogeneous, and distributed widely. In addition, data-quality concerns also might exist, occurring in both new and older legacy systems. Data from many information systems might not be shared easily or exchanged, as that might not have been a requirement of the system at the time of its development. Changing these systems in an environment of limited funding and time presents barriers that are at least as substantial as those for technologic and scientific concerns. Impediments include laws and regulations that preserve different data collection and sharing rules, privacy and security concerns, and academic and economic disincentives to sharing and collaboration. Technology Technology that seems the most innovative often relies on adopting and leveraging technology standards. Systems must have the ability not only to talk and listen, but also to understand each other. Unfortunately, adopting only certain standards is insufficient. Certain types of errors are associated with data manipulation. Even highly structured data-collection techniques do not completely eliminate data errors. For example, providing data elements that can be selected from a drop-down list cannot prevent the entry of a male who is documented as receiving a Papanicolaou test. However, structured data collection techniques can simplify minimizing or identifying many such data-quality problems. The standardization process that facilitates computer-readable forms of data, by its very nature, risks losing the richness of information found within unstructured documents i. Accessing and integrating both structured and unstructured data is a major focus in health informatics. As public health surveillance systems collect more and more structured data directly from clinical information systems, this capacity for structured and unstructured data access is increasingly important. Economic pressures on health care and public health are diminishing the practicality of conducting active surveillance techniques e. In addition, the need for speed in the face of rapid global pandemics and bioterrorism makes the often incomplete ascertainment from passive reporting processes a substantial challenge. The application of informatics science can help ensure that 21st century systems are as valid as current methods while providing improved efficiency. Transitioning Systems The process of change is difficult, and transforming information systems and work flows is no exception. Initial investments of time, human resources, and capital are difficult to assemble. Transitioning to interconnected i. For example, setting up automated data-collection streams from electronic health record EHR data sources is different from manual data abstraction from health-care records. Concerns related to data quality, data standardization, process automation, work flow design, and system validation all need to be addressed. The need to use new and legacy systems in parallel for a period must be considered and planned for, including the challenging process of transitioning users off legacy systems. Challenges and resistance to change must be balanced by clearly defined desirable goals and objectives associated with the new surveillance system and informed by strong, systematic informatics analyses. Leadership and Workforce Because 21st century surveillance crosses the lines of complex social and political systems, it can no longer rely solely on creative innovation among field personnel, but requires senior leaders who can see the opportunities and have the resources to address the challenges. Optimistic and strong leadership for public health informatics is critical to augment public health surveillance sufficiently in the 21st century. Public health leaders have the responsibility of examining their workforce and making the conscious decisions to augment it with public health informatics expertise. Leadership also requires the ability to assemble the appropriate set of stakeholders when addressing 21st century public health surveillance challenges. New challenges will, for example, require input and guidance from legal and privacy

subject-matter specialists. Leadership is needed to devote adequate funding to implement short-term improvements and long-term visions of informatics-augmented public health surveillance. The leadership challenge is complex considering the need to integrate siloed systems, which are often governed and funded independently i. All members of the team, from senior management to the end user, need to be invested in creating the most usable, goal-oriented system possible, identifying the ways electronic information can be managed and used for the maximum benefit. The demonstration of meaningful use of EHRs, as articulated in the Centers for Medicare and Medicaid Services CMS final rule, and described in detail in the next section, includes three public health requirements: The goal of this funding has been to modernize the health system by promoting and expanding the adoption of health information technology by For example, hospitals now have an economic incentive to electronically transmit reportable laboratory results to public health agencies electronic laboratory reporting. This can improve the speed and ascertainment completeness of reporting and also can affect the surveillance work flow and work load. As the semantics and the syntax of such electronic reports become more widely adopted a process also accelerated by the HITECH Act , such information can flow more easily between computer applications and systems i. This interoperability creates the potential to eliminate data-reentry into case management applications, which can improve efficiency while reducing resource requirements and data-entry errors. As clinicians and public health workers increasingly work in electronic environments using the same types of interoperable data, the opportunity for bidirectional communication around cases or clusters of conditions also can increase. To be eligible to receive CMS incentive payments for the use of electronic health record technology, participants must implement certified technology and also must demonstrate meaningful use of that technology. To receive incentive payments in and , eligible providers must perform one of three forms of reporting to public health agencies: EHRs also must record demographic and other data of interest for surveillance systems e. The requirements for meaningful use incentives will change and evolve over the next few years. In fact, though incentives are currently in place, financial penalties are scheduled to take effect by 5. Other Funding Several other programs provide additional funds to support the development of health IT solutions. SHARP awards have funded research to identify technology solutions to address well-documented problems impeding adoption of health information technology health IT. CDC is on the federal steering committee overseeing the SHARP program and is providing input to ensure that the public health perspective is considered. Another series of grants support HIE systems in states and advanced demonstrations for the use of exchange systems to improve care quality and public health outcomes in local areas BEACON grants. Another program, the Program of Assistance for University-Based Training, is prepared to produce trained public health informaticians in universities during the next few years 6. Technologic Advances Electronic real-time data regarding the environment e. As public participation in submitting information into the World Wide Web increases often labeled Web 2. Several of these types of data have been used to derive signals of important health trends faster and more broadly than more traditional case reporting systems e. Public Health Informaticians One of the most valuable resources to be tapped is the diverse population of public health professionals formally trained or not who have already made informatics a priority in their work. These include staff at CDC and other federal agencies; state and local health departments, members of the Public Health Data Standards Consortium and informatics leaders in several public health associations, workers from all walks of public health life who attend Public Health Information Network meetings, university scholars of public health informatics, and staffs of nonprofit organizations like the Public Health Informatics Institute. Representatives of these groups come together to harmonize an ongoing agenda for public health informatics at the Joint Public Health Informatics Taskforce, a coordinating body of several associations 9. By educating leaders and peers, testing innovations, and disseminating lessons learned, these persons and agencies are improving public health surveillance and ultimately health outcomes by reducing costs, bridging silos, and improving access to timely, quality information. Conclusion These opportunities also represent a crisis: Several steps can help public health agencies. ONC-specified standards to accept surveillance information from health-care providers

should be adopted but will require changes to established surveillance and other information management systems. Public health agencies with limited informatics support might find it valuable to work with academic centers or other agencies to facilitate their transition to the use of more standardized electronic data. Using this form of data should, in time, enable them to reduce labor while increasing the sophistication of their analyses in both surveillance systems and response systems. Active collaboration on new information system and data collection initiatives can reap substantial benefits. To achieve the vision, certain key points must be addressed. Stand-alone systems should be considered only when no other options are available.

Chapter 6 : Use of Information Technology to Improve the Quality of Health Care in the United States

Policy brief Health technology assessment An introduction to objectives, role of evidence, and structure in Europe by Marcial Velasco-Garrido The European Observatory on Health Systems and Policies is a partnership between the World Health Organization Regional Office Reinhard Busse.

Chapter 7 : Introduction | Meaningful Use | CDC

HTA Introduction to Health Technology Assessment is derived from an evolving set of seminars and other presentations that I have given on health technology assessment since the mids. This third version follows two done in and at the request of the National Information Center on.

Chapter 8 : EHR Product Select & Implement -- Health IT Guides

Technology can be a powerful tool for transforming learning. It can help affirm and advance relationships between educators and students, reinvent our approaches to learning and collaboration, shrink long-standing equity and accessibility gaps, and adapt learning experiences to meet the needs of all learners.

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