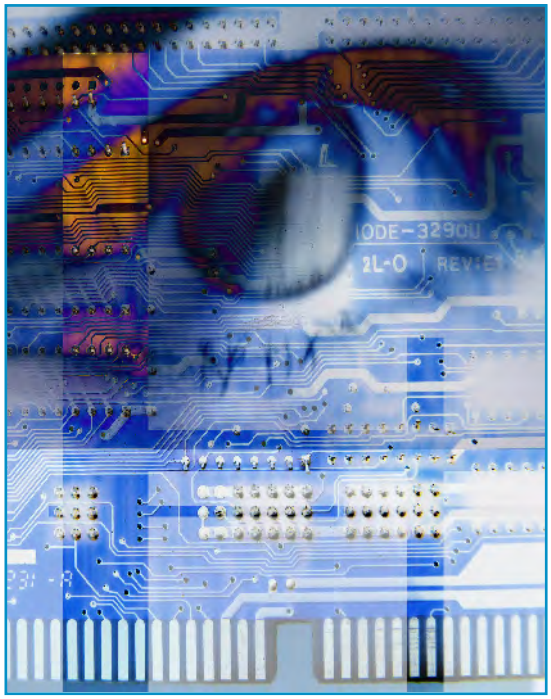
PACIFIC HEALTH SUMMIT

HEALTH INFORMATION TECHNOLOGY AND POLICY WORKGROUP

Health Information Technology and Policy Briefing Book



June 2006

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Foreword

Western and Asian governments share a common challenge in containing skyrocketing costs of chronic disease care, while addressing new threats brought on by infectious diseases. Innovative solutions are necessary, starting with a shift in the focus of health care from the current model that concentrates 80 percent of total spending on the last two years of life to a new paradigm that emphasizes disease prevention, early detection and treatment, and active aging. Governments, industry leaders, and health providers around the globe are exploring the potential of information technology to meet systemic needs.

Although "bulletproof" evidence that proves the efficacy, cost-savings, and improved quality of care of these technologies is still being developed, innovative information technologies show great promise for both detecting and containing public health threats, as well as in providing innovative solutions for chronic disease prevention, detection, and treatment. This collection of briefing documents and case studies illustrates how information technology can play an increasingly significant role in connecting science, technology, and policy for healthier outcomes.

This publication is also the initial platform for the Health Information Technology and Policy (HIT) Workgroup, an ongoing project launched at the Pacific Health Summit in June 2005. The group, with over 50 members from seven economies, examines the national and international public policy framework surrounding public health, science, and technology, with the goal of improving the environment for the adoption of information technologies that can improve health outcomes.

Every June the Pacific Health Summit (www.pacifichealthsummit.org) welcomes 250 of the best minds in health care, policy, and industry to discuss how we can build a global health model that will prevent, detect, and treat disease early enough to keep people healthy and dramatically reduce the human and financial cost of disease. Co-presented by The National Bureau of Asian Research and Fred Hutchinson Cancer Research Center, the Summit is guided by a senior advisory group co-chaired by George F. Russell, Jr. and William H. Gates, Sr. Sponsors for Summit 2006 include GE Healthcare, Microsoft, Coca-Cola's Beverage Institute for Health and Wellness, Intel, Pfizer, Fujitsu, National Cancer Institute, Amgen, Roche Diagnostics, Affymetrix, GlaxoSmithKline, Miraca, and the Canary Foundation.

We are particularly grateful for the strong financial support and leadership provided by Fujitsu, Ltd., for the Pacific Health Summit HIT Workgroup.

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Overview Documents

Electronic Health Records (EHRs)

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Overview

High costs, administrative inefficiency, medical errors, variable quality, and poor coordination are longstanding problems in health systems worldwide. Many of these problems could be addressed by applying HIT to medical care, in particular through electronic health records (EHRs). The records are convenient for patients and physicians alike, can significantly reduce medical errors, and will help track public health problems among populations.

Terminology

The terms EHR and EMR (Electronic Medical Record) have come to be used interchangeably. Some also use the term EPR (Electronic Patient Record). While all these acronyms refer to the same concept, "EHR" implies broader functions and features, which include but are not limited to the EMR component. On the other hand, it is also true that simple and stand-alone systems providing the feature of input, output, and storage of digital patient records no longer exist. Today's EMR is always associated with other important features or functions. For this document, such integrated EMR-based systems will be referred to as Electronic Health Records (EHRs) or EHR systems.

EHRs serve primarily in illness management. Regarding prevention and early detection of disease, periodical health check-ups and medical screening provide critical data. In considering life-long continuous care, these records are just as important as EHRs. Recently, the concept of Personal Health Records (PHRs) was introduced to represent this disparity.[1] EHRs supply information to a PHR in the form of care history.

Core Functions

The United States National Academy of Science's Institute of Medicine identified a set of 8 core functions of EHRs outlined in the chart below.[2] These functions correspond directly to trends in Japan and other economies.

Health Information and Data	EHRs provide immediate access to key information to improve caregiver's ability to make clinical decisions in a timely manner.
Result Management	EHRs are effectively a clearinghouse for new and past test results, increasing patient safety and effectiveness of care.
Order Management	EHRs facilitate entering and storing orders for prescriptions, tests, and other services in a computer based system to enhance legibility, reduce duplication, and improve the speed with which orders are executed.
Decision Support	EHRs contain computerized decision-support systems with reminders, prompts, and alerts, which help improve compliance with best clinical practices, identify possible drug interactions, and facilitate diagnoses and treatments.
Electronic Communication and Connectivity	EHRs provide a platform for secure and readily accessible communication among providers and patients to improve the continuity of care, increase the timeliness of diagnoses and treatments, and reduce the frequency of adverse events.
Patient Support	EHRs provide tools for patients to access to their health records, provide education about the disease, and help patients to perform home-monitoring and self-testing to improve control of chronic conditions such as diabetes.
Administrative Processes	EHRs contain scheduling systems which improve hospitals' and clinics' efficiency and provide more timely services to patients.
Reporting	EHRs facilitate data storage and employ uniform standards, enabling health care organizations to respond quickly to governments and meet private institution reporting requirements, including those that support patient safety and disease surveillance.

[1] "The Role of the Personal Health Record in the EHR," *Journal of AHIMA*, AHIMA e-HIM PHR Work Group Task Force Report, July 2005.

[2] "Key Capabilities of an Electronic Health Record System Letter Report," Committee on Data Standards for Patient Safety Board on Health Care Services Institute of Medicine of The National Academies, The National Academies Press: Washington, DC, 2003.

Benefits of EHR Adoption

Increased Availability and Accessibility	Patient records can be retrieved at any time and from anywhere.
Decreased Time Spent on Paperwork	• Time previously spent for searching paper charts, taking them to doctors, and returning them to storage is eliminated. • Human resources for managing charts can be decreased.
Care Enhancement	Resources used for managing charts are available for providing care.
Improvement in Safety	• By eliminating illegible handwriting, staff can avoid misunderstandings about diagnoses, suggested treatment, and prescriptions. • Automated drug cross-checking features help prevent inappropriate drug prescriptions by highlighting allergies, contraindication of drugs, and drug interactions.
Improvement in Efficiency	Time spent on leaving messages and waiting for responses is reduced because correspondence is conducted electronically.
Increased Collaboration	• Doctors and medical staff can share patient information among institutions and practices. • Such information sharing will support Team Medicine
Better Management	Analyzing EHR databases in connection with accounting database allows for easy extraction of information valuable for the management of medical organizations (e.g., cost of care for each department, doctor, and patient, as well as doctor performance).
Speeding up Statistics	• EHRs facilitate easy compilation of a variety of statistics. Providing such statistics to governments contributes to timely measures and policies for that region (e.g., an infectious disease occurrence could be reported and acted upon immediately).
More Opportunities for Research	By accumulating clinical data, clinic epidemiologic research can be conducted. Protecting privacy is required.

Obstacles

Lack of Standards	• Difficulties have already been encountered in institutions in many economies in connecting existing EHRs with other vendor's EHRs. • Implementing electronic health records without interoperability standards in place could result in huge costs with unrealizable benefits for doctors and hospitals (e.g., converting from one EHR vendor to another could result in huge expense). • Software purchased now might not work with standards eventually adopted by governments or the health care industry.
Scattered Records	• People visit multiple health care systems during their lifetime; as a result their medical records exist in many different organizations. To deliver continuous care, it is important to physically or virtually consolidate those records. However, it is technically difficult to do so because each hospital uses different patient numbering systems or assigns different IDs to the same patient.
High Costs	• Transitioning to electronic health record technology is costly, which makes adoption difficult for small hospitals and clinics. However, the mid- to large-size hospitals invest relatively lower amounts in IT in compares to trends in other industries.
Privacy and Security	• Digital data is easy to copy; therefore, security is a concern for many. • The Internet provides the least expensive infrastructure through which to use functionality of EHR. However, many believe that ordinary security technology, such as SSL, is insufficient for protect patient privacy.
Lack of Infrastructure	• Many hospitals and medical offices in rural areas and emerging markets do not have the electronic infrastructure to take advantage of EHRs even if they did exist.

Electronic Health Records: A Physician's Perspective

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Overview

There is no question that the potential benefits of EHRs are enormous—for saving physicians' time and office space, increasing the breadth, depth, and accessibility, of patient histories, and as a result, improving care. For many physicians, the adoption of EHRs carries many immediate advantages, such as time saved looking for specific files and compiling lab results and other data into graphs to observe trends or abnormalities with greater ease and speed than ever before.

But while EHRs greatly facilitate data management and the quick isolation of relevant information for each individual, EHRs can also carry significant financial and temporal costs, both in the initial implementation phase and throughout the longer term. These costs include technical maintenance, staff support for transferring files from paper to e-records, and time lost to adapting to new systems and creating new records. With such enormous e-files, physicians may also have a hard time getting "the big picture" for patients with longer histories. Since EHR adoption involves significantly changing the way many physicians do their work, there is also a significant learning curve. For many physicians, adopting EHRs is similar to learning a new language.

Involving physicians in the development of EHRs is one way to ensure that those systems take into account physicians' concerns and give physicians a stake in the process. Studies on the advantages and disadvantages of different types of EHR systems, software, and vendors would also help physicians understand the product and chose the system that is right for their practice. Finally, educating physicians and their staffs about the shift from paper to electronic records and the different kinds of EHR software available would create an easier transition for all parties.

Benefits of EHRs to Physicians

Central Clearinghouse of Information	• EHRs make searches for specific pieces of data, lab studies, and x-rays very easy. Instead of leafing through pages of paper records, physicians can perform an online search for the right data from the appropriate time period. • Instead of adding pages to paper charts each time a patient visits, physicians can scroll through EHRs and update areas that have changes or additions. For physicians who work primarily with outpatients or with clinics, EHRs are relatively short and easy to scan. • EHRs offer handy access to ancillary services such as medical dictionaries and other general information sources. Physicians no longer need to carry or keep heavy textbooks or manuals in their offices since this information is now only one click away.
Easy Compilation of Data	Laboratory data is easy to see in different formats, according to how physicians prefer that information laid out. For example, certain data sets can be viewed in list or graph form.
Easy Data Entry	EHRs facilitate entry of quantitative data or information that can be standardized by allowing physicians to check boxes, fill in numbers, and add comments quickly.
Easy Virtual Access	Physicians can access patient records remotely, from an office, hospital, or from their home computers. As a result, doctors no longer need to wait for records to be transferred or open up the office late at night when a patient has an emergency and their file needs to be accessed.

Challenges	Possible Solutions
Overwhelming Amounts of Data for Patients With Long Histories. Patients with complex conditions and long histories of medical problems and/or hospital stays can have extremely long medical records. For physicians accustomed to paper charts, these EHRs can be difficult to scan or scroll through online. The "big picture" is not immediately evident for these patients with extra long health records.	• **Print Out or Virtually Isolate Relevant Sections.** Staff or physicians can print out either the entire or most salient portions of a patient's record so that physicians can scan it as they would paper charts. • **Incorporate "Clinical Summary" Functions into EHRs.** Requiring physicians to enter summaries in addition to individual data points would create alternative ways for physicians to view the same data later – through those summaries or through already-established formats. • **Educate Physicians about Site Map and Index Functions Within EHRs**
Discomfort With Virtual Access. For some physicians who feel more comfortable with a paper record, accessing health records online is a real obstacle.	**Make Electronic Records Available to Physicians in Printed Form.** Staff can provide these physicians with printed copies of patients' health records so that those physicians who are uncomfortable with online access can still obtain the information they need to do their jobs effectively, while still supporting the transition to EHRs.
Time Lost Due to Discomfort with Data Entry. Physicians uncomfortable accessing and scrolling through EHRs online often have difficulty with online data entry, which can take a great deal of time when dealing with patients who have complex conditions and medical histories, particularly during the initial outlay. In this way, EHRs can sometimes increase physicians' workloads.	**Place the Data Entry Burden on Staff Instead of Only On Physicians.** Instead of forcing all physicians to enter comments and data electronically, paper forms can be made available that physicians would fill out and write comments on, and then give to staff to enter into the electronic database. As a result, the EHR would still be continuously updated and accessed, but physicians who feel more comfortable would be less inconvenienced.
Difficult Entry of Vague or Patient-Unique Data. Because the process for working with each patient is not uniform, the data physicians need to record for each patient is also often unique. Some EHRs do not contain enough fields to enter nontraditional symptoms or issues of concern that are often vague and cannot be quantified.	• **Make Sure EHR Software is Appropriate for Each Physician Practice or Specialty.** Many different kinds of EHR software exist that are shaped to fit the needs of each physician specialty. Purchasers should be aware of all their options and vendors should work with physicians to find an EHR package that is right for each practice. • **Custom-EHRs.** Physicians and IT companies could work together directly to develop custom EHR software for specific practices, which could eliminate many concerns. However, interoperability might become an issue with too many EHR formats in use.
Financial Risk. The immaturity of the HIT industry means that physician purchases have had little or no access to financial information or business analyses over time to help in choosing their vendor.	**More Studies of the EHR Industry and More Analyses of EHR Software and Vendors are Necessary.** With more analysis of the industry at present, as well as concentrated study on EHR financing and vendors, physicians will be better able to assess the EHR options available to them.
Maintenance Costs. EHR vendors often provide little maintenance or charge very high fees for maintenance for IT systems.	**Vendors Should Offer Free or Low-Cost Maintenance and/or Training.** Effective maintenance is essential for the success of EHRs. Even if only for specific time periods after adoption, help with maintenance or maintenance training would greatly increase physicians' and their staff's enthusiasm for EHRs.
Any Changes to the System Involve Long Processing Time. Even for minor changes in EHRs, among charting systems for example, physicians in big institutions need to file requests with a separate committee that must convene and debate financial and other issues before making a decision. Implementation of the change can take even longer. Since EHRs are shared by all—physicians, administrators, patients—and managed/maintained by EHR technicians, even small changes require significant time and energy.	**Streamline the EHR Feedback Process for Physicians and Put in Place Timely, Efficient Response and Change Mechanisms.** Change is never easy in large institutions, but if EHRs are going to become more widespread, physicians must have the capacity to make the changes they see fit to improve care and help them do their jobs. More efficient feedback mechanisms and frequent meetings of HIT review committees with authority are necessary.
Bandwidth. In some institutions, accessing and scrolling through EHRs can take a long time due to bandwidth issues.	**Ensure that IT Networks can Support EHRs with Real-Time Speed.** No matter how advanced an EHR system may be, if the institution or office does not have the bandwidth to support the necessary speed, the system will be sub-optimal.

Disease Detection, Reporting, and Tracking

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Overview

This document explores key technologies used in disease detection, reporting, and tracking; evaluates critical infrastructure; and provides current examples of effective technology adoption and collaboration.

Background

A global re-emergence of infectious diseases over the past 25 years has underscored the urgent need for sophisticated, coordinated public health systems that detect diseases early and track them effectively. The Asia-Pacific region has been the geographic area hardest hit by this resurgence. "Old diseases" such as dengue hemorrhagic fever, Japanese encephalitis, malaria, cholera, tuberculosis, and influenza, have repeatedly caused major epidemics in the region and have severely taxed public health infrastructure and economies. Dramatic new threats, such as SARS and new influenza strains, which can move rapidly via air travel, have become concerns for all areas of the globe. While flu viruses tend to spread from Asia, North America has been the source of slower-moving, but equally—if not more dangerous—diseases such as HIV/AIDS, which arrived from North America into Asia in the early 1990's as a result of increased trade and travel. Information technology (IT) is critical for in increasing the sophistication of, and coordination among, public health systems worldwide. IT is also necessary for the accurate assessment of the number of possible cases of infection, number of possible exposures, and common locations where a disease agent may have spread by linking lab results with epidemiological data.

Useful Technologies

Syndromic Surveillance Systems	These systems monitor data that are routinely collected—in emergency rooms, for example. Based on presenting complaints rather than final diagnosis, they can provide an early signal of unusual illnesses in patient populations. The automated technology offers an important tool to clinicians who are likely to be on the frontlines of detecting a disease outbreak or bioterrorist event by using computer programs to make faster diagnoses.
Combining Wireless Technology with Diagnostic Devices	Devices such as fever thermometers and stethoscopes, mini-MRIs, and X-ray devices, as well as blood pressure, heart rate, and urinalysis monitor can all wirelessly transmit the results directly into a patient's health records during doctor visits.
Infrared Fever-Sensing	Thermal cameras show differing temperatures through color. These cameras have been incorporated into airport security surveillance as a quick and non-intrusive tool to detect illness.
Radiofrequency Identification (RFID)	In addition to allowing precise tracking of drug products through the supply chain, RFID can also be used as an early warning system for the avian flu when biothermal RFID chips are implanted in chickens. RFID-based motion sensing can also profile the motion and daily routines of the elderly and those with chronic diseases. Logged data will show behavior changes (e.g., not taking medicine, not eating, staying in bed for a long time).

Critical Infrastructure

Communication technologies offer great potential to bridge geographic distances, coordinate surveillance and other activities, and provide training, consultation, and informal knowledge sharing through e-mail and other electronic means. Standards and specifications to support the timely and secure exchange of electronic information across organizations and systems that support early detection, outbreak management, and response administration are essential.

Skilled Public Health Workforce	Field epidemiology training activities have been launched in Thailand, the Philippines, PRC, South Korea, Japan, and other countries over the last decade in recognition of a critical lack of disease tracking and management capacity. Epidemiologists must possess the ability to assess their country, region, or city's capacity and readiness to conduct outbreak investigations.
Efficient Public Health Laboratories	Laboratories must have the ability to provide reference and molecular diagnostic services and consultations in quality control and improvement programs. Laboratory outbreaks of SARS and other pathogens have highlighted the need to strengthen laboratory security.

Current Collaborative System Exemplars

Although infectious diseases have challenged society's ability to respond to outbreaks, many systems that combine IT with well-trained personnel exist. These exemplars demonstrate how IT enables collaboration across time and space to protect public health.

APEC Emerging Infectious Diseases (APEC/EINET)	Designed with systematic user input, EINET provides bi-weekly disease alert bulletins, with information on new research, diagnostics, and interventions to one thousand users in Health and Commerce in 21 APEC economies. Operating continuously for a decade, EINET also provides a library access portal, and teaching materials on infectious diseases.
PulseNet, CDC	Coordinated by the CDC, PulseNet is a computer network of public health laboratories across the globe that enables epidemiologists to quickly identify food contamination. PulseNet uses pulsed-field gel electrophoresis to identify distinctive "fingerprint" patterns of *E.coli* O157:H7. Under the networked computer system, public health laboratories can use this technology and share information via the Internet to determine when food-borne disease outbreaks occur. PulseNet grew out of the experience of public health experts investigating an outbreak of *E.coli*, in 1993. PulseNet requires standardization of laboratory methods and communication protocols.
WHO SARS Diagnosis Project, 2003	In March of 2003, 11 laboratories in 9 countries joined a collaborative research project on SARS diagnosis, coordinated by the WHO. The network took advantage of e-mail and a secure WHO web site to share outcomes of investigations of clinical samples, electron-microscope images of viruses, sequences of genetic material for virus identification and characterization, and postmortem tissues from SARS cases in real time.
Realtime Outbreak and Disease Surveillance Laboratory (RODS) University of Pittsburgh	The RODS Lab uses information technology to improve detection of disease outbreaks. RODS analyzes and integrates clinical data from emergency departments within a geographic region to provide an instantaneous picture of symptoms and an early warning of disease outbreaks. The first real-time public health surveillance system for early detection of disease outbreaks, the Lab's RODS system examines hospital emergency room data from across the United States. RODS monitors information in real time that is routinely collected from patients visiting emergency departments.
PATH-Voxiva-India Japanese Encephalitis Information System	A partnership with the Indian government, Voxiva Inc., and PATH (Program for Appropriate Technology in Health) has streamlined Japanese Encephalitis detection and management in Andhra Pradesh (India). The project's Voxiva-developed information system uses existing communications infrastructure (e.g., mobile, pay, and land-based phones) to track the disease. Health officials log into the system via the web and use analytic tools to evaluate trends, identify outbreaks, and immediately deploy appropriate resources. The system allows health managers to work collaboratively with international experts on diagnostics, vaccine development, and clinical treatment.

Questions for Further Research

- What kind of public-private partnership can be constructed to assure the smooth fusion of advanced networking with public health into a seamless, "just-in-time" communications system?
- What governmental policies will assist health authorities in establishing strong disease control systems?
- How can current systems best be used to train staff for epidemiology and laboratory roles in disease detection?

Personal Health Technology for Aging in Place

By Jeremy BONFINI, Worldwide Digital Health Policy Manager, Intel Corporation; Contributions from the Center for Aging Services Technologies and the Alzheimer's Association

Overview

The United Nations estimates that the worldwide population of 60-year-olds (totaling 600 million in 2000) will rise to 1.2 billion by 2025 and over 2 billion by 2050.[1] Successfully preparing for this impending age wave is a major challenge that requires a collective effort. Families will likely provide the lion's share of care giving for these seniors as the number of professional caregivers diminishes in proportion to the elderly population over the next few decades. The massive aging of the population will cause health care spending of most countries to skyrocket and the cost of caring for older adults to escalate sharply.

Aging in Place

It is no secret that the elderly prefer to live their senior years in their homes rather than in institutions, however nurturing and comfortable nursing homes may be. Behind that preference rests a desire to maintain independence and quality of life, and with it, dignity. "Aging in place" refers to an older person being able to remain either in the location where they have lived for many years, or, alternatively, in a non-health care environment, using services and technologies that allow the individual to stay in their home of choice even as their circumstances or health care needs change. Using home-based technologies, the world has the potential to improve seniors' quality of life, reduce the burden on caregivers, and provide crucial information to physicians that can help with early detection and prevention of physically and financially costly medical conditions.

Home-Based Technologies

The technologies, outlined in the chart below, enable seniors and caregivers to take advantage of wireless networks that links computers and consumer electronic devices and could enable seniors to age in their home environment, thus deferring more costly care in emergency rooms and institutional settings and maintaining their independence for as long as possible. Once this digital home infrastructure is in place, as it is already in most homes and will be increasingly in the near future, any computer or consumer electronic device could also be used to deliver health and wellness applications. Older adults will be able to access home health applications through interfaces they are already familiar with (e.g., phones, PCs, or televisions) and they will not necessarily need to learn new technologies.

These technologies focus on:

- Prevention and early detection of health problems;
- Improved compliance with medications and care plans;
- Remote monitoring and online care support tools; and
- Systems that help coach and assist seniors to maintain their independence in the face of disabilities.

Technology Exemplars

Monitoring and Measurement	**Sensor Network Throughout the Digital Home**	• Tracks and monitors health status (blood pressure, heart rate, glucose level, walking patterns, distances traveled etc.) and activities of older adults via sensors on clothes, bracelets, drawers, medicine cabinets, and pill bottles. • Provides input for adult children to assess the health and well-being of their aging parents remotely.
	Home-Care Robot	• Transmits conversations and video back to caregivers, who can monitor voice patterns and cognitive skills of seniors. • Allows caregivers and family members to interact with and monitor seniors through the robot's camera and mobile phone.

[1] http://www.unfpa.org/sustainable/facts.htm.

Attention and Memory Loss	**Sensor Network**	• Helps seniors with memory loss to monitor and maintain their social health, even as they forget names and faces. • Sensors also help seniors take the appropriate medication at the prescribed time via an intelligent watch and the television.
	Portable GPS Device	Reminds seniors where they are, where they are going, and where they are coming from.
	Voice Activated Phone Dialer	Enables seniors to call friends, caregivers, and others without having to remember or look up telephone numbers or concentrate on dialing.
Vision Impairment	**Computer Screen Reader**	Presents computer graphics and text as speech by verbalizing, everything on the screen including names and descriptions of control buttons, menus, text, and punctuation.
	Talking Word Processor	• Uses speech synthesizers to provide auditory feedback of what is typed. • Useful for e-mailing with family and friends and conducting internet research.
	Label Reader and Scanner	• Allows seniors to scan labels that are read back to them. • Facilitates independence when looking for medicine, food, clothing, money, etc.
Hearing Impairment	**Amplification Device**	Raises the volume of phones, televisions, clocks, and can also be worn by an individual (assistive listening device or ALD).
	Visual Signaling and Alerting Equipment	Provides visual reminders and notifications that can be triggered by sounds seniors cannot always hear (e.g., telephone ring, alarms, or doorbells).

Government Participation

Government participation in addressing liability concerns and reimbursement issues is essential if economies are to prepare effectively to meet the needs of an aging society. The age wave will place a major burden on economies across the globe. Unless countries are prepared, workforce productivity could decline sharply within a decade as a growing number of employees continually miss work to deal with eldercare emergencies.

Questions for Further Research

- How can technology producers educating health care providers and caregivers on how to incorporate new technologies into their services?
- Who should train seniors in these technologies?
- How do we cultivate global relationships and partnerships to share information and build cross-border solutions for aging populations?
- How can policymakers support "Aging in Place"?

Legislative and Regulatory Considerations

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Overview

This document examines key regulatory and policy issues involved in health system transformation through e-Health or HIT regardless of national political systems, health delivery and insurance structures, GDP, or other factors. Increasing evidence supports HIT's potential to improve the quality and efficiency of health care while reducing overall costs and burden on patients and their families.

Core Issues: HIT Funding, Reimbursement, and Investment Policy

Increased financial support and incentives (from public and/or private sources) is necessary for technology adoption and implementation. Such support can be tied to requirements for information standards, interoperability, and health care quality improvement, as well as national or regional demonstration projects. HIT initiatives should also be integrated with any public or private sector value-based purchasing initiatives. Issues to consider in any reimbursement funding and incentive legislation or regulation include:

- Addressing inequity between those who purchase HIT and those who benefit from it (i.e., incentives should create a positive return on investment (ROI) as reflected in the costs of acquiring and maintaining HIT compared to the savings or increased revenue that may result);
- Emphasizing the *use* (not purchase) of HIT applications and ultimately focusing on performance, well as transmission of data to and from the point of care;
- Building routine payment and operations in at the regional and local levels into a national framework;
- Incentivizing applications that are standards-based to enable operability and connectivity;
- Supporting pilot or demonstration projects that will yield early lessons and best practices;
- Supporting provider practice transformation and the financial and technical assistance needed for small and large health care organizations in both urban and rural locales; and
- Supporting patient health education and empowerment, particularly for the chronically ill.

Collaboration

Collaboration between a myriad of relevant stakeholders is a prime ingredient for successful HIT reform implementation. Providers, hospitals, payers, patients, pharmaceuticals, HIT vendors, and others must be part of a collective conversation from which consensus-based approaches can emerge. Any legislation or regulation should encourage coordination and collaboration among leading stakeholders.

Public-Private Sector	• Government approaches to public sector involvement in HIT reform efforts vary. Some are hands-on and prescriptive, while others may only: 1) recommend specific actions to achieve an economy-wide interoperable HIT infrastructure; 2) serve as a forum for participation of a range of stakeholders to provide input on the achievement of interoperable HIT; and/or 3) recommend electronic health information exchange standards (including content, communication, and security standards) for national government and voluntary adoption by private entities. • Both public and private sector perspectives in any economy are invaluable to workable strategies. Each sector should collaborate to achieve successful HIT implementation.
National-Regional	• Local and regional HIT efforts are important with their unique needs, function as learning laboratories, and utility in being linked to any national HIT reform effort. In the U.S. over 200 electronic health information exchanges exist at the state, regional, or local levels. National HIT reform strategies must consider local innovation and a National Health Information Network. • Regional/local autonomy and innovation must be carefully balanced with the need for a national HIT infrastructure or information highway. • Decisions must be made about whether national HIT requirements are the ceiling or a floor upon which localities can add additional and/or more stringent requirements.

Interoperability & Standards

Cross-border interoperability and standards cooperation is one of the most promising, as well as one of the most complex, areas in health system transformation through HIT. Underlying any legislation, regulation, or voluntary agreements between the public and private sectors should be:

- Compliance with a core set or minimum threshold of interoperability protocols based on consensus-driven data content and transmission standards at a national, and potentially regional, level;
- Discussion about open and non-proprietary standards and how to link legacy systems; and
- Establishment of certification procedures to determine whether an HIT product incorporates appropriate interoperability data standards and compliance criteria.

Privacy, Security, & Information Collecting

Transparent policy, regulation, and uniform practices are critical to the success of any HIT reform effort as well as to ensuring public confidence. Norms and values inherent in the patient-provider relationship, as well as the concept of personal health information privacy vary from economy to economy. Issues to consider in developing privacy practices include:

Notice	Existence and purpose of record-keeping systems known.
Choice	Information is: • Collected only with knowledge and permission of subject; • Used only in ways relevant to the purpose for which the data was collected; and • Disclosed only with permission or overriding legal authority.
Access	• Individual right to see records and assure quality of information. • Accurate, complete, and timely.
Security	Reasonable safeguards for confidentiality, integrity, and availability of information.
Enforcement	Violations result in reasonable penalties and mitigation.
Storage & Identification	Issues of patient and provider identifiers, as well as health information storage methods (central versus federated databases) should also be considered.

Linkage to Other Electronic Infrastructure Efforts

Potential impact and interaction with existing national efforts to move towards electronic functionality and infrastructure for vital functions, such as e-citizen, e-government, or public health infrastructure reform should be weighed in HIT transformation efforts. For example, a robust public health infrastructure that can report data real-time is of growing importance to economies in the Pacific Rim as pandemic threats loom large. Policy and regulation should support the fusion of new HIT transformation and existing national and transnational e-initiatives.

Existing Legislative and Regulatory Roadblocks

As health transformation through HIT becomes more and more of a reality, common roadblocks—in existing legislation and regulation drafted in a an era before technological innovation could be contemplated—are emerging. Examples include commerce and trade laws, issues of medical liability and health care fraud and abuse, telecommunications policy, tax policy, device and pharmaceutical regulation, and outdated reimbursement and coding structures.

Questions for Further Research

- How extensive is interoperability and data standards implementation regionally, nationally or transnationally?
- What role do regional bodies such as APEC or others have in coordinating regional HIT discussions?
- What best practice, ROI study, or research information is most needed to advance HIT adoption?
- How do the Pacific Rim's HIT efforts intersect with North American or the European initiatives?
- What are the components (key enablers and barriers) of a multi-national HIT approach in the Pacific Rim?
- How can we leverage efforts from organizations like the WHO, the World Bank, and NGOs?

Patient Safety

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Overview

Many medical errors go unreported and tracking their exact prevalence is difficult. Nevertheless, while exact statistics for each economy are unavailable, patient safety is a critical issue in health care that affects every economy. Most medical errors are caused by inefficient records systems, miscommunication, and human factors. Such errors occur for the most part as a result of systemic problems rather than poor performance by individual doctors, nurses, or other health providers. In addition to the development of a "safety culture" in health care settings, HIT could drastically improve patient safety by:

- ameliorating records and communication systems;
- increasing the accuracy, timeliness, and amount of patient information available to health care workers across the continuum; and
- improving communication among those health care workers, as well as between patients and medical staff.

	Incidence of Medical Errors
Japan	Based on a survey on medical accidents conducted by the National Institutes of Public Health in Japan, around 40,000 people might die in Japanese hospitals each year as the result of medical accidents or adverse events, thus ranking these medical accidents between the 4th and 5th leading causes of death in the country.
United States	A 1999 report by the Institute of Medicine estimates that as many as 44,000 to 98,000 people die in U.S. hospitals each year as the result of medical errors. This means that more people die from medical errors than from motor vehicle accidents, breast cancer, or AIDS.
Australia	A 1999 article in the *Journal of Quality in Clinical Practice* estimated that at least 80,000 medication-related hospitalizations occur in Australia each year; between 32% and 69% of these hospitalizations were considered avoidable.
United Kingdom	According to the *British Medical Journal*, as many as 30,000 people in the United Kingdom die as a result of medical errors every year.

Examples of Medical Errors

- Incorrect identification of patients, treatment sites, and procedures due to ineffective communication (inadequate processes and verification) among health care providers in preoperative procedures.
- Preventable infections acquired while patients are hospitalized or under other medical care.
- Improper medical prescriptions leading to adverse side effects due to lack of information, misinformation, or misunderstanding of information.
- Drugs with similar names or appearances can be confused with one another.
- Abnormal test results may not shared quickly enough with those involved in a patient's care.

How IT Can Help

Information technology can reduce the likelihood of errors and prevent adverse events by providing instantaneous comprehensive information to health care providers, thus facilitating faster, better-informed decisions. IT can also help track adverse events, note trends, and provide feedback on what went wrong where and how to avoid future mistakes.

The benefits of IT in health care range from convenience, as repetitive paper work could become virtually obsolete, to life-saving early detection of a treatable cancer or an infectious disease outbreak, as anonymous data from emergency

rooms can be analyzed by public health systems. A benefit of HIT with clear policy implications includes enormous cost savings to governments, health care institutions, and patients by reducing duplicative and unnecessary testing; increasing health information sharing between providers, labs, pharmacies, and patients; and reducing unnecessary hospitalizations.

Current Exemplars

e-Prescriptions	• Reduce errors resulting from illegibility. • Reduce errors resulting from a lack of data on doses by requiring that data before the prescription can be finalized.
EHRs	These records make a broader range of information about a patient's history immediately available, helping physicians to provide timely, individualized care and flagging important notes about allergies, past procedures a patient may have had, and possible adverse drug interactions.
General e-Resources	Electronic dictionaries and medical databases provide immediate information on drug doses and calculations and can connect symptoms to possible ailments instantaneously to identify interactions among a patient's medications.
Bar-code/ IC-tips	Coded tags ensure the correct identification of patients, medications, and instruments.

Obstacles

Time and Workload	Computerized entry of data can increase the workloads of health providers, thus making IT a burden instead of a boon for some physicians.
Evaluation and Monitoring Challenges	Many EHRs/EMRs are not designed to conduct secondary data analyses, such as developing clinical indicators to evaluate and/or monitor quality-of-care, including patient safety.
Costs	Costs for investing in IT can be high, and it remains unclear how this burden should be born.
Interoperability	Due to a lack of standards in data entry and format, many IT applications do not communicate well, even within organizations.
Privacy	Some important types of data are considered private and policies are often unclear as to what information can be shared with who, and when.

Case Studies of Different Economies

Singapore Case Study: EMR Exchange (EMRX)

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Overview

In 2003, Singapore's incoming Minister for Health identified "Exploit IT Maximally" as one of his priorities with the aim of "One Singaporean, One EMR." The Exploit IT Maximally Workgroup (ITWG), chaired by the Deputy Secretary of Health, convened in September 2003 to drive the initiative. ITWG began as a small group with several sub-groups to tackle specific issues such as law and ethics, culture and change management, publicity, and IT architecture standards.

Background

Coverage	• Singapore is an island economy with a population of about 4 million. The government subsidizes public health services, and provides free basic emergency care. Government expenditure on health was 5.9% of total government expenditures in 2004. • Patients pay for a portion of their treatment, and the amount depends on the level of service they demand. The remaining funds come from government subsidies. Health savings plans include: Medisave, where Singaporeans contribute 6–8% of their income to inpatient and outpatient care; Medishield, which provides low-cost insurance in cases of catastrophic illness; and Medifund, which assists individuals unable to pay for treatment.
Providers	• The public health care delivery system comprises 7 acute care hospitals, 9 specialty centers, and 17 primary care polyclinics. In 1999, these were restructured into two vertically integrated clusters: National Healthcare Group (NHG) and Singapore Health Services (Singhealth). Both are owned by the government and partially funded through subsidiaries. • The public sector provides 80% of hospital care and 20% of primary care while the private sector provides the rest.
HIT Adoption	• By 2003, both the NHG and Singhealth clusters had already implemented clinical IT systems extensively. For example, Singhealth has a single-instance EMR system that covered the entire cluster. This meant that a clinician in any Singhealth institution would have access to EMRs generated from any other Singhealth institution. • Singhealth also implemented e-prescriptions and successfully achieved 100% adoption by clinicians. • Although NHG institutions had different EMR systems, they were linked through a Cluster Patient Record Sharing system. The clusters were, however, unable to share information.

ITWG Operating Principles

In sum, a pragmatic approach focused on implementing immediate goals was adopted when addressing issues rather than a holistic one that encompassed all foreseeable needs and concerns. To maintain focus, ITWG established the following guidelines:

- Key criteria for consideration would be the **improvement of patience care outcomes**. Data collection for research, though important, was a secondary concern.
- Focus would be on areas where market outcome is suboptimal and **central coordination adds highest value**. ITWG would not intervene with institutions' internal systems unnecessarily.
- ITWG chose to **live with diversity** and was careful to implement initiatives with the **lightest touch** possible. Recognizing the significant achievements of HIT implementation within the health system clusters described below, ITWG consciously steered away from proposals that required massive rebuilding of existing systems. ITWG **standardized only when absolutely necessary**.
- ITWG adopted the pareto principle by beginning with the clusters as they account for 80% of Singapore's acute care markets.

Obstacles

ITWG engaged various stakeholders in open consultation, including hospital CEOs and senior clinicians, who openly debated issues that might impede implementation. Issues and actions taken to address them include:

Issue	Problem	Solution
Privacy	• Legal implications of providing EMRs beyond cluster boundaries • Obtaining consent from individual patients would have been cumbersome, and impede widespread availability of EMRs.	• The Attorney General clarified that in seeking treatment, patients implicitly consented to attending clinicians' accessing of relevant records, regardless of source. • ITWG embarked on a public EMR education campaign by providing brochures to patients at the institutions, and through media coverage. An opt-out scheme was set up for patients with more specific concerns.
Data Standardization	• As both clusters had implemented their EMR systems independently, data exchange could not be easily achieved in spite of HL7 v2.3 adoption by both, as the standard was open to variations that impeded direct interoperability. • Modification of systems to enable data interoperability would have been costly, without direct benefits to clusters.	• For treatment, clinicians only required information that was "as good as paper records." Thus, ITWG determined that clinician-readable documents were sufficient for standard goals and that machine-readable EMR data was unnecessary at this stage. • ITWG acknowledged that standardization would probably be needed at a later stage, but deferred this expensive exercise until there is consensus on the need to do so.
Ownership of EMRs	• EMRs shared with other institutions could become outdated, and result in the source institution being liable if such outdated EMR became a contributing cause of medical errors.	• EMR Exchange (EMRC) adopted a pull-on-demand—rather than pre-delivery—model. • ITWG determined that EMRs will only be pulled at the request of clinicians and discarded after use. Storage was prohibited.

Implementation

Date	Document Type Shared
April 1, 2004	Hospital inpatient discharge summaries
July 1, 2004	Medical alerts and allergies
October 1, 2004	Laboratory and radiology reports
December 16, 2004	Medication (Prescriptions or Dispensed Medication)
October 14, 2005	Immunization records from Health Promotion Board
January 17, 2006	Critical Medical Information System (CMIS), which replaces the existing medical alert and allergies system. Features include: • Direct reporting by doctors instead of medical records offices; • New drug code developed (4,553 brands, 1,428 active ingredients); • Routing of adverse drug reaction reports to Pharmacovigilance unit; and • Integration to e-prescription systems for automated alerts.
March 31, 2006	School health system records from Health Promotion Board

Toward the Future

The success of ITWG so far are only the first steps. Next steps would include: sharing more types of medical records, such as radiology images; extending CMIS beyond the clusters to private-sector physicians nationwide; and experimenting with EMRX for coordination of care within a microcosm of the health care environment. ITWG would need to revisit assumptions and rework IT systems. Some data standardization would be required to serve needs beyond initial narrow objectives. ITWG would also need to ensure that privacy and confidentiality continue to be protected (especially with the extension of EMRX to other settings).

Taiwan Case Study

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Overview

Taiwan spends around 6.2% of its GDP on health care expenditure and about 3.7% on National Health Insurance (NHI). However, the NHI program offers comprehensive coverage for all 23 million residents. Applying health information technology to provide efficient and safe medical care is critical to the sustainability of the health system.

Background

Coverage	All 23 million residents in Taiwan are covered by the NHI, which includes medication and dental plans. The NHI covers 400 million outpatient visits and 28 million inpatients per year.
Providers	There are 33,000 physicians serving in the 513 hospitals and 17,931 clinics. More than 93% of all the providers participate in the NHI.
HIT Adoption	All hospitals and most clinics are connected to Bureau of National Health Insurance through a Virtual Private Network for e-claim purpose. All residents use Health Smart Cards which contain EHRs.

Specific Cases

Taipei Medical University—Wan Fang Hospital, Taipei	• Successfully implemented automatic notification of critical lab and examination results by sending SMS messages to physicians' mobile phones. • Shortened the information lag from 30 hours to 3 minutes. • Captured 20,000 high-risk events per year through computerized reports and detection.
National Taiwan University Hospital, Taipei	• Struggling with mainframe downsizing. • Plan to replace the legacy system by developing HL7 compatible systems gradually. • Successfully developed CPOE system. • Plan to replace whole HIS system in 2007.
Chang-Gung Memorial Hospital, Chiayi	• Opened January, 2002, aimed at building paperless hospital from the launch stage. • Fully paperless and filmless EHR system.

Obstacles

Interoperability	Some hospitals treat health and medical data as their exclusive property and are unwilling to share patient data with other hospitals.
Privacy	• Medical data is sensitive and "proprietary." • Many are concerned that de-identification is not sufficient to protect privacy as practice patterns, medication consumption, and outcome variations are all sensitive information.

NHI Smart Card

Launched by the NIH in January 2004 and formally implemented in July 2004, the Smart Card provides timely information and about patients' health and former care. Six hundred hospitals and 17,000 clinics are connected to the NHI in real time for card and data authentication. The card provides a network linkage environment through which it is possible to monitor monthly hospital expenditures, exchange data periodically with the CDC, monitor daily utilization of health services, and check patients' eligibility instantly. The card is currently in the second phase of its development.

The transition to the Smart Card was relatively fluid, due in large part to the fact that Taiwan has always had a strong IT foundation. The original paper-based health care system included 92% of contracted medical institutions with a computerization rate of at least 70% and public satisfaction levels of 71%. Nevertheless, despite effective management, problems existed with the paper records, such as identify fraud, excess insurance premium claims from health care institutions, and waste of financial and human resources as a result of high frequency of card replacement. Currently, over 95% of the population possesses Smart Cards and 70% of hospitals and clinics are now online and in operation for Smart Card use. In 2004, paper cards were phased out.

Goals of Smart Card	• Reduce administrative and medical costs. • Increase efficiency and safety of care.
Benefits	• Streamlined of administrative processes, with real-time transaction data. • The data on the cards can be expanded with minimal cost and effort. • Reduction of fraud. • Increased communication between different health care partners.
What's On the Card	The front side of card includes a unique ID number, the cardholder's name and photo, ID number, and date of birth. Information stored electronically in the card includes: • *Cardholder's status*: remarks for catastrophic diseases, number of visits and hospital admissions, use of NHI prevention programs, medical expenditure records and amount of cost-sharing. • *Medical service information*: drug allergy history, long-term prescriptions. • *Public health administration information*: such as immunizations and instructions for organ donation.
Development	Development of the Smart Card began in April 2001 and lasted 25 months. Major requirements: speedy deployment and stay within US $115 million budget • *Year 1*: created specifications that met the requirements for hospitals and clinics, computer back-end needs, security rules, and networks. • *Year 2*: manufactured the cards, developed applets to be loaded onto cards, audited information for all 22 million card recipients, and installed card readers in 16,000 participating hospitals. Tested and verified all processes. • *Throughout Implementation*: ongoing infrastructure upgrades and public education and acceptance campaigns, including commercials explaining how people use the cards. Until 2004, both health smart cards and paper cards were in use simultaneously.
How It Works	• Multiple technical applications co-exist securely on a single card. • The cards can be used for 5–7 years. Unless a card is damaged, there is no annual replacement. • At the health care provider: Smart Card readers are attached to PCs via USB ports. The PCs are connected to a Virtual Private Network (VPN) through an ADSL or leased line. The VPN, in turn, connects all the hospitals and clinics with the NHI data center. • The Smart Cards has 32 KB of memory, of which 22 KB is currently being used. 10KB is reserved for future use.
Privacy and Security	• High-grade card printing, comparable to credit cards. • Information stored on the Smart Card is encrypted. • Cardholder PINs protect personal information. This PIN has higher privileges than a health care professional, who cannot read beyond the most basic medical information without the cardholder inputting his or her pin. • The card does not store complete patient health histories, only what was on original paper cards.
Lessons Learned	• To be successful, similar smart card projects must ensure physical, platform, and application interoperability, along with well thought-out, culturally appropriate marketing plans, and a comprehensive plan for the first issuance of the card.

Japan Case Study

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Overview

Japan spends 6.3%[1] of its GDP on health care, and health care costs are expected to rise rapidly with the aging of the population and advancement of medical technology. As a result, controlling public spending on health care, in an environment of growing demand, in part through investment in IT, is one of the Japanese government's top priorities.

Background

Coverage	• *Population*: 127.7 million in 2005; projected to be 126.2 million in 2015. The ratio of the elderly (age 65 and above) to the total population: currently 20%; projected to be 26% by 2015. • *National spending on health care*: 31.5 trillion yen (approximately $300 billion) in 2003, with 26% from the national treasury; 9% from local government; 21% from employers; and 45% from individuals (medical insurance premiums cover 29%, and co-payments about 15.7%).[2] • *Health insurance*: Japan has universal health care coverage. All registered residents of Japan must enroll in one of the Japan's social health care systems. Salaried workers enroll in Employees' Health Insurance (KENKO HOKEN), which can be either government- or society-managed. Self-employed workers and those who are not employed enroll in the National Health Insurance (KOKUMIN KENKO HOKEN). Other profession-based insurance systems exist. Every citizen can receive medical treatment at any given medical provider. Co-payment is typically 30% for those under 70, and 10% for those above 70. Each insurance system pays the remaining costs to each medical provider through the Social Insurance Medical Fee Payment Fund.
Providers	• 163,000 physicians in hospitals and 93,000 in clinics, excluding dentists. • *Hospitals*: 9,077 hospitals total, of which 304 are national, 1,377 are public, 129 are operated by social insurance organizations, and 7,267 are non-profit medical institutions. 728 hospitals operate between 400 and 799 beds; 103 hospitals operate with 800 or more beds. • *Clinics*: 97,000 clinics (excluding dental) and 66,000 dental clinics.[3] In Japan, medical institutions operating under 20 beds are considered "clinics."
HIT Adoption	In 2001, 804 hospitals used Computerized Physician Order Entries (CPOEs) and 57 hospitals used EMRs. Those numbers increased exponentially to 1,302 hospitals using CPOEs and 494 hospitals using EMRs by 2005.[4] 320 clinics used EMRs in 2001 and that number grew to 4,214 by 2005.

HIT Implementation: Lessons Learned

Leadership Structures Need to Reflect IT Priorities	Matching IT to existing workflow creates complexity in system design and increases workload. It is essential to conduct organizational reform and transformation concurrently with IT adoption. Many failures have arisen due to the lack of leadership of hospital top management as well as inadequate project management of system integrators.
EHR Customization is Not Always Necessary	Until recently, EHR systems were mostly customized. Because of cost pressures, as well as better understanding over time of hospital requirements, non-customized EHR systems have increased. The initial cost of non-customized EHR system installation is now less than 1 million yen per bed.

[1] Fiscal Year 2003.
[2] Ibid.
[3] Fiscal Year 2004.
[4] Almost all of the above "EMR systems" are better expressed as "EHR systems." The EMR system is designed as a core database that is connected to other department systems such as CPOE, radiology, lab, nursing, etc. Some hospitals in Japan now have paperless records systems.

Obstacles

Issue	Current Obstacles	Solutions
IT Competency Among Hospital Leadership	Currently, there are few IT experts in Japanese hospitals. This is due to the late adoption of IT in these institutions, as well as tight labor market for computer engineers in the country. As a result, Integrated Hospital Information Systems and EHRs tend to be integrated by single vendors who are outsourced by hospitals.	The Ministry of Economy, Trade, and Industry hopes to institute policies that put into place skilled CIOs in hospitals and improve IT competency throughout the hospital.
Networking Hospitals and Clinics	In Japan, no standards exist for paper medical records. Each vendor created its own EHR system in consultation with the doctors in each corresponding hospital. This led to many versions of customized EHRs with identical functions that cannot be connected to each other. As a result, hospitals and clinics cannot share patient information.	The Ministry of Health, Labor, and Welfare and the Ministry of Economy, Trade, and Industry are trying to coordinate medical services and patient information sharing among hospitals and clinics in each region.
Online Medical Bill Claims	In late 2005, the Japanese government decided to promote online processing for medical bill claims submitted by medical institutions to screening and payment institutions. All medical institutions are obligated to adopt this online claim system by 2011.	The government is developing detailed designs for the online claim system scheme. Pilot projects will occur in 2006 involving more than a dozen large-size hospitals and their regional screening and payment institutions. The government will provide 30 Yen (about 25¢) per medical bill claim to each medical institution as an incentive to use the online system (the incentive applies only to institutions that use the on-line system along with some other HIT systems).
Individual Health Management	In general, a healthy person does not focus too much on health issues. A person will become worried about his or her health or that of a family member after someone becomes ill.	The society needs to encourage people to pay attention to their health, even when they are healthy. Education on health from an early age is critical in this regard.

Toward the Future: Health Information Bank

Because of rapidly increasing health care costs, the Japanese government is trying to enhance policies that encourage the prevention and early detection of disease. To this end, the government is exploring the possibility of accumulating individual health information under a scheme called the Health Information Bank (HIB).

The HIB is functionally very similar to the U.S. Personal Health Records system, where each individual or family would maintain a personalized health account in a broader HIB operated by an independent service provider. In this health account, an individual can store basic health information (e.g., allergies, immunization records, etc.), import medical history from hospital-managed EHRs, and store daily health information such as body weight, body fat percentage, and blood pressure measured from the home.

This system is especially valuable in Japan because annual health check-ups and medical screenings are mandatory for all salaried workers, students, and children from birth through age 6. Given recent policies promoting annual check-ups and screening for self-employed workers and the elderly by the local government, Japan will soon reach almost every citizen with such check-ups. A carefully designed digital HIB, with solid information accrual from check-ups and screening, is expected to contribute to personal health management, prevention and early detection of disease, and valuable research on health issues.

United Kingdom Case Study

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National Health Service Connecting for Health

Overview

Over the next 10 years, health service in the U.K. will incorporate information systems to support the improvement of quality of service and overall care. This use of information and communications technologies (ICT) is "fundamental to the concept of integrated care, considering the needs of patients rather than institutions, and introducing a 'whole system' approach."[1]

Background

Coverage	Health care is available free of charge at the point of need to all U.K. residents and is funded through national taxation. Net expenditure in the NHS (England) in 2005–06 will be £76.4 billion. The largest portion of NHS spending is on Hospital and Community Health Services, discretionary Family Health Services (HCFHS), and related services.
Primary Care Trusts (PCT)	There are more than 300 PCTs covering all parts of England. They report directly to their local Strategic Health Authority. As well as buying and monitoring services, they also play a crucial role in supporting NHS organizations.
General Practitioners (GP)	General practitioners (GPs) look after the health of people in their local community and deal with a wide range of health problems. Around 300 million consultations a year occur in England's GP surgeries. Every U.K. citizen has a right to be registered with a local GP. Surgery visits are free.
Hospitals	Hospitals are managed by Acute Trusts, which ensure that hospitals provide high quality health care, with efficient expenditures. Some Acute Trusts are regional or national centers for more specialized care. Others are attached to universities and help to train health professionals. Acute Trusts can also provide services in the community, for example through health centers, clinics, or in people's homes.
HIT Adoption	In the 2 years since NHS Connecting for Health contracts were awarded, almost 8,000 instances of new IT deployments of all types have gone live. Progress includes: • **Nearly 203,000** users registered for access to the NHS Care Record Spine; • **203,000** Choose and Book Electronic Bookings – live (on time) since July 2004 • **Almost 14,000** National Network (N3) secure broadband connections, including **9,637** GP locations (practices and branch surgeries); • **17,770,000** digital images stored using Picture Archiving and Communications Systems (PACS)—live in 25 NHS sites; • **625,000** prescriptions transmitted using Electronic Transmission of Prescriptions (ETP) system—live (on time) since February 2005; • **8,800 GP practices (28,000 GPs) using the Quality Management Analysis System that pays GPs £600m based on quality outcomes daily; and** • **166,000** registered NHS secure e-mail users, over 77,000 of whom use the system daily.

Obstacles

Historically, the NHS has not developed IT as a strategic asset in delivering and managing health care. While effective, usually local, IT initiatives sponsored by enthusiastic visionaries have existed, they were outweighed by an overall lack of funding and priority given to IT at all levels. Good experiences were not captured, and successful implementations were not scaled from their local origins to NHS-wide application. A number of barriers to the effective use of IT as a strategic tool in the delivery of health care by the NHS existed, including:

[1] "Securing our Future Health: Taking a Long-Term View" An Interim Report : Sir Derek Wanless, HM Treasury, November 2001, http://www.hm-treasury.gov.uk/consultations_and_legislation/wanless/consult_wanless_interimrep.cfm.

Funding	IT funding was a low priority for many Trusts, leading to low levels of investment.
Standards	Data and system standards lacked a cohesive, nationally-led IT architecture to allow information and processes to follow the patient's journey through the NHS seamlessly.
Coordination of Resources	Improve coordination of IT resources and procurements was needed to increase the pace of implementations and provide fast, better value for money IT projects.
Infrastructure and Security	NHS staff were limited by low levels of secure, high-bandwidth connectivity, backed by means of authenticating users to access sensitive patient information.

21st Century IT—The National Programme for IT in the NHS

The strategic vision being delivered through the National Programme for IT today is to connect delivery of the NHS Plan[2] with the capabilities of modern information technologies. NHS Connecting for Health has awarded a series of contracts worth a total of £6.2 billion to deliver the National Programme. The contracts, to run until 2013, are to provide local systems and services to access and use the NHS Care Records Service, provide IT support at a local level, deliver essential infrastructure and connect to existing systems in the NHS. The contracts will underpin the delivery of both the NHS Care Record and the Choose and Book Service (Electronic Booking). Suppliers are now working in partnership with the National Programme and the NHS to achieve a successful implementation. Core elements include:

NHS Care Records Service	• The NHS Care Records Service (NHS CRS) is being developed to provide a live, interactive NHS Care Record for every patient in England, accessible 24 hours a day, 7 days a week, by authorized health and care professionals, in whichever NHS organization they work. When fully implemented, the NHS CRS will function across care settings and organizations, supporting planned and unscheduled care, giving individuals access to their health record. • The rollout of the NHS CRS across the NHS will be phased over several years with completion expected in 2010.
Choose and Book (Electronic Booking Service)	• Choose and Book enables patients to select hospital appointments from a choice of those available, at a time, date and place to suit them. • Patients can leave the GP with their appointment date and time already fixed, or, if they prefer, to make their appointment later, either online or using a telephone booking management service, after consulting with family or caregivers.
The NHS National Network (N3)	• The network will allow more than 100,000 doctors, 380,000 nurses and 50,000 other health professionals to send and receive information, including voice and video, e-mails, medical information and test results—in a secure manner. • By February 2006, there were over 13,000 N3s covering 98% of GP practices.
Picture Archiving and Communications System (PACS)	• PACS captures, stores, distributes, and displays static or moving digital images such as electronic X-rays or scans, for more efficient diagnosis and treatment. • PACS will enable centralized storage of images, full compatibility with the National Programme's other services, and provide 100% access to digital images in NHS organizations throughout England.
Electronic Transmission of Prescriptions	The Electronic Transmission of Prescriptions (ETP) program is delivering a service that will allow prescriptions generated by GPs (and other primary care prescribers) to be transferred electronically between prescriber, dispenser, and reimbursement agency.
Quality Management and Analysis System (QMAS)	QMAS is a new single, national IT system, which gives GP practices and Primary Care Trusts objective evidence and feedback on the quality of care delivered to patients.
NHSMail	A secure national e-mail and directory service provided free of charge for NHS staff in England and Scotland, and has been developed specifically to meet professional requirements for clinical e-mail between NHS organizations.

[2] "The NHS Plan: A Plan for Investment, a Plan for Reform." UK Department of Health, July 2000 http://www.dh.gov.uk/assetRoot/04/05/57/83/04055783.pd; The NHS plan, A Summary: http://www.dh.gov.uk/assetRoot/04/05/58/63/04055863.pdf

United States Case Study

Howard ISENSTEIN, Vice President, Public Affairs & Quality, Federation of American Hospitals

Overview

While the United States has excelled in creating advanced information technology, adoption of health information technology (HIT) has been stymied for a myriad of reasons. Many observers expect that it will take at least a decade before the majority of U.S. providers use EHRs.

Background

Coverage	The U.S. spends about 16% of its GDP on health care. About 162 million Americans receive health care coverage through their employers while 41 million receive it from Medicare (the federal government program for the elderly). 53 million receive health care through Medicaid (the state/federal program for the poor). Millions more receive coverage through the U.S. Veterans Administration and individual health insurance. About 45 million people do not have coverage.
Providers	Two-thirds of doctors practice independently or in small groups. There are more than 4,000 hospitals in the United States, which vary from 10- and 20-bed rural hospitals to massively large university hospitals with 1,000 beds or more. In addition, there are a myriad of outpatient facilities, such as surgery centers and dialysis clinics.
HIT Adoption	Only 14% of physician practices use EHRs, while 25% of hospitals have fully implemented EHRs.

Current Exemplars

Cedars Sinai Hospital, Los Angeles	• Failed to implement EHR system due to lack of physician ownership.
Indiana Health Information Exchange, Indianapolis	• Successfully implemented a regional system to share clinical information across hospitals in Indianapolis, which is being expanded statewide. • Leveraged software from Reigenstrief Institute, and slowly expanded from Emergency Department data to inpatient data. • A relatively small regional area with a limited number of players, which facilitated community coalescence.
Partners HealthCare, Boston	• Successfully implemented EHR system within 12 Harvard-affiliated hospitals along with outpatient clinics. • Leveraged leaders in health IT on staff at Harvard Medical School. • Leveraged bias on quality as many providers are affiliated with academic medical center. • Slow roll out, lots of training. • Closed provider system where IT costs could be amortized over large infrastructure.
Intermountain Healthcare, Salt Lake City	• Operates 21 hospitals and other facilities in Utah and Idaho. • Perhaps the most advanced in implementing EHRs, clinical workstations, advanced clinical practice tools and bedside computers. Similar situation to Partners.
Veterans Administration, Washington, DC	• *Vista* (the EHR system) is the largest EHR network in the nation and is touted as the Linux of EHRs as it is free and can be used in an ASP model. • Can dictate technology to providers who are government employees. • Massive and sustainable development infrastructure, with little sensitivity to investment cost. • Closed provider system.

Obstacles

Type	Obstacles To Successful HIT Adoption	Proposed Solution
Economic	**Misaligned financial incentives.** Investors (physicians and hospitals) do not reap financial benefits of HIT adoption, which often go to payors and purchasers of care.	**Develop shared investment on IT.** Share investment among all parties (e.g., if a hospital invests in EHRs, health plans may rebate a portion of the savings to the hospital).
Legal	**Lack of adequate protections from sanction under federal fraud and abuse laws.** Recent regulatory proposals do not provide meaningful protections due to limitations on covered items and services under the Stark policy and the lack of a proposed anti-kickback safe harbor.	**Provide meaningful protections for HIT investment under the Stark and anti-kickback laws.** A legislative route may be the preferred means of moving forward on this versus currently proposed regulations.
Standards	**General lack of standards.** As the Health Insurance Portability and Accountability Act (HIPAA) simplification process illustrated, detailed guidance on implementation is critical to standards adoption.	**Guidance on implementation** should include: the transactions likely to occur; business processes to support them; and steps to ensure that all end users are implementing the standards consistently. A possible American Health Information Community contribution.
	Lack of standard clinical vocabulary or terminology for use in EHRs. Example, while SNOMED-CT® has been cited by the U.S. Department of Health and Human Services (HHS), it has never been officially designated. Vendors will not incorporate it until HHS designates its use.	**HHS needs to designate use of SNOMED** or some other standard terminology for use in EHRs, and facilitate adoption of that terminology.
	Different privacy standards at the federal, state, and local levels. Ensuring the privacy and security of health information is paramount. Establishing procedures that comply with them all may be impossible.	**Pre-empt state and local privacy regulations with the federal HIPAA standards**. Using HIPAA as the floor provides a single set of requirements that can be used to ensure privacy.
	Lack of standards for information that represent secondary uses of EHR data. Among classification codes used to report diagnoses and procedures is a 30-year old system. HHS designed replacements for this system in the 1990s, but did not adopt them. The replacements' format (which coincides with international disease classifications) differs from current formats.	**Provide 21st century disease descriptions and detail** to enhance the data provided and make the transactions under consideration by the AHIC more productive. Adoption of ICD-10 now means that vendors could incorporate standards into new products and purchasers could avoid expensive reformatting later.
	Inconsistent and unreliable mechanisms for matching patients to their records.	**Develop a single, numerical identifier for patient records.**
Leadership	**Multiple payors, disparate provider settings, and cultural bias toward markets have all resulted in a lack of national direction forward.**	**The federal government should provide leadership, and industry will engage and follow.** Beginning to gel with AHIC and the Office of the National Coordinator for HIT.
	Lack of engagement by consumers. The "consumer" includes individual beneficiaries, patients, family members, and the general public.	Federal government, providers, and health plans must engage in **a long-term education campaign**.

Snapshots of Additional Economies

Condensed HIT Survey

eHealth Initiative Leadership in Global Health Technology

Overview

This document summarizes the eHealth Initiative's Leadership in Global Health Technology (LIGHT) survey on HIT adoption among economies in 6 continents.[1] The full report, covering 30 economies, will be released by the eHealth Initiative in September 2006.

Snapshots of Economies

AUSTRALIA

Introduction of HIT	Australian federal, state, and territory health ministers established the National Electronic Health Records Taskforce in November 1999 to evaluate the potential of electronic health records for the Australian health system. Based on the recommendations of the National EHR Taskforce Report, ministers agreed in November 2000 to jointly fund two years research and development to assess the value and feasibility of a national EHR system. The project, **Health*Connect***, involves the systematic collection of clinical and demographic data in the form of "event summaries" transmitted to Health*Connect* nodes via HL7 messages and EHR extracts. The project has a national governance structure with representatives from both the public and private sectors.
Evolution of HIT Adoption	In March 2004, the Australian Government announced that Health*Connect* will be implemented nationally on a state-by-state basis, beginning with Tasmania and South Australia. Plans for the implementation of Health*Connect* are being developed in consultation with every state and territory government and other key stakeholders in Australia. State-wide implementations have begun in Tasmania, South Australia, and the Northern Territory. Trials are also now underway in Queensland and New South Wales. Implementation will proceed in other states and territories on a case-by-case basis, in line with each state and territory's needs and readiness.

BANGLADESH

Introduction of HIT	The private health care industry in Bangladesh—in extensive collaboration with the public health sector—launched the first national HIT project entitled the **Integrated Rural Health information System (IRHIS)**. IRHIS is a privately funded project with public benefits, where a micro-credit finance mechanism is applied for field level medical professionals and applications. Phase I of the pilot will network 64 private and 64 government rural medical centers using a hybrid portal with outsourced software and local applications.
Evolution of HIT Adoption	2004 marked the IRHIS-Telemedicine Reference Center Ltd. Partnership, through which rural doctors will be provided with expert medical consultative services from Dhaka, the capital city. This effort is aided by strong fiber optic networks covering 80% of mobile phone network areas and growing auxiliary telecommunications networks.

[1] This information stems primarily from the May 2004 eHealth Initiative LIGHT Geneva Summit. Leaders from 16 nations shared overviews of HIT adoption and infrastructure in their home countries, key challenges they encountered, and strategies for engaging patients and citizens.

CHINA

Introduction of HIT	The Chinese government adopted a developmental policy of "informanization" in 1992, actively promoting IT development in the major industries, including the health care sector. From 1994, a **Hospital Information System (HIS)** was enforced as a major criterion in the hospital ranking system, resulting in the national-scale implementation of HIS. HIT adoption has come to symbolize a modernized and competent image of the health provider.
Evolution of HIT Adoption	• In 2003, the Chinese Ministry of Health planned to construct five public health information system components: (1) the SARS direct report system; (2) the epidemic and emergent public health events monitoring system (3) the medical rescue information system; (4) the health legislation and inspection information system; and (5) a directive center and decision support system responsive to emergent public health events. • HIT is also a visible force of change at the provincial level in China. For example, officials and health care experts in China's Qinghai Province seek to use HIT to improve care delivery and support health workers in this remote region. Long-term goals include using HIT for consultation and two-way referral, health care reporting, monitoring and supervision, and education.

MALAYSIA

Introduction of HIT	The Malaysian government actively employs HIT and telehealth capabilities to create Mass Customised Personalised Health Information and Education (MCPHIE) capabilities, as well as teleconsultation and continuing medical education for health care providers. A component of MCPHIE, **e-Farmasi** was jointly developed by the Pharmacy Division, the Ministry of Health, the Malaysian Pharmaceutical Society, and private interests to link communities to their neighbourhood pharmacies and provide an impartial database on illnesses and medicines.
Evolution of HIT Adoption	Using information and communications technology, community members can direct questions to a pharmacist and, where appropriate, complete a pharmaceutical transaction over the internet. e-Farmasi also include a program that helps pharmacists manage their pharmacy, maintain patient medication records, and provide effective pharmaceutical care. The e-Farmasi database contains information on over 27,000 products that are nationally registered in both English and Bahasa Malaysia. An online search locates medicines by ingredient or brand name, and assistance is provided to guide patients towards the right product for non-critical ailments.

[2] A. M. Siika, J. K. Rotich, C. J. Simiyu, E. M. Kigotho, F. E. Smith, J. E. Sidle, K. Wools-Kaloustian, S. N. Kimaiyo, W. M. Nyandiko, T. J. Hannan, W. M. Tierney, "An Electronic Medical Record System for Ambulatory Care of HIV-Infected Patients in Kenya," *International Journal of Medical Informatics* 75, no. 5 (June 2005): 345–355.

KENYA

Introduction of HIT	In 2001, the Kenyan Ministry of Health and the Moi University Faculty for the Health Sciences, in principle collaboration with the Indiana University School of Medicine, the Regenstreif Institute for Health Care, and the Veterans Affairs Medical Center in Indianapolis, Indiana implemented the **Mosoriot Medical Record System (MMRS)**, the first EMR system used for ambulatory care in sub-Saharan Africa. Within its first year of operation, MMRS captured relevant data for more than 13,000 patients and 26,000 visits. The system is run by the Kenyan Ministry of Health and is the sole means for capturing clinical data in the Mosoriot Rural Health Center, which provides primary health services to 40,000 patients annually.
Evolution of HIT Adoption	The system was designed by incorporating input from clinicians who understand the local community and its constraints in providing care in resource-poor settings. MMRS also supports comprehensive outpatient HIV/AIDS care. To date, the HIV/AIDS EMR component of MMRS contains more than 30,000 visit records for more than 4000 HIV/AIDS patients, almost half of which are taking antiretroviral drugs.[2] Future system development and expansion plans include wireless connections, tablet computers, and migration to a Web-based platform.

SOUTH AFRICA

Introduction of HIT	In 1994, South Africa's Minister of Health established a committee to develop HIT in the country. The committee consists of provincial members of the Executive Council for Health, the Department of Health, other relevant government agencies, academic and research institutions, and the private sector. The National Health Bill of 2003 provided further guidance and required provinces, municipalities, and the private sector to establish, implement, and maintain health information systems. The resulting **National Health Care Management Information System (NHC/MIS)** now employs EMRs, patient registration, billing, and scheduling models to select hospitals in all South African provinces, with emphasis on standards adoption and adherence, and interoperability across provinces. In September 1998, the South African National Telemedicine System was unveiled and at present links 42 health facilities in 9 provinces through a telemedicine network to appropriately review and exchange digitized x-rays, ultrasound clips, and ophthalmologic images transmitted using ISDN lines to referral hospitals where specialists provide remote consultative opinions.
Evolution of HIT Adoption	• There is a recent move in South Africa toward standardized EMRs using HL-7 message protocols, which contain information from a variety of health care providers and have a complete and accurate record of an individual's personal health history. Related to this priority is the Home Affairs National ID System, in development, which will use a smart card to house a minimum patient record including blood group, allergies, donor status, the last ten diagnoses, treatment, and prescriptions. • NGO funding streams have made possible a system driven by the University of the West Cape to capture and integrate public health data at the district level. This project enabled all 4,153 public health clinics in South Africa to collect information on 10 public health indicators including pre-natal visits and growth monitoring, as well as immunization and STD rates and condom utilization. • HIT also provides important support for projects such as the World Health Organization-sponsored TB DOTS Plus project that uses an electronic system to track patients on a standardized regimen for multi-drug resistant tuberculosis.

SAUDI ARABIA

Introduction of HIT	A National Information Technology Strategy in the Health Care Sector for the Kingdom of Saudi Arabia was initiated by Royal Decree in February 2001, and the project was completed in July 2003. This strategy includes the **King Faisal Specialist Healthcare System (KFSHS) Telemedicine Network**, which features local area networks installed in all KFSHS Hospitals. These hospitals are linked to one another and to 15 public Ministry of Health hospitals to perform telemedicine functions.
Evolution of HIT Adoption	The KFSHS Research Center as well as 5 hospitals are also hooked into an international telemedicine network that involves the WHO and five recognized centers of excellence in the United States including the Cleveland Clinic, Johns Hopkins, the Mayo Clinic, Sloan Memorial Hospital and facilities at MD Anderson.

CANADA

Introduction of HIT	**Canada Health Infoway,** an independent, not-for-profit organization whose members are 14 federal, provincial, and territorial Deputy Ministers of Health, was launched in 2001. Infoway and its public sector partners have over 100 projects. Funding flows through to provincial and territorial level jurisdictions and their EHR programs, with pass-through to hospitals that have aligned EHR plans. Infoway's 6-year plan is to have the basic elements of interoperable EHRs in place across 50% of Canada by 2010, labeled the Pan-Canadian Interoperable Electronic Health Record. Canadians view the Canada Health Infoway program as a major part of enabling and accelerating health care reform within the country.
Evolution of HIT Adoption	• Infoway's investments to date have focused on infrastructure, enterprise registries, and domain repositories for laboratory and drug data. In 2004-05, Infoway committed project investments of $195 million, 56% more than in the previous three years combined, for a total of $321 million since the organization was created. To make it easier for provinces and territories to provide their share of the funding for EHR projects, Infoway now covers an average of 75% of project costs. • In 2004-05, Infoway also continued to focus on interoperability. It began updating the EHR Solution Blueprint, which shows how different components of the EHR system can interact with one another, to include privacy and security architecture. Many jurisdictions and vendors have indicated that the Blueprint has already provided them with valuable guidance for aligning their systems with the overall EHR vision. Infoway also played a leadership role in standards development to support interoperability.

Conclusion

Common Challenges	Common Areas for Global Support and Collaboration
• Maintaining HIT on national agendas in shifting political and budgetary environments. • Need for increased coordination and leadership. • Dearth of up-front funding and proper incentives alignment. • Antiquated legislation and regulation that does not recognize the complex dynamic of HIT within health care. • Addressing cultural barriers and stigmas. • Creating a truly integrative EHR. • Lack of standards and interoperable systems.	• Developing a multinational approach based on geographic location and cultural similarity. • Developing an aggressive, formal agenda for funding HIT in different countries. • Facilitating interactions between public and private sector initiatives. • Encouraging an increasingly active role from international organizations in developing countries. • Encouraging globally accepted data standards and inter-operability protocols.

PACIFIC HEALTH SUMMIT

HEALTH INFORMATION TECHNOLOGY AND POLICY WORKGROUP

The Pacific Health Summit HIT Workgroup joins leaders from the public and private sectors with health care practitioners and other stakeholders to examine the national and international public policy framework surrounding public health, science, and technology with the goal of improving the environment for the adoption of information technologies that can improve health outcomes.

For more information about the Workgroup please visit *www.pacifichealthsummit.org* or contact Claire Topal, Pacific Health Summit Workgroups Manager, at *ctopal@nbr.org*.

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