THE NATIONAL BUREAU *of* ASIAN RESEARCH
Center for Health and Aging

HEALTH INFORMATION TECHNOLOGY AND POLICY LAB

HIT
Briefing Book

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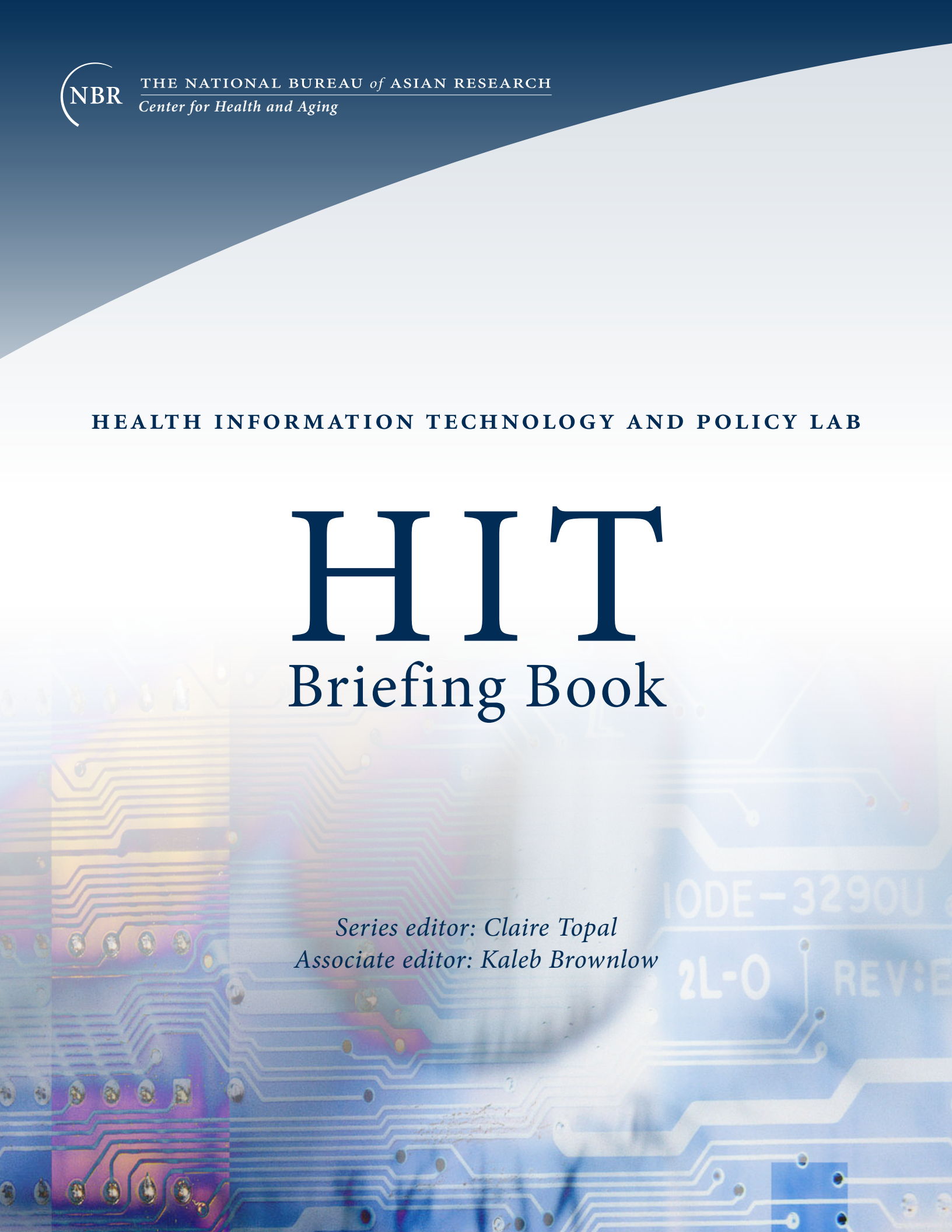

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Foreword

The NBR Center for Health and Aging launched its Health Information Technology and Policy (HIT) Lab in January 2006 with a targeted workshop in Washington DC. That workshop brought together a select group of industry executives, policymakers, and health professionals to talk about how to make advances in IT work for health systems across the globe. Since that time, the Lab has convened numerous outcome-oriented workshops and site visits in Beijing, Mumbai, Singapore, and Tokyo. Those discussions have led to new collaborations and new understanding among stakeholders HIT field, as well as in the broader global health arena. The library of case studies in this briefing book is the just one of the products of those collaborations.

Managed by the NBR Center for Health and Aging, the HIT Lab 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 across the globe. Target areas for research and discussion include:

- Facilitating communication about HIT among key stakeholders in science, medicine, policy, public health, and industry.
- Leveraging information and other technologies to scale healthcare for resource-poor settings.
- Documenting case studies of adoption and exploring transferability of successful HIT programs and projects.

In keeping with these goals, the HIT Lab has compiled the library of case studies and overview briefs in this book—written by the IT professionals and technology end users themselves—to provide specific examples of how IT can play an increasingly significant role in connecting science, technology, and policy for a healthier world.

Claire Topal
Senior Project Director

More information on the HIT Lab is available online at:
http://www.pacifichealthsummit.org/initiatives/hitlab/default.aspx

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HEALTH INFORMATION TECHNOLOGY AND POLICY LAB

Overview Briefs

Overview Briefs provide definitions of common HIT terms, as well as descriptive outlines of basic elements of HIT and the specific technologies involved.

HIT Primer

Brandon Savage, *Chief Medical Officer*, GE Healthcare Integrated IT Solutions

Computerized Clinician Order Entry (CCOE)

See *Computerized Provider Order Entry (CPOE).*

Computerized Provider Order Entry (CPOE)

A computer application that allows physicians to enter orders for diagnostic and treatment services (such as medications, laboratory, and other tests) electronically instead of being recorded on order sheets or prescription pads. The computer compares the order against standards for dosing, checks for allergies or interactions with other medications, and provides information to physician about potential problems.

Digital Imaging Communications in Medicine (DICOM)

DICOM is a global information technology standard used in virtually all hospitals worldwide. It is designed to manage all types of medical images and to ensure the interoperability of systems used to produce, store, display, process, send, retrieve, query, or print medical images and derived structured documents. See *http://medical.nema.org*

Electronic Health Record (EHR)

Real-time patient health record with access to evidence-based decision support tools used by clinicians to aid in decision-making. The EHR can automate and streamline a clinician's workflow, ensuring that all clinical information is communicated. EHRs can also prevent delays in response that result in gaps in care and can support the collection of data for uses other than clinical care, such as billing, quality management, outcome reporting, and public health disease surveillance and reporting.

See *EMR*.

Electronic Medical Record (EMR)

An online version of a patient's medical chart created in a hospital or ambulatory setting, where information is entered either digitally or scanned into the record from a paper-based source.

See *EHR*.

Electronic Prescribing (eRx, e-prescribing)

Computer technology that enables physicians to use handheld or personal computer devices to review drug and formulary coverage and to transmit prescriptions to a printer or to a local pharmacy. E-prescribing software can be integrated into existing clinical information systems so physicians can access patient-specific information to screen for drug interactions and allergies.

Health Information Exchange (HIE)

The electronic mobilization of healthcare information across organizations through shared infrastructure between organizations. Shared community-level information services are built once for many users. Examples include results delivery, historical patient information (such as a prescribed medication diagnoses), and other health information, which are supported by regional implementation of technologies. These technologies may include a document sharing registry, secure Web portal, healthcare terminology translation tools, a master patient index (MPI), authentication and authorization infrastructure, and products that aggregate information from multiple sources.

Health Information Management Systems Society (HIMSS)

An international healthcare industry member organization focused on providing global leadership in the use of HIT and management systems in providing quality patient care. See *http://www.himss.org*

Health Information Technology (HIT)

The application of information processing involving both computer hardware and software that deals with the storage, retrieval, sharing, and use of healthcare information, data, and knowledge for communication and decision making. Examples of HIT include electronic health record systems, radiology information systems, picture archiving and communication systems, laboratory information systems, administrative and billing systems, and workflow systems.

Health Level 7 (HL7)

HL7 is the international standards-setting organization that develops standards for healthcare and is the interface standard for communication between various systems employed in the medical community. HL7 adopted a standard for clinical document architecture, a standard for the functionality of an EHR and a standard reference information model.

Integrating the Healthcare Enterprise (IHE)

IHE is a global initiative by healthcare professionals and vendors around the world to improve the way computer systems in healthcare share information. IHE promotes the coordinated use of established standards, such as DICOM and HL7, to address specific clinical and administrative interoperability needs in support of optimal patient care. Compatibility of vendors' product implementations of the IHE standards-based profiles are tested at Connectathons, held primarily in North America and Europe. See *http://www.ihe.net*

International Standardization Organization, Health Informatics Technical Committee (ISO TC 215)

A committee in the field of information for health, and health information and communications technology (ICT) to achieve compatibility and interoperability between independent systems. These groups ensure compatibility of data for comparative statistical purposes (e.g. classifications) and reduce duplication of effort and redundancies.

Interoperability

The ability of disparate HIT systems to share patient information effectively and to use that shared information to create a lifetime patient record that is the basis of patient-centered care.

Master Patient/Person Index (MPI)

A way to uniquely identify a patient in relation to their medical records.

Organization for the Advancement of Structured Information Standards (OASIS)

A nonprofit, international consortium whose goal is to promote the adoption of product-independent standards for information formats, such as Standard Generalized Markup Language (SGML), Extensible Markup Language (XML), and Hypertext Markup Language (HTML). Currently, OASIS (formerly known as SGML Open) is working to bring together competitors and industry standards groups with conflicting perspectives to discuss using XML as a common web language that can be shared across applications and platforms.

Pay for Quality (P4Q)/Pay for Performance (P4P)

A method of providing incentives, both financial and recognition, for quality outcomes in healthcare, rather than paying simply for services.

Personal Health Record (PHR)

A single source of medical information maintained by a patient, in either electronic or paper form. PHRs can include information that is recorded by the patient (rather than by a provider), such as exercise routines, dietary habits, or daily glucose readings.

Regional Health Information Organization (RHIO)

An independent corporation intended to operate an exchange of clinical health information among competing stakeholder organizations supporting multiple use cases. A RHIO is the organization through which most HIE services are selected, developed, and delivered (although technical implementation might be performed by contracted third parties).

Remote Medicine

See *Telemedicine*.

Systematized Nomenclature of Medicine (SNOMED®)

Provides a common language that enables a consistent way of indexing, storing, retrieving, and aggregating clinical data across specialties and sites of care. SNOMED® International, a division of the College of American Pathologists, maintains the technical design, the core content architecture, the core content and related technical documentation.

Telemedicine

Involves the electronic exchange of medical information between different sites in order to provide care to the patient. Telemedicine includes consultation between providers, diagnosis, and even treatment—for example, allowing intensive care specialists to monitor remote or rural hospital ICUs.

Achieving Early Health Using HIT

Brandon Savage, *Chief Medical Officer*, GE Healthcare Integrated IT Solutions

Overview

Barely half of the residents in the United States—a country with highly advanced medical technology—receive appropriate acute, chronic, or preventive healthcare.[1] This lack of quality is pervasive and irrespective of age, sex, or economic status. The challenge we face is not just providing better care. What we need, both in the United States and across the globe, is a fundamental system change to ensure that medical care is safe and effective, based on clinically-proven best practices, and focused earlier in the disease process. This document explores the framework that HIT provides, which brings together comprehensive patient data with the most current evidence-based medical knowledge and state-of-the-art diagnostics, enabling more proactive, personalized care that is not only more efficacious, but also more cost-effective. In order to reach this goal, HIT systems must become interoperable.

[1] Asch, S.M., Kerr, E.A., et al., "Who Is at Greatest Risk for Receiving Poor-Quality Health Care?" *New England Journal of Medicine* 354: 1147–56, 2006.

Using HIT to Predict and Treat Disease Earlier

Of the four phases of healthcare—predict, diagnose, treat, and monitor—the vast majority of healthcare spending occurs in the treat phase. In Hong Kong, treatment for acute myocardial infarction alone totaled $45 million or 0.5% of the entire 2000-2001 healthcare expenditure.[1] Likewise, in 1999, total medical expenditure for chronic obstructive pulmonary disease in Japan was $927.8 million.[2] In the United States, 80% of healthcare spending goes towards treatment, rather than prevention or early diagnosis.

By focusing care earlier in the process (on an individual's health rather than on a patient's disease) we can make significant strides in improving overall health and curbing costs. Early health is an approach to care based on access to information across all phases and the intersection of diagnostics, therapeutics, and information technology. With this transformative approach, providers use technology and clinical knowledge to prevent and/or treat chronic diseases in the earliest phases, when health impacts are less severe and treatment is less costly.

[1] Lee, V.W.Y., Chan, W.K., Lam, N.L.C., et al., "Cost of Acute Myocardial Infarction in Hong Kong" *Disease Management and Health Outcomes* 13 (4): 281–285, 2005.

[2] Izumi, Takateru, "Chronic Obstructive Pulmonary Disease in Japan" *Current Opinion in Pulmonary Medicine* 8(2):102–105, March 2002.

The Role of Information Technology in Early Health

Inform
• Integrates medical imaging, lab results, medical history, and other patient data into a single comprehensive lifetime patient record (also known as an electronic medical record or EMR) • Guides treatment by incorporating evidence-based practice guidelines that can be widely disseminated and easily updated • Reduces medical errors by using EMRs to check for adverse drug interactions and patient test results • Confirms that the right patient receives the right dose of the right drug via the right route at the right time

Predict	Diagnose	Treat	Monitor
• Predicts the likelihood of disease based on genetic, demographic, and behavioral factors • Molecular diagnostics and molecular imaging can identify risk factors before symptoms are evident or before the onset of disease • Delivers personalized care based on the patient's condition and medical history	• Diagnoses diseases at the earliest possible stage using advanced technologies, such as PET scans • Links patient records and scans to online knowledge bases to provide clinicians with the data they need to make better, more informed diagnoses	• Uses sophisticated outcomes analysis to determine the least invasive treatment protocols for specific conditions • Customizes therapies based on a patient's individual genetic composition • Enables the entire care team to collaborate, reducing redundant tests and other procedures	• Uses EMRs as tools for actively managing chronic diseases • Provides performance and quality data so organizations can better assess and improve their own performance, and so consumers can select the highest quality providers • Uses health information exchange to collect and analyze population outcomes and detect disease outbreaks earlier

Using HIT to Ensure Clinical Best Practices

Much of worldwide healthcare is inconsistent and unpredictable, with practices varying widely by region or provider. Procedures that have been used for dozens of years persist, even when there is no scientific evidence to prove their effectiveness.[3] For example, evidence indicates that exercise, physical therapy, and time are just as effective as spinal fusion in relieving back pain—yet 325,000 fusions are performed each year in the United States.[4] On average, it takes 17 years for a new scientific discovery to become widely disseminated and

[3] See "Medical Guesswork," *Business Week*, May 29, 2006.

[4] Ibid.

accepted as a medical practice.[5] As a result, patients do not receive the preventive measures necessary to avert suffering and cost. Basic care decisions often deviate from the latest scientific evidence.

Yet there are comprehensive evidence-based guidelines for treating many diseases, especially for chronic illnesses, which are responsible for nearly 80% of healthcare expenditures in the United States[6] and 22.4% in Australia.[7] These guidelines exist primarily in paper-form in voluminous tomes that are difficult to transport and access, making consultation awkward for clinicians in the midst of making a diagnosis or prescribing treatment.

There are efforts under way to transform best practice guidelines into an electronic format that can be integrated with a patient's EMR. The system would then provide the clinician with the most relevant information based on a patient's individual condition and medical history, and would assist the clinician in selecting the appropriate treatment plan. While current development is occurring within individual EMR systems, the eventual goal is to have interoperable, shareable guidelines that can interact with any EMR.

Using HIT to Connect Providers, Patients, and Data

Unlike paper records, multiple clinicians can access electronic data simultaneously, giving all members of the care team access to the most current and comprehensive patient data, enabling more accurate diagnoses and treatment decisions.

HIT not only facilitates a shared story of care, it also makes the patient an empowered member of the care team. Personal health records (PHRs) allow patients to monitor their own health status and record more frequent observations about their disease state. Although patient observations are not part of the official medical record, they can be dynamically integrated as needed for care decisions, playing a critical role in management of chronic illness.

The need for interoperability

Ultimately, *interoperability*—the ability of disparate systems to share health information—is the linchpin in realizing the benefits of HIT in early health. Without interoperability, the fragmentation that characterized paper records will be carried forward into the electronic realm.

Achieving interoperability depends on the evolution of accepted uniform standards that facilitate the exchange of critical patient information, regardless of location. Based on the

[5] Balas, E. Andrew, "Information Systems Can Prevent Errors and Improve Quality," *Journal of American Medical Informatics Asso*ciation 8: 398–399, 2001.

[6] Anderson, G. and Horvath, J., "The Growing Burden of Chronic Disease in America," *Public Health Reports* 119: 263–270, 2004.

[7] http://www.aihw.gov.au/cdarf/data_pages/health_care_costs/index.cfm.

examples of DICOM[8] for imaging and IHE[9] for regional and national health information networks, the development of standards is most successful when driven by industry collaboration rather than by government mandate. Nevertheless, government support is still critical to the effort.

[8] DICOM (Digital Imaging and Communications in Medicine) is a global information technology standard used in hospitals worldwide. Its current structure (developed in 1993) is designed to ensure the system interoperability used to manage related workflow produce and to store, display, process, send, retrieve, query or print medical images and derived structured documents. See http://medical.nema.org for more information.

[9] IHE (Integrating the Healthcare Enterprise) is a healthcare professional/industry initiative to improve the way healthcare systems share information. IHE promotes the coordinated use of established standards, such as DICOM and HL7, to address specific clinical needs in support of optimal patient care.

Electronic Health Records (EHRs)

Hajime Miyamoto, *General Manager*, President's Office, MEDINET Company, Ltd.
Risaburo Nezu, *Senior Managing Director*, Fujitsu Research Institute

Summary

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. This document explores the core functions of EHRs, discusses terminology, and outlines benefits of and challenges to adoption.

Terminology

The terms EHR and electronic medical record (EMR) have come to be used interchangeably. Some also use the term electronic patient record (EPR). 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.

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 lifelong 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 eight 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 Filtering

EHRs provide immediate access to key information to improve caregivers' ability to make clinical decisions in a timely manner.

[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.

Result Management

EHRs are, effectively, a clearinghouse for new and past test results prescription information, land history of illness. Together, this information informs new decisions, thus increasing patient safety and effectiveness of care.

Order Management

EHRs facilitate the 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 filled.

Decision Support

EHRs contain computerized decision-support systems with 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 and inform them about the disease; EHRs also help patients to perform home-monitoring and self-testing to improve control of chronic conditions, such as diabetes.

Challenges

Lack of standards	• Institutions in many economies have already encountered difficulties in connecting existing EHRs with other vendors' EHRs. • Implementing EHRs without interoperability standards in place could result in huge costs with unrealizable or reduced 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 future standards eventually adopted by governments or the healthcare industry.
Scattered records	People visit multiple healthcare 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 ID numbers to the same patient.

High costs	The up-front costs of transitioning to EHR technology are high, which makes adoption difficult for small hospitals and clinics. However, the mid- to large-size hospitals invest relatively lower amounts in IT compared to trends in other industries.
Privacy and security	• Digital data can be easy to copy; therefore, security is a concern. • The Internet provides the least expensive infrastructure through which to use functionality of EHRs. However, many believe that ordinary security technology, such as SSL, is insufficient for protecting 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.

Benefits

Increased availability and accessibility of information	Patient records can be retrieved at any time and from anywhere.
Less time wasted	• Time previously spent for searching paper charts, taking them to doctors, and returning them to storage is eliminated. • Staff time previously devoted to managing charts is decreased with EHR adoption.
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 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, clinical epidemiologic research can be conducted. Privacy protection is required.

Electronic Health Records: A Physician's Perspective

Makoto Aoki, *Scientific Executive*, Sakura Seiki Company Limited

Summary

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 EHRs can also carry significant financial and time costs, both in the initial implementation phase and over 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. 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.

Challenges

Large Amounts of Data for Patients With Long Histories

Challenges	Possible Solutions
For physicians accustomed to paper charts, EHRs for these types of patients can be difficult to scan or scroll through online.	• Print out or isolate relevant sections. • Incorporate "clinical summary" functions into EHRs. • Educate physicians about site maps and index functions within EHRs.

Discomfort With Accessing Health Records Online

Challenges	Possible Solutions
Some physicians are simply feel unwilling to make the transition to EHRs.	Make electronic records available to physicians in printed form.

Time Lost Due to Discomfort with Data Entry

Challenges	Possible Solutions
For physicians who are uncomfortable electronically inputting data about their patients, EHRs translate into a significant increase in workload.	Make paper forms available that physicians would fill out and write comments on, and then give to staff to enter into the EHR.

Difficult Entry of Vague or Patient-Unique Data

Challenges	Possible Solutions
Some EHRs do not contain enough fields to enter nontraditional symptoms or issues of concern that are often vague and cannot be quantified.	Purchasers should be aware of all their options and vendors should work with physicians to find an appropriate EHR package, all the while keeping interoperability in mind.

Financial Risk

Challenges	Possible Solutions
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 selecting a vendor.	More studies of the EHR industry and more analyses of EHR software and vendors are necessary.

Maintenance Costs

Challenges	Possible Solutions
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 along with software purchase.

Long Processing Time for Changes to the System

Challenges	Possible Solutions
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 about changing any aspect of the institution's EHR. Implementation of the change can take even longer.	More efficient feedback mechanisms and frequent meetings of nurses and physicians with HIT review committees with authority are necessary.

Bandwidth

Challenges	Possible Solutions
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.

Benefits

Central information clearinghouse	• EHRs simplify searches for specific pieces of data, lab studies, and x-rays. • 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.
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.
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.
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 during non-business hours if the patient has an emergency and their file needs to be accessed.

HIT for Patient Safety

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Summary

Many medical errors go unreported and tracking their exact prevalence is difficult. As a result, patient safety is a critical issue in healthcare that affects every economy. For example, a survey by the National Institutes of Public Health in Japan found that medical accidents ranked between the 4th and 5th leading causes of death in the country. 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. Finally, a 1999 report by the Institute of Medicine estimates that 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.

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. HIT could drastically improve patient safety through system standardization and streamlining communication and information.

Key Technologies

e-Prescriptions	Digitized prescriptions reduce errors resulting from illegibility.
EHRs	EHRs reveal a broader range of information about a patient's history, helping physicians provide timely, individualized care and flagging important notes about allergies, past procedures, 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.
Adverse drug event (ADE) surveillance system	Monitoring systems facilitate ADE reporting and enable comparisons across healthcare settings. The resulting improved data on medical errors can lead to improvements in training and new safety protocols.
Barcode/ IC-tips	Coded tags ensure the correct identification of patients, medications, and instruments.

Challenges

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 borne among stakeholders.
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. Policies are often unclear as to which information can be shared with who, and when.

Benefits

Cost savings	HIT benefits with clear policy implications include: 1) enormous cost savings to governments, healthcare institutions, and patients by reducing duplicative and unnecessary testing; 2) increasing health information sharing between providers, labs, pharmacies, and patients; and 3) reducing unnecessary hospitalizations.
Convenience	With integrated HIT, repetitive paperwork could become virtually obsolete, reducing the opportunities to make errors.
Early detection	HIT can help detect treatable cancer or an infectious disease outbreak in their early stages by analyzing anonymous data from emergency rooms.
Increased communication	For healthcare workers, HIT can improve patient safety by: 1) strengthening records and communication systems; 2) increasing the accuracy, timeliness, and volume of patient information available; and 3) improving communication between colleagues and patients.
Instantaneous information	Information technology can reduce the likelihood of errors and prevent adverse events by providing instantaneous comprehensive information to healthcare 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.

Remote Medicine: Implications for Resource-Poor Regions

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Summary

The term *remote medicine* typically refers to the provision of health services beyond the traditional physical boundaries of the hospital or clinic through the use of communications technology. Several other terms used to describe this method of care delivery, depending on the type of technology used, include: *telemedicine*, *tele-health*, *e-health*, *e-medicine*, and *Internet or web-based healthcare*.

Remote medicine technology has the potential to positively affect several aspects of healthcare delivery, especially in areas without strong health infrastructure. Much of the use of remote medicine has been thus far limited to the developed world. The technology is fairly new and expensive, and protocols for use are still being defined. As a result, the implementation of remote medicine can present significant challenges in resource-poor regions.

Key Technologies

Communication technologies	Devices
Internet, telephone, television, and radio	Laptop computer, PDA, videoconferencing kit, cell phone, and portable patient monitors (e.g., blood glucose level or blood pressure)

Use Areas & Functionality

Remote medicine can be applied to several aspects of healthcare delivery. Some common areas for use of remote medicine include:

Clinical Signs & Symptoms

Remote medicine can be used to monitor a patient's signs and symptoms from a remote location. The technology used to facilitate this process depends on the type of clinical data transmitted.

Lab Data

Several portable devices are available to record patient lab data at home or in the field. Some examples include portable glucometers and blood pressure monitors. These devices can send data to the relevant health personnel using communication technologies.

Education & Motivation

Education and motivation play an important part in ensuring that patients adhere to clinical advice from health personnel. This need is particularly pronounced in populations with sporadic contact with the

health system. Remote medicine can facilitate the provision of structured and standardized education materials from a central location.

Coordination & Communication Between Health Personnel

Health delivery is a complex process involving various health personnel. Remote medicine can be used to store and forward patient data efficiently among health personnel located in different geographic regions.

Stakeholders

Remote medicine programs involve several distinct stakeholder groups due to the complex and multidisciplinary nature of the intervention. The following table gives a brief summary of important characteristics of each group. Focus should be placed on how stakeholders affect different stages of a remote medicine program such as design, budgeting, implementation and evaluation of outcomes.

Stakeholder Group	Stakeholder Concerns
Patients/population served	• Even remote health facilities may require a several-hour walk. • People may not be well-educated about when to access services. • People may hesitate if there are costs for the service or if patients are uncertain about what services will be available.
Local health workers	Large workload
Government and in-country program managers	• Long-term sustainability of remote medicine systems • Capacity to manage and oversee the program • Regulation of the communication of sensitive information
Physicians	Remote medicine offers physicians a chance to assist underserved populations without having to live in areas with little infrastructure. Some doctors may return to the cities when remote medicine becomes an option.
Technologists	Building and maintaining a working system
Funding agencies	• Effectiveness of programs • Cost-effectiveness of remote medicine compared to more traditional approaches to health in rural areas

Challenges

Remote medicine programs present some unique challenges due to the nature of communications technology. These include infrastructure concerns and availability of

skilled manpower. Communications technology needs often change rapidly and the initial assessment of the environment should take into account both short and long term requirements.

Characteristics of implementation region	Remote medicine technology may not be viable in very low income regions with poor communications infrastructure.
Standardizing care delivery	High variability in the protocols for care delivery can increase the cost and decrease benefits from remote medicine.
Quality of care and patient safety	Remote medicine's minimal face-to-face interaction between patients and doctors can lead to difficulties in monitoring and enforcing quality of care and patient safety standards.
Skilled labor	The skill sets required to design and maintain information systems for remote medicine may not be available locally, and skilled labor may be expensive.
Security and confidentiality of patient data	Maintaining security and confidentiality of patient data is critical in the use of remote medicine where face-to-face contact is not available. As a result, communication technologies like the internet or cell phones may need additional security features and protocols.
Cost	Remote medicine technology is currently expensive and may not be financially sustainable in poor regions. A careful financial assessment is required to measure if the expected outcomes can justify the high cost.

Benefits

Remote medicine programs can offer numerous benefits, the most important being improved access and more efficient use of limited resources. The value of each of the areas below should be evaluated against conventional alternatives through mechanisms such as cost effectiveness or return on investment (ROI) analysis.

Access to Healthcare

Remote medicine has the potential to deliver healthcare across geographic boundaries and can reach populations located in remote regions or in areas with poor health service penetration.

Reduced Burden on Health Resources

The provision of healthcare services from a centralized location can reduce the burden of health delivery on peripheral health services both in terms of infrastructure and manpower.

Facilitated Specialist Consultation

The provision of specialist services is often difficult in geographically isolated and impoverished regions. Remote medicine can help provide a link between primary care

physicians in rural areas and specialists in a tertiary level facility for better management of complicated cases.

Disease Specific Management

Disease specific management of patient populations is particularly useful for chronic diseases like diabetes, congestive heart failure, and hypertension, where there is a need to periodically monitor patient status.

Centralized Monitoring & Surveillance

Remote medicine technologies can be adapted for use as a surveillance tool to detect outbreaks of infectious diseases and for epidemiological studies of a region.

Reverse Brain Drain

Expatriate doctors can use remote medicine platforms to provide care and expertise to resource-poor regions in their native countries. Their understanding of cultural and language barriers in their native regions can be a valuable asset in improving quality of care.

Current Exemplars

Home Tele-health Partners Home Care, U.S.	Partners Home Care, a non-profit home-care provider, offers home tele-health services to high-risk, high-cost, and chronically ill patients (such as those with congestive heart failure). Their home tele-health system consists of a monitoring station, which collects health data, including vital signs, and transmits it to Partners' provider station. The system also helps with patient education and disease specific. The system functions over an ordinary telephone line. *http://www.partnershomecare.org/telehealthproject.htm*
Telemedicine Network Narayana Hrudayalaya Institute of Medical Sciences, India	The Narayana Hrudayalaya Telemedicine Network runs through 26 locations in India and abroad, offering round-the-clock video consultation, primarily for heart patients from remote areas. The Tele-medicine project is a nonprofit project sponsored by Asia Heart Foundation, Kolkatta, Narayana Hrudayalaya, Bangalore, Indian Space Research Organization, and various state governments. *http://www.narayanahospitals.com/tele_medicine_network.html*
Hispano-American Health Link Technical University of Madrid & Engineering Without Frontiers, Peru	The EHAS program links 39 previously-isolated health facilities in Peru's Alto Amazonas province using voice and communication technology (email via VHF radio.) The system provides services in the following areas: • voice and email messages for emergency care and coordination of healthcare activities • distance training via email • exchange of epidemiological and vigilance reports • electronic publications and local health news *http://www.ehas.org*

Scalability

One of the advantages of remote medicine is the ability to scale programs to serve a larger population, thereby reducing the cost per patient. For scaling to provide value, however, standardized protocols for care delivery must be maintained and sufficient demand needs to be generated for use of these services.

Initial program testing of remote medicine technology often requires a smaller pilot or feasibility study. Pilots and feasibility studies can be very expensive and innovative approaches should be explored to provide funding. Public-private partnerships and entrepreneurial models may help to reduce initial costs and maintain financial viability.

Policy Considerations

In considering remote medicine projects, policymakers should engage in a thorough analysis of the needs of each region. Such an analysis should include the epidemiology of disease, socioeconomic features, and available infrastructure in the region. Other policy considerations are detailed below.

Cost-benefit analysis	Since remote medicine technology can be very expensive in the short term, cost-benefit or ROI analyses can help clarify financial implications. Important—yet often underestimated—cost-drivers include the time and resources involved in training the workforce to use new technology.
Training and education	A steep learning curve can add to the workload, reduce efficiency, and lower morale among frontline health workers. A well-planned approach to training and education on the use of technology can mitigate some of these issues, as well as increase belief in the benefits of remote medicine.
Demand assessment	Without adequate demand even the most well-designed and cost-effective project can fail. Policymakers should therefore engage in an assessment of demand, including a study of public and end-user needs and expectations of the remote medicine system.
Incentives	Physicians and health workers represent important channels for communication with the public and can help stimulate demand in the community. However they often have no incentive to adopt a new system and may have conflicting interests. Adequate reimbursement mechanisms and incentives for physicians and health workers can create a strong group of stakeholders, align interests, and help manage demand.

Useful Links for Further Reading

Center for Connected Health, Massachusetts General Hospital, Boston
http://www.connected-health.org

American Telemedicine Association
http://www.atmeda.org/

Dgroups—Online discussion group on telemedicine in low resource settings
http://dgroups.org/groups/telemedicine/

"IT Infrastructure for Health & Telemedicine Standardization" Report, Ministry of Communications Information Technology, Government of India
http://www.mit.gov.in/telemedicine/home.asp

Network for e-health in Africa developed with the help of Geneva University Hospitals
http://raft.hcuge.ch/ (in French)

Personal Health Technology for Aging in Place

Jeremy Bonfini, *Worldwide Digital Health Policy Manager*, Intel Corporation*

Summary

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 these changing demographics is a major challenge that requires a collective effort. Ultimately, families will have to provide a significant 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. A burgeoning aged population will, also, cause healthcare spending for most countries to skyrocket as the cost of caring for older adults escalates sharply.

"Aging in place" refers to an older person using services and technologies that allow them to stay in their home of choice even as their circumstances or healthcare needs change. Home-based technologies provide the world with the potential to improve seniors' quality of life, reduce the burden on caregivers, and provide crucial information to physicians to facilitate the early detection and prevention of costly medical conditions. Importantly, technology enables and encourages good behavior, with the aim of keeping elderly people active and connected to others.

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

Key Technologies

The technologies outlined in the chart below enable seniors and caregivers alike to take advantage of wireless networks that link computers and consumer electronic devices. 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
- systems that help coach and assist seniors to maintain their independence in the face of disabilities

Monitoring and measurement	Sensor network throughout the digital home, home-care robot
Attention and memory loss	GPS device, voice-activated phone dialer
Vision and hearing impairment	Talking word processor, label reader and scanner, hearing aids, and visual signaling and alerting equipment

* With contributions from The Center for Aging Services Technologies and the Alzheimer's Association.

Real-World Application

Prevention of Accidents and Disease

Problem	Technology Solution
Falls are common reasons why older adults can no longer maintain their independence in their own homes. Oftentimes, a short fall can lead to costly, uncomfortable hospitalizations for older adults for fall-related injuries.	A walking cane or a rug with a wireless force sensor can detect changes in a senior's movements and look for patterns indicating instability before they actually fall.

Early Disease Detection

Problem	Technology Solution
There are no real means—in the clinic or the home—to detect diseases like Parkinson's early. Only 15% of Parkinson's cases are diagnosed before age 50. By the time people are diagnosed, the disease has progressed for years.	Embeded sensor tests in devices that people use everyday can detect changes in seniors' progression by analyzing the frequency and steadiness of their keyboard and remote control usage, as well as how often they leave activities unfinished

Medication Compliance/Adherence

Problem	Technology Solution
Poor drug adherence is a fundamental healthcare issue, rooted in behavior that leads to hospitalization, institutionalization, and sometimes death. 66% of patients don't adhere to medicine regimens, even when access and affordability are non issues.	Technologies with which seniors are already familiar can help them take the right pill at the right time. For example, a smart watch or a wireless pill dispenser can provide prompts when it is time to take medicine, as well as visual cues for which pill to take and the correct dosage.

Challenges

	Challenges	Opportunities
Acceptance	Many seniors will be slow to adopt technologies they are unaccustomed to using. For those with Alzheimer's or dementia, even the most straightforward technology can be intimidating and confusing.	With the tech-friendly generation that is currently aging, integrating technology into the day-to-day lives of elderly populations will become easier with time. 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 how to use new technologies.

	Challenges	Opportunities
Cost	Even though many technologies are inexpensive, sensor and wireless technology can still be prohibitively expensive, especially in resource-poor settings and developing countries.	Technology enables 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. These savings apply not only to individuals and their families, but also to governments and healthcare providers.
Infrastructure	Many technologies require wireless services and take for granted reliable sources of electricity in the home. In the developing countries that are most likely to experience the sharpest rise in aging populations, this type of infrastructure can be difficult to find, especially in rural areas.	Once a digital home infrastructure is in place, as it is already in many homes throughout the world and will be increasingly in the near future, any computer or consumer electronic device could also be used to deliver health and wellness applications.

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. Changing demographics of the aging population will serve as 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 educate healthcare providers and caregivers on how to incorporate new technologies into their services?
- Who should train seniors to use 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"?

Clinical Trial IT Management Systems (CTMS)

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Summary: Clinical Trial Site Perspective

Prolonged timelines and large expenses associated with bringing new drugs to market have prompted a new focus on improving the operational efficiency of clinical trials.[1] As a result, industry sponsors of clinical trials are increasingly reliant upon a variety of IT-enabled Clinical Trial Management Systems (CTMS) in order to improve managerial control in trial conduct. These systems provide sponsors with tools to assist in the planning, preparation, performance and reporting of clinical trials.

While these systems provide trial sponsors with improved oversight of trial conduct, they often fail to consider the perspective of the clinical trial site. Clinical trial sites require similar functionality, but because they often conduct trials for many different sponsors and coordinating centers they require operational systems that can be used independently of the trial sponsor. This case study proposes that gains in efficiency and cost-effectiveness are more likely when clinical sites can leverage the functionality of a CTMS independent of trial sponsor. The document also provides an overview of a CTMS developed by the Duke Clinical Research Institute, which has proven successful in increasing site efficiency.

[1] Bringing a new drug to market generally takes between 12–15 years and costs about $900 million, with nearly 45% of this cost accrued during the clinical trial phase. Studies indicate that 75% of all trials conducted in the United States are significantly behind schedule.

Problem Addressed by CTMS

Clinical sites conduct multiple trials of differing stages with many different sponsors. Such diverse activities require sites to manage their portfolio of research projects independent of the sponsor. However, the high cost of implementation inhibits many clinical sites from acquiring adequate tools with which to manage their portfolio of clinical trials most efficiently. As a result, some sites—even those running several large-scale international trials—rely on common desktop applications to track their clinical activities. Sites continue to rely on manual processes to merge large amounts of complex, disparate data to produce a comprehensive analysis of each trial's operational and financial performance.

Key Technologies

A CTMS is a web-based software solution in which essential clinical trial workflow processes are embedded into the operations of the system. These systems effectively serve as central trial dashboard for sponsors, coordinating centers, and site personnel. In keeping with its dashboard function, a CTMS typically requires a significant IT infrastructure consisting of large scale database and application servers, while end-users need only access the system over the internet with their preferred web-browser.

How It Works: CTMS During the Study Phase

Stage of Study Phase	A CTMS Can Help Increase Efficiency and Reduce Staff Workload by:
Feasibility analysis	• Establishing a baseline study budget with revenue and cost estimates • Tracking confidentiality agreement • Tracking contract negotiations
Study start-up and pre-enrollment	• Tracking completion of essential documents such as 1572, Investigator CV, and conflict of interest • Tracking International Review Board (IRB) submissions and renewals • Defining protocol visit schedules and activities • Defining contract milestones and payment amounts • Defining study teams • Managing contact information for sponsor/coordinating center
Enrollment and follow-up	• Scheduling and tracking patient study visits • Tracking study related expenses • Tracking completion of financial milestones • Tracking revenue received and reconciling to the patient leve • Forecasting revenue and expenses
Study close-out	• Clarifying outstanding patient visit activities • Finalizing study-related expenses and outstanding financial milestones • Verifying that all earned revenue has been collected from the sponsor • Comparing budgeted to actual revenue and expenses

Current Exemplar

Duke Clinical Research Institue Open-Source CTMS

Duke University's Clinical Research Institute (DCRI)[1] designed an open-source CTMS to meet the needs of the typical clinical trial site.[2] Over the last two years DCRI has used this CTMS in conducting 129 different clinical trials and tracking the study visits of more than 1,500 study participants. The trials that use this CTMS range from small single site research studies to large multi-site international mega-trials. This site-based approach to CTMS

[1] The Duke Clinical Research Institute (DCRI) is the world's largest academic clinical research organization with more than 270 Phase I–IV clinical trials and outcomes research projects and a total enrollment exceeding 570,000 patients.

[2] Through the Clinical Trials Best Practices (NIH Roadmap grant).

provides the site with tools to improve coordination of patient visits, capacity planning and resource utilization, financial and regulatory compliance, and managerial reporting.

	Lessons Learned
Establish clear processes prior to implementation	• Successful implementation of a site-based CTMS is dependent on well-defined business processes. In particular sites must establish methods for accounting of expenses, revenue recognition, and budgeting. Site personnel rely on manual processes and are often reluctant to change. • Integration with sponsor/coordinating center systems depends on well defined processes.
Start with the simple cases	Focus on improving the simple things first, such as: • Tracking of patient visits • Contracts • Regulatory documents • IRB submissions Success in these goals provides momentum to identify solutions for the more complex area of financial management.
Focus on usability factors	Experience and comfort with software tools varies greatly among site staff. A CTMS should be intuitive, and easy to use by users with limited experience with computers. Additionally, user training programs are essential to promote appropriate use of the CTMS. Early pilot studies may help to ensure site staff comfort with usability and that the system functions as desired.

Research Without Borders: IT-Enabled Clinical Research Administration

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Summary: Changing Paradigm for IT in Clinical Research

It takes approximately 10 years and upwards of $1 billion to bring a drug to market. The need to reduce this time and cost has created immense pressure on stakeholders involved throughout the discovery and development lifecycles. While information systems that streamline administrative processes have been commercially available and on the market for decades, their adoption and proliferation by the end user is just now beginning change the "business as usual" mentality in study administration. Today, advances in communication technologies and software applications are pushing research business units beyond the initial steps of task-oriented operations consolidation towards defining new strategies for extending how we create, plan, and implement clinical research trials. This document articulates the benefits of, and need for, incorporating IT into clinical research administration.

A Bold Vision for the New Millennium

The Past: 1987 *An upstart Southern California biotech company's clinical trial site for what will eventually become a blockbuster product*	During a tour of the clinical trial site we witness a study-driven patient encounter, where a clinical research assistant is recording data on a paper based case report form (CRF). This CRF is then sent to a centralized data storage location, double-entered into a database, analyzed, and eventually submitted by the company as part of the paper-based U.S. FDA New Drug Application filing for seeking market approval. Upon visiting one of the Clinical Research Organizations (CRO) contracted to manage this large multi-center study, we find that much of the administrative tasks are both labor intensive and technology exclusive. Evidence of the lack of technological sophistication can be found in a number of storage rooms containing stacks of paper training manuals for study staff and extra copies of CRFs for data collection. In addition, at another security-managed facility warehouses are filled with copies of original-source documents and study-audit notebooks that are used during the final data base cleaning, analysis, and submission processes.
The Future: 2025 *A National University Hospital in an East African country*	During morning clinical rounds, colleagues from the United States join us virtually to help examine patients recently enrolled on three different industry-sponsored study protocols for diabetes, breast cancer, and congestive heart failure. After rounds conclude, the University research director showcases a wall-size, plasma study administration dashboard provided by a clinical research infrastructure 'basket fund' from the recently created "Global Clinical Trials Regulatory Authority." The dashboard helps manage patients and staff supporting active trials throughout the country and region. The director approaches the screen and rearranges several icons by touch, and we witness a dizzying array of statistical information displayed, including the numbers of international study collaborations and patients enrolled; a map indicating active patient follow-up and details on missed appointments and adverse events; and an SMS adherence monitor tracking system. Next, a 3-D holographic conference call connects the director with colleagues in India, China, and the United States to discuss a new study testing a rapid test diagnostic device manufactured in Mumbai under a joint IP arrangement formed under the new TRIPS technology design collaborative agreement between the African Union, the United States China, and the European Union.

Key Technologies

Distributive communications platforms	These platforms are available on hand-held WiFi and voice-over-Internet protocol (VOIP)-enabled devices that connect portable, inexpensive vital sign monitoring devices and facilitate synchronous remote data collection by the bedside, in the home, or even while on vacation.
High-speed study inclusion algorithms	High-speed algorithms can search medical conditions among millions of study participants to develop real-time lists of those who might benefit most from novel therapies across conditions.
Electronic document management systems and integrated patient medical records	Such systems provide synchronized institutional review board (IRB) submissions for existing and new studies as well as automated clinical trials data collection capabilities for medications dispensed, laboratory tests taken, and even personalized patient complaints made for mild reactions to adverse events.
Standardized informed consent and educational sessions messages	Standardized messages reduce costs associated with continuing patient education throughout the lifecycle of a study across multiple sites and countries. They are also highly scalable.

Challenges

Despite advances in how industry, hospitals, and patients utilize technologies collaboratively to design, manage and participate within clinical research studies, there are still several critical bottlenecks that need to be resolved in order to fully transform the existing clinical trials administration process into an efficient streamlined production system. Bottlenecks may include:

- overhead associated with negotiating and closing successful site management contracts
- time associated with existing methods for recruiting and enrolling subjects within the community as well as across institutions and study sites
- delays in reporting of side effect and adverse event data
- delays in the compilation and review of data from disparate information systems into consolidated and streamlined regulatory submissions
- high costs associated with organizational change management, deployment and training of staff onto new study systems (These costs would include eliminating concerns associated with security and privacy of patient level information stored within electronic systems)

Recently, regulatory bodies responsible for reviewing and approving new therapeutics in some countries have experienced criticism for major drug recalls and their perceived inability to effectively review and fast-track lifesaving medications that are available elsewhere. While industry and private hospitals are vastly expanding budgets to improve processes, adopt technologies, and expand the types of data they collect and analyze, regulatory agencies do not have the ability to make market-driven, autonomous investment decisions to expand capacities.

Investments in IT and infrastructure for public regulatory bodies could help streamline approval processes and capacity building for clinical trials administration. In the United States for example there have been calls over the years from the U.S. FDA to increase the level of funding to improve infrastructure as well as strengthen the public's perception and input into the electronic submission of study data. Thus, there are subtle hints that a pathway forward does exist, but questions still remain regarding the political will and ability to align key stakeholders to ensure that all necessary changes and investments will occur.

Benefits

Are advances in technologies truly enhancing drug development by bringing therapeutics faster to market or are they simply high-tech cost drivers?

Effective clinical trials administration is not simply a compartmentalized endgame within the drug discovery and development lifecycle. Rather, when integrated properly within the organization and across stakeholders, improvements in clinical trials administration create a common and binding set of knowledge management processes across the entire development lifecycle. These processes help to link pure R&D efforts into the clinic and vice-versa, either indirectly—through continuous patient and provider education, or directly—through translational research efforts designed to bring basic science advances directly to bedside innovations. Moreover, there are specific direct bottom-line and tangible benefits realized that can save millions of dollars to justify technology investments for improved administration. These benefits include:

- ability to stop a failed trial earlier
- risk management support between key stakeholders such as the patient, trial site, and industry sponsor
- prevention of costly delays in collating and processing information for the final NDA submission
- improved mechanisms to ensure patient confidentially and privacy through the systematic de-identification of study records

But the danger of limiting the impact assessment of the investment on these low-hanging fruit items devalues the overall benefits statement, especially during times when hospitals are faced with declining revenues due to a more competitive landscape. Under these scenarios, administrative investments for clinical trials are then slashed and put on the shelf, saved for a future date.

Future Direction

In spite of all the remarkable advances in clinical trials administration for patients, providers, and industry stakeholders, we still have a very long and hard journey ahead. Currently, over 90% of the world's pharmaceuticals and medical devices are initially developed, tested, and distributed to less than 10% of the world's population.

If we are to advance clinical research in ways that recognize no borders and leave no patients behind, we must continue to explore and invest in emerging technologies and

new global partnerships. These investments can help expand our capabilities to rationally design and test new therapeutics as well as be inclusive in strengthening research networks to recruit as well as bring benefits to patients whom live in developed as well as emerging market settings.

Achieving HIT Interoperability: Considerations for Policymakers

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Summary

Over the course of his or her lifetime, or even for a single serious illness, a patient usually receives care from many different providers. Each clinician needs an accurate, comprehensive, and up-to-the-minute picture of a patient's condition on which to base critical treatment decisions. For the most part, that capability is unavailable today. As a result, patients often receive incomplete, redundant, or—at worst—dangerously conflicting care.

Most commonly, errors arise when patients cross a healthcare-setting boundary (on being discharged from the hospital or changing residence, for example) because the appropriate medical information does not make the transition along with them. The key to allowing information to flow freely among EMRs, imaging, cardiology, administrative, and other HIT systems is interoperability. In this context, interoperability means the ability of disparate HIT systems to share patient information effectively and to use that shared information to create a lifetime patient record that is the basis of patient-centered care.

Policy Implications of Interoperability

Achieving interoperability entails challenges far beyond the technology itself. Stakeholders in the process span both the public sector (national and local governments and public health authorities) and the private sector (vendors, providers, payors, and patients). Aligning the disparate interests of these groups with both the policies and the technology needed to accomplish interoperability requires careful analysis of a number of factors to overcome potential barriers.

Challenges

Technological

Challenges	Possible Solutions
• Inconsistent implementation of existing standards • Variety of incompatible data models and terminologies	• Public-private collaboration to define and implement complete, consistent standards

Financial

Challenges	Possible Solutions
• Cost of implementing HIT systems slows initial adoption • Costs of switching locks institutions into a vendor's proprietary system • Market incentives reward quantity of care, not quality of care	• Best practices for HIT implementation to achieve more rapid return on investment • Pay for performance: realign reimbursement models to reward quality and efficiency gains from interoperable EMRs

Cultural

Challenges	Possible Solutions
• Patient concerns about privacy and security of electronic data • Clinician resistance to adopting HIT • Competition among local healthcare providers discourages data-sharing	• Effective security and privacy policies for protecting health data, coupled with rigorous security technology • Demonstration of efficiencies, cost savings, and quality improvements derived from interoperable EMRs

Benefits

Interoperability comes into play at many levels, from integrating different vendors' systems inside a single enterprise, to creating a continuum of inpatient and outpatient care within an integrated delivery network (IDN), to establishing regional health information exchanges and overarching national and international health information networks.

For Patients	For Providers	For Payors	For Policymakers
• Ability to manage their own health using personal health records (PHRs) • Increased transparency about cost and outcomes so patients can make better decisions about their own care	• Financial savings from greater workflow efficiencies • Faster, more reliable delivery of results • Easier, more reliable results interpretation	• More efficient submission of claims • Access to appropriate clinical information to support submitted claims	• Ability to track quality improvement and efficiency of healthcare system • Improved quality and cost-effectiveness of care • Bio-surveillance support for earlier detection of possible epidemics or bio-terrorism

Government's Role in the Development of HIT Standards

In economies across the globe, various government agencies are pursuing policies and regulations that will affect the growth (or stagnation) of HIT for years to come. The policy choices that are made today regarding adoption of HIT will determine whether existing barriers to portability and transparency of health information are maintained, or whether market forces will be encouraged to demand interoperable solutions that will support the delivery of highest quality care.

Standards for HIT are complex, because they involve multiple types of data and terminologies that are not 100% congruent from one specialty to the next—or even from one hospital to the next. Government can play an important role in supporting the industry's efforts —for example, convening public-private initiatives.

When government…	Pros	Cons
Leads on interoperability, it determines the content of standards, specifies time and manner of adoption, and regulates compliance.	• Uniformity of solution • Clear management and funding core	• Without stakeholder buy-in, it may be difficult to achieve effective adoption of standards • Solution may not adequately respond to "real-world" situations
Supports interoperability, it facilitates private-sector collaboration; adjusts regulations to support market-driven solutions.	• Government can use its market power to align interests and gain consensus on standards • Stakeholders own the process • Government can use its market power to align interests and gain consensus on standards	• Must be sufficient incentives and fairness for stakeholders to participate

Legislative and Regulatory Considerations for HIT

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Summary

This document examines the key regulatory and policy issues involved in health system transformation through eHealth 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 healthcare 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 healthcare 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:

- address 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)
- emphasize the use (not purchase) of HIT applications and ultimately focusing on performance, as well as transmission of data to and from the point of care
- build routine payment and operations in at the regional and local levels into a national framework;
- incentivize standards-based applications to enable operability and connectivity
- support pilot or demonstration projects that will yield early lessons and best practices
- support provider practice transformation and the financial and technical assistance needed for small and large healthcare organizations in both urban and rural locales
- support 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, payors, 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	National-Regional
• 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 through which a range of stakeholders can provide input; and/or 3. Recommend electronic health information exchange standards (including content, communication, and security standards). • Both public and private sector perspectives in any economy are invaluable to workable strategies. Each sector should collaborate to achieve successful HIT implementation.	• 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 United States over 200 electronic health information exchanges exist at the local, state, or regional 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 and Standards

Cross-border interoperability and standards cooperation is one of the most promising and complex areas in HIT. The following should underlie any legislation, regulation, or voluntary agreements between the public and private sectors:

- 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, as well as 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, and 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 and the concept of personal health information privacy vary from economy to economy. Issues to consider in developing privacy practices include:

Notice	Ensure that the existence and purpose of record-keeping systems is 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	• Individuals have a right to see records and assure quality of information. • Access must be accurate, complete, and timely.
Security	Reasonable safeguards for confidentiality, integrity, and availability of information are necessary.
Enforcement	Violations of protocol should result in reasonable penalties and mitigation.
Storage and 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

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

Challenges

As health transformation through HIT becomes more and more of a reality, common roadblocks—in existing legislation and regulation drafted during a pre-technological innovation era—are emerging. Examples include: commerce and trade laws, issues of medical liability and healthcare fraud and abuse, adapting existing privacy and security policy, telecommunications policy, tax policy, device and pharmaceutical regulation, and outdated reimbursement and coding structures.

Questions for Further Research

- How does Asia-Pacific's HIT efforts intersect with North American or the European initiatives?
- How is consumer control over health data held in EHRs and other HIT-related tools defined? Is there a common understanding that can be established about this within Asia-Pacific and within other non-Asia-Pacific economies and multi-national bodies?
- How can we leverage efforts from organizations (e.g., WHO, World Bank, and NGOs)?

THE NATIONAL BUREAU of ASIAN RESEARCH
Center for Health and Aging

HEALTH INFORMATION TECHNOLOGY AND POLICY LAB

Economy Case Studies

Economy case studies provide a big-picture overview of HIT adoption in different economies, with information on who drives and pays for HIT, unique successes and barriers to implementation, and existing HIT policies.

China HIT Case Study

Grace Yu, *China Project Manager*,
Dorenfest China Healthcare Group*

Summary

Economic reforms in the early 1980s resulted in major changes in China's healthcare system, especially as a result of the dismantling of the rural cooperative medical system. After being given considerable financial independence, hospitals began to generate the majority of their income through user fees, a practice that continues today. Healthcare is now provided on a fee-for-service basis. The pricing structure attempts to facilitate equity by providing basic care below cost, with profits reaped through the (often excessive) sale of drugs and high-technology services; this structure leads to inefficiency and inappropriate patient care. Healthcare insurance coverage in China is low, with less then 30% of the population receiving any medical insurance.

China's HIT development has a brief history. Development commenced in the mid-1990s with financial management systems; only in the last five years or so have clinical systems been implemented. China has made great progress in a relatively short time period, but weak application software and a scarcity of implementation skills delay further progress. Most Chinese hospitals hope to dramatically improve and extensively digitize their work processes in the near future.

HIT Adoption

Health IT is now entering its second software generation in China, and IT usage in hospitals resembles that of the late 1970s in the United States. Most hospitals in China incorporate IT software into their payment and billing systems, and many have also begun integrating IT into clinical systems in the past five years.

The use of IT in clinical systems has emerged on a departmental basis. As a result of inexperience with IT infrastructure, however, hospitals have encountered several obstacles. Fragmentation, duplicative systems, and poor integration between diverse software systems have created "information islands" that impede data sharing.

Three valuable lessons are evident from China's HIT development over the past ten years:

- Medical information should be integrated across all departments in the hospital. Poor integration of diverse software systems within hospitals impedes inter-hospital information exchanges and creates problems as IT use expands.
- In order for IT systems to benefit clinical services and hospital management, effective overall IT planning is necessary. Oversimplification of IT planning and a lack of clinician engagement have in the recent past led to poor return on investment (ROI) in HIT.
- Implementation requires not only strong project-management skills but also attention to end-user requirements and needs as well as to work processes re-engineering. Poor implementation has resulted in a large amount of work-process redundancy.

* For more comprehensive information on health IT in China, contact the author at (yuz@dorenfest.com) or Sheldon Dorenfest, President, Dorenfest China Healthcare Group at (Sheldon@dorenfest.com).

Government Policy

The Chinese government adopted an "informatization" approach in the 1990s, promoting IT development in all major industries, including the health sector, with one goal being to bridge the information divide. HIT policy began in 1995 with the "Golden Health Project," which sought to create the foundation for electronically linking health administration departments and hospitals as well as medical education and research institutes.

Government efforts in the 21st century increasingly focus on health IT. For example, the 2003–2010 Ministry of Health Guidelines for HIT Development in China call for the introduction of EHRs and regional health information networks to be implemented throughout the country. Many hospitals are considering system-wide upgrades, and larger budgets are more readily available for these kinds of investments.

Who Drives HIT?

The Ministry of Health within the government and independent hospital administrators are the primary drivers of HIT adoption in China. Following the SARS epidemic, the Chinese government realized the importance of integrating an effective IT infrastructure into the country's health system. Additionally, after a decade of small investments in IT systems hospital leaders have become aware that IT can improve work processes and increase management efficiency.

Many other associations involved in HIT thrive in China, including the National Medical Information Education (NMIE) organization, Association of Chinese Health Informatics, Chinese Health Information Association, and Chinese Hospital Information Management Association (CHIMA). CHIMA is a branch of the Chinese Hospital Association, a non-profit national industry and academic association focused on Health IT (similar to the AMIA in the United States).

Who Pays For HIT?

Provincial and local governments in China are the primary funders for regional health information networks and HIT in public hospitals. The national government facilitates investigation of standards and IT infrastructure development. Hospitals invest their own funds into clinical and institutional HIT systems.

China currently spends a little over 0.7% ($700 million) of its national health budget on HIT. Of these funds: 70% goes toward hardware, 20% toward software, and 10% toward services.

Challenges

Chinese software in its infancy	Chinese hospital application software currently has limited capabilities, and Chinese software vendors are not as experienced in healthcare applications as foreign vendors. Proven products for clinical information systems do not yet exist.
Lack of skilled HIT professionals	Skilled workers with IT and healthcare and hospital management knowledge are lacking in China.
Lack of strong change management expertise	Strong change-management expertise is missing in China. The great challenge facing many Chinese hospitals is that they have limited experience to manage the changes after implementing major IT systems. Thus, many hospital leaders are hesitant to increase IT investment.

Current Exemplars

Shenzhen Regional Health Information Network (RHIN)	The Chinese government established as a national goal the implementation of a series of RHINs supported by digital hospitals throughout the country by 2010. The Ministry of Health selected the city of Shenzhen as a pilot site for the development of these RHINs.
Chinese CDC surveillance system	Responding to a request by the Ministry of Health in 2003, the Chinese CDC created a national web-based surveillance system for 37 communicable diseases to receive direct reporting from the majority of hospitals at the county level and above and from more than half of hospitals and clinics at the township level.
Lack of strong change management expertise	Shenzhen will support this RHIN by digitizing all of its hospitals, thus creating more efficient work processes and better management systems to improve healthcare delivery. The Ministry of Health hopes that the Shenzhen RHIN will become a model of what can be done in China.

Future Direction

Spending on healthcare in China will grow dramatically over the next five years, potentially rising to 7% of GDP. HIT spending in China will likely grow even faster, with China's national goal to create EHR and regional health information networks throughout China. Major IT upgrades are now being considered in many hospitals. The focus of future HIT development in China includes the following:

- electronic health records
- regional health information networks to share electronic health data
- better integration of diverse systems within individual hospitals, including agreement upon standards to support IT progress, and better management of change so that the new IT systems will make Chinese hospitals operate more efficiently

In order to accomplish these objectives over the next several years, hospitals will involve outside experts for IT planning and implementation of the new systems. To support the HIT goals of China, better software will emerge from both Chinese software companies and Western software companies that will produce China versions of their software.

Healthcare Landscape

Expenditure

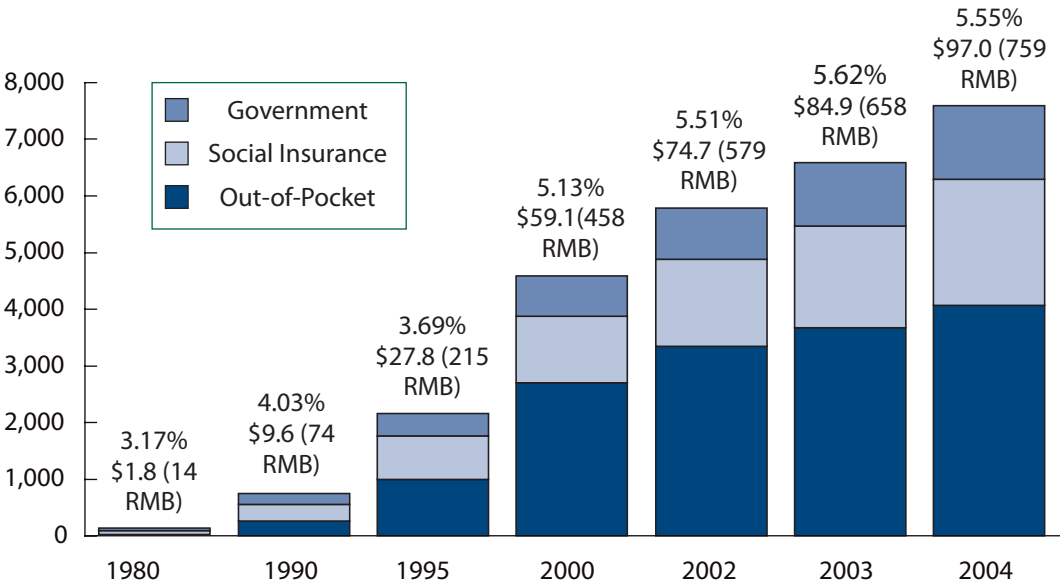
China spent $97 billion, or 5.6% of its GDP, on healthcare in 2004. As previously stated, public spending on healthcare remains low; public spending in 2004 accounted for only 17% of total healthcare expenditure while out-of-pocket expenses reached 53.6%.[1]

Coverage

About 130 million people are covered under the National Social Insurance Program for Urban Employees, a program established in 2005. Another 50 million people are covered through government insurance. Yet less than 30% of the China's population has medical insurance. Indeed, over 40% of the urban population and 57% of people in rural areas have no coverage at all.

[1] China Healthcare Statistic Yearbook 2006.

Healthcare cost as a percent of GDP (USD and RMB in billions)*



Infrastructure

China's current healthcare system is primarily composed of large public hospitals, supplemented by a small number of private, for-profit hospitals. As of 2005, there were 18,703 hospitals in China. Among them, 2,027 were private hospitals (10.83%). Chinese hospitals can be divided into three categories: general hospitals (70%), traditional Chinese medicine (TCM) hospitals (14%), and specialty hospitals (16%).

In addition, China has 5,895 outpatient facilities: 1,266 outpatient facilities and 541 traditional medicine facilities. As of 2005 China had 1,938,272 registered doctors who are primarily employed by hospitals.

* Source: China Healthcare Statistic Yearbook 2006.

India HIT Case Study

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Vikram Kumar, *CEO*, Dimagi Inc.

Summary

India's population is 1.1 billion and growing.[1] Significant, consistent growth of the Indian economy over the last decade has made it the fourth largest economy in the world, with a GDP of $4 trillion in terms of purchasing power parity (PPP). Furthermore, India is the world's leading destination for information technology and related services. Nevertheless, it is still a low-income country, and while pockets of extraordinary innovation exist, its national HIT infrastructure and basic infrastructure continues to lag.

[1] The WHO country report, 2006, http://www.who.int/countries/ind/en/.

HIT Adoption

Despite India's recent ascendancy as the hub of the IT and IT-enabled services industry powered by a vast pool of skilled manpower, it has lagged tremendously behind other countries in HIT adoption. Large corporate hospitals in India spend under 1% of their operating budget on IT, while spending is closer to 3% in the West. Barring a few preliminary attempts to computerize basic hospital administrative and some clinical functions, there has been little appreciation or impetus given to HIT adoption.

Government Policy

Currently, official HIT adoption or implementation policies are almost nonexistent. However, HIT is on the government's radar and serious exploratory initiatives are underway to explore coordination of a national health IT infrastructure and network.

Framework for Information Technology Infrastructure for Health	In consultation with Apollo Health Street Limited, the Department of Technology (within the Ministry of Communication and Information Technology) created the ITIH Framework in 2003. The Framework is a guideline document and comprehensive roadmap that prescribes IT standards and guidelines for each stakeholder across diverse healthcare settings in India with the goal of building an Integrated Healthcare Information Network.
National Knowledge Commission (NKC)	Established in 2005 with a three-year mandate, the NKC is a high-level advisory body to the Prime Minister of India, with the objective of transforming India into a knowledge society. It covers sectors ranging from education to e-governance, with a working group focused on health information technology.

Who Drives and Pays For HIT?

In the last 4 to 5 years many positive developments have set the tone for potentially much greater HIT adoption in India. With a maturing private healthcare sector, the private hospital chains have become the

primary consumers and financiers of HIT. The aggressive IT sector in India is slowly managing to move large government hospitals toward HIT adoption.

Challenges

Policy	Absence of clear, coordinated government policy to promote HIT adoption
Government funding	Almost non-existent government funding for HIT has resulted in lack of HIT adoption in government health facilities and a lack of trained medical informatics professionals
Computer literacy	Low computer literacy among the government staff, and to a large extent in the private provider community
Infrastructure and coordination	Lack of supporting infrastructure and coordination between public and private sector.
Legacy systems	Except for a very few privately owned large hospitals, most patient records are paper based and very difficult to convert to electronic format.
Standards	Local HIT systems that do not adhere to standards for information representation and exchange. This could be further complicated because of the use of multiple local languages by patients and some health workers
Privacy	Patient confidentiality is an open area. The Supreme Court of India has not addressed the specific right of privacy issue with respect to health information.

Current Exemplars

Private Sector

- The private sector has seen the entry of established HIT vendors like GE and Siemens, and homegrown vendors have begun implementing IT solutions in private healthcare facilities such as Wockhardt Hospitals, a tertiary care hospital group throughout India.
- The Apollo Hospitals group, the leading private hospital group in India, plans to integrate all its systems across 42 hospitals with a common platform. It is introducing HIPAA standards across all its EMR implementations and has a core IT team of 30 people and a growing IT budget that makes up about 4.5% of its operational budget.

Government

- The central government has announced projects to build a national disease surveillance system called the Integrated Disease Surveillance Project (IDSP) sponsored by the World Bank, making it the largest such project in the nation. Two of the authors (SK, VK) directed the design of an informatics engine behind a short-listed proposal for IDSP.
- The Indian Space Research Organization (ISRO) has taken the initiative to establish telemedicine centers across India.
- Efforts are underway by the Ministry of Health and Family to computerize basic information systems at the top public tertiary hospitals.

Future Direction

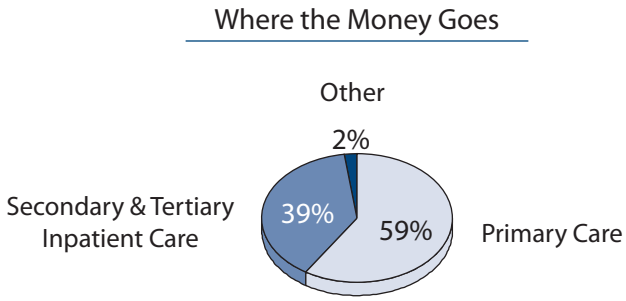
The privatization of medical insurance will become a major driver of HIT adoption in the future, which will create a big push for comprehensive patient information and consequently the use of HIT. Regarding education and awareness, several small medical informatics and related organizations have become extremely active and have grown in membership. In 2006 one such organization, the Indian Association for Medical Informatics, became the official medical informatics body representing India at the International Medical Informatics Organization.

Healthcare Landscape

Expenditure

The Indian healthcare system is mainly funded by out-of-pocket payments, followed by government spending and a small contribution from insurance coverage.

- Individual households bear 70–75% of healthcare costs.
- Total national spending on healthcare in 2006 was close to 5.3% of GDP (approximately $45 billion).[1] Private spending accounts for 82% of this expenditure with public spending constituting the remaining 18%, which turns out to be abysmally low (1.3% of GDP). However, the total spending is expected to rise to 5.7% of GDP by 2009.



Coverage

No national community health insurance model exists, though some NGOs are trying to collaborate with hospitals to introduce such services at a local level. Acceptance and availability of private health insurance was very limited until a few years ago, when the government permitted foreign direct investment in this economic sector. The entry of several established western insurance companies has contributed to the sector's rapid growth in the last few years; only 4 to 5 million people were covered under insurance a few years ago but this number has jumped to 12 million by 2006.[2] Nonetheless, much of the population works in informal jobs or is self-employed and is thus extremely unlikely to have access to employment-related plans.

The Indian healthcare services industry is composed of both public and private entities. The Union Ministry of Health and Family Welfare is the umbrella body for formulating and implementing various health programs and setting policies. The state governments are the major providers of healthcare and the Directorate General of Health Services (DGHS)

[1] The India Brand Equity Foundation. The Healthcare Sector Report. 2006, available at www.ibef.org.

[2] Ibid.

provides technical advice on all medical and public health matters and implementation of health schemes. Organization of the public and private healthcare sectors is as follows:

- ***Public Sector.*** The government provides and manages the majority of the services through a hierarchical network of hundreds of thousands of rural village, primary, and community health centers and more than 5,000 hospitals. The primary health centers refer the complex cases into secondary and tertiary centers. Public health services are provided at no cost to patients, with the state taking responsibility for service delivery.
- ***Private Sector.*** A fee-levying private sector co-exists with public healthcare. It accounts for 82% of the overall health expenditure. The private sector provides services through Allopathic, Ayurvedic, Homeopathic, and Unani practitioners. Most in-patient services are delivered through 1–10 bed nursing homes, which are usually staffed by a single physician.

Infrastructure

In 2005 there were close to 5,000 hospitals with an average of 89 beds per 100,000 people for a total of approximately 870,000 beds.[3] The population to bed ratio in India is one bed per 1,000 people while the WHO average is one bed per 300.

[3] The India Brand Equity Foundation. The Healthcare Sector Report. 2006, available at www.ibef.org.

Japan HIT Case Study

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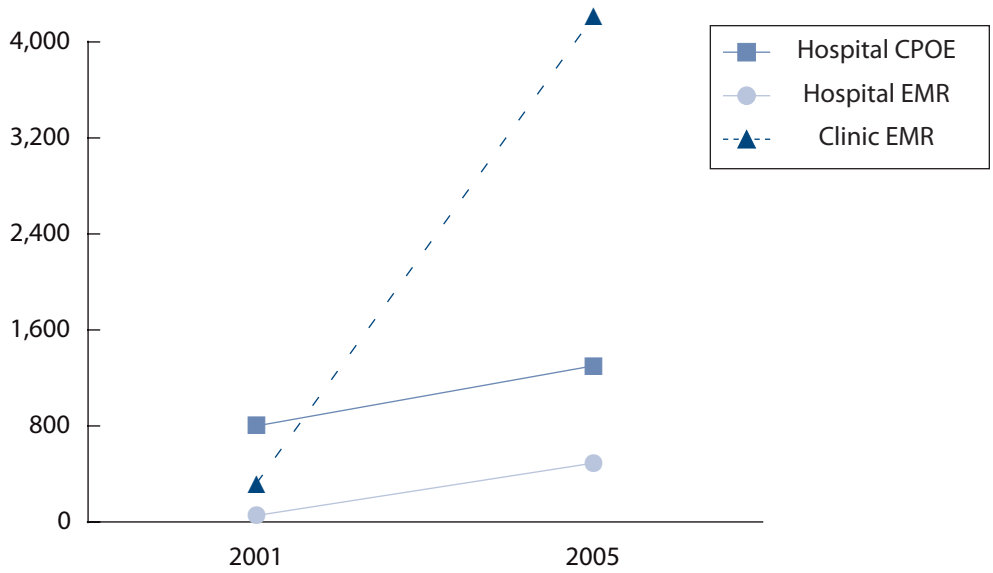
James Kondo, President, Health Policy Institute, Japan

Summary

Japan has the world's highest proportion of people over 65-years-old, and this population's medical bills in Japan continue to increase by 1 trillion Yen each year. Healthcare costs are expected to rise rapidly with the further aging of the population and increased demand on health systems. In response, one of the Japanese government's top priorities is controlling public spending on healthcare, in part through investment in IT. While use of HIT in individual institutions is growing rapidly, interoperability remains a major challenge, and reaching agreement over the appropriate approach to a national EHR system has been difficult.

Hospital and Clinic Use of EMRs and CPOEs



HIT Adoption

The Japanese Ministry of Health, Labor and Welfare (MHLW) is exploring several new initiatives to expand HIT adoption, including requiring physical exam data to be stored electronically as well as introducing health smart cards.[1]

Thirty-five million national health insurance e-cards have been issued in Japan since 2003, and the implementation of a personalized medical file is being considered for 2011.

[1] "Japan Plans to Digitize Health Information," *Nikkei Report*, February 14, 2007, http://www.ihealthbeat.org/index.cfm?Action=dspItem&itemID=130617.

Success. In late 2005 the Japanese government began promoting online processing for medical bill claims. 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 began in 2006 involving more than 12 large hospitals and their regional screening and payment institutions. The government provides 30 Yen (about $0.25) 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 online system along with some other HIT system).

Setback. In 2006, half the participating municipalities abandoned a Ministry of Economy, Trade and Industry (METI) EHR pilot project when the ministry ended its financial support for the project after the first year. This was a major setback for national HIT adoption in Japan.[2]

HIT Implementation: Lessons Learned

Framework for Information Technology Infrastructure for Health	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 both to lack of leadership by hospital top management and to inadequate project management by system integrators.
EHR customization is not always necessary	Until recently, EHR systems were mostly customized. Cost pressures, as well as better understanding over time of hospital requirements, have led to an increase in non-customized EHR systems. The initial cost of non-customized EHR system installation is now less than one million Yen per bed.

Government Policy

In January 2006 Japan's Cabinet IT Strategic Headquarters issued its most recent "e-Japan" strategy, which seeks to reduce health and other social costs through structural reform. The focus is on the establishment and promotion of both healthcare and e-government ICT infrastructures.

Who Drives HIT?

Japan's Cabinet IT Strategy Headquarters has been driving IT adoption, primarily through the e-Japan project and since 2006 through its IT New Reform Strategy. In March 2007 the government announced the "Information Grand Design on Healthcare, Health, Elderly Care, and Social Security," which outlined four specific areas of reform:

- collection and analysis of health check-up, treatment, and receipt data
- installing EMRs and creating interoperability in medical institutions
- creating receipts for data online
- establishing personal health cards

[2] "Japanese EHR Project Rejected," *Daily Yomiuri* Online, August 16, 2006, http://www.ihealthbeat.org/index.cfm?Action=dspItem&itemID=124268.

Who Pays For HIT?

Previously, the government subsidized HIT adoption. For example, from 2001 to 2003 the government provided 280 hospitals with subsidies worth 45 billion Yen to promote electronic medical record adoption. In 2004, at the end of the subsidy period, 12% of hospitals had adopted EMR (half the rate in the United States). After 2004 the pace of adoption declined as hospitals became responsible for paying for EMR.

Challenges

Challenges	Solutions
Few IT experts in Japanese hospitals. This shortage is due to the late adoption of IT in these institutions as well as to a 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 outsourced by hospitals.	METI hopes to institute policies that put into place skilled Chief Information Officers (CIOs) in hospitals and improve IT competency throughout the hospital.
Difficulty networking hospitals and clinics. No standards exist for paper medical records, nevermind EHRs. As a result many uninteroperable versions of customized EHRs with identical functions exist.	The Ministry of Health, Labor and Welfare and METI are trying to coordinate medical services and patient information sharing among hospitals and clinics in each region.
Heavy focus on late-stage disease rather than early health. In general, a healthy person does not focus too much on health issues until the onset of illness.	Society must incentivize healthy behaviors and a proactive approach to health. Health education from an early age is critical in this regard.

Future Direction

Personal health cards are under discussion in the Japanese government, and next steps will be reached by during FY2007. The card would initially be distributed on a voluntary basis to all holders of national insurance (including dependents) and would contain all health check-up, medical, and payment records for participating individuals. The benefit would be for the individual to accrue, own, and analyze all of his or her own health-related information. Personal health cards would be interoperable between medical institutions and would facilitate a streamlined payment processes. Current expectations call for a minimum of five years for card roll-out.

Healthcare Landscape

Expenditure

In 2005 Japan spent 7.7% of its GDP on healthcare. The government spent 17.2% of its general budget on health.

Coverage

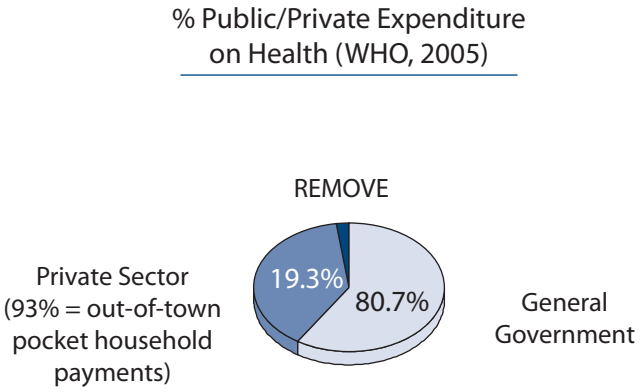
- Japan has universal healthcare coverage, which the country provides through the community-based National Health Insurance scheme or the Employees' Health

Insurance. Membership in one or the other scheme is compulsory. Monthly premiums are calculated slightly differently for each, but are based mostly on salary. Coverage for medical costs also varies between the schemes.

- Members in the Employees' scheme must also join the Employees' Pension Insurance scheme; there is also a National Health Program for the Elderly for people over age 70 that is funded by contributions from the two main insurance schemes. These schemes currently pay 10% of costs, though this figure is expected to increase. Private health insurance is rarely utilized in Japan.

Infrastructure

As of October 2002 there were 169,079 medical institutions in operation in Japan. From the early 1950s through 1990 the number of hospitals in Japan increased annually, but in 1992 the number decreased to less than 10,000. By contrast, the number of general clinics with no beds continues to increase.[3]



[3] Director-General for Policy Planning, Ministry of Internal Affairs and Communications, "Guide to Official Statistics in Japan," http://www.stat.go.jp/English/index/official/215.htm#2.

New Zealand HIT Case Study

Andrew Terris, *CEO*, HealthMAP Ltd. and *Co-Founder*, Healthphone Ltd.

Summary

New Zealand has a highly integrated health IT capability, which is facilitated by its having implemented a single national patient identifier—the National Health Index (NHI)—in the 1980s. National secondary patient information collections have since grown over time.

New Zealand's current Health IT Strategy (HIS-NZ), established in August 2005, targets 12 action zones, with a heavy focus on primary and community care, as well as the integration between care settings. The strategy recognizes the need to transition from a focus on secondary health information to an integration of information between secondary, primary, and community care settings. The initial focus of the governance group established for the stewardship of the strategy (HISAC) has been the National Network Strategy and National Systems Access.

HIT Adoption

The evolution of systems has been based on establishing and maintaining primary and secondary information systems integrated by a core set of systems with a focus on public, inpatient events. HIT in New Zealand has seen a high uptake of general practitioner systems—99% for approximately the last ten years—with four main systems in use, including:

- National Health Index
- Health Practitioner Index
- National Minimum Dataset (hospital event summary)
- Medical Warning System

With this core established, the focus shifts to integrated primary, community, and secondary information, including:

- national non-admitted patient (outpatient) collection
- integrated mental health system (service provision and outcomes from primary and secondary care settings)
- national primary and community care collection

Though patient management systems exist in all government-funded secondary care facilities, their use of data in clinical systems has been limited, with inconsistent deployment. Interchange of information, particularly in the diagnostics and clinical support arena, is a focus area not yet widely implemented. This is driven primarily by the development of standards. New Zealand's Health Information Standards Organization (HISO) has standards initiatives targeted at electronic referrals, status, and discharge, eLab results, and ePharmacy.

Lessons Learned

- Successful HIT adoption requires clinical information buy-in among all stakeholders. Accuracy of information relies on having data collected as close as possible to the point of care. Engaging clinicians to do this relies on having the information serve a clinical purpose first, with the ability for it to be mined for management and administrative purposes as a secondary goal.
- Information-sharing and collaboration rely primarily on the adoption of standards.
- Real value comes from outcome information as well as inputs/episodic information.
- Sector innovation should be encouraged. New Zealand has approached this by supporting the Health IT cluster of NZ Health IT Vendors.

Government Policy

HIS-NZ: The New Zealand Health Information Strategy[1]

Action zones	The HIS-NZ, published in 2005, outlines 12 actions zones which can be generally grouped into three areas: 1. Improvement of the national systems and communications infrastructure. 2. Introducing standards, depth, and availability of information around primary, community, and chronic (long-term) care. 3. Improving connectivity between providers (eReferral, eLabs, eDischarge, and ePharmacy).
Focal areas	• Continuum of care and patient-centric information. • Coordination and bridging of gaps between healthcare providers.

Who Drives HIT?

Health IT standards are primarily driven through national (and, in some cases, regional) compliance reporting. As a public health system, New Zealand combines a range of national statistical data collection and compliance reporting for funding. Bulk funding requires reporting to validate case volumes and, oftentimes, payment subsidies. NGOs and community care providers are usually funded via regional contracts with District Health Boards (DHBs) who have a range of different requirements for compliance reporting. Although process improvement and better health outcomes are a goal, the direct adoption of IT tends to focus primarily on meeting compliance and legislative requirements to ensure continuity of funding.

Who Pays For HIT?

The cost of technology is borne by the users of the systems, whether this is DHBs, local GPs, pharmacies, or other health organizations. After new compliance requirements are announced by the Ministry of Health each year, vendors update their applications to meet the new requirements.

The government funds new, and updates to existing, national collections and registers at a central level while vendors absorb the other update costs into annual maintenance fees to meet new requirements for the end-user community. Where new collections are required,

1 See http://www.nzhis.govt.nz/publications/strategy.html.

subject matter experts are co-opted from the health community (across vendor, clinical, healthcare providers, and consumers) to have input to the new standards—investment of time on these advisory panels is largely on a voluntary basis. There is a national Health IT vendor vehicle (the New Zealand Heath IT Cluster), a voluntary organization which sponsors collaboration initiatives funded by dues from its membership (the New Zealand Ministry of Health is a founding member of this organization).

Challenges

Transferable models	There is a dearth of successful business models and available capital for HIT adoption.
Standardization	The age and divergence of existing patient management and practice management systems make standardization and information-sharing between institutions difficult.
Cost	Deferred maintenance and low budgets for new and replacement HIT systems delay progress and integration.
Capacity	Capacity for new national projects is limited. It can be difficult to balance the need to meet current demand and shifting the focus to a new paradigm of health information.
Collaboration	Collaboration is easy to describe yet difficult to engineer (who pays and who benefits?).
Leadership	Strong sector and central leadership is necessary.

Future Direction

New Zealand faces a growing aging population and an increased burden of chronic illness. Successful health information will be gauged on efficacy of healthcare delivery and decreasing the reliance on secondary care.

This places the focus on a patient-centered record, available at point of care with standards-based information available to validated healthcare professionals (in line with most other countries). As New Zealand heads toward its goal of integrated data, including a primary healthcare record and outcomes measurements, the challenge will be to replace yesterday's "hospital-centric" health information with a borderless record. In navigating this course, New Zealand continues with center-driven health standards and an encouraging clustering of initiatives—a collaborative health record across care settings with the patient at the center. The true test will be in the leadership, funding, and execution of the vision.

Healthcare Landscape

Expenditure. New Zealand's health system is funded mainly by the government, and provides health and disability services to all citizens. New Zealand has a population of 4.1 million with a commonwealth-based (publicly funded) healthcare system and a public health budget of $6.5 to 7 billion. Over 75%of healthcare is publicly funded.

- Public health expenditure in 2003 was 6.3% of GDP
- Private health expenditure in 2003 was 1.8% of GDP

Coverage. Essential healthcare is still provided free to all residents through the public health system; 38% of New Zealanders are privately insured. The New Zealand health system is comprised of public, private, and voluntary sectors that work together to provide and fund healthcare, which is provided at two levels:

- Primary care is offered by practitioners that people access outside a hospital; for example, GPs, mobile nursing and community-based services, dentists, physiotherapists, osteopaths, and counselors.
- Secondary health services are hospital-based.

Infrastructure. Twenty-one DHBs are responsible for the health of their respective population. DHBs have a provider arm (secondary services) and a funder arm (funding primary healthcare organizations) within their region for an enrolled population.

- There are approximately 17,000 general practitioners, specialists, nurses, midwives, pharmacists, physiotherapists, occupational therapists, and private hospital providers.
- There are a further approximately 800 community, aged care, and non-government mental health providers—partly funded by charity, DHB contracts, and private insurance-based funding.

Singapore HIT Case Study

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Bee Kwan Lim, *Deputy Director*, Infocomm Division, Ministry of Health
Peter Chin Seng Tan, *Assistant Director*, eHealth, Infocomm Division, Ministry of Health

Summary

Singapore is an island economy with a population of about 4.2 million. HIT is a priority for the government, and hospital administrators and clinicians alike recognize the importance of continuing to integrate IT into Singapore's health system. From the early stages of HIT adoption, the government adopted a pragmatic approach focused on implementing immediate goals rather than a holistic one that encompassed all foreseeable needs and concerns.

HIT Adoption

In 1999 acute care hospitals, specialty centers, and primary care polyclinics in Singapore were restructured into two vertically integrated clusters: the National Healthcare Group (NHG) and Singapore Health Services (SingHealth). Both are owned by the government and partially funded through subsidies. By 2003 both clusters had already implemented clinical IT systems extensively. For example, Singhealth has a single-instance EMR system that covers the entire cluster. This means that a clinician in any Singhealth institution has access to EMRs generated from any other Singhealth institution. Singhealth has also implemented e-prescriptions and successfully achieved 100% adoption by clinicians. Although NHG institutions have different EMR systems, they were linked through a Cluster Patient Record Sharing system. The clusters were, however, unable to share information.

To address problems of interoperability between clusters, the Singapore government implemented an EMR Exchange (EMRX) system to enable secure health information exchange between clinicians in the public sector. In reaction to sensitivity expressed by the public, data on HIV and STD status are not shared through this exchange. Both SingHealth and the NHG are also working on deploying Computerized Clinical Order Entries (CCOE) across their hospitals and polyclinics as an important step toward improving patient safety with the help of clinical decision support systems.

IT in Polyclinics

Singapore has also been leveraging technology in healthcare through offshore outsourcing of teleradiology in polyclinics. As a result, patients save time as return trips for results are no longer necessary. Increased competition has resulted in cheaper X-rays and improved turnaround times from local radiologists, benefiting almost 60,000 patients per year. The country is also moving beyond simple X-rays to CT scans and MRIs.

IT in Primary Care Clinics

In 2006 Singapore's Infocomm Development Authority initiated a program to encourage HIT adoption among private primary care clinics through commercial vendors that provide integrated clinic management systems through a software-as-a-service model. Adoption was facilitated by the fact that both systems had integrated functions for claims submission from the Ministry of Health under its Chronic Disease Management Programme.

Progress: From Paper to Electronic Documents

Date	Document Type
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 codes for 4,553 brands with 1,428 active ingredients • routing of adverse drug reaction reports to Pharmacovigilance unit • integration to e-prescription systems for automated alerts • routing of adverse drug reaction reports to Pharmacovigilance unit • integration to e-prescription systems for automated alerts
March 31, 2006	School health system records from Health Promotion Board
October 1, 2006	Launch of Chronic Disease Management and Clinic Management System Programmes
October 6, 2006	Operating theatre and endoscopy reports
March, 2007	Cardiac and ED Reports

Government Policy

In 2003 Singapore's incoming Minister for Health, Khaw Boon Wan, identified as one of his priorities "Exploit IT Maximally," with the aim of "One Singaporean, One EMR." The Exploit IT Maximally Workgroup (ITWG), chaired by Deputy Secretary of Health Goh Aik Guan, convened in September 2003 to drive the initiative. The 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.

ITWG Operating Principles

- 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.** The ITWG would not intervene with institutions' internal systems unnecessarily.
- The 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 above, ITWG consciously steered away from proposals that required massive rebuilding of existing systems. ITWG **standardized only when the business case is strong.**
- ITWG adopted the Pareto principle by beginning with the NHG and SingHealth clusters, as they account for 80% of Singapore's acute-care markets.

Who Drives HIT?

Public sector hospitals lie at the forefront of HIT implementation in Singapore. Visionary clinician champions willing to commit the time and energy to drive implementation and encourage change among their peers have been the primary leaders of adoption. At the national level, the Ministry of Health drives country-wide HIT efforts such as EMRX. The Infocomm Development Authority (IDA), in collaboration with the Ministry of Health, has set the broad direction for HIT with the development of its iN2015 plan for the healthcare and biomedical sectors.[1] IDA also catalyzes HIT development by matching vendors with potential early adopters, as well as through the provision of seed funding for innovative pilot projects.

Who Pays For HIT?

HIT implementation is primarily funded by individual institutions themselves, driven by their own assessment of the benefits of HIT adoption. Even in the charity sector, some institutions have been able to raise funds from philanthropic organizations targeted at specific HIT projects. However, the government funds a large part of national HIT systems, such as EMRX.

Challenges

The 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 the following:

Privacy

Challenges	Solutions
• Legal implications of providing EMRs beyond cluster boundaries were considerable. • Obtaining consent from individual patients would have been cumbersome and impeded 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. • The ITWG embarked on a public EMR education campaign through printed brochures for patients and through media coverage. An opt-out scheme was set up for patients with more specific concerns.

[1] Intelligent Nation 2015 (iN2015) is Singapore's ten-year master plan for realizing the potential of infocomm over the next decade. Led by the Infocomm Development Authority of Singapore (IDA), iN2015 is a multi-agency effort that is the result of private-, public-, and people-sector co-creation. For more information, see http://www.in2015.sg.

Data Standardization

Challenges	Solutions
• 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, because 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 the clusters.	• For treatment, clinicians required only information that was "as good as paper records." Thus, the ITWG determined that clinician-readable documents were sufficient for standard goals and that machine-readable EMR data was unnecessary at this stage. • The 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

Challenges	Solutions
• EMRs shared with other institutions could become outdated, resulting in the source institution being liable if such outdated EMR became a contributing cause of medical errors.	• EMRX adopted a pull-on-demand— rather than pre-delivery—model. • The ITWG determined that EMRs will only be pulled at the request of clinicians and discarded after use. Storage is prohibited.

Current Exemplars

SMS health systems	• Tan Tock Seng Hospital developed an SMS system to transmit information to its doctors. • SingHealth and the NHG have deployed SMS for patients at Specialist Outpatient Clinics through appointment reminders and queue management.
National Heart Center and Singapore General Hospital home telecare solution	This solution integrates the Internet, SMS, web portal, and mobile phones to monitor patients' vital signs at home. The system sends SMS alerts to both doctors and the patients whenever vital signs are beyond set thresholds.
National University Hospital computerized patient support system (CPSS)	CPSS at National University Hospital enables an integrated view of patient data from multiple source systems such as X-rays, laboratory results, surgical operating notes, discharge summaries, clinical results, and reports.
SingHealth motorized mobile triple LCD X-ray light box	SingHealth designed the wireless light box to allow doctors to bring digital images and EMRs to patients' bedsides for more effective, personal consultations.
Changi General Hosital interactive patient guide (IPG)	Changi's IPG allows patients to obtain information on treatments, surgical procedures, and aftercare of 25 common medical conditions through online video and printable text.

Future Direction

Now that EMRX has been fully implemented in the public sector, the next logical step is to extend it to the private and charity sectors. However, as these sectors are more diverse, Singapore needs to take more deliberate steps in close consultation with the community. In particular, the obstacles that the country had previously overcome—regarding privacy, data standardization, and data ownership—will need revised solutions in a broader landscape amidst rising clinician expectations for HIT.

Healthcare Landscape

Expenditure

The government subsidizes public health services, and provides free basic emergency care. 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.

- In 2005 total expenditure on health was 3.6% of GDP, with 34.7% coming from the general government and the private sector spending 65.3%.
- The government expenditure on health was 6.3% of general government expenditures.[2]

Coverage

- ***Medisave.*** A national medical savings scheme which helps individuals put aside part of their income into their Medisave Accounts to meet their future personal or immediate family's hospitalization, day surgery, and certain outpatient expenses. Introduced in 1984, Singaporeans contribute 6 to 8% of their income to Medisave.
- ***Medishield.*** A low-cost catastrophic insurance scheme designed to help patients meet the medical expenses their Medisave balance would not be sufficient to cover. Medishield was introduced in 1990.
- ***Medifund.*** An endowment fund set up by the government in April 1993 to help needy Singaporeans who are unable to pay for their medical expenses. This fund acts as a safety net for those who cannot afford medical care even with Medisave and MediShield coverage.
- ***ElderShield.*** An affordable severe disability insurance scheme, introduced in 2002, designed to help Singaporeans meet expenses associated with severe disability. ElderShield premiums can be paid using funds from the individual's Medisave accounts.

Infrastructure

- Private practitioners provide 80% of primary healthcare services while government polyclinics provide the remaining 20%. Public hospitals provide 80% of the more costly hospital care, however, with the remaining 20% provided by private hospitals.
- The public healthcare delivery system is comprised of seven acute care hospitals, nine specialty centers, and 17 primary care polyclinics. In 1999 these institutions 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 subsidies.

[2] See http://www.who.int/nha/country/SGP.pdf.

- The private healthcare sector comprises 16 private hospitals and approx 1600 primary care clinics. A vibrant charity sector includes four community hospitals that provide intermediate care as well as five "Chronic Sick" hospitals and 56 nursing homes that provide long-term care.

Taiwan HIT Case Study

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Summary

Taiwan has a population of over 22 million and covers an area of 13,900 square miles. Technology-intensive industries make up over half of the economy. Taiwan began implementing its health information network in the 1980s and continues to invest in HIT today, perfecting existing systems and incorporating new applications. Leaders in Taiwan acknowledge that HIT not only helps to provide efficient and safe medical care but will also play a significant role in sustaining the economy's national health insurance system. Currently, all hospitals and most clinics are connected to the Bureau of National Health Insurance through (BNHI) a Virtual Private Network (VPN) for e-claim purposes. Additionally, all residents use health smart cards that contain limited EHRs.

HIT Adoption

1989	Government-initiated decision to establish a National Health Information Network (HIN)
1991–1993	Pilot HIN tested in Hsinchu medical care region
1994–1996	HIN plan extended to other regions in Taiwan
1999	Phase II of HIN begun with the following foci: bandwidth and VPN upgrades, local resources analysis, and web-based application and standards development.
2001	BNHI introduced smart cards

Health Information Network

In the 1990s the government of Taiwan built an island-wide information network consisting of four regional centers and a TCP/IP over-frame relay backbone. The relay connects the Department of Health, regional information centers, and BNHI. The network also includes telemedicine centers that function in collaboration with several university hospitals.

The first version of the health information network succeeded in supporting basic public health administration, hospital regulation, and cancer registries. The network faced bandwidth problems, however, as applications began to involve more multimedia. Additionally, systems were not always interoperable among different institutions. Finally, despite the system's existence only 13% of health insurance claims and almost no patient referrals were conducted electronically. As a result, in 1999 the government launched Phase II of its health information network plan, which included VPN connections and placed emphasis on privacy and security, EHRs, a health insurance smart card, and access to information for health professionals.

Smart Cards

In 2001, the BNHI began the process of replacing paper-based patient ID cards with smart cards in order to increase efficiency and reduce fraud and cost in the health system. The smart cards include the following patient information:

- ***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, and long-term prescriptions
- ***Public health administration information.*** Such as immunizations and instructions for organ donation

Additionally, the cards consolidate functions of four different vouchers, including the regular paper ID card, the Children's Health Handbook, the Prenatal Exam Handbook, and the Catastrophic Illness Certificate. Smart cards are convenient for both the card holders—as they condense material and information to keep track of and do not need to be renewed—and healthcare providers and medical institutions as they streamline previously time-consuming and costly processes and transactions and drastically reduce fraud.

Who Drives and Pays For HIT?

The government is the key driver of an integrated island-wide health information system in Taiwan, and is responsible for the creation (and funding) of Taiwan's successful health smart card. But hospitals, too, have played an important role in integrating IT into the health sector and generally cover the costs of their individual HIT systems.

Challenges

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 use, and outcome variations are all sensitive information.

Current Exemplars

Taipei Medical University — WanFang Hospital, Taipei	• Successfully implemented automatic notification of critical lab and examination results by sending SMS messages to physicians' mobile phones • Shortened information lag from 30 hours to 3 minutes • Captures 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 • Successfully developed CPOE system • Plan to replace whole health information system in 2007
Chang-Gung Memorial Hospital, Chiayi	• Fully paperless and filmless EHR hospital from its launch stage in 2002

Healthcare Landscape

Expenditure

Taiwan spends around 6.2% of its GDP on healthcare and 3.7% on National Health Insurance (NHI).

Insurance

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. Insurance is funded through employer contributions, government subsidy, and enrollee premiums. More than 93% of all physicians, hospitals, and clinics in Taiwan participate in the NHI.

Infrastructure

There are 16,742 clinics and 594 hospitals in Taiwan, all of which offer both Western and traditional Chinese medicine. Government Hospitals are comprised of medical centers and municipal hospitals, which focus on acute and long-term care, and city hospitals. Private hospitals consist of medical centers, regional hospitals, and local and small hospitals.

Thailand HIT Case Study

Thongchai Thavichachart, *CEO*, Thailand Center of Excellence for Life Sciences
Narong Kasitipradith, *President*, Thai Medical Informatics Association

Summary

For over twenty years, both public and private hospitals have been trying to take advantage of the benefits of IT to improve health services in Thailand, yet varying resources and requirements of each institution have made for scattered, unharmonious HIT development throughout the country. The Ministry of Public Health made several attempts over the last ten years to develop a nationwide electronic medical record. However, hospitals responded unenthusiastically to the lack of immediate incentives and perceived benefits for each institution in exchange for the investment that building a common system for data sharing would require. Nevertheless, in 2007 an EMR exchange network remains in development, with the 21st century attempt likely to bring about new success in this area.

HIT Adoption

At present all 82 government provincial and large private hospitals in Thailand use some form of IT internally to manage drug dispensing, receipts, outpatient card searching, and appointment booking. The electronic medical record exchange system initiative in Thailand currently involves a few public and private institutions with a clear goal of supporting the medical tourism industry. This small but advanced partnership will act as the pilot project to help develop a model for wider coverage and a more comprehensive, farther-reaching system in the future.

Hospitals share this information externally through hard copies, such as claims for health insurance. Most hospitals have unique software programs that are designed specifically for their internal use and operate quite comfortably within each institution's legacy IT systems. Unfortunately, these unique IT systems make electronic information-sharing across hospitals impossible. This has not been a major issue however, as most hospitals tend not to share a great deal of data externally.

12-Files System. In 1997 the Ministry of Public Health began designing a health IT system to facilitate the sharing of medical data among healthcare providers and the Ministry's Health Statistics Unit. Known as the "12-files system," this HIT system currently incorporates hospital outpatient and inpatient records, financial information, referral data, and health coverage data. More than 800 provincial and district hospitals across Thailand are linked or participate in the 12-files system.

18-Files System. Separate from the 12-files system, the 18-files system is used by primary care units (PCUs) throughout Thailand and will be in full operation in June 2007. The system includes outpatient data on disease surveillance, behavior, death records, immunization, and family planning. The 18-files system will also incorporate data on community health prevention and promotion. The data will be transferred from subdistrict to district levels, to the province, and finally, to the central government unit at the Bureau of Health Planning and Strategy. Database records are projected to number 150 million by the end of 2007. The National Health Security Office (NHSO) has committed to support this data transfer by providing compensation for data mobilization to every PCU and relevant PCU Contracting Unit Purchaser (CUP) as well as to every Provincial Medical Office. Although there is currently no connection between the 12- and 18-files systems, linkages may be addressed in the future.

Who Drives HIT?

Traditionally, the Ministry of Public Health has been the primary driver for HIT in Thailand. For the purpose of promoting medical tourism, however, TCELS is now a driving force behind HIT. Additionally, the Thai Medical Informatics Association has been promoting technical input to the development of a national HIT system.

For a system to achieve success, however, both government agencies and private-sector organizations (hospitals and insurance companies) will need to join forces in support of HIT implementation. The National Health Security Office, whose major responsibility is to provide quality health services to the community, could play a vital role in mobilizing funding for such an important endeavor.

Who Pays for HIT

Until 2007 financial support for HIT, offered primarily by the government, had been limited. This year the government increased funding for HIT. The Ministry of Public Health currently finances the development of a nationwide health IT system, and the National Health Security Office (NHSO) has committed to support data transfer between hospitals to the office for reimbursement. Individual hospitals pay for IT systems and standardization in their respective institutions. Private-sector institutions do not play a large role in financing HIT in Thailand.

Challenges

Funding

Challenges	Proposed Solutions and Current Measures
Because it is a colossal and complicated undertaking, HIT requires both an immense budget and unique collaboration between private- and public-sector partners.	The government has already contributed significant financial resources to HIT development, but now needs to inject a handsome amount of budget to propel HIT implementation. Hospitals alone cannot and will not cover the cost of adoption.

Political Commitment

Challenges	Proposed Solutions and Current Measures
The amount of work to be done, the resources required, and the time scale for HIT adoption are all tremendous. Thus, HIT implementation requires an unwavering commitment from the government, which the Ministry of Public Health has for the most part provided.	In order to show results and sustain official support from policymakers HIT adoption should be phased into smaller pilot projects, working in small steps to achieve the goal of a national health IT system.

Privacy and Security

Challenges	Proposed Solutions and Current Measures
The public has expressed anxiety over the possible abuse of widely available health data for discrimination in jobs and insurance eligibility.	This fear warrants careful consideration. Cautionary steps in preventing abuse, including national policies on information-sharing, should be introduced to ensure the pubic of anonymity and confidentiality.

IT Professionals

Challenges	Proposed Solutions and Current Measures
Shortages of IT professionals, especially in the public sector due to government headcount limitations present a challenge for the growth of HIT.	Creating incentives for those with IT skills to enter the healthcare realm are necessary.

Current Exemplars

HIT Standards in Hospitals	Major hospitals, such as Siriraj Hospital, Ramathibodi Hospital and Bumrungrad, a prominent private hospital in Bangkok, have incorporated the HL7 standard into their IT systems.
Pharmacogenomics Database Project	Thailand Center for Excellence in Life Sciences (TCELS), in collaboration with Mahidol University's Faculty of Medicine, Ramathibodi Hospital and Oracle Co. Ltd. (Thailand), is conducting a study in patients with Thalassemia, diabetes, cardio vascular diseases, rheumatoid arthritis, HIV/AIDS, leukemia in children, Dihydropyrmidine dehydrogenase, and post-traumatic stress disorder. The project's clinical database of patients with these different diseases will facilitate quick, cost-effective clinical research. Currently, the project's database system and its clinical data record program are complete and have passed preliminary testing. Ultimately, TCELS and its partners seek expand the project database into a national genetic database.

Future Direction

Thailand intends to develop an electronic medical record exchange system in a limited number of private and governmental hospitals. The system will follow the standard Clinical Document Architecture (CDA) format, which is based on the HL7 Reference Information Model standard. The "exchange" element of this system will take place among healthcare providers from different sectors within Thailand, as well as with the home institutions of some foreign tourists. The timeline for standards adoption is as follows:

- The CDA standard will facilitate a smooth transition to HL7, which will be become a nationwide standard in the foreseeable future.
- Level 2 CDA is relatively undemanding and easy to learn as it does not require much medical vocabulary coding. When all involved parties (i.e., hospital administrators, clinicians, and It professionals) feel comfortable using level 2 CDA, they will then

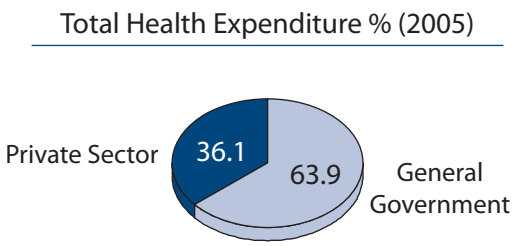
be introduced to the next step of Level 3 CDA, which requires more medical coding, such as SNOMED (Systematized Nomenclature of Medicine). There will be nationwide training programs for all systems.

- After the implementation of Level 3 CDA, the Ministry of Public Health will facilitate the HL7 migration for interested hospitals.

Healthcare Landscape

Expenditure

- In 2005, expenditure on health totaled 3.5% of Thailand's GDP.
- Private households' out-of-pocket payments represent 76.6% of total private expenditure on health.
- Total expenditure on health per capita is $96.
- General government expenditure on health per capita is $61.[1]



Coverage

Civil Servant Medical Benefit Scheme (CSMBS)	Social Security Scheme (SSS)	Universal Coverage Scheme (UCS)
• % of Population covered: 10 • Financed by: Ministry of Finance	• % of Population covered: 11 • Financed by: Social Security Office, Ministry of Labor	• % of Population covered: 79 • Financed by: National Health Security Office and Ministry of Public Health
A fee–for–service payment system, CSMBS provides medical coverage to government employees, retirees, and their dependents (including parents, spouses and up to three children who are less than 20 years old). This scheme is the largest in terms of expenditures involved and features the most extensive benefits package. Covered persons are entitled to free medical care in public hospitals and partial reimbursement for care in private hospitals.	The SSS provides seven types of benefits under the Social Security Fund (SSF) and three types of benefits under the Workmen's Compensation Fund (WCF) for workers working in enterprises with one or more employees. Employers and insured employees each pay 5% of wages to the Social Security Fund. The government contributes an additional 2.75%.	The UCS was introduced in October 2001 to provide essentially free medical care for all who are not covered by other systems, with small co-payments of 30 Thai baht per hospital visit. The program is designed to provide health benefits to those who cannot afford to purchase their own healthcare or health insurance. Within the UCS, the number of individual patient records currently totals about 6 million each year, with private and public hospitals combined.

[1] WHO values, calculated using the March 2007 exchange rate.

Private health insurance policies are also available for those who can afford the premiums, which are usually higher than that of well developed countries due to a narrower clientele. In addition to Western-style medical care, there are also alternative treatments for minor ailments such as Thai traditional medicine, Thai massage and spa.

Infrastructure

- There are 298 private and 1,185 public hospitals, with a cumulative total of 133,245 beds.
- Approximately two-thirds of Thailand's population of 64-million resides in rural areas. Although beds and doctors (in both public and private institutions) are concentrated in Bangkok, the government has built up primary care health centers in community hospitals in more than 90% of districts throughout the country. Most Thai healthcare professionals are employed by the government, but there is a new trend of medical professionals working full-time in private hospitals.

United Kingdom HIT Case Study

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National Health Service Connecting for Health

Summary

Over the next ten years, health service in the United Kingdom 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]

The UK's National Programme for IT is already providing essential services to support patient care and the smooth operation of the National Health Service (NHS), without which it could not properly function. Installation of a modern, high-speed, secure infrastructure and national network has been completed ahead of schedule and supports millions of NHS business transactions daily. Key systems have been successfully deployed on time and are benefiting patient care. At the heart of the National Programme is the NHS Care Records Service, which will provide a lifelong, electronic personal health record for NHS patients in England.

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

HIT Adoption

Growth in volumes of activity on National Programme for IT systems is rising dramatically with the increase in functionality across the NHS Care Records Service (NHS CRS) and continuing roll out of the various elements of the system. The spine is already the world's largest structured healthcare messaging system. The national Picture Archiving and Communications System (PACS) program will ensure that all acute trusts will have the technology in place by the end of 2007, with the south and London on target to achieve this by the end of March. By the end of 2007, every GP and community pharmacy in England will have access to the Electronic Prescription Service (EPS).

In the three years since NHS Connecting for Health contracts were awarded, over 15,000 instances of new IT deployments of all types have gone live. Progress includes the following:

- over 339,000 users registered for access to the NHS Care Record Services
- over three million Choose and Book Electronic Bookings since July 2004
- nearly 19,000 National Network (N3) secure broadband connections, including 9,637 GP locations (practices and branch surgeries)
- 193 million digital images stored using PACS live in 84 NHS sites
- nearly 16.5 million prescriptions transmitted using Electronic Transmission of Prescriptions (ETP) system since February 2005
- over 8,600 GP practices (more than 28,000 GPs) using the Quality Management Analysis System that pays GPs £600m based on quality outcomes daily
- over 241, 000 registered NHS secure e-mail users, many of whom use the system daily

Government Policy

21st Century IT—National Programme for IT[1]

NHS Connecting for Health has awarded contracts worth a total of £6.2 billion to deliver the National Programme. The contracts—to run until 2013—have been awarded to local systems and services to:

- facilitate access and use of the NHS Care Records Service
- provide IT support at a local level
- provide essential infrastructure
- connect to existing systems in the NHS

The contracts underpin the delivery of 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. The Summary Care Record went live in early adopter sites in spring 2007. Development of the detailed care record continues. 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, seven days a week, by authorized health and care professionals, in whichever NHS organization they work. When 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.
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.
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. • The images are available to all health professionals authorized to access then by reason of their role and their relationship with the patient, and subject to the patients' consent • PACS will enable centralized storage of images as well as full compatibility with the National Programme's other services and will provide 100% access to digital images in NHS organizations throughout England.

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

Electronic Transmission of Prescriptions	The ETP program delivers a service that will 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 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 is provided free of charge for NHS staff in England and Scotland and has been developed specifically to meet professional requirements for clinical exchange between NHS organizations.

Who Drives HIT Adoption?

The national HIT implementation framework in the UK is designed to encourage innovation and investment from the private sector, for example through initiatives like the Preventative Technology Grant that promote the use of telecare to enable older people to live independently and with dignity for longer.

Investment in HIT and the coordination of HIT implementation is led through national programmes such as the National Programme for IT and its equivalents in the devolved administrations. The underlying drive for the adoption of HIT in healthcare, however, comes from clinicians and hospitals concerned with the good clinical practice and the safe and effective delivery of healthcare.

Who Pays For HIT?

The Government funds the vast majority of HIT in the UK both via the Department of Health in England and the health departments of the devolved administrations in the remaining UK. The National Programme for IT is funded directly by the Department of Health. The NHS in England spends roughly $2 billion on information management and technology. Individual hospitals also make significant individual investments in IT.

Challenges

Historically, the NHS has not developed IT as a strategic asset in delivering and managing healthcare. 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 healthcare by the NHS existed, including the following:

Funding	IT funding has been a low priority for many Primary Care and Acute 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	Improved 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 has been limited by low levels of secure, high-bandwidth connectivity, backed by means authenticating users to access sensitive patient information.

Healthcare Landscape

Expenditure

- Net expenditure in the NHS (England) is about 7% of GDP in 2006–2007. The largest portion of NHS spending is on Hospital and Community Health Services, discretionary Family Health Services (HCFHS), and related services.
- General government expenditure on health in 2003 (WHO): 85% of total health expenditure
- Private expenditure on health in 2003 (WHO): 14.3% of total health expenditure
- General government expenditure on health in 2003 (WHO): 15.8% of total government expenditure

Coverage

Healthcare is available free of charge at the point of need to all UK residents and is funded through national taxation. About 11% of the population is covered by private healthcare insurance, used predominantly as complementary to NHS healthcare (e.g., for cosmetic or non-urgent procedures).

The distinction between public and private healthcare provision is not always clear. Private hospitals can offer NHS treatment, and NHS hospitals can offer private treatment. Having private health insurance (or otherwise paying for private treatment) does not of course preclude patients from receiving NHS care, and it is quite possible for a patient to elect to pay for private treatment as part of a course of NHS care.

Infrastructure

- ***Primary Care Trusts (PCTs).*** About 150 PCTs cover all parts of England and report to their local Strategic Health Authority, buy and monitor health services, and support NHS organizations.
- ***General Practitioners (GPs).*** GPs attend to local community health and provide over 300 million consultations each year. Every UK citizen has a right to be registered with a local GP. Surgery visits are free.
- ***Hospitals.*** Acute Trusts manage hospitals to ensure efficient operations and the highest quality healthcare. 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. There are about 174 private hospitals in the UK, run by nine organizations, and just under 100 private units in NHS hospitals.

United States HIT Case Study

Howard Isenstein, *Vice President for Public Affairs and Quality*,
Federation of American Hospitals

Summary

U.S. adoption of health information technology (HIT) has been stymied for a myriad of reasons. Many observers expect that it will be at least a decade before the majority of U.S. providers use electronic health records (EHRs). Efforts to bolster the diffusion of EHRs include plans to create a national infrastructure, develop standards, and promote public-private partnerships to develop regional HIT organizations. Pockets of high quality, widely-adopted EHRs have developed at the Veterans Administration (VA), Intermountain Healthcare, Partners Healthcare, and elsewhere in the country, but these successes remain the exceptions to the rule of relatively low adoption by providers, particularly doctors who practice in one- to five-physician settings. The key challenge in the United States remains driving broad-based adoption in a nation where health is financed by a wide variety of payers, all of whom have different visions, priorities, and budgets.

HIT Adoption

U.S. providers have been experimenting with HIT since at least the 1960s. However, providers have been slow to adopt HIT for a variety of reasons, including:

- high cost of initial investment and ongoing maintenance
- short-term loss of productivity due to adoption of new systems
- fear of and difficulty in changing workflow

Though high-quality data about HIT adoption is fairly thin, the best studies indicate that about 17–24% of physicians in outpatient settings use EHRs. The outlook in the hospital sector is considerably brighter. According to a 2007 American Hospital Association survey of its members, 68% reported fully or partially implemented EHRs in 2006. However, only about 11% reported fully implemented EHRs. Hospitals in the second category are likely to be large, urban, or teaching hospitals.

Government Policy

Only in the last few years has Washington, D.C., attempted to create any HIT policy. A timeline of selected government HIT developments is outlined below:

2007	• FY2008 U.S. HHS Budget Proposal includes $118 million for ONCHIT • The Personalized Health Information Act (H.R.6289) bill introduced on March 1st, offering financial incentives to providers that contribute to PHRs sectors (not passed)
2006	• AHIC delivered first set of recommendations to HHS Secretary addressing consumer empowerment, chronic care, EHRs, and biosurveillance. • CCHIT certified 37 ambulatory EHR products. • U.S. House of Representatives approved the "Better Health Information System Act" (HR 4157) to establish a National Coordinator to implement a nationwide plan that organizes and manages federal government activities relating to health information technology for both private and public
2005	• Establishment of the Office of the National Coordinator for Health IT (ONCHIT) • Formation of American Health Information Community (AHIC), a federally-chartered advisory committee that makes recommendations to the HHS Secretary on how to make health records digital and interoperable, encourage market-led adoption, and ensure that the privacy and security of those records are protected at all times • ONCHIT awarded nine contracts to conduct work on related HIT issues: security, standards, EHR adoption, etc. • Certification Commission on Health Information Technology (CCHIT) established
2004	• State of the Union Address, President Bush called for EHRs for all Americans by 2014 • Presidential Executive Order 13335 to establish the National Coordinator for HIT to provide counsel to the Secretary of the Department of Health and Human Services for the development of a nationwide, interoperable HIT infrastructure

Congress, for its part, has taken up a wide variety of bills in both the House and Senate on HIT. In 2006 the House and Senate separately passed HIT legislation, but the legislation ended up dying in a conference committee made up of House and Senate negotiators. The 110th Congress has several proposed bills on health IT and personalized health records; it is unclear whether a comprehensive HIT bill will be passed by the House and Senate, but given a variety of other key health legislation being considered prospects for HIT legislation are not bright.[1]

Who Drives HIT?

Efforts by both Congress and the Administration have accelerated in the past few years, and there is clear momentum across the country to enable Americans to enjoy EHRs. Neither Congress nor the Administration, however, has moved very far in terms of passing legislation and funding HIT efforts. Instead, individual providers, payers, states, regional organizations, and others are engaged in a wide variety of separate efforts. It should be noted, however, that the Department of Veterans Affairs, the Department of Defense, and the Indian Health Service maintain robust EHR systems.

There are five key factors that drive HIT adoption in the United States:

- financial incentives
- laws/regulations

[1] For information on specific HIT-related legislation in the United States, please visit the "Policy Landscape" page on the eHealth Initiative website, http://www.ehealthinitiative.org/ initiatives/policy/.

- increasing demands on providers to improve quality and report quality metrics to payors
- the state of the technology
- organizational culture/influences

Who Pays For HIT?

Healthcare providers pay for virtually all HIT adoption and implementation in the United States. Payors, such as Medicare and health insurance plans, generally believe that HIT should be treated like any other cost of doing business, such as labor, rent, and capital equipment. They argue that healthcare providers should adopt HIT because it can make them more efficient and hence more profitable. It should be noted, however, that there are a variety of experiments taking place throughout the country whereby payors incentivize providers to purchase and maintain HIT through one-time grants, slightly increased reimbursement, and other methods. Congress is also considering the possibility of increasing Medicare reimbursement for a limited period (five years or less) to increase HIT adoption among physicians as well as making HIT one measure in a pay-for-performance reimbursement scheme.

Challenges

Financial

Challenges	Proposed Solutions & Current Measure
Misaligned financial incentives remain.	Share investment among all parties (e.g., gainsharing and federal funding for HIT).

Legal

Challenges	Proposed Solutions & Current Measure
Concerns about newly created liability and actual or perceived legal burden of compliance with regulations.	Increase education for physicians, including advising them that liability with EHRs is relatively unchanged compared with current paper-based records.

Standards

Challenges	Proposed Solutions & Current Measure
General lack of standards that lead to inconsistent and unreliable mechanisms for matching patients to their records.	Certification should increase confidence among potential buyers and accelerate adoption: • AHIC and the Health Information Technology Standards Panel (HITSP) are working to create a wide variety of standards, including those that concern interoperability. (HITSP is a cooperative partnership between the public and private sectors.) • The Certification Commission on Health Information Technology (CCHIT) certifies such standards and will certify Inpatient EHR products in 2007. (CCHIT is a voluntary, private-sector organization.)

Technology

Challenges	Proposed Solutions & Current Measure
EHRs do not integrate with other provider software, are difficult to use, do not passively report quality metrics, and suffer from a variety of other issues.	Gradually increase certification requirements to drive EHR vendors to improve their products

Workflow

Challenges	Proposed Solutions & Current Measure
Providers have been trained to conduct medicine based on decades-old workflow, which is not conducive to new technologies.	Modify financial incentives and bolster training and management, including redesigning workflow so that EHR adoption is easier for physicians and other healthcare professionals

Education & Leadership

Challenges	Proposed Solutions & Current Measure
Multiple payors, disparate provider settings, and cultural bias toward market solutions have all resulted in a lack of national direction, a situation that is exacerbated by a relative 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.

Current Exemplars

My HealtheVet (MHV) U.S. Veterans Health Affairs	• MHV, the Veterans Health Administration's EHR system built on its Vista platform, provides access to health information and links to Federal and VA benefits and resources, as well as patients' Personal Health Journal. This closed provider system also allows patients to refill prescriptions online. • After Hurricane Katrina in 2006, the thousands of veterans who had been displaced by the storm still retained fully intact medical records. The VA's progressive Computerized Patient Record System enabled all patient records, prescriptions, and laboratory and radiology results from all New Orleans, VA patients to be accessed by any VA physician nationwide.
Systemized Nomenclature of Medicine, Clinical Terms (SNOMED CT)	• SNOMED CT is a standardized medical vocabulary available for download as part of the National Library of Medicine's Unified Medical Language System Metathesaurus (please see *http://umlsinfo.nlm.nih.gov*). The vocabulary is available free for anyone in the United States, but users must register online to receive information. • With terms for more than 300,000 current medical concepts, SNOMED CT is a comprehensive clinical terminology database that many hope will provide uniform terminology incorporation into the information systems of healthcare providers, hospitals, insurance companies, public health departments, and medical research facilities.

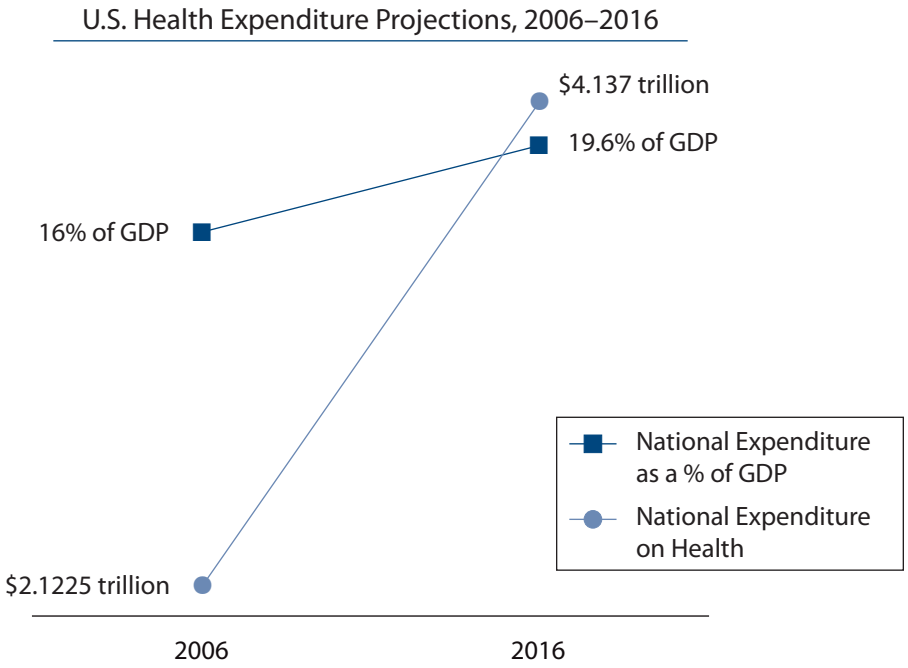
Future Direction

There is no question that EHR adoption has gained significant mindshare among U.S. providers and are generally moving in a positive direction. Undoubtedly, EHR diffusion will grow as physicians and hospitals increasingly come to see them as part of a standard of care. But without significant financial incentives, broad use of EHRs will take many years to achieve.

Advocates on all sides of the issue are also struggling to resolve ways to assure that privacy, security, and confidentiality are assured. Some consumer advocates are concerned that sensitive health information can be more easily compromised in electronic form. Until advocates reach a consensus, adoption will remain limited.

Healthcare Landscape[2]

Expenditure

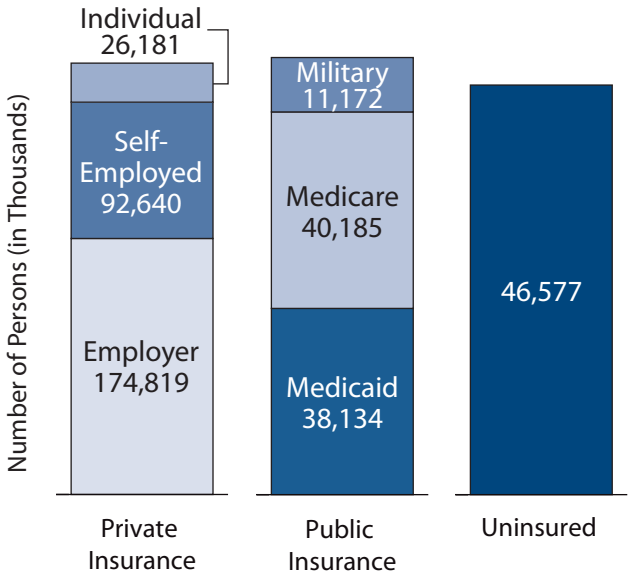


[2] U.S. Census Bureau, "Current Population Survey 2006," Annual Social and Economic Supplement, Table HI05, Health Insurance Coverage Status and Type of Coverage by State and Age for All People, 2005; and Centers for Medicare and Medicaid Services, "National Health Expenditure Projects 2006–2016," http://www.cms.hhs.gov/NationalHealthExpendData/03_NationalHealthAccountsProjected.asp#TopOfPage.

Coverage

Unlike most industrialized countries, the United States does not have a national healthcare system. As the U.S. Insurance Type figure illustrates below, 67.7% of the U.S. population receives private insurance, 27.3% of the population is covered by public insurance schemes, and the remaining 15.9% is uninsured.[3] Insurance coverage is not mutually exclusive; as a result, some individuals are covered by multiple types of health insurance.

U.S. Health Insurance Type Disaggregated, 2005



Infrastructure

Two-thirds of doctors practice independently or in small groups. There are more than 4,000 hospitals in the United States, which vary from ten- and twenty-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.

[3] Medicare is the government health insurance program for people over age 65 and for those who are on Social Security disability. Medicare is a medical insurance program, and except for a limited short-term nursing home benefit, is not coverage for nursing home or other long-term care. Medicaid, by contrast, is funded jointly by the Federal Government and individual states and provides benefits for long-term care. Military healthcare programs are provided by the U.S. Department of Defense and the Department of Veterans Affairs.

Vietnam HIT Case Study

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Summary

Attention to HIT from health policymakers and medical and IT professionals in Vietnam has been steadily increasing. Computerization and network development to improve both the quality of healthcare the management of health services and to provide information for decisionmakers are proceeding in most parts of the country. A number of hospitals are successfully employing IT to manage pharmacy and financial disclosure activities, with some initial measurable time-savings for patients and medical staff. SARS and H5N1 outbreaks in the past few years have also underscored the need for reliable records and faster reporting mechanisms.

HIT Adoption

The Department of Therapy and Department of Science and Training within the Ministry of Health are now responsible for managing and providing guidelines for IT application in the health sector. Health centers and hospitals develop their HIT based on those guidelines. HIT strategies for each hospital and health center are first determined by the institutions themselves. After settling on a specific HIT plan, a health institution can apply for approval and a budget from its direct authority in the Ministry of Health or the nearest city's health department for the following fiscal year.

Overall, computer hardware and software are present at most levels of Vietnam's public health system, but only sporadically at local levels. Telemedicine activities have just begun in tele-consultation, tele-surgery assistance, tele-imaging, and tele-cardiology. These activities have proven very useful for medical staff and patients. Examples are provided in the "Current Exemplars" section of this document.

	HIT Infrastructure
National/central hospitals	Many top-level hospitals in Vietnam have individual health information systems, The quality and daily usage of these systems vary. Most of these systems incorporate in some way Medisoft 2003 software developed by the Ministry of Health for hospitals at all levels to send statistics and reports to the Ministry's Department of Therapy.
Provincial hospitals	Provincial hospitals generally have IT networks, as well as some health information systems with linked databases for patient master indices, consultations and emergency, finance, and pharmacy.
District hospitals and commune health centers	District and commune health centers tend to have just a few computers with dial-up internet connections. Lower-level units derive much of their general medical information from television and newspaper and via training courses. Together with the United Nations Development Program, the Ministry of Health's Department of Financial Planning developed software for district and commune health information system management; however, this software is not yet widely used.

Government Policy

Policymakers in Vietnam outlined their interest in HIT development in several internal government documents relating to the suggested orientation of a national health information system. These documents include suggestions for the following:

- increasing the application of IT in health sector management
- building common software for hospitals
- improving staff capacity on IT
- strengthening cooperation with national and international organizations in HIT

The Ministry of Health is the primary driver of HIT in Vietnam, providing financial support for hospitals that have submitted appropriate IT development plans. A steering committee that includes members of the different Ministry of Health departments assesses each plan.

Vietnam's Minister of Health also recently tasked the Department of Science and Training with the management of IT application in Vietnam's health sector. Complementing those efforts, the Department of Therapy provides guidelines for hospital information systems. Finally, the Ministry's Health Information Center has additional responsibility for implementing IT projects in the health sector. Though the Health Information Center has to date experienced very limited capability to take substantive action, it streamlined activities in 2006 and anticipates much more productivity in 2007.

Official decisions regarding the application of IT in health include the following:

2006	• Decision 5574/QD (December 29) by the Ministry of Health issued guidelines for the development of IT application in hospital management • Decision 5573/QD-BYT (December 29) by the Ministry of Health presented criteria for HIT software for hospital management • Information Technology Law on IT (June 22) approved by the National Assembly regulates the application of IT to all social activities • Announcement 358/TB-BYT by the Ministry of Health announced the conclusion of the National Meeting on IT Adoption in Hospital Management • Decision 169/2006/QD-TTg (July 17) by the Prime Minister stipulated the investment and purchase of IT products for organizations or companies using the government budget
2004	Decision 2824/2004/QD-BYT (August 19) by the Ministry of Health determined that Medisoft 2003 would be the standard software for all hospital statistic medical reports
2002	Decision 2554 (July 4) by the Ministry of Health legalized the use of simplified registers and reporting forms nationwide
2001	Decision 112/2001/QD-TTG (July 25) approved the project on computerized the administrative management for public sectors, for the period from 2001 to 2010

Who Drives HIT?

The Ministry of Health is the primary driver for HIT adoption in Vietnam, but such adoption requires effective coordination between many government departments, especially between the Ministry of Posts and Telematics, the Ministry of Finance, and the Ministry of Planning and Investment.

Who Pays For HIT?

In the future, the government plans to increase its investment in HIT. Currently, the Ministry of Health provides most of the funding for HIT, and hospitals pay for their own health information systems with funding from the Ministry of Health at the central level and from the Health Department at the provincial level. Other national and international sources also provide limited funding for HIT.

Challenges

Skilled HIT technicians	While there is great interest among health workers in Vietnam at all levels of the health system, the majority of the population is unaware of the vast potential of HIT.
Infrastructure and resources	• There is a shortage of stable IT network connections throughout Vietnam, especially in rural areas and in small health centers. • Although mobile phones are prevalent in cities, they are not as widespread in rural areas; as a result, the use of telemedicine and mobiles phones as key infrastructure for HIT may not be feasible.
Cost	• For a health center, the cost of one computer alone can be prohibitively high, not to mention the cost of a network of computers. • Most hospitals and health centers have very limited budgets for HIT operation and maintenance. • Software is also expensive, especially the cost of the software's copyright.
Standards	HIT software is not standardized at each point of care; as a result, some hospitals must enter a patient's information repeatedly in different programs.

Current Exemplars

Health information systems in major hospitals

According to the Department of Therapy, hospitals currently employing particularly effective health information systems include: the National Hospital of Pediatrics, Bachmai Hospital, Obstetric Hospital, Vietduc Hospital in Hanoi, Thai Nguyen General's Hospital, Uong Bi Vietnam-Swedish Friendship General Hospital in Quang Ninh, General Hospital in Khanh Hoa, and Children's Hospital No.1 in Ho Chi Minh City.

Infrastructure and resources

Decision 2824/2004/QD-BYT (August 19) by the Ministry of Health determined that Medisoft 2003 would be the standard software for all hospital statistic medical reports

Medisoft 2003 standard

About 300 hospitals in Vietnam are now using Medisoft 2003 software to manage statistical reports and medical records.

Telemedicine

- Since 2005 the National Hospitals of Pediatrics in Hanoi (NHP) has enjoyed live video conferences for tele-consultations and tele-training with other hospitals in different areas of the country for severe patient cases and diseases. NHP has also conducted telemedicine activities via live video conferences with other countries such as Japan, Australia, and France on bird flu, nursing training, and radiology.
- Other exemplars include tele-surgery and tele-imaging assistance between hospitals in different cities, as well as tele–cardiac intervention assistance between the Heart Institute in Hanoi and a hospital in Singapore.

Healthcare Landscape

Expenditure

Vietnam spent about 5% of its GDP on health (both public and private expenditure) in 2005 (WHO).

- General government expenditure on health as a percentage of total health expenditure (THE) is 22.6%.
- Private sector expenditure on health as a percentage of THE is 77.4%.
- Private households' out-of-pocket payment as a percentage of private health expenditure is 88.0%

Coverage

There are four types of public health insurance in Vietnam, as listed below. At the end of 2006 a total of only 34,702,000 people had health insurance coverage (41% of Vietnam's population).

- ***Compulsory Health Insurance.*** Available to civil servants and retired government staff, employees of state enterprises and enterprises with ten or more workers, employees of foreign-owned companies and organizations, and veterans. Under this scheme, 30% of Vietnam's population is covered.
- ***Voluntary Health Insurance.*** Available to pupils, students, and organizations or associations in communes. Fees are slightly lower for those in rural areas. Under this scheme, 11% of Vietnam's population is covered.

Government Announcement 16/2007/NQ-CP (February 27, 2007) states that the government intends to enhance Vietnam's insurance system by building voluntary insurance for farmers, as well as formalized unemployment Insurance. These forms of insurance are not yet functioning. A healthcare fund for the poor is still available from the official Government Fund for the Poor, but this is not officially listed in the insurance system.

Infrastructure

Vietnam's public health system consists of four levels:

Level	Managed by	Infrastructure
Provincial	Health Department of the Province of the People's Committee	• 304 general and specialist provincial hospitals located throughout the 64 provinces often have 50–100 beds as well as consultation and treatment rooms and are staffed by doctors, nurses, and administrators • 64 preventative medicine centers • 61 medical secondary schools • 61 pharmaceutical companies
District	Health Department of the District of the People's Committee	• 3014 medical specialist groups1507 hospitals and polyclinics. (More than 600 hospitals) • district hospitals have about 100 beds each, with a focus on obstetrics, geriatrics, and pediatrics
Commune	Health Station of the Commune of the People's Committee	• more than 10,600 commune health stations, each with four to six beds, a delivery room, and a full medicine cabinet • health stations are staffed by doctors, pharmacists, and nurses who transport serious cases to district and central hospitals • health workers who are volunteers involved largely in immunization and family planning

According to a December 2006 Department of Therapy report, Vietnam has 1,040 public hospitals. Approximately 81 hospitals belong to, and are managed by, other specific entities, such as the Ministry of Traffic and Transportation and the Ministry of Defense. The number of private hospitals and health clinics is increasing in Vietnam, attracting wealthy clientele with their reputation for high-quality care and speed of service.

THE NATIONAL BUREAU of ASIAN RESEARCH
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HEALTH INFORMATION TECHNOLOGY AND POLICY LAB

Functional Case Studies

Functional case studies provide a summary of projects that utilize IT to improve health and healthcare in a specific area—from remote medicine, to disease surveillance. The documents discuss the scalability and transferability of each project, as well as implications for policy.

China Information System for Disease Control and Prevention (CISDCP)

Long-De Wang,[1] Yu Wang,[2] Gong-Huan Yang,[3]
Jia-Qi Ma,[4] Li-Ping Wang,[5] and Xiao-Peng Qi[6]

Summary

In the aftermath of the 2003 SARS outbreak, the Chinese government strengthened its public health disease surveillance system, taking advantage of modern information technology to build an integrated, effective, and reliable disease reporting system.

1950–1985	1985–2003	2004–present
Paper-based monthly reports	Digital monthly reports	Web-based, real-time reports covering 37 diseases across all areas of the country

China's network-based infectious disease reporting system—coordinated by the Chinese CDC—has transformed how the country collects, analyzes, and reacts to disease information. A standardized platform throughout the entire nation gives healthcare systems the unprecedented ability to detect, analyze, prevent, and respond to any communicable disease outbreak in the country. There are also many unplanned benefits, such as increased transparency and empowerment of local medical institutions and personnel. The ability to harness technology and maximize the value of information is a critical milestone in the field of disease surveillance, and the system—assembled in less than two years across one of the largest countries in the world—provides a scalable model for safeguarding public health that could be applied to all nations.

[1] Vice Minister, Ministry of Health, China
[2] Director, Chinese CDC
[3] Deputy Director, Chinese CDC
[4] Acting Information Center Director, Chinese CDC
[5] Head of Infectious Diseases Surveillance Office, Center for Public Health Surveillance and Information Service, Chinese CDC
[6] Head of System Maintenance, Center for Public Health Surveillance and Information Service, Chinese CDC

Reach	Information
At the end of 2006, the Chinese CDC recorded 50,000 direct report entry points across China, including 94.9% of medical institutions at the national-level and above, 80% at the provincial level, and 70.3% of township hospitals and clinics.	The disease surveillance system gathers epidemiologic information on 37 infectious diseases across every province from every hospital and clinic (see Table 1 in the Appendix for a breakdown of diseases).

Advantages	People Served
• Real-time data reporting and aggregation. • National system structure and protocols eliminate issues of noncompatibility. • The system's relational database enables local CDCs and other healthcare organizations to aggregate data in a number of ways at any time, and in any region.	The system serves all of China's 1.3 billion people by relying on direct reports from hospitals, clinics, local CDCs, and other medical institutions at all levels that feed into an expanded CDC network.

Funding

Both central and local treasury departments within the Chinese government provided construction funds for the system, totaling to 730 million RMB, including: 120 million RMB from the central government for the construction of the central system platform and the data center; 130 million RMB from the central government for the construction of the local networks; and 480 million RMB from the local governments for general construction.

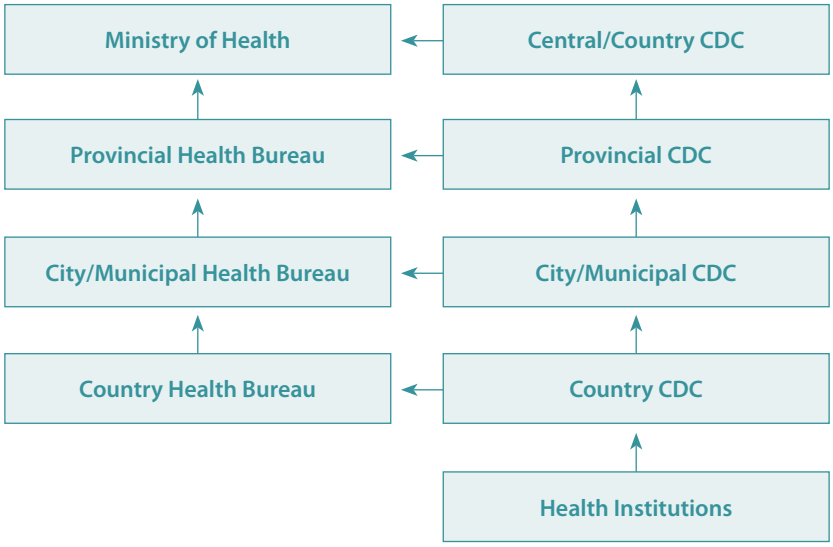
Overall, the investment was about $100 million, which primarily funded the system's hardware and software, as well as Internet access, training for personnel, and the salaries of a limited number of computer programmers.

Leadership

China's central (or "national-level") CDC works with the central government to coordinate the country's public health system at the provincial, municipal (prefecture), and county (district) levels. The government at all levels—including the Ministry of Health in the central government and departments of health of all other levels—ensures the availability of resources and collaboration from all healthcare institutions for this initiative.

China's information reporting system for infectious diseases vertically (e.g., hierarchically) covers all medical institutions at the national, provincial, prefectural, and county levels. The system also horizontally (e.g., where each institution has the same influence and decision-making power) covers CDCs and public health administration departments in all regions throughout China. One of the key reasons for the success of China's infectious diseases information reporting system is that this vertical and horizontal health infrastructure was already in place—the system simply connected each institution so that all healthcare organizations and agencies could communicate and coordinate. Without the vertical and horizontal infrastructure, the information system might not have been so transformational.

Figure 1: Vertical Reporting Structure, Chinese Infectious Diseases Reporting System

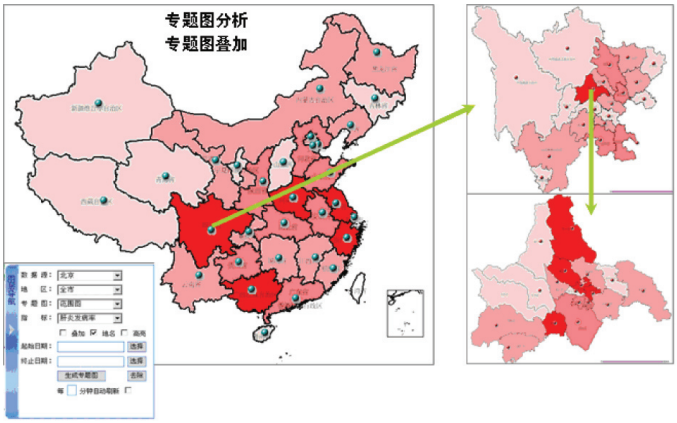


Key Technology

China's Web-based infectious disease surveillance system features a relational database that can process information from all medical institutions through a virtual private network (VPN) connection, using Java 2 Platform Enterprise Edition (J2EE standard) technology.

The system also uses a Web-based geographic information system (GIS) dynamic display feature for epidemic information, which illustrates case clusters, providing an early warning system for infectious disease outbreaks.

Figure 2: The System's Web-GIS Dynamic Disease Surveillance Capability Illustrates Disease Clusters at the Provincial, Municipal, and County Levels



Data

Storage	Analysis
The Chinese CDC Data Center stores and processes all disease information in a central data warehouse.	Data reports can be tailored according to different analytical needs, including assessing local health conditions, investigating an outbreak, or presenting findings for publication (Figure 3). Modularized information analysis and retrieval features facilitate different types of data drill-down and aggregation.

Reporting	People Served
Daily and weekly reports, as well as a general analysis report, are distributed across the system to ensure appropriate attention and response.	Clear protocols and security clearance levels exist for entering and accessing certain data. This ensures that information is available to authorized individuals at a variety of healthcare organizations in all geographic locations and at all levels of the healthcare system.

Impact and Achievements

Since its early operation, the Web-based reporting system has played an unparalleled role in discovering and containing infectious diseases in a timely fashion and protecting the lives and health of the entire population by reducing the financial and human impact of diseases on society as a whole. This system is currently the largest in the world for reporting infectious disease cases. System impact and achievements include:

- ***Increase in the Timeliness and Accuracy of Data.*** In this working model, the pre-2004 aggregated monthly reports for infectious disease are replaced by real-time, case-specific direct reports. As of 2004, the system can boast a tenfold increase in overall reporting speed and a 33% increase in the number of complete reports. This working model gave rise to a material leap in the infectious disease surveillance and public health information management in China. "Missing reports" have been greatly reduced with the transition to real-time, Web-based reporting.
- ***Early Health.*** More accurate, timely disease reporting has lead to the early detection and containment of outbreaks, which not only protects the public from illness but also mitigates other potential negative impacts (e.g., economic, social) associated with the spread of disease. The system maximizes the efficiency of outbreak response efforts by mobilizing professional forces quickly and appropriately, thereby minimizing the hazards of a serious infectious disease outbreak.
- ***An Accurate Picture of Disease Prevalence.*** After the completion of the Web-based system, the number of disease cases increased. This increase reflects more accurate, frequent reporting rather than an actual increase in infection. Figure 4 in the Appendix illustrates the reporting of tuberculosis cases; similar examples abound of other diseases where reporting levels are sometimes at double their previous rates. The system also facilitates the investigation of cases where a diagnosis may be uncertain or the cause of death unknown. Piecing together these unexplained cases can lead to the early detection of new diseases or outbreaks (see Figure 3 in Appendix).
- ***An Affordable, Easy-to-Use Standardized Platform.*** Epidemic disease surveillance has become standardized across institutions, facilitating communication and efficiency.

Costs are low, deployment is easy, and information is timely and valid. Additionally, modularized information analysis and retrieving features are easy to operate.

- ***Improvements in Health Infrastructure.*** The implementation of the Web-based system has paved the way for improvements in infrastructural networks for local medical institutions and increased the computer proficiency of healthcare personnel.

Challenges

China's infectious disease surveillance system has come online quickly and made significant progress over the past two years. Its structure allows cases to be entered throughout the reporting chain, which means that the system effectively covers the entire population. Yet, as with all such systems, challenges remain, and the Chinese central government and CDC are continuously working to further improve the system.

Hardware Infrastructure	Cross-Institutional Cooperation and Information-Sharing
Some localities lack the necessary infrastructure to take full advantage of the disease surveillance system. For example, some remote areas in rural China do not have a sufficient number of computers. Internet access can also be a challenge. As a result, 5% of county level hospitals and 29% of township-level hospitals and clinics must phone in their cases to another institution that has Internet access.	Within the healthcare system, cross-organizational collaboration (between public health, clinics, and hospitals) has been very efficient; however, information-sharing between healthcare organizations and non-health departments, such as the government's agriculture department, has not been extensive. Animal and human health disease surveillance databases are not currently linked.

Future Direction

The Chinese government is considering a system expansion whereby the infectious disease reporting system would link to animal health surveillance systems throughout the country. Additionally, the government is exploring the possibility of expanding the disease surveillance infrastructure to include chronic disease data, with links to different cancer and other non-communicable disease registries.

Appendix

Table 1: Priority Diseases for the China Information System for Disease Control and Prevention

Group A(2)	• Cholera	• Plague	
Group B(25)	• Anthrax • Bacillary & amebic dysentery • Brucellosis • Dengue fever • Diphtheria • Gonorrhea • Hemorrhagic fever with renal syndrome • High pathogenicity avian influenza	• HIV/AIDS • Japanese encephalitis • Leptospirosis • Malaria • Measles • Meningococcal meningitis • Neonatal tetanus • Pertussis • Poliomyelitis • Rabies	• SARS • Scarlet fever • Schistosomiasis • Syphilis • Tuberculosis • Typhoid/ Paratyphoid fever • Viral hepatitis
Group C(10)	• Acute hemorrhagic conjunctivitis • Echinococcosis • Epidemic typhus/ Endemic typhus • Filariasis	• Infectious diarrhea • Influenza • Leprosy • Kala-azar	• Mumps • Rubella

Figure 3: Surveillance Results of Mysterious Pneumonia 2005–2006

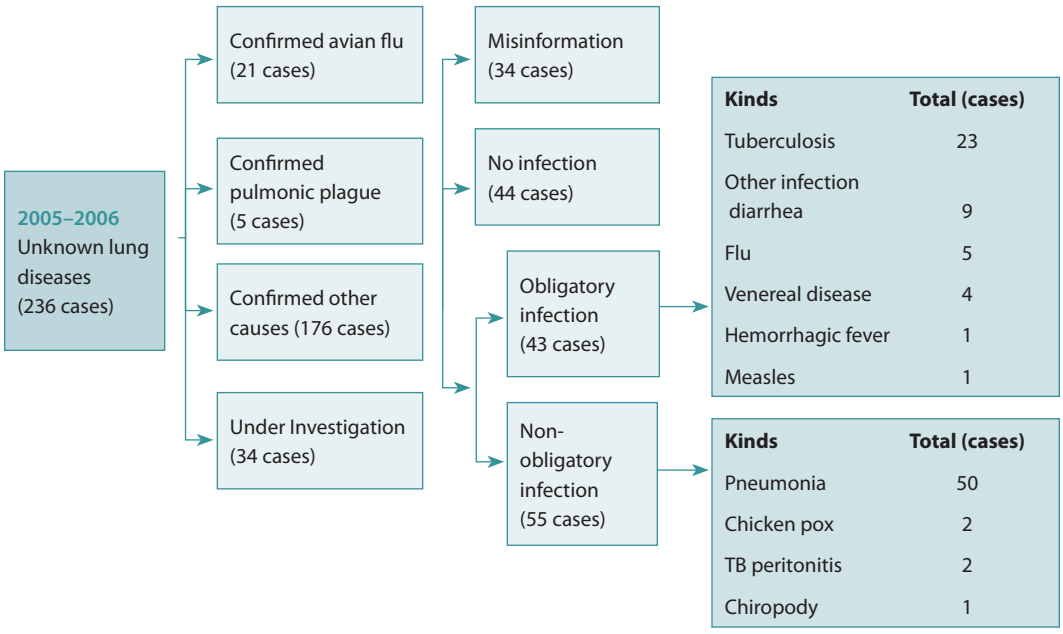
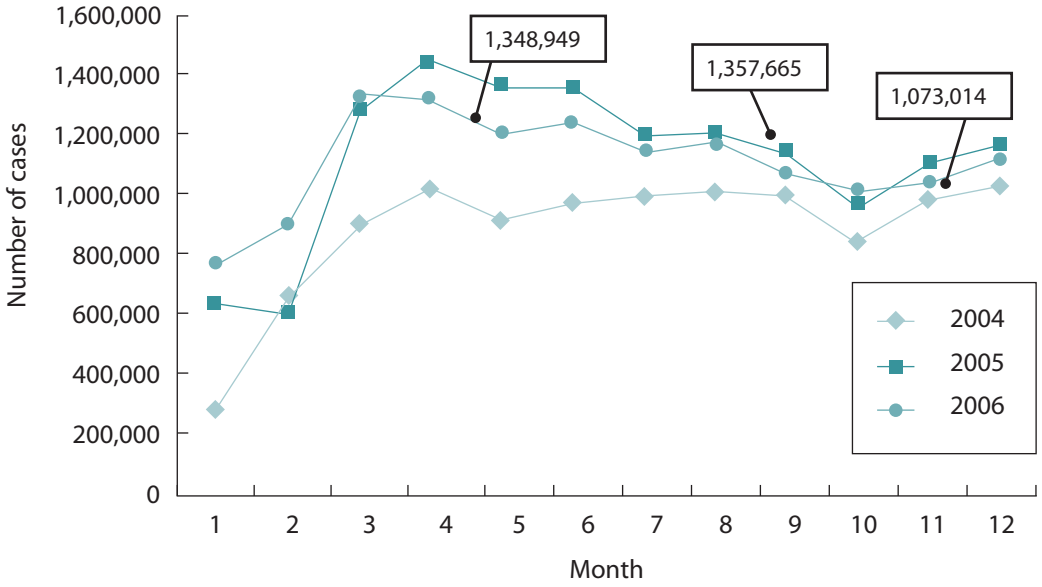


Figure 4: Monthly Distribution of Pulmonary Tuberculosis 2004–2006



Mekong Basin Disease Surveillance (MBDS) Network

MBDS Network Partners, with support from The Rockefeller Foundation

Summary

After a meeting in Bangkok in February 1999, delegates from Ministries of Health in all six Mekong countries agreed to collaborate in disease and outbreak management through the MBDS Network. A Memorandum of Understanding (MOU) formalized this collaboration in 2001, marking the first such regional agreement and framework for collaboration across WHO regional office areas. A new MOU was recently signed on May 15, 2007, reinforcing the partnership.

The MBDS Network not only helps improve health outcomes and empowers health workers in the Mekong Region but it also provides a neutral mechanism for information-exchange and collaboration between countries that do not traditionally share information freely or work together easily.

Partners	Activities	Priority Diseases
• Kingdom of Cambodia • Yunnan Province, People's Republic of China • Lao PDR (Laos) • The Union of Myanmar • The Socialist Republic of Vietnam • The Kingdom of Thailand	• Regular, cross-border information exchange • Joint outbreak investigation and response • Training of health personnel • Development and implementation of protocols • Disaster preparedness and response tabletop exercises	• Avian flu • Cholera • Dengue fever (DF)/Dengue hemorrhagic fever (DHF)/ Dengue shock syndrome (DSS) • Dysentery • Emerging infectious diseases (EID) • HIV/AIDS • Malaria • Measles • Pneumonia • SARS • Tuberculosis • Typhoid fever

Supporters

The Rockefeller Foundation and WHO provided initial support for the MBDS Network in 1999. Along with the Rockefeller Foundation, the Nuclear Threat Initiative's Global Health Security Initiative provided targeted support for pandemic preparedness exercises. The U.S. Centers for Disease Control and Prevention (CDC) supported the RAND Corporation's technical inputs to these exercises. Funding from the Rockefeller Foundation is expected to continue over the next three years. Participating countries' Ministries of Health have also expressed interest in contributing support for the Network.

Key Technology

MBDSNet is an open-source, Web-based application that serves as a data integration hub for the various surveillance systems used by the six participating MBDS countries. The website was developed after MBDS project coordinators and consultants traveled to each member country to review and collect information on the surveillance systems to ensure compatibility.

Data managers from each country submit surveillance data to their respective MBDS coordinator, who then collates the information within the regional database, making it available to other MBDS members. Each of the six participating countries has one information officer who is responsible for collecting, posting, and translating surveillance information. Currently, all data is posted in English. The next phase of work on the system will explore language translation software.

	MBDSNet
Core functions	1. Collect and upload data files from the different country systems 2. Consolidate parse data and convert to XML for data exchange 3. Generate content for website publishing and data visualization through graphics
Content management	MBDSNet features a content management system to enable country administrators to post news and articles on the website.
System management	The MBDS project coordinator in each country is responsible for maintenance of the system.

Activities

MBDS countries have piloted an integrated approach to disease surveillance and response across borders through the following activities:

Regular, Cross-Border Information Exchange. Data from routine surveillance on priority diseases in each site are exchanged via e-mail or fax to national coordinators and the adjacent province's site coordinator using standard forms.[1] Reports of suspected outbreaks are also conveyed informally by phone. Information exchanges are carried out daily, weekly, monthly, or quarterly (depending on the disease) across border provinces. While country and site coordinators closely monitor these exchanges, the timely and relevant flow of information between surrounding communities, cross-border sites, and district and provincial levels remains a challenge. The details of diseases exchanged are illustrated by Table 1 in the Appendix.

Joint Outbreak Investigation and Response. After cross-border teams made up of health, customs, immigration, and border officials were established in 2006, three activities took place:

1. Joint dengue fever investigation between the Lao and Thai provincial sites, enabling officials to effectively stamp out the cross-border outbreak.
2. Joint typhoid investigation between the Lao and Vietnam provincial sites.

[1] The forms were developed through consensus by MBDS participants.

3. Joint avian influenza investigation of cases in humans, triggered by the discovery of an infected Lao citizen in Thailand. Within less than 24 hours of the initial report from the MBDS coordinator in Thailand to his counterpart in Laos, a team was dispatched from Thailand to Laos to support the Lao investigation.

Development and Implementation of Protocols. Regular meetings are held between the adjacent border teams to discuss standards for common forms.

Training of Healthcare Personnel. The joint Thai-U.S. CDC Field Epidemiology Program, Mahidol University, and SEAMEO-TropMed programs coordinate annual training for MBDS participants.[2] Participants are selected from central surveillance offices, border provinces, and other peripheral areas essential to a coordinated regional response. As a result of these efforts, participants have enhanced their skills in research, outbreak investigation, and communication, as well as established friendships and mutual trust with officers from adjacent provinces across borders. Progress in 2006 and 2007 includes:

- 45 health workers from the region received training in field epidemiology, disease surveillance, and response.
- An additional 42 workers can now apply skills in geographic information systems and other analytic techniques.
- An additional 23 health workers have undergone in-depth training in the social, political and economic aspects of border health.

People and Communities

The MBDS Network serves the region both by empowering health workers and by preventing the spread of disease throughout the general population. Each implementation site features a border health team of between five to seven public health workers, border control and immigration officers, and community members.

The MBDS Network demonstrates and supports mechanisms for multicountry collaboration and response at two levels: subregional, and provincial/cross-border. Four demonstration sites comprise cross-border collaboration, with Laos at the geographic center of the region (see Table 2 in Appendix). While neither Thailand and Vietnam nor Cambodia and China share common borders, they do share information, strategies, and experiences through the national-level MBDS coordination mechanisms.

Impact and Achievements

The MBDS Network has given birth to new relationships that have influenced the way health officials in the region interact with each other and how much information they share. Additionally, the policy impact of the MBDS in terms of strengthening country-to-country ties and transparency is evident by the increase in the collaborative nature of each new disease detection and response activity and the willingness of each Ministry of Health to help its counterparts build capacity through training.

A Policy Framework for Cross-Border Cooperation. During the 2003 SARS outbreak, the MBDS communications infrastructure and relationships between technical officers in each country's Ministry of Health proved essential to the subregion's coordinated response. The 2001 MBDS Memorandum of Understanding also served as a model for a

[2] Each country may send an equal number of participants for training.

subsequent collaborative agreement of ASEAN+3.[3] Additionally, the Thai Ministry of Public Health hosted an MBDS-facilitated meeting of ASEAN+3 to jointly develop a training plan for disease surveillance.

A Proven Model for Collaboration, Growing in Strength and Capacity.

The Asian Development Bank has committed $30 million to strengthen surveillance systems in Vietnam, Laos, and Cambodia. The MBDS Network has also facilitated broad regional discussions with regional and international bodies, such as WHO, ASEAN, and PACNET.[4] Examples include:

- The MBDS Network helped establish a working relationship between WHO-SEARO and WPRO[5] in Asia.
- The MBDS Network demonstrates systems that facilitate compliance with International Health Regulations through development and testing of guidelines and protocols with multiple sectors at border sites, including customs, immigration, transport, interior, and communities.
- Participating countries' Ministries of Health have allowed bilateral and multilateral investigations of disease outbreaks through MBDS. Efforts now focus on strengthening pandemic preparedness, with the regional simulation exercises that took place in Cambodia in March 2007 (described below).

Tabletop Exercises: Disaster Preparedness and Response

The MBDS Network has held in-country exercises for over six years; in March 2007 participating countries joined forces to test their preparedness as a region.[6]

Senior government officials from the MBDS Network countries, as well as representatives from the UN, UNICEF, UNSIC, and UNOCHA,[7] participated in the first-ever simulation exercise designed to test responses to a pandemic influenza emergency in the region. Using techniques similar to those in modern war-gaming, the tabletop exercise was designed to foster cooperation within the region seen as the most likely source of a potentially devastating pandemic, such as avian flu. The exercise also helped identify gaps and weaknesses in systems for detecting, monitoring, tracking, and containing the spread of disease.

Throughout the planning process, health officials from neighboring MBDS countries were invited to participate in national exercises, resulting in a rich informal exchange of strategies and approaches to rapid detection, response, and communication later adopted by other countries.

This process—new to most countries—helped catalyze the testing of national pandemic preparedness and response plans in Cambodia, Laos, and Myanmar, and advanced ongoing

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[3] ASEAN countries: Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam. Plus-3 countries: China, Japan, and South Korea.

[4] Pacific Disease Surveillance Network (PACNET).

[5] Regional Office for South-East Asia (SEARO) and Regional Office for the Western Pacific Region (WPRO).

[6] The RAND Corporation helped participants organize and conduct the exercises, which were sponsored by the Nuclear Threat Initiative's Global Health and Security Initiative with additional funding from the U.S. Centers for Disease Control and Prevention and the Rockefeller Foundation.

[7] UN Children's Fund (UNICEF), UN System Influenza Coordinator (UNSIC), and UN Office for the Coordination of Humanitarian Assistance (UNOCHA).

efforts in China's Yunnan Province, Thailand, and Vietnam. The tabletop exercises also generated interest and support from additional sectors, including agriculture, foreign affairs, finance, defense, tourism, and trade. The ability of country delegations to bring in sectors other than health to participate in these tabletop exercises represents a significant change from only one year ago, when preparedness efforts largely took place within the domain of the health sector.

Challenges

Language Barriers

The MBDS Network operates across multiple languages in the region (Thai, Lao, Vietnamese, Burmese, and Mandarin), which presents practical communication challenges—not only between MBDS partner agencies, but also with local communities.

Information Security

Because public health information can be very sensitive—especially if that information carries potential economic ramifications—security concerns remain a significant barrier to effective data integration across borders.

However, the trust and relationships that have developed through the MBDS Network now allow for much greater sharing of information.

Silos Between Animal and Human Health

MBDS participants recognize a need for closer communication between vertical programs within the health sector, and with other sectors such as veterinary public health. Integration of animal and human health sectors' surveillance and response is at a very early stage.

Infrastructure

MBDS participants continue to grapple with limitations in human resources and weak health systems.

An additional hurdle includes unreliable communications technologies and systems, especially in rural areas.

Future Direction

Health Situation Analyses. The MBDS Network is in the process of conducting a health situation analysis for each of its implementation sites. The analyses will become baselines for further monitoring of health development in selected provinces. In addition, the analyses create an opportunity to collect in-depth information about the surveillance structure within each province, as well as other tools for outbreak response. MBDS coordinators will communicate results of the analyses to each implementing site so that participants can identify approaches for more effective cooperation.

Scale-Up Models. Effective collaborative cross-border and joint preparedness and planning models have become catalysts for scaled-up models in other border sites with the support of new donors. In order to support such efforts, MBDS participants will share lessons learned about effective regional collaboration with other regional surveillance networks in the Middle East and South Asia.

Network Expansion. The MBDS Network is evolving into a broader platform for regional coordination across sites and donors, and will continue to integrate additional technical aspects of data analysis, forecasting, and policy to assure the region's capacity to comply with International Health Regulations.

Appendix

Table 1: Diseases Exchanged for MBDS Cross-border Project

Project sites	Daily report	Weekly report	Monthly report	Quarterly report
Savannakhet (Laos), Mukdahan (Thailand), and Quang Tri (Vietnam)	Acute Flaccid Paralysis (AFP) SARS Cholera Avian flu	DF/DHF/DSS Typhoid fever Measles	Malaria Pneumonia	HIV/AIDS Tuberculosis
Champassak, (Laos) and Strung Treng (Cambodia)	AFP SARS Cholera Avian Flu	DF/DHF/DSS Measles AFP	Malaria	HIV/AIDS Tuberculosis
Luang Namtha (Laos) and Mengla County (China)	AFP Syndrome ARS Cholera Avian flu	DF/DHF/DSS Dysentery Pneumonia Measles EID	Malaria	HIV/AIDS Tuberculosis

Table 2: MBDS Demonstration Sites

Laos-China	Luang Namtha	Mengla County (Yunnan)
Laos-Cambodia	Champassak	Stung Treng
Laos-Thailand	Savannakhet	Mukdahan
Laos-Vietnam	Savannakhet	Quang Tri

IT and Supportive Supervision for Immunization

JVG Krishna Murthy, *Senior Program Manager*, PATH India

The Andhra Pradesh Partnership Project on Immunization

Summary

The Andhra Pradesh Partnership Project on Immunization's successful use of innovation and technology made Andhra Pradesh the first state in India to protect the vast majority its children against hepatitis B—a major health problem throughout the country. The Project's training and supportive supervision system involving local medical colleges and regional coordinating officers succeeded both in improving the health infrastructure of Andhra Pradesh and in providing policymakers with metrics that paint a clear picture of the need for, and impact of, immunization services. The Project is being replicated in other states in India and provides a transferable model for immunization programs outside the country.

Objectives

Problem. Initial assessments exposed systemic failures of management of immunization initiatives, including:

- insufficient knowledge and skills among health workers
- insufficient on-the-job supervision and monitoring
- insufficient logistics and supplies

Objectives. The Project tackled these problems head-on through a five-year initiative implemented by PATH and the Government of Andhra Pradesh established in 2001 with the following objectives:

- introduce the hepatitis B vaccine as a part of routine immunization
- improve injection safety
- strengthen routine immunization services
- establish a name-based registry for effective immunization status tracking
- provide technical support for the control of Japanese encephalitis in the Andhra Pradesh State

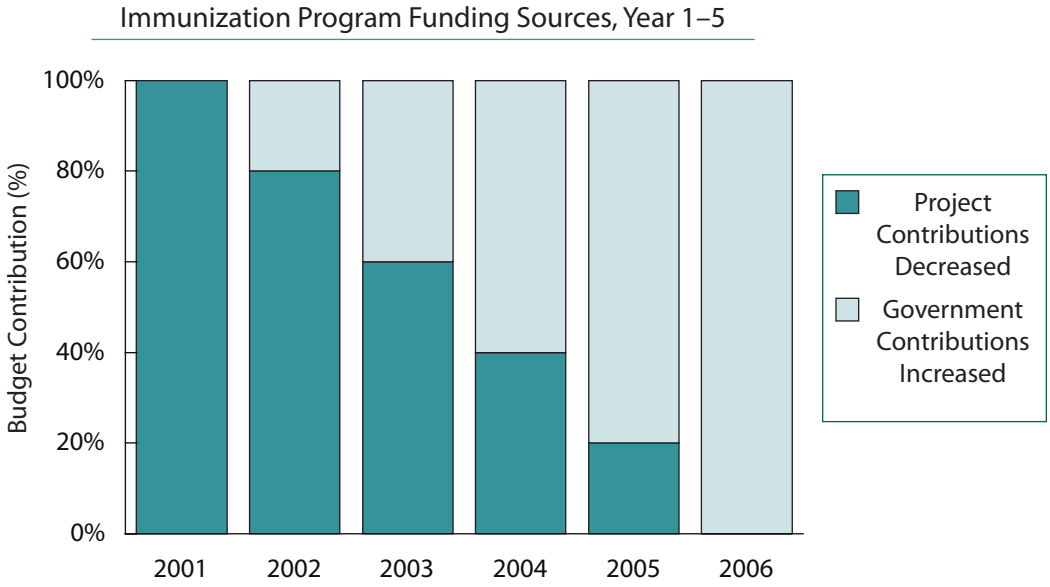
Funding & Sustainability

Financial Responsibility Shifted Steadily from the Project to the Government of Andhra Pradesh

- ***Project Funding Sources.*** Private foundation[1] and state government.
- ***Year 1.*** Funds for supportive supervision were provided from the Project with the stated aim to secure—and maintain—the long-term sustainability.

[1] Support from the Bill & Melinda Gates Foundation.

- ***Year 5.*** The State Government covered all recurrent costs for hepatitis B vaccine and auto-disable (AD) syringes.[2]
- ***Post-Project.*** After the Project's conclusion in 2006, all activities have continued in full force, managed by Government of Andhra Pradesh, primary health centers (PHCs), and local medical colleges.



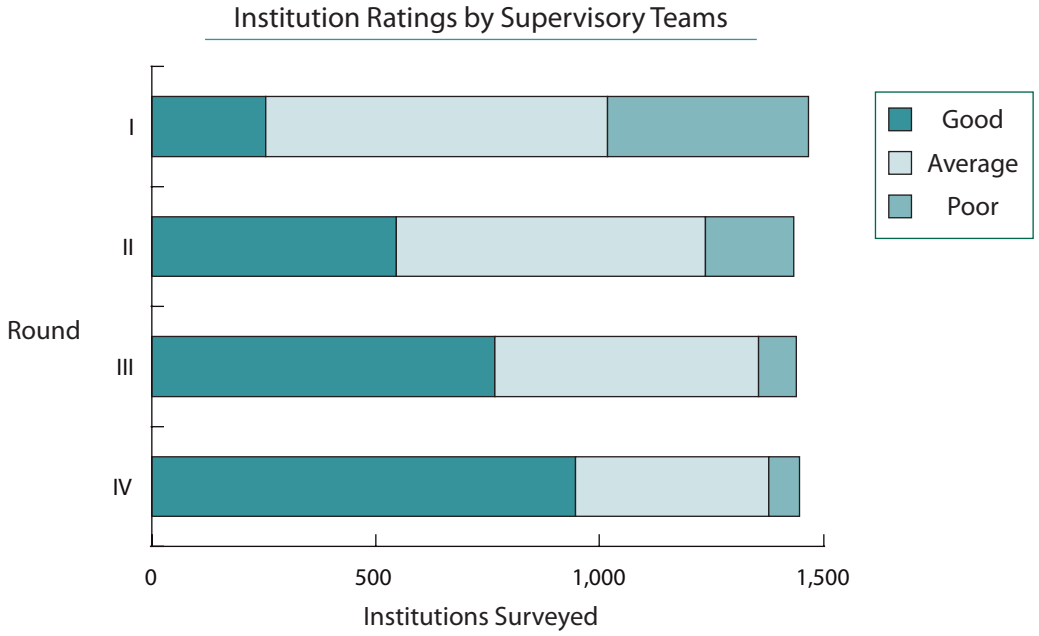
Technology—Leveraging Existing Resources

Hardware	Existing hardware available at the primary health center (personal/ desktop computers).
Software	Existing software from Microsoft Office Suites, which had already been installed on all computers.
VCDs	Video CDs (VCDs) containing 25-minute video clips demonstrated the usage of new needle cutters that were introduced to cut the needles properly. Since the PHCs had desktop computers, the Project could run VCD training sessions for the whole staff in each PHC.
Immunization Technology	AD syringes are the immunization delivery system of choice. In 2003 the Project team field-tested needle removers, a new technology designed to remove the needle from a used syringe safely to further reduce risk of accidental needle-sticks.

[2] Adapted from figure in "Andhra Pradesh: Building a Model Immunization System," PATH, Seattle, WA, December 2004.

Key Strategy: Supportive Supervision

Project assessments during the first three years revealed that there was no system of supportive supervision to help frontline immunization workers in Andhra Pradesh (AP). Many workers admitted that they had never had a face-to-face visit from higher ups, and they felt they had no experts to guide them in solving problems and utilizing the technologies they had to their full potential. To address this disjointed system, in the fourth and fifth years of the Project, the AP government and PATH introduced a formal process for supportive supervision, outlined below.



Immunization Service Delivery Support

- The Project contracted with three local medical colleges to conduct regular supervision and support visits to primary health centers and immunization sites.
- Six to seven consultants made regular visits to PHCs in each district along with district officials. Visits to a single PHC were planned six months apart and all centers in a district were covered over a 3-4 day period.
- By the end of 2004, approximately 1,400 primary health centers had had at least two supervisory visits.
- The new system was institutionalized to ensure continuation after the end of the project.

Data Capture

- Project staff, consultants from local colleges, and district officials surveyed PHCs and immunization sites using pre-formatted check lists, which they filled out each day.
- Preformatted check lists enabled rapid tabulation of data on quality and performance.
- The supervisory team's data provided a clear picture of how each center was faring against defined indicators and ranges (e.g., very good, good, average, and poor).[3]

[3] These were calculated on a point system of 75, with weighed criteria and the centre is graded as "Good" or "Average" or "Poor".

- Results—As illustrated by the figure titled "Institution Ratings by Supervisory Teams," the number of institutions ranked "Good" increased significantly from Round I to Round IV.

Training

The supervisory visits also provided training for hey health personnel on such tasks as:

- Vaccine Storage Methods
- Waste Disposal
- Stock maintenance
- Computer reporting
- New equipment training (e.g., needle cutters)

Old System Challenges

Sustaining the efficient use of information technology and its adoption was the hardest part of this intervention. Users at the primary health center level needed very simple tools for data collection. Over time, more training and better analytical tools could be incorporated to further address this limiting factor. Field visits during the first three years of the project also indicated some major gaps in routine immunization pertaining especially to holes in:

Planned Session Achievement	Immunization sessions were not planned according to the population load.
Logistics and Cold Chain Handling	• Improper vaccine storage resulting in irregular supplies, some health centers with too much stock, and some with no stock at all. • Inconsistent temperature in vaccine storage containers (frozen vaccines)
Injection Safety	• Needles reused without proper sterilization. • No disposal system in place for syringes and needles. • Dumping of sharps in open areas exposed the community to the hazardous waste.
Program Management	Management focus on family planning and outpatient department (OPD) areas without any real supervision or monitoring in place for immunization programs.
Adverse Events Following Immunization (AEFI)	There was no specific system that captured or followed-up on the AEFI, which resulted in low levels of preparedness when such events occurred.

New System Benefits

Coverage	Increase in hepatitis B vaccine coverage in Andhra Pradesh from 10% statewide to 60% in some districts. Previously hepatitis B vaccine was available only through the private sector and less than 10% of infants—those from rich and urbanized families—were vaccinated annually. Coverage now ranges from 40-60%, depending on the district.)
Quality and Safety	• More effective planning of sessions; • Better cold chain management; • Safer handling and disposal of sharps, and • Improved dropout tracking.
Staff Satisfaction and Effectiveness	• Higher levels of satisfaction as a result of increased technical support. • More effective corrective actions and record keeping processes as a result of more accurate records. • Improvements in the technical skills of key primary health center staff, most visibly in the skills and learning of nursing staff—the main health service interface for communities. • Increased awareness about new techniques and the importance of immunization.
Standards	The Supportive Supervision system set up a competitive grading system that rated primary health centers on the agreed upon criteria, which contributed to enhanced local leadership and adherence over time to high standards for effective delivery of immunization services.

Policy Impact

The rapid turnaround of results and tabulation of the data into meaningful, aggregated analysis became a critical tool for policymakers in the short term. These metrics enabled policymakers to understand the need for, and importance of, improved immunization services and support in Andhra Pradesh.

The Project has catalyzed the following policy measures:

- Government decisions pertaining to the introduction of safe injection devices such as Auto Disable syringes, needle cutters, safety pits; and
- Government-approved guidelines on VCDs and posters to educate proper needle cutting techniques and biomedical waste disposal.

Scalability and Transferability

The Project's systematic data collection and regular supportive supervisory visits can be easily transferred to other health programs in the country. The templates and data collection modules are also simple to adapt to other programs. Furthermore, since the technology is easy to use and limited training is required, the Project can be easily replicated. PATH has, in fact, used the same templates for other projects with a few modifications. Additionally, the Project's immunization checklists are used as an input in designing the Ministry of Health's

China Information System for Disease Control and Prevention

PHC quality improvement project in Uttar Pradesh, Karnataka, Uttaranchal, Maharashtra, Assam, and West Bengal.

The Government of Andhra Pradesh is extremely enthusiastic about expanding this strategy to other program areas such as family planning, mother and newborn care, TB, and HIV in the health sector. The model has also been shared in different state and national level forums.

Taiwan National Health Insurance Smart Card

Yu-Chuan (Jack) LI, *Professor and Chair*, Graduate Institute of Biomedical Informatics, National Yang-Ming University

Summary

Launched by Taiwan's Bureau of National Health Insurance program (BNHI) in 2001, the smart card provides timely information and about patients' health and former care. 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.

The card was conceived, developed, and implemented by the BNHI and Giesecke & Devrient, together with the Telco Electric & Machinery Company. Rollout of the card took place in the final 12 months of a 28-month project.

Objectives

The smart cards were introduced to address health system abuses, increase efficiency, and reduce medical errors and administrative and medical costs. In addition, the BNHI required that the card development budget stay within a fixed budget and that deployment took place on an aggressive schedule.

Funding & Sustainability

The total bid price for the project was US$108 million, and contractors were requested to finish within 25 months of the start date, April 12, 2001. The BNHI achieved break-even in the smart card's first year of operation, and the card is saving the system millions with increased efficiency and reduced duplication of efforts.

Key Technology

Platform	The smart card is based on an open platform (Java) and uses a 32 KB microprocessor chip with both symmetrical and asymmetrical encryption. Multiple technical applications co-exist securely on a single card.
Memory	Each card has 32 KB of memory, of which 22 KB is currently being used. 10KB is reserved for future use.
Application	At the health care provider, card readers are attached to PCs via USB ports. The PCs are connected to a VPN through an ADSL or leased line, and the VPN, in turn, connects all the hospitals and clinics through the BNHI data center.
Privacy and Security	• 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.

Development Schedule

Development of the Smart Card began in April 2001 and lasted 25 months. Throughout the initial implementation phase, BNHI integrated ongoing infrastructure upgrades as well as public education and acceptance campaigns, including commercials explaining how people use the cards. In addition to training people to use the cards on an individual basis, the BNHI also had to install card reader security access modules to ensure that health institutions had the capacity and technology to read the cards. Call centers were also established to support the transition. Until 2004, health institutions accepted health smart cards and paper cards as a way to transition the public gradually.

Year 1	Year 2
BNHI and its partners created specifications that met the requirements for hospitals and clinics, computer backend needs, security rules, and networks.	BNHI and its partners 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.

Health System Integration

Six hundred hospitals and 17,000 clinics are connected to the BNHI for real-time 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%.1 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.

Old System Challenges

Before the card's introduction, the BNHI used paper cards to ID patient information, requiring that the cards be renewed after patients used medical services six times. Even with the best possible maintenance, the paper-based system experiences such problems as identity fraud, cost associated with card replacement fees, false insurance premium claims from health institutions, and complex program vouchers.

New System Benefits

- Real-time transaction data streamlined administrative processes.
- The data on the cards can be expanded with minimal cost and effort.

[1] "The Taiwan Health Care Smart Card Project," Smart Card Alliance, 2005. Available from: http://www.smartcardalliance.org/resources/pdf/Taiwan_Health_Card_Profile.pdf

- Card security drastically reduced fraud.
- Clinicians found that the card facilitated communication within and across institutions.
- The cards are good for 5–7 years. Unless a card is damaged, annual replacement becomes unnecessary.

Scalability and Transferability

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.

Taiwan experienced many failures before it experienced success: the first smart card concept was integrated with driver's licenses and ID cards. While a visionary idea, the multiple-function card did not turn out to be appropriate at this stage. In exploring the integration of health smart cards, flexibility is key.

NBR

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