OPTIMIZING THE USE OF THE FISCAL STIMULUS FOR HEALTH IT IN THE U.S.

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ABSTRACT

The fiscal stimulus of 2009 allocated about $19 billion over five years to advance the country's push for a nationwide health information network. Information sharing among public health agencies and private health care providers has the potential for reducing public health threats and increasing public access to measures of provider quality. It can also help build and disseminate a database of cost-effective best practices in health care delivery. An analysis of existing evidence on enablers and barriers to adoption and effective use of electronic health records suggest that government intervention is justified. The market system will result in low utilization because of scale economies, externalities, network effect, and a need for national standards to ensure interoperability, privacy and data security,. However, optimal use of the fiscal stimulus requires that financial and technical assistance be targeted on smaller physician practices and independent hospitals. Such assistance must be made conditional on adoption and effective use of a certified, interoperable system. The public health benefits will also be maximized the more health care providers participate in the national health IT network. Thus, in addition to awarding financial incentives, electronic submission of aggregated or de-identified health information must be mandated of all health care providers, not only those that are participants of Federal health programs.

JEL: I18

KEYWORDS: electronic health records, electronic medical records, national health IT infrastructure, government intervention to promote adoption of health IT

INTRODUCTION

The impetus for using electronic health records in the United States is increased concern regarding the quality of patient care. A landmark study published by the Institute of Medicine eight years ago reported that more people die in hospitals each year due to medical errors than from breast cancer or AIDS or highway accidents, and more people die due to medication errors than from work-related injuries (IOM, 2001). The IOM's report pointed directly to an increased use of information technology (IT) to reduce fatalities stemming from human error. It was not until April 2004 that the Bush administration made a commitment to develop nationwide use of health IT so that by the year 2014 each person in the U.S. will have an electronic health record (EHR). To that end, the Office of National Coordinator of Health Information Technology (ONC) was established within the Health and Human Services Department. (HHS). The ONC and the American Health Information Community (now called the National eHealth Collaborative) formed work groups comprising health care providers, software vendors, academic institutions, federal health agencies, and health plans, to formulate a national health IT policy and strategy (Leavitt, 2008). In September 2005, the ONC created a quasi-public Certification Commission for Health Information Technology (CCHIT) by merging leading private sector health IT associations. With a three-year HHS grant, this Commission was given the charge of developing national certification standards for functionality, interoperability, and data security of health IT products (CCHIT, 2009).

In February this year, the Obama administration allocated about $19 billion of the Fiscal Stimulus (American Recovery and Reinvestment Act) to accelerate adoption and effective use of health IT nationwide (White House, 2009). The Stimulus provides for matching grants to states and Indian tribes to plan and implement EHR diffusion from 2011 to 2013. A state can use the grant to extend loans to health care providers for purchase and/or improvement of health IT systems. With 50% Federal subsidy, states will also be able to establish nonprofit regional extension centers to provide technical assistance for adoption, implementation, upgrade, ongoing maintenance, and effective use of health IT. In addition, the Stimulus provides for incentive payments to physicians and hospitals that participate in Federal health programs to encourage meaningful use of health IT. Meaningful use apparently includes e-prescribing, use of standardized billing codes, reporting of predetermined health care quality measures, and providing evidence of coordinating care with other providers. The amount awarded is set to decline from 2010 to 2015 to incentivize early adoption. Lastly, matching grants will be awarded, on a competitive basis, to academic institutions who integrate multidisciplinary health informatics and IT courses into the curricula of medical and allied health degree programs.

The objectives of this study are: (1) to benchmark the state of health IT adoption, use, and public spending in the U.S. with other countries, (2) to establish the rationale for government intervention in the development of a national health IT infrastructure, and (3) to determine the optimal use of public funds by analyzing the evidence on factors that promote early adoption, as well as barriers that impede adoption and implementation. The remainder of this paper is organized into five sections: Literature Review, Methodology, Research Findings, Analysis, Conclusion, and Areas for Future Research.

LITERATURE REVIEW

To understand the levels of IT applications in health care and the measurable benefits and costs of adoption, this section will review the existing literature on health care informatics and relevant government websites.

Levels of IT Applications in Health Care

The use of information technology in the health care industry can range from the basic electronic medical record (EMR) to an enterprise-wide, comprehensive electronic health record (EHR) system, to a national health IT infrastructure. An EMR is a patient-focused electronic data storage facility designed for use by physicians. It replaces the traditional patient's file containing patient's contact information, date of birth, insurance information, medical history, drug allergies, adverse reactions to certain treatment, documentation of physician encounters (symptoms, diagnosis, treatment, and outcome), and billing code cross references. Unlike paper files, an EMR enables real-time data access and electronic search capabilities (Amatayakul, 2007). An EHR system is designed for use by an integrated network of health management organization, hospitals and providers like the University of Pittsburgh Medical Center System in Pittsburgh, or a large federal health program like the Veteran's Administration and Medicare. It allows multiple healthcare providers (physician's offices, laboratories, hospitals, pharmacies, home care, rehabilitation and long-term care facilities) access to patients' electronic health information for the purpose of coordination of care, and collection of data for cost control (Hartley and Jones, 2005). As described in Stead and Lin (2009), the most comprehensive EHR system can include:

a) *Computerized Physician Order Entry (CPOE)* for e-prescribing, orders for diagnostic tests, and reminders for corollary orders and diagnostic tests intended to improve compliance with preventive care and chronic disease management guidelines, and reduce errors of omission;
b) *Picture Archiving Communication System (PACs)* for storage and transfer of radiology tests results;
c) *Computerized Decision Support Systems (CDSS)* for evidence-based, best practice diagnosis and treatment databases that physicians can access to arrive at prompt, reliable, and optimal diagnoses and treatment options.

When EMR and EHR systems can communicate with each other (i.e. interoperable), and integrated into health IT systems of public health agencies like the Center for Disease Control and Homeland Security, a national health IT infrastructure is formed. Through it, physicians can quickly transmit data on the occurrence of a set of predetermined symptoms to public health agencies, enabling them to see aggregate patterns or identify disease clusters, and quickly deliver geographically targeted warnings about outbreaks of infectious diseases, food poisoning, or bioterrorist incidents (Scanlon, 2009). Interconnected EMRs and EHR systems can also generate electronic data on health outcomes and cost of care, which can aid public and private health plans in identifying cost-effective treatments, efficiently allocate resources, and design performance incentives accordingly (ONC, 2009).

Benefits and Costs

At its website the Department of Health and Human Services states its vision that nationwide use of HIT has the potential to "improve health care quality, prevent medical errors, increase the efficiency of care provision and reduce unnecessary health care costs, increase administrative efficiencies, decrease paperwork, expand access to affordable care, and improve population health" (HHS, 2009). Empirical studies that formally quantify the benefits and costs experienced by early adopters of EMRs or EHR systems are often limited as far as sample size and geographic representation, but they nonetheless offer evidence of the sources of realized cost savings and improved patient outcomes.

Among a small sample of hospitals that have comprehensive EHR systems in place, Simon et al (2005) reported that prompts generated by Computerized Decision Support Systems (CDSS) resulted in a 5.8% increase in Pap test alerts, and 18.3% improvement in flu vaccine alerts. The CDSS also improved drug dosing, preventive care, diagnosis, and patient outcomes in two of every three hospitals studied. In addition, a combination of the CDSS and Computerized Physician Order Entry (CPOE) systems reduced medication errors and increased adherence to medication ordering guidelines in nine of 12 hospitals studied. These benefits come at a reasonable cost. An American Hospital Association survey estimates a one-time acquisition and installation cost for an EHR system of $70~-$100 billion or 15% of average capital spending in the hospital industry, plus annual operating cost of $1.7 billion or 2% of average operating cost in the industry (Stead and Lin, 2009).

For a three-doctor practice, installing an EMR could cost $70,000 to $80,000 plus annual operating cost of $8,000 to $10,000 (King, 2009a). Wang et al. (2003) reported that full EMR implementation yielded net benefits of about $86,400 per physician. Most of the savings were generated in the areas of cost-effective drug prescriptions and reduced medication errors (33%), and reduced personnel needed for chart pulling and filing (28%). The rest of the cost savings came from eliminating duplicate radiology tests and better documentation of services for billing purposes.

Enterprise-wide use of an EHR system in the U.S. is so far limited to a few, but well recognized success stories. One is the Veterans Health Information Systems and Technology Architecture (VistA) developed by the Veterans Administration 25 years ago. It is now used by over 1,400 VA hospitals and health facilities. It allows clinicians to access patient EHRs from other VA facilities. When records at the VA Medical Center in Gulfport Mississippi were destroyed during Hurricane Katrina, for example, VA hospitals in other states were able to retrieve records for nearly 40,000 veterans (Hill, 2007). Use of the VistA system has transformed the VA from a provider of substandard care to an institution that outperformed most private hospitals in 14 out of 15 quality assurance areas (Hill, 2007). Because of its proven benefits, the Defense Department's Military Health System and the Indian Health Services have both adopted VistA. The open source version, WorldVistA, is freely available to the public and private sector through the Freedom of Information Act, and has been adopted overseas by the *Instituto Mexicano del Sequro Sociale*, Berlin Heart Institute, National Cancer Institute of Cairo, and other health care organizations in Finland, Nigeria, and American Samoa (VA, 2009). Another enterprise-wide EHR user is

Kaiser Permanente, an integrated health network, which currently uses a commercial product (Epic System) in two-thirds of its hospitals, and all of its medical clinics, pharmacies, and laboratories. About 14,000 of its salaried physicians access electronic records for 8.7 million patients in nine states and Washington, D.C. Kaiser estimates that it has spent about $4 billion as of 2008, but its use of health IT is a big factor in reducing fatalities from heart disease and cancer (King , 2009a).

At the national level, the Office of National Coordinator for Health IT (HHS, 2008) estimates that health care cost in the country can be reduced by $200~300 billion per year, well above an estimated cost to the government and the private sector of about $50 billion per year. Improvements in public health are not easy to quantify, but there are some indicators of possible benefits. For example, it is estimated that food-borne illnesses accounts for about 6% of the country's health care cost (Scanlon, 2009). A national health IT infrastructure can reduce this cost by facilitating the flow of information between public health agencies and health care providers. Coordination of care among hospitals, physicians, pharmacies, and laboratories through an EHR system can also reduce duplication of expensive diagnostic scans, preventable hospitalizations, and medical errors. It is estimated that 30% of health care spending in the U.S. goes to ineffective or redundant care (Fisher and Wennberg, 2009). A study funded by the Rand Corporation in 2005 estimated that annual savings from efficiency gains could amount to $77 billion over 15 years, assuming adoption by 90% of larger hospitals (those with 100 beds or more) and doctors' offices (Hillestad et al., 2005). Adoption by hospitals of Computerized Physician Order Entry systems for medications could also eliminate around 200,000 adverse drug events each year for an additional annual savings of about $1 billion. In addition, a significant number of deaths can be avoided from the use of IT to scan patient records for risk factors, and generate prompts for two types of vaccination and three types of screening (see Table 1).

Table 1: Estimated Annual Benefits and Costs of Preventive Vaccinations and Screenings

Service (in millions/year)	Annual Cost ($Million)	Deaths Avoided/year
Influenza vaccination	$134 – $327	5,200 – 11,700
Pneumonia vaccination	$90	15,000 – 27,000
Colorectal cancer screening	$1,700 – $7,200	17,000 – 38,000
Breast cancer screening	$1,000 – $3,000	2,200 - 6,600
Cervical cancer screening	$152 – $456	533

Source: Hillestad et al. (2005), *Increased utilization of preventive services through prompts generated by EHR systems could save many lives at a relatively modest cost.*

METHODOLOGY

In order to put the $19 billion allocated by the 2009 Stimulus for health IT in perspective, we need to look at how much the U.S. and other countries have spent since the year they started their national health IT effort. We also need to know how U.S. adoption rates compare with those of other countries. This study compiles domestic and international data on public investments in health IT and rates of adoption from primary and secondary sources. In addition, an understanding of the factors that promote or impede adoption and use of health IT is necessary to establish the rationales, if any, for government intervention. Rather than reinvent the wheel, this study compiles the evidence gathered by national and international surveys of physicians and/or hospitals.

RESEARCH FINDINGS

Extent of Health IT Adoption

The U.S. is in a relatively early stage of developing health IT on a national scale; lagging behind at least eight other industrialized countries that made such a commitment between 1993 and 2002 (see Table 2). The HHS Department supports two national surveys of health IT adoption (HHS, 2008). First, is the

Center for Disease Control Ambulatory Medical Survey of 2,700 physicians conducted from 2006-2008. This survey reports an increasing trend in adoption rates, but as of 2008 only about one of five physicians use an EHR system. This is below the 24% targeted by the federal government.

Table 2: Time Frame for Nationwide Health IT Implementation

Country	eHealth Policy Established	Target for Completion
Germany [1]	1993	2006
Finland [2]	1995	2004
Denmark [2]	1996	2000
Iceland [2]	1996	2004
Canada [1]	1997	2009 (50%)
France [2]	1997	N/A
Australia [1]	2000	N/A
United Kingdom. [1]	2002	2014
United States [1]	2004	2014
Austria [2]	2005	2008
Switzerland [2]	2006	N/A

Sources: [1] Anderson, et al. (2006) and [2] WHO (2007). *This table shows that at least eight other industrialized countries started their national health IT effort earlier than the U.S.*

Second, is the national survey of 3,037 hospitals conducted by the American Hospital Association, which found that only one of ten hospitals has adopted an EHR system as of 2008 (see Table 3). Two levels of usage: Basic and full usage are defined according to different functionalities in the physician's practice and hospital settings (see Tables 4 and 5). Among the adopters (physicians as well as hospitals), only one of five use all the functionalities of EHR systems.

Table 3: Survey Results on EHR Adoption and Usage in the U.S.

Setting	2006	2007	2008
Physicians offices	14%	17%	**21%**
Basic	11%	13%	17%
Full	3%	4%	4%
Hospitals			**10%**
Basic	N/A	N/A	8%
Full	N/A	N/A	2%

Source: HHS (2008). *A national survey found that only one of five physicians and one of ten hospitals in this country have an EHR system in place as of 2008. Most of the adopters use only the basic functions*

Table 4: Basic vs. Full Usage: Physicians

Type of Usage	Basic	Full	Type of Usage	Basic	Full
Health Information and Data			***Order Entry Management***		
Patient demographics	X	X	Prescription orders	X	X
Problem list or symptoms	X	X	Laboratory orders		X
Current medications	X	X	Radiology orders		X
Clinical notes	X	X	Rx sent electronically		X
Diagnosis and follow up		X	Orders sent electronically		X
Clinical Decision Support			***Results Management***		
Drug warnings		X	View lab results	X	X
Out of range levels highlighted		X	View imaging results	X	X
Clinical reminders		X	Images returned		X

Source: HHS (2008). *This table compares basic and full functionalities of health IT designed for physicians.*

Comparing the extent of adoption of health IT in the U.S. to those of other countries is not easy. First, the cross-country survey available does not include the U.S. in the sample (Dobrev, 2008). Second, this survey reports adoption rates at a level of IT usage that is more disaggregated (see Table 6) than the national surveys done in the U.S. Nonetheless, it is probably safe to infer from these data that, on average, health IT adoption in the European Union is more widespread and usage is more intense than here.

Table 5: Basic vs. Full Usage: Hospitals

Type of Usage	Basic	Full	Type of Usage	Basic	Full
Electronic Clinical Information			***Results Management***		
Patient demographics	X	X	View lab reports	X	X
Physician notes	X	X	View radiology reports	X	X
Nursing assessments	X	X	View radiology images		X
Problem lists	X	X	View diagnostic test results		X
Medication lists	X	X	View diagnostic test images		X
Discharge summaries	X	X	View consultant report		X
Advance directives		X	***Decision Support***		
Computerized Provider Order Entry			Clinical guidelines		X
Lab reports		X	Clinical reminders		X
Radiology tests		X	Drug allergy results		X
Medications	X	X	Drug-drug interactions		X
Consultation requests		X	Drug-lab interactions		X
Nursing Orders		X	Drug dosing support		X

Source: HHS (2008). *This table compares basic and full functionalities of health IT designed for hospitals.*

Table 6: EHR Adoption Rates in Select EU Countries (Percentages as of 2007)

Type of Usage	EU Average	Denmark	UK	France	Germany
Data Storage					
Diagnoses	90	93	94	89	99
Medications	90	99	98	91	93
Basic Medical Parameters	83	96	98	93	80
Lab Results	79	99	96	77	78
Symptoms/Complaints	77	97	92	92	67
Medical history	75	97	95	89	52
Exams and results	75	95	88	81	56
Vital signs measurements	74	92	92	88	59
Treatment outcomes	65	96	77	66	52
Radiological Images	34	98	30	65	15
Electronic Exchange of Medical patient data					
Medical data with providers	10	74	26	5	4
Analytic results from labs	40	96	85	33	63
Telemonitoring of patients	1	0	2	1	1
Medical data across borders	1	2	0	2	0
Electronic Exchange of Administrative patient data					
With other providers	10	74	32	4	3
With reimbursers	15	48	43	26	4
Security Features					
Password protected access	94	97	98	88	95
Password protected file transmission	57	71	58	39	63
Encryption of transmitted files	42	68	42	36	53
Use of *e*-signatures	19	93	10	16	7
Electronic Prescribing	6	97	5	1	0

Source: Dobrev et al. (2008) *A survey of 6,789 primary care physicians in 27 EU member show high rates of adoption of health IT for a wide variety of applications.*

Financing of Health IT

The lower rate of health IT adoption in the U.S. compared to some developed countries reflects the fact that it started late and less public funds have been invested into this endeavor. Estimates of public investments on health IT by Anderson et al. (2006) suggest that the governments of the United Kingdom, Canada, Germany, and Australia have invested at least seven times more in total amounts, and at least 11 times more on a per capita basis, than the U.S. as of 2005 (see Table 7). However, some figures are not easy to replicate. For example, another study (Arnold et al., 2007) reports that by 2003, the Canadian government had already invested $1.2 billion on Health Infoway, the nonprofit corporation which leads the national effort. This would imply that by 2005, Canada's investment would be more than the $1 billion reported in Table 7. In addition, the figure of $125 million for the U.S. may be too high. The budgets for the Office of National Coordinator of Health IT and the Agency for Health Quality Research,

both under the Department of Health and Human Services, only show about $73 million of federal funding as of 2005 (see Table 8).

Table 7: Public Investment on Health IT (as of 2005)

Country	Total (U.S.$ million)	Per Capita (U.S.$)
Germany	1,800	21.20
Canada	1,000	31.85
Australia	979	4.93
U.K.	11,500	192.79
U.S.	125	0.43

Source: Anderson, et al. (2006) . As of 2005, the U.S. government spent much less than four other industrialized countries in health IT.

Table 8: Federal Funding for Health IT in the U.S. Prior to the 2009 Stimulus (in $millions)

Funding Source	2004	2005	2006	2007	2008	2009
Office of National Coordinator [1]						
Health IT strategy/policy		0	42	42	42	18
Program level funding [2]		20	61	61	61	66
Agency for Health Quality Research [3]						
Patient Safety Budget		14				
Planning Grants			12			
Implementation Grants			31			
Research on health IT and patient safety		7				
State & Regional Health IT Demonstration Projects	16	16				
Electronic Prescribing Pilot Projects (with Center for Medicare and Medicaid)			6			
Privacy and Security of Health IT Project			11.5			
Total federal funding of $526.5 million	**$16**	**$57**	**$163.5**	**$103**	**$103**	**$84**

Sources: [1] Government Printing Office. The Budget for Fiscal Years 2004, 2005, 2006, 2007, 2008, Figures for 2008-2009 are labeled as 'estimate'; [2] Includes $7.5 million per year in 2005-2007 for development of EHR certification standards granted to CCHIT; [3] Fitzmaurice, et al. (2006). The federal government invested just over half a billion on health IT from 2004 to 2009.

In addition to the federal funding of $526.5 million prior to the passage of the Stimulus in February, state and local governments, as well as public-private partnerships have also made commitments to provide financial incentives to physicians and/or community health centers to encourage health IT adoption (see Table 9). The city governments of New York and the states of Massachusetts, Hawaii, Oregon, Washington, Alaska, and Idaho have appropriated a total of $107 million. Data compiled by the Certification Commission for Health IT indicate that as of 2008, hospital organizations and public-private partnerships have launched about 90 programs to provide incentives for physicians to acquire, implement and maintain EHRs (CCHIT, 2008). About $722 million have already been committed to 36 of the 90 programs. One example of these programs is the Pay-for-Performance Initiative of the Bridges to Excellence, a nonprofit organization with a mission to reward providers who have implemented improvements in the quality of health care delivery through the use of health IT. Eighty participating purchasers of group health insurance, including Cisco, Intel, Oracle, At&T, Verizon, GE, IBM, and UPS (CCHIT, 2008) support this initiative.

Altogether, about $1.36 billion have been committed to developing health IT in this country prior to the passage of the 2009 Stimulus. Thus, the commitment of $19 billion over five years represents a significant leap in funding commitment relative to past commitments, and relative to other countries.

Table 9: Funding Commitments for EHR Adoption Incentives (in $million as of 2008) by State and Local Governments and Public-Private Partnerships in the U.S.

Funding Source	Amount
New York City's Primary Care Information Project	60
Massachusetts eHealth Collaborative [1]	25
Hawaii State Blue Cross Blue Shield Plan	20
Washington, Oregon, Alaska, Idaho: Public-private partnerships	2
36 adoption incentive programs by hospital organizations	721.85
54 adoption incentive programs by public-private partnerships	N/A

Source: CCHIT (2008). State and local governments as well as public-private partnerships in the U.S. provide funding to promote health IT adoption by health care providers.

ANALYSIS

The preceding section highlighted the fact that the U.S. lags behind other developed countries in the development of a national health IT infrastructure because it started late, and invested less money. In this section, we determine the factors that promote or impede adoption of EHR systems, and then identify rationales for government intervention.

Positive and Negative Determinants of Health IT Adoption and Use

A regression analysis funded by the Rand Corporation found that the probability of EMR adoption among physician groups was negatively correlated with the size of the practice, and location in rural or underserved communities. The study also found this to be true of hospitals. Smaller hospitals were those that operated as independent hospitals, i.e. not part of a health care network or hospital system. In addition, hospitals with a high share of Medicare patients were also found to have a lower probability of having an EHR system in place (Fonkych and Taylor, 2005). Goldstein (2009) likewise reported that 74% of hospitals surveyed, which were small and independent, cite the high acquisition and maintenance cost of health IT as the biggest deterrent of adoption.

Insights on problems encountered at the implementation stage come from a study funded by the National Research Council (Stead and Lin, 2009). This study paid IT experts from Intel, Google, and five universities to shadow clinicians at nationally recognized medical centers while they were using EHR software. The long list of implementation problems observed includes:

- misinterpretation of information due to incomplete or inaccurate data entry;
- inefficient workflow because clinicians spend more time entering data than using data, and waste time retrieving information in the form they want to use;
- data security is inadequate;
- meaningful interoperability is almost non-existent;
- support for evidence-based medicine and computer-based advice is rare;
- the systems result in a rigid work flow, not suitable for a dynamic environment;
- implementation to reach enterprise-wide functionality is expected to take more than a decade; and
- most clinicians perceived the benefits as significantly less than anticipated

Other studies corroborate these findings. For example, Goldstein (2009) found that over a third of hospital IT adopters surveyed encountered resistance from physicians who argued that use of health IT takes away from patient care. Another study published in the New England Journal of Medicine cites renowned physicians who also claimed that EMR technology diverts their attention from the patient. They also complained that the system created chart notes that were seriously flawed (Hartzband et al. 2008). Evidently, physician's revenues also suffer because of workflow disruption in the early stages of

implementation. The practice usually does not go back to a full schedule until two to three months later (King 2009a). Moreover, electronic monitoring and exchange of information can reduce the need for patients to come for follow-up visits. One study that measured the decrease in office visits found that this could be as high as 15% over a year (Gans et al., 2005).

Rationales for Government Intervention

The preceding analysis of determinants of health IT adoption points to four rationales for government intervention to attain the goal of having a national health IT infrastructure: (1) the need for national standards to ensure interoperability, data security and privacy, (2) economies of scale, (3) externalities, and (4) network effects. Each of these rationales is discussed below.

National Standards for Interoperability, Data Security, and Privacy. – A national network of interoperable health IT systems can generate data for three purpose: (1) reducing public health threats, (2) public reporting of standardized quality measures of health care services, and (3) creation of a database of evidence-based best practices in diagnosis and treatment. Due to the multiplicity of software and hardware vendors in the U.S. and abroad, there is a need for the government, at the federal level, to establish national standards to ensure that health care providers purchase EHR systems that will enable health care providers to share health information with each other, and with public health agencies. Standardized measures of health care quality for different chronic illnesses, a predetermined set of symptoms linked to different public health threats, and billing codes to track cost-effective treatments, and evidence-based best practices, are all necessary.

From the point of view of consumers of health care, data security and privacy are of utmost importance. Currently, pharmacies are able to sell detailed records of patient medications to clearinghouses, which then create profiles on individuals and sell that information to interested parties such as insurance companies for underwriting purposes (King, 2009b). In the absence of a single-payer system in this country, or a law that prevents private health plans from denying insurance coverage to someone with pre-existing condition or genetic susceptibility, patient's concern about the privacy of medical records is understandable. Thus, uniform or national standards are also needed to ensure privacy and data security among patients. In 2005-2006, the quasi-public Certification Commission for Health IT developed national standards for functionality, interoperability, and data security and privacy. It began certifying EMR and EHR software in 2006, and has certified more than 200 EHR products by mid-2009, representing over 75% of the marketplace CCHIT, 2009). As mandated by the Stimulus, HHS released a document on June 16, 2009, which provides hospitals and physicians affiliated with Federal health programs a draft of guidelines on what it takes to establish "Meaningful Use" of health IT, and hence be eligible for financial incentives (HHS, 2009). Among others, health care providers will be required to ensure privacy and security protections for confidential information not only through operating policies and procedures, but also by adopting appropriate technology to be in compliance with state law and HIPAA Privacy and Security Rules. They will also be required to provide transparency and consumer choice about what health information is shared, with whom, and for what purpose. Accordingly, an HIT Policy Committee recommended that the following measurable outcomes be monitored during 2011-2015 to determine if physicians and hospitals remain eligible for financial incentives (HHS, 2009):

- conduct or update a security risk assessment and implement security updates as necessary;
- be cleared by the investigating authority of any HIPAA privacy or security violation;
- incorporate and utilize technology to segment sensitive health information;
- provide aggregated or de-identified health information, when sufficient, to satisfy a data request for population health purposes;
- provide patients, on request, with a timely accounting of disclosures for treatment, payment and health care operations.

Economies of Scale and Externalities. - Early adopters of health IT tend to be the larger hospitals and physicians practice groups, especially those that belong to an integrated health network. The huge investment in health IT hardware, software, technical staff, and training of users coupled with the inability to internalize the benefits tips the balance of benefits and costs against adoption by independent hospitals, and clinics with fewer than five physicians. This situation is even worse for providers located in rural and low-income areas. The purchase and installation of an EHR system would be worthless unless physicians use it. Resistance among physicians may be due to their inability to internalize or share in the benefits of improved patient outcomes, fewer redundant tests, cost-effective medications and treatments, among others. For example, the benefits of cost-effective drug prescriptions and elimination of duplicate radiology tests accrue to the health insurer. Physicians are not rewarded for performance or for cost-savings passed on to health insurers. Moreover, their revenues fall because of reduced office visits and work disruption during the early phase of IT installation and implementation. As a result, the adoption rate is higher among health plans that integrate hospitals, physicians, and laboratories into one health system. Examples are Kaiser Permanente, the Cleveland Clinic, Intermountain Health Care, and UPMC.

Thus, rather than providing loans and technical assistance to smaller hospitals and physician practices directly, it may be more cost-effective for the government to mandate insurers or health plans to invest in EHR systems, or else pay into a pool of funds that can be invested in shared facilities either at the city, state or regional level. The cost of providing EHR systems for use by small physician groups and independent hospitals within a health plan can be substantially reduced if instead of installing and maintaining the hardware and software in each office or hospital, the health plan provides remote access to a shared health IT facility on a subscription basis. This is known in the health IT industry as the software as a service or SaaS model (Close, 2009). Lastly, society as a whole also benefits from health care cost savings that can slow down the rise in health insurance cost. When the uninsured uses emergency care, hospitals raise the bill for insured inpatients. Private health insurers subsequently pass this on to the insured by raising future premium or cost-shares. As the cost of insurance increases, individuals with lower health risk opt out of health insurance. The adverse selection problem implies that the cost of health insurance will continue to spiral upward among the remaining higher risk pool of insured individuals. Cost savings from effective use of health IT can potentially offset the rise in cost of health insurance in this country.

Network Effect. - Building a national health IT infrastructure through a network of interoperable EHR systems is on top of the country's health IT priorities. A nationwide network, that allows private sector providers to feed data on a predetermined set of symptoms linked to food-borne illnesses, contagious diseases, and bioterrorism into eHealth systems, which the Center for Disease Control or Homeland Security can access in real time, is immensely valuable from the point of view of early detection of threats to public safety. Moreover, a national health IT system can substantially enhance the dissemination of information to the public, and containment of these threats. In addition, consumer choice and market competition can be enhanced if a nationwide health IT network can generate quality or performance ratings on various hospitals and physicians. The Agency for Health Care Quality Research under the Health and Human Services Department has gone a long way towards identifying measures of quality in health care delivery (AHRQ, 2009). Physicians and hospitals who perform well on these measures have the incentives to publicize this information, but those who underperform do not. Needless to say, the more hospitals, laboratories, and physicians participate in periodic submission of information to public health agencies through the national health IT infrastructure, the greater the public benefits are. On their own, however, private sector providers will have no incentive to participate in this nationwide exchange of health information since they do not internalize the benefits to society as a whole. This network effect justifies monetary incentives that the Stimulus proposes to award to physicians and hospitals for effective or "meaningful use" of health IT. The Stimulus does propose to establish regional exchanges that will provide loans and technical assistance for the purchase, installation, and maintenance of interoperable

EHR systems. However, it does not mandate health care providers outside of Federal health programs to adopt health IT systems. This precludes the full realization of potential public health benefits.

CONCLUSION

The U.S. lags behind other developed countries in terms of adoption and public investment in a nationwide network of electronic health records systems. The fiscal stimulus of $19 over five years represents a significant increase compared to past funding commitments, and per capita spending by other countries. Evidence gathered by surveys of physicians and hospitals indicate the presence of economies of scale, externalities, network effects, and public concerns about data security and privacy. Thus, government intervention is necessary to accelerate adoption and widespread use. However, to optimize the use of public funds, loans and technical assistance must be targeted to health care providers who cannot reap the economies of scale and externalities inherent in the purchase, maintenance and use of EHR systems. These are smaller practice groups of less than five physicians and independent hospitals, including those in rural and disadvantaged communities. Shared access to an EHR system installed and maintained by a nonprofit facility at the city, state or regional level is more cost-effective than having each hospital or practice group acquire and maintain separate systems. As an alternative, each practice or hospital can subscribe to software provided and maintained by certified commercial vendors.

Moreover, financial incentives awarded to physicians and hospitals for meaningful use of health IT must be made conditional on their use of certified EHR systems. This will ensure that various EHR systems in the country can communicate with each other, and have passed the standards for data security and privacy. Reporting by health care providers of health care quality measures and costs through a national network of EHR systems could generate valuable information for consumer choice. Submission of depersonalized or aggregated health information with public health agencies also has the potential of reducing threats to public health. Lastly, to maximize the network effects, electronic submission of such information must be mandated of all health care providers, not only those within federal health programs.

AREAS FOR FUTURE RESEARCH

It would be interesting to document case studies that provide evidence of health care quality improvements attributable to the use of health IT. Another study of future interest is the job market implications of the health IT stimulus. The stimulus is flexible enough in that it does not restrict physicians, if they prefer, from using the financial incentives that they receive to pay IT support staff. It would be interesting to see how many more health IT professionals will graduate from educational institutions receiving grants provided for in the stimulus.

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ACKNOWLEDGMENT

We would like to thank Robert Faulkner for his research assistance in the Fall 2008, while a senior student at the School of Business, Robert Morris University.

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