Stakeholder Perspectives on Electronic Health Record Adoption in Taiwan

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Abstract

To cope with the challenges of Taiwan’s healthcare system, the Department of Health (DOH) has proposed a five-year National Healthcare Information Project (NHIP) to establish a nationwide infrastructure for electronic health record (EHR) and health information exchange. An interoperable EHR adoption project, as part of NHIP, setup among eleven medical centers in 2007. We conduct a study to assess the major issues and challenges of EHR adoption in Taiwan and use a qualitative approach to solicit stakeholder opinions from pertinent hospital staff, experts, vendors and consumers. Several suggestions are made for stakeholders that may adopt EHR and for policymakers to set related strategies and policies. These suggestions include enhancing the patient information transparency, strengthening privacy and data protection, accelerating system interoperability and standard adoption, and creating financial incentives for EHR adoption. Our study suggests that EHR may be widely used as an alternative tool for DOH to improve continuity of patient care and furthermore enhance cost containment in healthcare.

Keywords: Electronic health record (EHR), National Healthcare Information Project (NHIP), health information technology (HIT)

1. Introduction

Information technology has significant potential to improve patient safety, organizational efficiency, and patient satisfaction in healthcare (IOM, 2001). Over the past decade, significant initiatives, such as computerized physician order entry with decision support, and electronic health record (EHR) systems, have been proposed to prompt the adoption of healthcare information technology (HIT) (Poon et al., 2006). Attention to the use of electronic health records is intensifying recently in Taiwan, with the Department of Health (DOH) calling for widespread adoption of EHR system within the next five years (STAG, 2006; DOH, 2007).

To cope with the challenges of Taiwan’s healthcare system, the DOH has proposed a five-year HIT project in 2007, called National Health Information Project (NHIP), to establish a nationwide infrastructure for EHR and health information exchange. An interoperable EHR adoption project, as part of the NHIP, has been setup among eleven medical centers (DOH, 2007). Under DOH plan, patient health records will be digitized in these participating hospitals and the full implementation of EHR in all hospitals will be targeted for 2011. The majority of patients will be able to retrieve their electronic personal health record online during their hospital visits, and will have the choice of keeping the data themselves or storing it at a data bank in the future. The national estimates of the EHR implementation will reduce...
medical care expenditures by at least NT $10 billion and create market opportunities for storage and safekeeping of patient histories.

However, despite emerging evidence about the potential benefits of EHR, there are considerable barriers to adoption (Tang et al., 2006; Simon et al., 2007). Since few experiences of EHR in Taiwan are available to apply, it is unclear what challenges will be encountered when stakeholders start considering the adoption of EHR. Few studies have been performed to understand the major issues and challenges of EHR adoption in Taiwan. We therefore conduct a study to assess more comprehensively the challenges of EHR adoption in healthcare from different stakeholder perspectives. The results of our study, we expect, will be beneficial for stakeholders in setting related strategies and policies to facilitate the widespread of EHR adoption.

2. Literature review and background

2.1 Traditional paper-based patient record and electronic health record (EHR)

The patient record is an amalgam of all the data acquired and created during a patient’s course through the healthcare system. The purpose of a patient record is “to recall observations, to inform others, to instruct students, to gain knowledge, to monitor performance, and to justify interventions” (Reiser and Anbar, 1984). Traditional paper-based patient record may have worked reasonably well when care was given by a single physician over the life of a patient. However, given the increased complexity of modern healthcare, the broadly trained team of individuals who are involved in a patient’s care, and the need for multiple providers to access a patient’s data and to communicate effectively with one another through the chart, the paper record no longer adequately supports optimal care of individual patients (Tang and McDonald, 2006). The electronic health record offers the hope for such improved access to patient-specific information and several major advantages in practice.

EHR can be defined as “a repository of electronically maintained information about an individual’s lifetime health status and health care, store such that it can serve the multiple legitimate users of the record” (Tang and McDonald, 2006). An EHR is a superset of an electronic medical record and a personal health record, which might collect information as appropriate from across the health care systems (i.e. from several electronic medical record systems) and a variety of personal information sources (Stead et al., 2005).

An EHR system (EHRs) is the addition to an EHR of information management tools, which automates of clinical practice, such as placing a care provider order, recording a clinical note, capturing administrative functions such as scheduling and billing. A patient’s EHR is generated as a by-product of these clinical and administrative functions. It often lives within the specific EHR system that created it and is unique to that system. Since traditional EHR data are produced from various hospital information systems (HIS), their data formats are usually defined by users. To share EHRs among different healthcare organizations, a standard for interoperable EHR is required (Li et al., 2001; Hammond and Cimino, 2006; Jian et al., 2007).

EHRs has a wide variety of potential benefits for consumers and clinicians (IOM, 2003; Tang et al., 2006; DOH, 2009). For consumers, EHR provides greater patient access to a wide array of credible health information, data, and knowledge. For clinicians, these systems can facilitate workflow and improve the quality of patient care and patient safety (Wang et al., 2003). According to a EHR survey of clinicians (CHIT, 2005), the most beneficial features of EHR to their practices are “quick access to patient records”, “manage medication list, clinical documents and notes”, “search for the data”, “e-prescribing” et al. However, EHRs has several limitations. It requires a larger initial investment than its paper counterpart due to hardware, software, training, and support costs. The human and organizational factors often dominate
the technical challenges. Another risk associates with computer-based systems is the potential for subtle as well as catastrophic failures (Shortliffe and Tang, 2006).

2.2 Global trend of EHR development

There is growing evidence that the use of HIT improves patient safety, quality, and continuity of care (IOM, 2001; 2003; Tang et al., 2006). In U.S., healthcare spending and health insurance premiums continue to rise at rates much higher than the rate general inflation in recent years. However, studies have shown that nearly 30% of healthcare spending, or up to $300 billion each year, is for treatments that may not improve health status, may be redundant, or may be inappropriate for the patient’s condition (Thompson and Brailer, 2004). Hence, the U.S. government in 2004 has established a 10-year plan to transform the delivery of healthcare by building a new national healthcare information infrastructure (NHII), including EHR and a new network to link health records nationwide. The goal of NHII was setup to provide EHR for the majority of Americans by 2014 and its new vision is to realize the consumer-centric and information-rich care through the use of HIT (Sittig et al., 2005).

To achieve the major functions of informing clinical practice and interconnecting clinician in NHII, an interoperable infrastructure is required and uniform standards are essential for EHRs to interoperate and exchange data in meaningful ways. The Health Level 7 (HL7) is selected in NHII as the primary message standard, Digital Imaging and Communications in Medicine (DICOM) for radiology images, Logical Observations, Identifiers, Names, and Codes (LOINC) for laboratory test observations for transmission of EHR data in U.S.. Other countries, such as U.K., Canada, Korea, and Taiwan, have already developed their own EHR standards which are compatible with these international standards (Hammond and Cimino, 2006; DOH, 2009).

Many developed countries have devoted considerable time and resources to building their NHII and encouraging EHR adoption in recent years (Yasnoff et al., 2006). In Canada, a ten-year “Health Infoway” project has been setup to provide EHR for 50% Canadian citizens by 2010, and the next stage will be 100% citizens by 2016. In U.K., a ten-year “National Programme for Information Technology” has been established in 2000 to build an integrative HIT infrastructure for transmitting healthcare information securely (Detmer, 2000). In South Korea, the government has built a “Center for Interoperable EHR” in 2006 to provide anytime, anywhere electronic health record at the point of care. Other countries, such as South Africa, Sweden, Germany, France, and Holland, have also allocated considerable resources to develop their nationwide EHRs (DOH, 2009).

2.3 Challenges of Taiwan’s healthcare system

Ever since 1996, the National Health Insurance (NHI) program in Taiwan has provided medical care for most of the 23 million people. By the end of 2008, over 91 percent of medical institutions (18,540 in total, including 492 hospitals and 17,026 clinics) had joined the NHI system. In 1998, health insurance expenditures began to exceed revenues and this financial gap has continued increasing. According to the DOH statistics, insured individuals consulted doctors an average of 13.94 times and the average number of hospital admissions was 13.12 persons per hundred in Taiwan, which means more than 342,000 outpatients visits and 17,000 emergency visits made to medical facilities per day in 2007. This high ratio of consultations has resulted in higher-than-projected costs for the NHI program and the figure was much higher than in many western countries (BNHI, 2008).

In addition, due to the lack of patient information transparency in healthcare, many patients tend to visit several hospitals for the same medical problem and their personal health records are fragmented and scattered across multiple healthcare settings (Li et al., 2001). Such phenomenon of discontinuity in patient care has increased a large amount of duplicate tests
and redundant orders among healthcare providers, and furthermore added more unnecessary medical expenditures (THRF, 2008). To deal with the redundant waste of medical resources and financial crisis, the DOH has introduced several tools for cost containment. The main tool for cost containment has been sectoral global budgets; while effective in the short run, over the long run they have triggered some untoward side effects and should be replaced with more flexible tools to control costs (THRF, 2008; Reinhardt, 2008).

To cope with these challenges in Taiwan’s healthcare system, DOH therefore has decided to propose a five-year HIT project (NHIP) in 2007. The vision of NHIP is “giving health information back to the people” which requires an interoperable health information infrastructure linking patient health record across multiple healthcare settings. To improve the system interoperability among healthcare providers, an interoperable EHR project has been established in NHIP in order to achieve the goal of improving continuity of patient care and enhancing cost containment in healthcare (DOH, 2007).

2.4 An interoperable electronic health record project in Taiwan

In 2007, an interoperable EHR project has been setup in Taiwan which included eleven participating medical centers. Due to the large volume and variety of patient services offered, these participating hospitals always have a great need for exchanging health information with other healthcare organizations. They have also implemented computerized physician order entry (CPOE) systems for many years. In this project, a format for exchange of EHR nationally, called Taiwan Electronic Medical Record Template (TMT), was developed by DOH to improve the EHR system interoperability among hospitals. TMT is a set of local standard EHR templates which are compatible with international medical standards (DOH, 2007; Jian et al., 2007). The DOH has also provided a server and a free software tool which is able to transfer each hospital’s code sets to TMT-mandated codes. A complete EHR browser system has been created which allow hospitals to easily integrate it with their CPOE systems seamlessly through the conversion of their own EHR formats and TMT (Jian et al., 2007). Additionally, DOH has provided 2,200 free USB disks for patients to encourage their use of portable EHR.

EHR will be deployed in two forms in this project. One form is a web-based EHR system which provides an integrated EHR for the clinicians. The other form is named “Health Key” which consists of a mobile USB disk provided by participating hospitals at the patients’ request. In these two forms, the health records include data about outpatient episodes, outpatient prescriptions, referrals, laboratory and examination results, inpatient admissions, and discharge summaries. All these data are recorded in the TMT format and any other portable devices, such as cell phone, CD, PDA, are also compatible for storage. The future application of interoperable EHR of NHIP in Taiwan is depicted as Figure 1 (DOH, 2007).
3. Methods

In this study, we define stakeholders as individuals or group, either within or outside an organization, that have some claim on the organization (Hill and Jones, 1998). Stakeholders can be divided into internal and external stakeholders. We identified the hospital staff as our internal stakeholder group; customers, experts, vendors, and government agencies as our major external stakeholder groups (Markle Foundation, 2003; DOH, 2007). In order to gather detailed comments from our stakeholder groups, a qualitative approach was taken. Several elements were used, including a survey of hospital personnel, expert panel discussions, and seminars for the consumer and the vendor. The details of our methods are described as follows.

3.1 A survey of hospital personnel

First, we conducted a survey to explore in-depth, the difficulties encountered by a hospital in adopting an EHR system. One of participating hospitals in this EHR adoption project, National Cheng Kung University Hospital (NCKUH), was selected because its staff members have had more practical experiences in EHR diffusion. An open-ended questionnaire was designed based on literature reviews. Specific study questions were included: In your opinion, what are anticipated problems of adopting an EHR system in your hospital? What aspects of issues should be addressed during the adoption process of EHR? The questionnaire suggested that users consider several major issues that hospitals typically encounter in the EHR adoption process: hospital information system (HIS), workflow, medical record management, organizational change, security and confidentiality, and education and research (Wang et al., 2003; Tang and McDonald, 2006; Tang et al., 2006).
A seminar was held in May 2007, prior to administering the survey, to help respondents understand the goals of this EHR project. A briefing of the project was provided with the questionnaire to study participants. Thirty pertinent participants recommended by the project leader of EHR were invited from across departments that would potentially be involved in EHR adoption, such as medical informatics, medical records, medical affairs, and clinical departments at NCKUH. Of these, 20 staff members returned the completed survey. The length of time to complete a questionnaire for each respondent was 20 minutes on average.

3.2 Expert panel discussions

Following the survey, panel discussions were used to obtain opinions from experts nationally. Two expert panels were convened separately, each for half a day, on 8th of May and 14th of September 2007 in NCKUH, which were sponsored by the Taiwan Association of Medical Informatics (TAMI), an authorized institution for administering the nationwide EHR project. Experts recommended by TAMI and DOH from research institutions, schools, hospitals, and government agencies in the medical informatics field were invited to discuss the challenges to and their recommendations for EHR adoption in Taiwan. There were approximately 40 experts participating in each panel discussion.

Prior to the panel discussions, several major issues based on the result of an EHR survey (DOH, 2005) and NHIP expert panel (DOH, 2006) were discussed by the EHR expert group of TAMI. Then the invited experts were provided with a briefing of the NHIP and documents prepared by TAMI describing major issues in EHR adoption including infrastructure, interoperability and standards, supporting mechanism related to application domain, security and legal concerns. About 30% of the experts provided written opinions after the panel discussion. Meeting minutes were recorded in each panel discussion.

3.3 Seminars for the consumer and the vendor

Then, a public seminar was held in NCKUH following expert panel discussions on 14th of September, 2007. The general public in south Taiwan was invited to attend this EHR public seminar through the e-mail, web and post in the public areas. This public seminar was sponsored by TAMI for obtaining the consumer’s opinions and concerns regarding EHR adoption. The consumers were provided with a briefing of EHR in NHIP prepared by TAMI describing major issues in health information transparency, security and confidentiality protection, and ethical, legal and social concerns. There were 135 persons in south Taiwan participating in this seminar.

In addition, to gather the opinions of the HIT industry, a seminar for the vendor was held by the Taipei Computer Association (TCA) on 10th of August, 2007. Prior to the seminar, a briefing describing major issues in supporting mechanism of EHRs development, security, interoperability and standards, and a demonstration case of EHR were presented by TCA. All members of TCA were invited and there were approximately 40 representatives of major computer vendors participating in this seminar. Meeting minutes were also recorded in each seminar discussion.

In analyzing the opinions of these different stakeholder groups, we reviewed their written opinions and meeting minutes, and with the help of the two project leaders of NCKUH synthesized the issues and recommendations. Several challenges identified and suggestions for facilitating EHR adoption were discussed and proposed in the following section.

4. Results

The most common problems identified by the participants of the public seminar are the need of improving patient information transparency, and concerns regarding data privacy, confidentiality, and security. In addition, the most common problems identified by the
hospital staff and the vendor are difficulties associated with the system integration and interoperability, and the lack of incentives for adopting EHR. The problems listed above are consistent with those obtained from the expert panel discussions. In order to further examine the study findings, we performed a brief follow up interview with two project leaders of NHIP office, who are in charge of the EHR adoption project. The important issues that were identified in the survey, panel discussions, and seminars are summarized and described below.

4.1 The need of improving patient information transparency

Consumers often lack information to understand their treatment choices or to select physicians and other clinicians appropriate for their needs (Thompson and Brailer, 2004). In Taiwan, there are several healthcare institutions still refuse to provide a complete health record to their patients (THRF, 2008). Accessing the patient’s own medical record is not an easy task in hospitals, expressed by many consumers in the seminar. This phenomenon of information disparity has caused another concern, in the seminar, regarding the property right of patient records which should belong to patients or their hospitals. Although DOH has setup some corresponding EHR strategies to enhance the patient information transparency, there are several challenges identified in our study.

Our findings indicate that an EHR system could possibly change the traditional provider-patient relationship in a hospital setting. Some clinicians in our survey expressed that health care providers may perceive that EHR data kept by their patient will threaten their control, autonomy, and authority. Because consumers, with the help of EHR, would be able to access their treatment information and could make better decisions and take more control over their health status, maintenance, and treatments. Another perceived challenge comes from the distrust among physicians in concurring with other physicians regarding their patients’ diagnosis and treatment plans. Legal concerns of EHR also exist both at the individual level of care professions and consumers.

To overcome these challenges, our experts suggested that the benefits of EHR, such as reducing administrative and clinical costs, improving quality of care and clinical outcomes, and managing patient record keeping better, should be addressed in the diffusion. And the use of EHR can actually help clinicians in many ways. For example, patients entering data into their health records can elect to submit the data into their clinicians’ EHRs. Having more data helps clinicians make better decisions (Bates et al., 2001; Tang et al., 2006). EHR may also become a conduit for improved sharing of medical records, provide collaborative disease tracking, and free clinicians from the limitations of telephone and face-to-face communication between patients and members of their health care teams.

4.2 Concerns regarding data privacy, confidentiality, and security

A key issue in EHR adoption is related to the privacy, confidentiality and security of patient information. All participating stakeholders perceived that there is an increased risk of disclosure of confidential patient information due to health records being in electronic form and being shared over the network with other institutions. The consumers particularly perceived that all efforts to make health records more accessible for appropriate and authorized purposes simultaneously carry the risk of increased availability for unscrupulous use. Our findings indicate that EHR adoption involves legal concerns on the part of hospitals and the privacy concerns of individuals (Tang et al., 2006; DOH, 2009).

Our experts pointed that there are several ways to restrict inappropriate access to patient data, including technological methods as well as institutional or policy approaches. In terms of technological methods, the DOH has implemented a Healthcare Certification Authority (HCA) project at the national level, which will completely integrate with the government public key infrastructure and a smart card system of National Health Insurance next year. The
EHR exchange would occur within this secure infrastructure in order to reduce the risk of loss of confidential patient information. However, the hospital staff and vendors mentioned that hospitals still have to upgrade their systems which would add to their expenses. Besides, most experts expressed that current laws regarding these issues relate mainly to a paper world and are inadequate for security of EHR. While the DOH is in the process of helping create laws and making regulations for patient information security and privacy, much remains to be done (Yang et al., 2006).

4.3 Difficulties associated with the system integration and interoperability

Difficulties associated with the integration of EHR systems and HIS is a major constraint for hospitals adopting EHR. Since traditional EHR data are produced from various HIS, they could not interchange among different healthcare providers. The hospital staff indicated that by using Extensible Markup Language (XML) as the data exchange carrier, TMT may achieve the function of EHR exchange and content sharing among HIS (Jian et al., 2007), but all participating hospitals need to change their information system environment.

Some experts indicated that the progress in establishing national standards in healthcare data interchange has been slow. The progress of establishing national healthcare standards in Taiwan is lagged behind than other industries, such as financial and computer industries. Only recently, the DOH has worked towards establishing the EHR national exchange standard. The adoption of TMT standards would facilitate the interoperability of EHR. However, the implementation of the standard will require additional investments to make the existing systems compatible with the standard.

From the hospital staff and vendor perspective, TMT could achieve the goal of sharing EHR among hospitals (DOH, 2007; Jian et al., 2007), but many changes will need to be made to the systems and workflows in a hospital setting. Another issue is the immaturity of EHR technical support and product in market. Several vendors pointed out that most computer vendors cannot catch up with such emerging EHR technologies. Thus, their technical support and product are not readily available to meet the requirements of their hospitals.

4.4 The lack of incentives for adopting EHR

Perhaps one of the most difficult challenges to adoption of EHR systems is that incentives for adopting such changes are lacking under the current “global budget” payment system of the National Health Insurance Program in Taiwan. The global budget system is essentially a fee-for-service reimbursement with declining reimbursements when thresholds have been crossed for the type of service for which claims are being made (THRF, 2008; BNHI, 2008). The hospital staff expressed that the cost of EHR system adoption will increase the financial burden of the hospitals, but the financial return on the investment appears uncertain. Thus, it seems no significant incentives for hospitals to provide additional EHR services for patients under such a payment system.

On the other hand, the experts pointed out that the use of EHR will bring a wide variety of potential external benefits to the whole society. For example, when patients are seeking medical care at different hospitals, a patient-centered EHR will improve the continuity of care and reduce unnecessary medical expenditures. Such systems also can be very beneficial in the patient’s self management and in the timely detection and control of disease outbreaks nationally. Therefore, the experts emphasized that the government should be more proactive to develop incentives supporting the adoption of EHR systems.

Table 1 summaries all stakeholders’ points in this section related to benefits and barriers of adopting EHR in Taiwan’s healthcare industry.

Table 1. Benefits and barriers of adopting EHR in Taiwan’s healthcare industry.
<table>
<thead>
<tr>
<th>Stakeholder (hospital staff)</th>
<th>Benefits</th>
<th>Barriers</th>
</tr>
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<tbody>
<tr>
<td>Internal stakeholder</td>
<td>Reduced administrative and clinical costs.</td>
<td>Clinicians may perceive that EHR data kept by their patient will threaten their control, autonomy, and authority.</td>
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<td></td>
<td>Improved sharing of medical records, quality of care and clinical outcomes.</td>
<td>The distrust among physicians in concurring with other physicians regarding their patients’ diagnosis and treatment plans.</td>
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<td></td>
<td>Better management of patient record keeping.</td>
<td>Legal concerns of HER.</td>
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<td></td>
<td>Helped clinicians to make better decisions.</td>
<td>Difficulties associated with the system integration and interoperability.</td>
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<td></td>
<td>Improved the efficiency of communication between patients and members of their healthcare teams.</td>
<td>Many changes will need to be made to the systems and workflows in a hospital setting.</td>
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<td></td>
<td></td>
<td>High cost to guarantee data security and patient confidentiality. Additional investments are required to make the existing systems compatible with the standard.</td>
</tr>
<tr>
<td>External stakeholder (customers, vendors, experts, government agencies)</td>
<td>Benefits</td>
<td>Barriers</td>
</tr>
<tr>
<td></td>
<td>Improved patient information transparency.</td>
<td>Concerns regarding data privacy, confidentiality, and security.</td>
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<td></td>
<td>Greater access to a wide array of credible health information.</td>
<td>Current laws regarding these issues relate mainly to a paper world and are inadequate for security of EHR.</td>
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<td></td>
<td>Provided collaborative disease tracking and improved communication between patients and caregivers.</td>
<td>The progress in establishing national standards in healthcare data interchange which are compatible with international standards has been slow.</td>
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<td></td>
<td>Patients could make better decisions and take more control over their health status, maintenance, and treatments.</td>
<td>Computer vendor’s technical support and product are immature.</td>
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<td></td>
<td>A patient-centered EHR will improve the continuity of care and reduce unnecessary medical expenditures for the whole society.</td>
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<td>EHR system can be very beneficial in the patient’s self management and in the timely detection and control of disease outbreaks nationally.</td>
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5. Discussions and policy implications

To overcome these barriers identified in Table 1, our study, after a follow up interview with NHIP experts, proposed the following major policy areas and suggestions.

5.1 Enhancing patient information transparency

To improve the optimal use of medical resources in Taiwan, we suggest that EHR should be adopted as a major tool for enhancing the patient information transparency. When patients are seeking medical care at different hospitals or healthcare organizations, a patient-centered EHR would be integrated and readily available for clinician’s access to avoid patients seeking redundant medical treatment. As patients move from clinician to clinician, their information would move seamlessly with them. Clinicians would optimally inform about their patients, and patient care would not be interrupted or compromised.
Through the use of EHR can improve continuity of patient care, reduce the need for duplicate tests and redundant orders, and eliminate clinical guesswork when a new patient receives treatment (Thompson and Brailer, 2004; DOH, 2007). We suggest that DOH may widely use EHR to advance the consumer’s role and develop a consumer-centered care to enhance consumer choice and involvement in healthcare and treatment decisions. Additionally, more certified public health knowledge portals and public education programs will need to be established for consumers. Such credible health information will be very beneficial in the consumer’s self management.

5.2 Strengthening privacy and data protection

There has been heightened awareness by stakeholders of the need for strong privacy and security protections for identifiable health information since the initiation of EHR project in 2007. Due to the major concerns about the privacy and security of medical records, many hospitals have not participated yet in a large scale effort to share patient information in Taiwan (STAG, 2006). We suggest that information technology may in many ways provide better controls over information by offering more privacy and security for health information than paper-based health records. Therefore, the DOH should provide more technical support to enhance the security of the IT infrastructure at hospitals and furthermore establish a secured network to prevent unauthorized access and improper uses and disclosures of individually identifiable information.

In terms of the policy or institutional approach, we suggest that government should investigate privacy and security concerns of patients and providers urgently and enact appropriate legislation. Hospitals in the interim can create their own security and confidentiality policies and programs. The consumer education about the security of EHR and health management should begin early. Among others, the experiences from the Health Insurance Portability and Accountability Act in U.S. may provide a lesson for us (HIPPA, 1996; Yang et al., 2006).

5.3 Accelerating system interoperability and standard adoption

Interoperable EHR will require an interchange infrastructure to interconnect clinicians and help clinicians get access to critical health care information when their clinical or treatment decisions are being made. However, difficulties associated with the integration of EHR systems and HIS will be one of challenges for hospitals and vendors adopting EHR. Because this integration task is highly complex, it will dramatically increase risks of HIS modification and costs of workflow change for hospitals. To lower the technical hurdles and risks, we suggest readily available and shared software tools, technology transfer, and education programs be provided to hospital technical staff and vendors.

Furthermore, policymakers should accelerate the interoperability of EHR systems by promoting the standardization of clinical terminology and communication protocols. This would lower the cost of EHR implementation and give hospitals access to a larger variety of EHR vendors. Also, DOH should speed up the pace of establishing national standards which are compatible with international standards. Then hospitals could build their IT infrastructure over time without worrying that the next component would make all existing component obsolete. With improved system interoperability, the cost of EHR implementation would decrease, allowing more hospitals and vendors to implement EHR systems.

Certification criteria for EHR systems will also need to be setup, which can refer to the US experiences in the Certification Commission for Healthcare Information Technology (CCHIT, 2008). By creating an efficient, credible and sustainable product certification program, the market of EHRs in Taiwan will grow faster in the future.
5.4 Creating financial incentives for EHR adoption

Some of the concerns around EHR adoption are centered on cost because of the upfront investment needed for technology and infrastructure, and also because of the high costs of managing concomitant clinical and administrative changes. We suggest that the most important step in achieving the NHIP vision for adopting EHR systems is to establish financial incentives that will make it attractive for hospitals and vendors to invest in EHR. Payers and regulatory agencies will play important roles in developing incentives and encouraging healthcare organizations to improve quality and adopt new measures. NHI can adopt contracting and reimbursement strategies that reward healthcare organizations that use EHR effectively. Such strategies could include for example, requiring that claims be submitted with the medical record electronically, or requiring that hospitals use EHR as a tool to improve their quality indicators.

These incentives could also take the form of grants, tax credits or low-interest loans from the government or payers to healthcare organizations and vendors making investments in EHR areas that have demonstrated excellent outcomes. Non-financial incentives could also play a role in encouraging EHR adoption. For example, under the hospital accreditation system, the DOH might give healthcare organizations special recognition if they adopt EHR systems.

6. Conclusions and suggestions

This study solicited stakeholder opinions and investigated challenges regarding the adoption of EHR in Taiwan. Several benefits of EHR identified from the hospital staff's perspective include reducing administrative and clinical costs, improving communication efficiency, quality of care, clinical outcomes and better decision. From the customer's perspective, EHR may improve patient information transparency and communication efficiency with caregivers. Also, patients may own greater access and more control over their own health status. From the government agency’s perspective, a patient-centered EHR will improve the continuity of care, reduce unnecessary medical expenditures, and provide a timely detection and control of disease outbreaks nationally. However, there are several barriers identified in our study including the need of improving patient information transparency, concerns regarding data privacy, confidentiality, and security, difficulties associated with the system integration and interoperability, and the lack of incentives for adopting EHR.

Our findings indicated that EHR will bring a wide variety of potential benefits to the whole society, but hospitals have to increase their upfront investment for EHR technology and infrastructure and add their expenses of managing changes. Since nearly 99 percent of Taiwan’s population was covered by NHI in 2008, such a healthcare insurance system has provided a unique and more favorable environment for EHR adoption compared with other countries (Reinhardt, 2008; DOH, 2009). Several suggestions are made for stakeholders that may adopt EHR and for policymakers to set related strategies and policies. These suggestions include enhancing the patient information transparency, strengthening privacy and data protection, accelerating system interoperability and standard adoption, and creating financial incentives for EHR adoption. To achieve the potential external benefits of EHR for the whole society, the government can play a more proactive role to develop incentives supporting the adoption of EHR systems in healthcare organizations. Our study suggests that EHR may be widely used as an alternative tool for DOH to improve continuity of patient care and furthermore enhance cost containment in healthcare.

The findings and suggestions from this study should be interpreted in light of its limitations. First, the respondents of this study may not represent the population of interest in
all participating hospitals and stakeholders. Second, the qualitative methods used in this study may yield less precision than quantitative methods. As more adopters join in the diffusion, additional studies to investigate the cost-benefit or economic analysis of EHR may be necessary. More consumer informatics, sociotechnical, and legal issues which are caused by EHR adoption need further exploration. Furthermore education and research are required for different stakeholders while users are moving toward the widespread adoption of EHR in Taiwan.

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Reference

Department of Health (DOH), Executive Yuan, Taiwan. (2007) National Health Information Project Proposal.
Department of Health (DOH), Executive Yuan, Taiwan. (2009) Seminar of Electronic Health Record Policy in Taiwan.
standard Taiwan Electronic Medical Record Template. Computer Methods and Programs in Biomedicine, 88(2), 102-111.


Thompson, T.G., Brailer, D.J. (2004, July 21) The Decade of Health Information Technology: Delivering Consumer-centric and Information-rich Health Care. Department of Health and Human Services, USA.

