

Adoption of Health Information Technology (HIT) in selected European Countries

Monica Yung, John Murphy, Melody Dungee

Introduction

The purpose of this literature review is to research and review several European countries to document their progress and challenges in the adoption and deployment of Health Information Technology, specifically the Electronic Health Record and Computerized Physician Order Entry.

As the United States turns its attention to improve its own health care system and increasing the availability of health care, it becomes imperative to improve the quality of care while at the same time bringing down the costs that burden the current system. Health Information Technology can play a significant role in driving down costs and improving quality of care. To better understand the challenges and successes that lie ahead of the United States, it is important to look at a region that is roughly a decade ahead in terms of national commitment and implementation of an advanced Health Information Technology initiative. That region would be Europe.

According to an article by McGlynn in 2004, it is not necessarily how much a nation spends on health care but how the money is spent¹. For example, the United States underperforms in many health categories including life mortality, medical errors, and high out of pocket expenses². Many European countries, including France are ranked near the top according to the World Health Organization, yet spend less. The implementation of the electronic health record proposes several benefits that could address improving the quality of care, reduction in medical errors and lowering of costs. There are also public benefits of an electronic health record such as early detection of diseases that can affect the general population, and closer tracking of chronic diseases that are responsible for much of the high cost of health care³. The ability to have a true Health Information Exchange environment begins with the EHR.

In this study we found it challenging to compare each country in direct comparison to each other, but we did find enough information to come to some conclusions and lessons learned that the US can leverage. Health care improvement is an international challenge. Each country has its own unique set of variables such as how that particular country is set up politically and culturally, to the specifics of its health care system, such as the structure of the payer system, or the attitude and approach to personal privacy laws regarding information. The US system has its own set of unique characteristics. The challenge is to find enough valid information and come to some reasonable conclusions that transcend political boundaries.

This study looks at 4 countries (UK, Germany, Netherlands, and Denmark); each had its own beginnings earlier than 2005. It should also be noted that the European Union (EU) has had a regional action plan to improve Health IT. In 2004, the European Commission Action Plan stated that some of the regional objectives that the EU should promote and support included amongst other things the strengthening of the electronic health record, e-prescribing, and to invest more in interoperability by 2008⁴.

Interestingly Europe has adopted the US EMR Adoption Model to track the progress of Electronic Health Record adoption. However, they have made some enhancements to the model to better function in conjunction with the uniqueness of the European health care model⁵. For example, in the US Adoption Model, Stage 1 requires the Lab, Pharmacy, and Radiology IS to be installed. But in Europe many hospitals do not have those departments self-contained in a hospital, so the adoption model states that as long as those functions which are provided by an outside vendor, have an IS installed, that is sufficient.

Computerized Physician Order Entry or CPOE is a considerable component in the exchange of health information as it allows clinicians to legally prescribe and electronically enter orders for medical care ranging from prescriptions to orders for medical tests from a primary care or community center to an integrated central electronic system. CPOE systems offer many benefits in that they have been found to prevent adverse events, avoid medical errors due to ambiguous handwriting or misspelled transcriptions, provide rapid order completion, as well as significant cost savings. Ultimately, it has been internationally recognized as leading to more timely and efficient care.

Therefore, CPOE is an important technology that promises a significant role in health information exchange. However, CPOE systems are largely dependent on having an established Electronic Medical Record in

place as its success depends on its degree of integration to an IT platform and medication management systems⁶. While CPOE promises numerous benefits and many European countries hope for significant progress in CPOE implementation, the adoption of CPOE systems have had a slow growth rate in Europe due to initial and integration costs⁷.

However, with the higher adoption rates of health information exchange and EHRs the growth of CPOEs has also been directly impacted/encouraged. Therefore, despite the challenges, CPOE is an emerging market and is anticipated to grow 11.5% in Europe over the next seven years⁸. In 2010, the market for CPOE in Europe was worth \$106 million and it is estimated to reach around \$173.5 million by 2017 according to market research firm Frost & Sullivan.

Methods

In conducting our literature review, we searched Medline, PubMed, and other scientific search engines for terms such as “electronic health records,” health information exchange,” “computerized physician order entry,” “electronic medical records,” and “health technology” limiting the results to each of the specified countries discussed in this review. This enabled us to find various articles published in scientific journals, such as the Cambridge Journal, the New England Journal of Medicine, JAMA, and the International Journal of Medical Informatics, and study results regarding our topic of interest. In addition to published reviewed journal articles, surveys, relevant charts, and reports were also used to supplement our findings along with reported funded studies from reputable organizations, such as HIMSS, Accenture, Computer Science Corporation, the Commonwealth Fund and other international governmental HIT agencies. The sources reviewed spanned from 1995 to the present in order to keep the material as current as possible. Through these various data sources, we were able to garner an accurate representation of the state of Health IT, health information exchange, EHR, and CPOE adoption in the nations of interest.

Results

For the ease of comparison we’ve organized our literature review by each country in the European Union. We discussed the country’s plan for HIT adoption, its progression, challenges they face, benefits of HIT adoption, financial incentives, and the nation’s health system and also pulled in data for each nation’s eHealth Report Card.

Over 50 pieces of literature from reputable sources provided surveys and charts comparing the nations one against the other in categories such as EHR Use by General Practitioners, Health Information Exchange Strategies, CPOE Adoption Rate, EHR Use in Hospitals and other categories shown later in this paper. The studies consistently showed that European countries overall had a much higher adoption rate of EHR and CPOE with Denmark in the lead and the Netherlands close behind followed by the UK and Germany.

Our research shows that the United States still lags behind, however, with the federal government mandate of the HITECH Act 2009, it is expected that there will be a significant increase of EHR and CPOE adoption in the U.S by the year 2015.

Finally, based on our research, we were able to confirm and agree with Dr. Blumenthal’s (et al) (the former National Coordinator for the Department of Health and Human Services) findings (2008) that the huge success of EHR adoption in Europe is due to several factors. These factors include but are not limited to, financial and nonfinancial support, standard terminologies, billing mandates and peer pressure⁹. We also determined that even though there is a high interest in adoption of health information technology, many nations are still struggling today to achieve this goal.

Progress Dashboard of Health Information Technology in selected European countries

	US	UK	Germany	Netherlands	Denmark
National HIT Start Date	2009	2000/2005	2003	2006	1994
National Health ID	RHIOs	National Program for IT	D2D, Smart Cards	National SwitchPoint	Danish Health Data Network
Unique Pt Identifier	None	NHS number	KVK (health insurance card)	Citizen Service Number (BSN)	CPR number
Comprehensive e-Health Portal	No single comprehensive gov't portal though various online resources available	National Health Service : 24/7 access to Web or phone-based healthcare info	Available but less access to information	Available but less access to information	Sundhed.dk - Advanced gov't run; HIE between patients and healthcare providers
% Country Wired (households with Internet connection)	78%	82%	82%	90%	86%
Government Mandate	None	N/A	Electronic billing	N/A	e-prescribing mandated for PCP; electronic patient referrals
Who bears IT financial burden	Incentives and funding by gov't; No single payer health care system;	National Program for IT (NPfIT)	N/A	Subsidy for national infrastructure	Publicly funded; 85% of healthcare costs financed through taxes
EHR Adoption Rate (PCP)	28%	89%	42%	98%	95%
EHR Adoption Rate (Hospitals)	8%	3%	<5%	<5%	35%
CPOE Market Penetration Hospital	~15% of hospitals	2% with full CPOE implementation	No hospital-wide CPOE	In 6 AMCs and 12 non-AMCs; ~20% of hospitals	N/A though suggested to rank high
Direct Link to Pharmacy	Yes; Problems with lost data are common	Yes	No	Yes	Yes

*Information to populate the dashboard was garnered from multiple resources including Accenture and AARP's European Experiences with Health IT, Internet World Stats, etc. and A.K. Jha, et.al., "The Use of Health Information Technology in Seven Nations," International Journal of Medical Informatics 77, no. 12 (2008): 848-854. And Jos Aarts and Ross Koppel, "Implementation of Computerized Physician Order Entry in Seven Countries," Health Affairs, 28, no. 2(2009): 404-414.

I. United Kingdom

UK e-Health Report Card *

Population	GDP	Life Expectancy	Annual Health Expenditures	Health expenditures as % of GDP	Per Capita Health Spend	Doctors
61M	\$2.31T	79 yrs.	\$206B	8.40%	\$2,784.00	221/10,000

Largest publicly provided health system offering health care free at the point of use to all UK citizens. The National Programme for IT, underway since 2004 aims to dramatically modernize the UK Health system through delivery of IT which supports single patients records available wherever, whenever, and to whoever needs them, subject to security constraints.

Source Systems

- ⤴ Acute Integrated Systems >80% (Y)
- ⤴ Primary Care Integrated Systems >80% (G)

Usage and Access

- ⤴ Systems Used for Clinical Decision Making (Y)
- ⤴ Patient access to records (R)

National Integration and Sharing

- ⤴ National Electronic Health records and unique ID's (Y)
- ⤴ E-Health Infrastructure (G)
- ⤴ Agreed clinical coding and data transfer standards (G)
- ⤴ Tailored legislative and privacy frameworks (Y)
- ⤴ Clear political and clinical leadership (Y)

G- Status of Green (on track and in place)

Y- Status of Yellow (promising some progress)

R- Status of Red (challenges not started)

* Pulled directly from a report from Computer Science Corporation¹⁰, which researched several organizations to gather this information such as the World Health Organization (WHO) and present a summary dashboard

Adoption of Electronic Health Record

The UK has a universal health care system called the National Health Service (NHS) where all citizens have health care coverage that is primarily free of charge. There are few cost sharing services, as most inpatient and outpatient, as well as prescriptions are covered. Financially, the NHS covers about 86% of all medical costs, and is funded by taxation¹¹. General Practitioners are the primary gatekeepers to advanced services, as all citizens are required to see their assigned GP first before any other services can be rendered. With such a central control of

health care services in place, the pressures to contain costs and improve quality are typically high on the agenda for the NHS.

In 2000, the UK identified Health IT as a key component to improving health care through modernization. The national vision was dubbed “Connecting for Health” through the National Programme for IT (NPFIT) initiative. The vision was bold and had an objective to build a patient focused health care system¹². The scope was described as “. . . wider and more extensive than any ongoing or planned healthcare IT programme in the world, and it represents the largest single IT investment in the UK to date”¹³. One of the specific objectives included the promotion of the Electronic Health Record, and is defined as an NHS Care Records Service, and the promise of health information exchanging across the country through a top down approach and government financing model. Progress towards these objectives was slow as of 2006¹⁴.

Government estimates for this effort were initially around \$12B, but rose to roughly \$24B for the 10 year effort. The Government does not expect the benefits to initially outweigh the costs, instead focusing on an improved health care system in general as an investment for the long term care and costs savings that will naturally occur over time¹⁵.

The UK does have a National Health ID for citizens called the NHS number. In the UK there is no explicit right to privacy, unlike many other countries¹⁶. Instead, what the government does is communicate a guarantee (NHS Care Record Guarantee), stating that all patient information will be handled in a confidential and secure manner¹⁷. The UK enacted a Data Protection Act in 1998 that is the legal basis for this guarantee. And according to the AARP article, the Freedom of Information Act of 1998 allows people to access information disclosed and how that information was obtained. According to AARP, in 2002 the use of HIT by clinicians stood at 58%.

Unfortunately, as of the last few months, the UK has pulled the plug on this effort. The government had already invested roughly \$12B and was not seeing the expected results, had many missed deadlines, and costs continued to rise. According to an article in HealthIT News in association with HIMSS in February of 2012, the root cause of the failure was the government led top down approach. This is an area US leaders in the field should be observing as part of lessons learned and best practices. The UK approach had the government selecting vendors, and trying to implement a one size fits all approach.

Adoption of CPOE in Hospitals

Although the United Kingdom (UK) has had a fairly high adoption rate of EHRs and has been a leader in health technology innovation, its adoption of CPOE and electronic prescribing systems has been slow. In early 2007, it was reported that only three hospitals in England had whole-hospital electronic prescribing systems¹⁸. Similar results were also found in an article which surveyed 188 hospitals in the UK. In 2000, 89% of hospitals had no electronic prescribing system and of the 11% that did have a CPOE system in place, only 2% were fully electronic prescribing facilities¹⁹. This also remains consistent according to a survey conducted in 2004 that reported that only 2.6% of hospitals have electronic prescribing²⁰.

II. Germany

German e-Health Report Card *

Population	GDP	Life Expectancy	Annual Health Expenditures	Health expenditures as % of GDP	Per Capita Health Spend	Doctors
82.6M	\$2.8T	80 yrs.	\$273B	10.40%	\$3,328.00	344/10,000
Health system funded by citizens and employers and the government. Patients have choice of care and private insurance is available. German citizens all have an insurance card required for hospital treatment. Some patient co-payment is often required. Upcoming e-Health initiatives include new e-Health cards, health portals and health exchanges.						

Source Systems

- ⤴ Acute Integrated Systems >80% (G)
- ⤴ Primary Care Integrated Systems >80% (Y)

Usage and Access

- ⤴ Systems Used for Clinical Decision Making (Y)
- ⤴ Patient access to records (R)

National Integration and Sharing

- ⤴ National Electronic Health records and unique ID's (Y)
- ⤴ E-Health Infrastructure (Y)
- ⤴ Agreed clinical coding and data transfer standards (Y)
- ⤴ Tailored legislative and privacy frameworks (Y)
- ⤴ Clear political and clinical leadership (R)

G- Status of Green (on track and in place)

Y- Status of Yellow (promising some progress)

R- Status of Red (challenges not started)

* Pulled directly from a report from Computer Science Corporation²¹, which researched several organizations to gather this information such as the World Health Organization (WHO) and present a summary dashboard

Adoption of Electronic Health Record

Germany has probably the oldest government sponsored health care system in the western world. Having started the initiative under Chancellor Bismarck, it was the first country to look at health care as a primary right and service that its citizens should have. The German health care system makes it mandatory for its citizens to have health insurance. If someone makes under \$40,000 they are required to have statutory health insurance. Those that are wealthier can supplement the basic health insurance with their own private insurance company²². The government does not own any hospitals, providers, or payers. Most hospitals are public non-profit institutions.

However the German government does have health care regulation power, and this authority is seen most visibly in the regulation or pricing. The government sets the rates of services in health care.

With access to health care provided to virtually all of its citizens, and the prices charged for these services regulated, the result is a system under pressure to become more and more efficient. Hence the promise of what Germany calls e-Health. In this sense, Germany is not that unlike the US., in that it is a distributed system with no central point of data collection, and added redundancy²³. Interestingly, some believe this is a weakness in the German system and point to the UK as a better model. However, as noted earlier in the UK literature, the recently failed experiment in the UK in trying to provide a centralized “top-down” approach to Health IT may cause some to rethink that notion.

As of 2005, the thinking was that the e-Health initiative would have to be built in segments over a period of time; much like the US is attempting to do now. With hospitals costs rising, and some hospitals closing²⁴, there is added pressure to reduce costs and improve efficiency. The % of GDP spent on health care as of 2005 in Germany was 10.7%, which is still much lower than the US, but a bit higher than other EU countries.

In 2003, the government made it a priority to begin the rollout of the e-Card (eGK) for all patients and EHR's, as a way to improve HIE and encourage more use of EHR's. Although EHR's appear to be quite advanced in Germany due to the distributed health care system, they may not be as advanced in leveraging this information across regions, providers, etc. This new e-Card was supposed to resolve all those issues so that all 80 million German patients, doctors, and pharmacists could leverage the EHR. Financing for this new e-Card would be primarily born by the insurance companies as a mandate. As in many EU countries, the government feels that the insurance companies would feel the cost savings of improved efficiency in the system, and therefore should bear some of the financial burden. Providers also will bear some of the financial burden in an indirect fashion²⁵. Instead of charging the physicians with the direct costs, the government will reimburse them with less money (1%) if the physician is not participating in an EHR. The extra money saved by the German government is then used to fund groups that support sharing of HIE.

Although most German PCP's have an EHR for patients, the adoption rate of a national EHR in hospitals across the country is lower than in other EU nations, yet still higher than the US. Germany sees this e-Card initiative as a way to promote and advance the EHR nationally. The more one studies EHR's and their usefulness, the more comes to the conclusion that an EHR is nothing more than a digital version of a paper based system unless it can be leveraged to share data across boundaries. Studying the German system is interesting in that although EHR's are in place in many PCP's, etc. the German government realizes that unless Health Information Exchange is encouraged to share this collected patient information on the EHR, it is not valuable.

The e-Card program is one way to encourage HIE, another is the e-Prescription initiative, another is the German government's regulation that all hospitals send bills electronically to insurers, and eMDLetter. EMDLetter is a German government program to standardize messaging of EMR's between providers.

One of the barriers to EHR and e-Card adoption as a national effort is the health care system itself as currently structured. Much like the US, stakeholders in the current system, do not like change if it will not benefit them directly, at first. For example, in Germany, the physicians are reimbursed by Regional organizations and not directly by an insurer. If the e-Card and EHR system is put in place, the insurance companies will have better line of sight as to which physicians are providing better service and at a better cost than they currently do now. Therefore, the physicians may not like this additional line of sight provided to insurance companies and push back on adoption. Add that fact, to the fact that the initial benefits will go to the insurance companies, and one can see that physicians will need to be sold on the benefits before full implementation is seen.

Since Germany has a distributed health care system, it is not easy to implement an infrastructure to support any of the above initiatives, nor is it easy to implement standards by which the collected information can be exchanged. As the e-Card initiative gets rolled out, it will most likely occur in regional pilots, using the best practices from the most successful as building blocks. However, as challenging as this is, it may prove to be the one worth watching most. The US does not have centralized healthcare governance, it does not have an infrastructure specifically built for Health IT, it is a distributed system, where market and business pressures typically result in winners and losers that come out of competition and best of breed. This seems to be similar enough to the German

system to watch how they have success and failures, how standards that work rise to the top, and those that do not disappear, and learn from them.

Results seen to date as of 2007 were that the Program was 2 years behind schedule due primarily to several of the factors mentioned above. With that in mind, at a milestone checkpoint, the German government (National Ministry of Health) decided to take over the Program. There were 7 pilots underway regionally with approximately 10,000 patients in each and E-Prescriptions were launched in 2008²⁶.

However, as of 2010, the Government suspended the Program due to cost over runs, and lack of progress. As mentioned above, as the implementation got closer, doctors in Germany not only pushed back against this new system, they took to the streets and marched aggressively against full implementation.

Lesson learned for the US might be that, just as in any corporate environment where large IT rollouts are planned and started under the best intentions, they do not work. They are just too large, too costly, too unmanageable, and struggle under the burden of top down infrastructure. The German health care system will use portions of the e-Card already in place at those regions, and will continue with their EHR usage, but full HIE is still down the road.

Adoption of CPOE in Hospitals

Germany was also found to have few if any hospital-wide CPOE systems. An article in the International Journal of Medical Informatics suggests that less than 1% of hospitals have electronic clinical notes and less than 0.5% of hospitals use electronic prescribing²⁷. Additionally, although the German lab systems support electronic lab results viewing, paper and fax are still the preferred means of communication results within the hospital²⁸. Although reliable data was difficult to find and few data sources provided precise and well-defined results, it is compellingly suggested that electronic transmission to and from the pharmacy with CPOE is fairly uncommon in Germany with no hospital-wide direct linkages existing between medication ordering systems and pharmacies. Additionally, Germany has a more modest adoption of HIE and ePrescribing is not listed as a focus for the future.

III. Netherlands

Netherlands e-Health Report Card *

Population	GDP	Life Expectancy	Annual Health Expenditures	Health expenditures as % of GDP	Per Capita Health Spend	Doctors
16.6M	\$595B	79 yrs.	\$56.5B	9.80%	\$3,837.00	329/10,000
Universal health care system based entirely in tightly regulated private insurers, with co-payments. Patients have choice regarding plans and doctors, have capitation and fee for service payments. The Dutch are leaders in e-Health initiatives – the National Switch Point (LSP) enables nationwide e-exchange of patient data in a highly secure model.						

Source Systems

- ⤴ Acute Integrated Systems >80% (G)
- ⤴ Primary Care Integrated Systems >80% (G)

Usage and Access

- ⤴ Systems Used for Clinical Decision Making (Y)
- ⤴ Patient access to records (G)

National Integration and Sharing

- ⤴ National Electronic Health records and unique ID's (G)
- ⤴ E-Health Infrastructure (G)
- ⤴ Agreed clinical coding and data transfer standards (Y)
- ⤴ Tailored legislative and privacy frameworks (G)
- ⤴ Clear political and clinical leadership (G)

G- Status of Green (on track and in place)

Y- Status of Yellow (promising some progress)

R- Status of Red (challenges not started)

* Pulled directly from a report from Computer Science Corporation²⁹, which researched several organizations to gather this information such as the World Health Organization (WHO) and present a summary dashboard

Adoption of Electronic Health Record

According to a 2008 study provided by the Commonwealth Fund, the adoption of EHRs by General Practitioners (GPs) in the Netherlands is approximately 98%. Nearly all GPs use an EHR system to document progress notes and review laboratory results in an ambulatory setting³⁰. It is important to note that this is a high percentage of adoption with minimal financial support from the Dutch government. GPs are required to finance eHealth initiatives through their practice budget although the public budget does fund a small portion of initiative.

Even though the use of an EHR for electronic documentation and viewing results shows high numbers, the country has not yet implemented health information exchange across the healthcare sector³¹. This is due in part to each healthcare sector having its own local EHR. As the literature indicates, GPs, out-of-hours clinics, pharmacies, and hospitals all have their own EHR systems with different data structures and terminology standards making it difficult to share clinical patient data across the healthcare community³².

To help mitigate the issue, regional EHRs were developed to improve clinical communication between the disparate EHR systems, but were unsuccessful because of several reasons. One main reason was the lack of standardized terminologies across each EHR system. In 2002, The Dutch ministry of Health delegated the task of designing and developing a nationwide EHR to the Nictiz (the National IT Institute for Healthcare in the Netherlands) organization. The Nictiz organization serves as the “national coordination point and knowledge centre for IT and innovation in the healthcare sector” in the Netherlands³³. The task was to produce one EHR solution for all patients, providers and healthcare stakeholders in the healthcare community.

The EHR solution would be a virtual EHR using a centralized services architecture where providers would continue to store and maintain their own patient data but would share and exchange data through the healthcare information broker (HIB) also known as AORTA. AORTA is the Dutch national infrastructure using HL7 v3 messaging and documents for information exchange. Only providers whose local EHR system is HL7 v3 compatible are able to participate in the exchange of patient data between other providers, pharmacies and out-of-hours clinics³⁴. Dutch hospitals have been progressing well in the participation of the eHealth initiative. More data suggests that there is a large focus on clinical data exchange between laboratories and GPs, pharmacies and GPs and hospitals and GPs with the expectation that these systems would be up and running by 2007³⁵. In 2010, almost half of the Dutch GPs, out-of-hours clinics, pharmacies and hospitals were connected to the Dutch nationwide EHR.

Adoption of CPOE in Hospitals

The Netherlands has one of the highest use rates of CPOE among the countries studied and was one of the earliest adopters of health information technology. The first report of a fully implemented CPOE system in the Netherlands dates from 2003³⁶ although some hospitals have used some form of electronic order entry much earlier³⁷. In 2004, a published article compared CPOE implementation in two Dutch hospitals, one being an academic medical

center, the other a large, regional non-academic hospital. The study found that the introduction of CPOE in the university medical center failed while it was a success in the non-academic hospital³⁸. The different outcomes suggests that both social and technical aspects are interrelated and are both influential in the organizational implementation of CPOE in the Netherlands. After these first reports, a 2009 article found that medication CPOE systems are implemented in 6 Academic Medical Centres (AMC) in the Netherlands while 12 non-AMCs have adopted CPOE³⁹. It is roughly estimated that 20% of total hospitals in the Netherlands have adopted a system for the electronic exchange of prescriptions and its growth will only continue to accelerate as the country continues to seek significant progress in CPOE implementation⁴⁰.

IV. Denmark

Denmark e-Health Report Card *

Population	GDP	Life Expectancy	Annual Health Expenditures	Health expenditures as % of GDP	Per Capita Health Spend	Doctors
5.4M	\$213.6B	79 yrs.	\$23.6B	9.80%	\$3,512.00	360/10,000
Predominantly a publicly funded healthcare system with few private hospitals and only 1 state run insurance. Fully integrated health and social services support the population. A leader in e-Health initiatives sundhed.dk – the national e-Health portal, a National Patient Registry, exchange of EMR's and improving integration between central and local providers.						

Source Systems

- ⤴ Acute Integrated Systems >80% (G)
- ⤴ Primary Care Integrated Systems >80% (G)

Usage and Access

- ⤴ Systems Used for Clinical Decision Making (G)
- ⤴ Patient access to records (G)

National Integration and Sharing

- ⤴ National Electronic Health records and unique ID's (G)
- ⤴ E-Health Infrastructure (G)
- ⤴ Agreed clinical coding and data transfer standards (Y)
- ⤴ Tailored legislative and privacy frameworks (G)
- ⤴ Clear political and clinical leadership (G)

G- Status of Green (on track and in place)

Y- Status of Yellow (promising some progress)

R- Status of Red (challenges not started)

* Pulled directly from a report from Computer Science Corporation⁴¹, which researched several organizations to gather this information such as the World Health Organization (WHO) and present a summary dashboard

Adoption of Electronic Health Record

Denmark is one of the leading nations in the European Union with its adoption of healthcare technology. It has a history of dedication for eHealth initiative dating back to 1996 with the development of the Electronic Patient Record⁴².

Despite the limited funding from the Danish government for HIT adoption, today nearly all of Denmark's primary care physicians use an EHR with full clinical functionality⁴³. Full clinical functionality is the ability to electronically manage a patient's problems, mediations, document progress notes, use an integrated clinical decision support tool, automatically generate patient reminders for preventive medicine, send and receive prescriptions, and so on⁴⁴. How has Denmark been able to achieve such great success with their adoption and use of an EHR? A research study from the Commonwealth Fund, March 2010⁴⁵ found that 98% of their primary care physicians (PCP) and other healthcare stakeholders use an EHR. The study lists the elements that contribute to their success: 1. All out-of-hours services use the same EHR as the primary care physicians; 2. PCPs and specialists are paid a small fee to electronically communicate with their patients; 3. They use over 60 standardized messages to send and receive clinical data across the sector; 4. Every Danish citizen has a unique patient identifier which is used for health and taxation. With all of the capabilities that EHR adoption and health information exchange offers, some of the more compelling reasons for the paramount success of Denmark's healthcare technology adoption are provider competition and peer pressure. Providers were considered to be "second rate" by the patient population if they were not using an EMR⁴⁶. In 2004, PCPs were mandated to use health information technology although most already were. In contrast, approximately half of Danish hospital beds use a full electronic health record but the goal is to have full coverage by the end of 2012⁴⁷.

The literature goes on to say that over 90% of clinical communications between the primary care sector and the secondary care sector is exchanged electronically. The Danish Health Data Network (DHDN) was established and maintained by MedCom, an organization developed in 1994 to facilitate the electronic clinical communications between different sectors in the healthcare community using standardized terminologies⁴⁸. Other factors contributing toward the success of Denmark's health information exchange is the Danish National Health Portal, Sundhed.dk, which has been in place since 2003. It is also funded by those same entities that funded MedCom⁴⁹. According research, May 2006 (Gartner), the portal was developed by an IBM branch which promotes an easy to use portal application that encourages patients to be heavily involved in managing their healthcare. It allows patients to renew prescriptions, view their medication lists and other data, book appointments with PCP and have electronic consultations with their providers⁵⁰. Other literature states that the eHealth portal was delivered through the DHDN provided safe connections for all healthcare users including PCPs, laboratories, pharmacies, and hospitals⁵¹. It also states that the DHDN extends across almost all healthcare sectors in Denmark which provides rapid and secure data transfer of clinical information to make more informed clinical decisions in the care of the patient.

As stated by the eHealth Strategies Report, October 2010⁵², the Danish eHealth system is the frontrunner for having one of the most advanced uses of healthcare technology as compared to other European countries. It is one of the leaders in the industry because of early adoption of EHR and health information exchange, its nationwide use of the eHealth portal for patient access to their records, and its standardized terminologies across the healthcare sector allowing for easy clinical communications for healthcare stakeholders in the care of their patients.

Adoption of CPOE in Hospitals

It is suggested in the literature that Denmark has a high use rate of CPOE in hospitals but an exact rate of adoption could not be found. As of early 2004, 100% of all pharmacies used IT and communicated electronically with practitioners and hospitals⁵³. Additionally, virtually all hospitals had laboratory information systems established⁵⁴ which allows for electronic messages to be exchanged. This concept is evidenced by statistics reported by MedCom, which is a co-operative venture between authorities, organizations, and private firms for contributing to the development and quality assurance of electronic communication and information in the Danish healthcare

sector. According to their 2009 report, a large proportion of electronic messages are exchanged between hospitals and laboratories with the percentage of messages exchanged across the counties of Denmark by healthcare providers ranging from 70% to 99%⁵⁵. Moreover, 80% of primary care providers in Denmark report being able to order medical tests electronically. This universal health IT adoption is heavily influenced by Danish government mandates, including making e-prescribing mandatory for primary care providers. Therefore, Denmark clearly leads the way in electronic exchange of clinical information between sectors and it is suggested that Denmark ranks high in hospitals' use of CPOE.

Summary

In reviewing the literature and findings for each of the European countries we selected regarding the progress of Health IT and EHR (EMR) adoption in each, it appears that adoption has been slower than anticipated in most of the region. Only Denmark is experiencing considerable progress. One common theme according to the literature is cost overruns, push back from various stakeholders in adoption for one reason or another, and slow health information exchange progress. It appears that a centrally controlled top down approach has many flaws, and is inefficient. One size does not fit all in any industry, never mind an industry as disparate as the health care industry. And any change will be slow to adopt unless the physicians see a true benefit. When the benefits appear to go to the payers or the government, push back can be expected. One lesson learned that jumped out was in the case of Denmark, where although it is a much smaller country than the US, and the US could never imitate some of the successes of Denmark, the US could leverage the competition concept. In Denmark, a PCP is not viewed as efficient or successful unless they use an EHR and share that information. Much like any business, the consumer is deciding where to put their business. The more one reads the literature and observes the enormous costs and grand plans for infrastructure, the more one realizes that government can play a critical but limited role, one where they place incentives in the right places, especially for physicians and hospitals, but should stay out of the business regarding "how" things such as HIE can be accomplished. Allow the marketplace determine the winners.

In evaluating the state of adoption of CPOE in various industrialized European countries, various literatures, including published articles, surveys, and other sources reveal that CPOE is still emerging. Although countries differ in the structure of their health care organization and their rates of EHR adoption, rates of CPOE adoption still remain fairly low internationally. This may be due to a variety of factors. Integrating new CPOE systems with existing hospital information systems is a tremendous and complex challenge in CPOE adoption⁵⁶. However, the study of CPOE implementation at two hospitals in the Netherlands suggests that social and not only technical factors play a role in influencing CPOE adoption. The highest reported use rates of CPOE were found to be in the United States and the Netherlands though rates were still modest at 20% or less. A 2002 survey of hospitals in the US found that 9.6% of hospitals had a completely available CPOE system with 6.5% reporting partial availability⁵⁷. Other more recent studies indicate fairly similar but improved results. In a 2008 review of health information technology, the US was reported to have a slightly higher adoption rate of CPOE than other studied countries with an adoption rate range of 5-10%⁵⁸. A 2009 survey of CPOE adoption in seven countries reported the United States having an approximately 15% adoption rate for CPOE⁵⁹ while another 2009 study found that CPOE for medications had been implemented in 17% of hospitals⁶⁰. The CPOE adoption rate is perceived to be high in Denmark as evidenced by their nearly ubiquitous health information exchange though there is no specific data that reports precise rates. Additionally, the other countries studied, Germany and the United Kingdom, had few if any hospital wide CPOE systems. Although CPOE adoption is still low, all studied countries hope for significant progress in CPOE implementation and it is identified as a goal in most countries' HIE policy agenda. Interest in health information exchange is clearly of great international interest with each nation having its own level of investment, planning and efforts. Although there are various barriers, it is apparent that great strides and progress has been made both in the US and abroad. There still remains much work to be done but with the right resources, support, and standards implemented, the innumerable benefits of health information exchange can be reaped across the spectrum of healthcare around the world.

References

- [1] McGlynn, E. 2004. "There Is No Perfect Health System." *Health Affairs* 23(3):100-02.
- [2] Huffington Post. http://www.huffingtonpost.com/steven-hill/what-obama-can-learn-from_b_173154.html
- [3][14] AARP; "European Experiences with Health Information Technology"; http://www.aarpinternational.org/usr_doc/ldrstudy_healthit.pdf
- [4][16] Singleton, J. 2006. "Health Privacy in the UK." In *Does IT Work? Next Generation Care in the Information Age*, pp. Washington, D.C.
- [5] Karel de Smet. "The Dutch nationwide Electronic Health Record. Why the Centralised Services Architecture?" 2011 Ninth Working IEEE/IFIP Conference on Software Architecture
- [5] HIMMS, *Adaptation Concepts and Next Steps*, 2010. <http://www.himssanalytics.eu/docs/100721EMRAMforEuAdaptationConceptNextSteps.pdf>
- [6] Kaelber, DC and DW Bates. "Health Information Exchange and Patient Safety," *Journal of Biomedical Informatics* 40, no. 6 Supp. (2007): S40-S45.
- [7][8] Frost and Sullivan, *European Computerised Physician Order Entry Systems (CPOE) Markets* (London: Frost and Sullivan, 2007).
- [9][35][42] Blumenthal D, DesRoches C, Donelan K, Ferris T, Jha A, Kaushal R, Rao S, Rosenbaum S and Shield A. "Health Information Technology in the United States, 2008. Where We Stand". Massachusetts General Hospital and the Schol of Public Health and Health Services at George Washington University, June 2008
- [10][21][29][41] Computer Science Corporation; "CSC Global e-Health Atlas"; http://www.csc.com/au/ds/33253/33346-csc_global_e_health_atlas
- [11] Boyle, Sean *The UK Health Care system, 2008*; http://www.commonwealthfund.org/usr_doc/UK_Country_Profile_2008.pdf?section=4061
- [12] Severs, M. 2006. "Presentation to AARP Board of Directors: The National Programme for IT." London, England
- [13][15] Comptroller and Auditor General, N. A. O. 2006. "The National Programme for In in the NHS: Report by the Comptroller and Auditor General." London.
- [17] Detmer, D., E., Steen, Elaine. 2006. *Learning from Abroad: Lessons and Questions on Personal Health Records for National Policy*. pp. 69. Washington, D.C.
- [18] Goundrey-Smith Stephen. *Principles of Electronic Prescribing*. New York: Springer, 2008.
- [19] Summers V. "Electronic prescribing the way forward?" *Pharm J*, vol. 265, no. 7125 (2000): 834.
- [20] M. Bywater, *UK Findings from HINE European Hospital Survey*, Harrogate, England, 2005.
- [22][23][24][25] Deutsch, Dr. Harold, *Healthcare in Germany Today*, mThink. <http://mthink.com/content/healthcare-germany-today>
- [26] *Germany's national e-health programme: contested but driven forward*; eHI, Ehealth Europe; <http://www.ehealthurope.net/Features/item.cfm?docId=189>

- [27][28] A.K. Jha et al., "The Use of Health Information Technology in Seven Nations," *International Journal of Medical Informatics* 77, no. 12 (2008): 848-854.
- [30][31] Ashish K. Jha, David Doolan, Daniel Grandt, Tim Scott, and David W. Bates. "The use of health information technology in seven nations" *International Journal of Medical Informatics* 77, 2008
- [33] Accessed on March 3, 2012 <http://www.nictiz.nl/page/Home/English>
- [34][47] Bradford H. Gray, Thomas Bowden, Ib Johansen, and Sabine Koch. "Electronic Health Records: An International Perspective on "Meaningful Use" The Commonwealth Fund, November 2011
- [36] Kalmeijer MD, Holtzer W, van Dongen R, Guchelaar HJ. Implementation of a computerized physician medication order entry system at the Academic Medical Centre in Amsterdam. *Pharm World Sci* 2003; 25(3):88-93.
- [37] H. van der Sijs et al. "Functionality of Drug Safety Alerting in Computer Physician Order Entry Systems." *International Journal of Medical Informatics* Volume 79, Issue 4 , Pages 243-251, April 2010
- [38][39][40][56][59] Aarts J, Berg M. A tale of two hospitals: a sociotechnical appraisal of the introduction of computerized physician order entry in two Dutch hospitals. *Medinfo* 2004; 11(Pt2):999-1002.
- [43][44][45][46] Denis Protti and Ib Johansen. "Widespread Adoption of Information Technology in Primary Care Physician Offices in Denmark: A Case Study" The Commonwealth Fund, March 2010.
- [48][49][50] Jonathan Edwards. "Case Study: Denmark's Achievements with Healthcare Information Exchange" Gartner, 30 May 2006
- [51] Christina E Wanscher, Claus D Pederson, and Tom Jones. "MedCom, Denmark: Danish Health Data Network (DHDN)" *eHealth Impact*, Bonn, January 2006
- [52] P. Doupi, E. Renko, S. Giest, and J. Dumortier. *eHealth Strategies, Country Brief: Denmark*, October 2010
- [53][54] Christian Nøhr et al. "Development, implementation, and diffusion of EHR systems in Denmark. *International Journal of Medical Informatics* (2005) Volume: 74, Issue: 2-4, Pages 229-234.
- [55] "Statistics," MedCom, n.d. <www.medcom.dk/default.asp?id=110197&imgid=341&fullsize=orig> (accessed February 29, 2012).
- [57] Joan S Ash, Paul N Gorman, Veena Seshadri, and William R Hersh "Computerized physician order entry in U.S. hospitals: Results of a 2002 survey." *J Am Med Inform Assoc.* 2004 Mar-Apr; 11(2): 95-99.
- [58][60] Ashish K. Jha et al. "Use of Electronic Health Records in US hospitals." *N Engl J Med* 2009; 360:1628-1638.

Other References Used

The Leapfrog Group, "Computerized Physician Order Entry," c/o AcademyHealth, Washington, DC, March 3, 2009. <www.leapfroggroup.org/media/file/FactSheet_CPOE.pdf> (accessed February 28, 2012)

Humphrey Taylor and Robert Leitman. "European Physicians Especially in Sweden, Netherlands and Denmark, Lead U.S. in Use of Electronic Medical Records" Healthcare News, Harris Interactive, August, 2002.

The Economist, "Future of Health Care in Europe"; http://www.eufutureofhealthcare.com/sites/default/files/EIU-Janssen%20Healthcare_Web%20version.pdf

Detmer, D., E. 2003. "Building the National Information Infrastructure for Personal Health, Health Care Services, Public Health, and Research" [accessed on March 15, 2006]. Available at: <http://www.biomed-central.com/1472-69473/3/1>.

C. Schoen, R. Osborn, P.T. Huynh, M. Doty, J. Peugh, K. Zapert, "On the front lines of care: primary care doctors' office systems, experiences, and views in seven countries, Health Aff. (Millwood) 25 (6) (2006) w555-w571.

HIMMS; <http://www.himssanalytics.eu/EMRAM.html>

Internet World Stats: <http://www.internetworldstats.com/stats4.htm>

Gur-Arie, Margalit; 2011 EHR adoption rates: <http://thehealthcareblog.com/blog/2011/12/02/2011-ehr-adoption-rates/>

Accenture, Overview of EHR/EMR

Markets; http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture_EMR_Markets_Whitepaper_vfinal.pdf

Personal Health Records to Improve Health Information Exchange and Patient Safety

James R. Friction, DDS, MS; Diane Davies, MD; http://www.ahrq.gov/downloads/pub/advances2/vol4/Advances-Friction_21.pdf

Denmark - privacy profile: <https://www.privacyinternational.org/article/denmark-privacy-profile>

Buddrus, Uwe, "EMR Adoption in Europe", 2011.

http://www.worldofhealthit.org/education/documents/UWE_Buddrus.pdf

New York Times; Denmark leads the way in Digital Care:

<http://www.nytimes.com/2010/01/12/health/12denmark.html>

Health Care IT News; "Lessons from the UK"; <http://healthcareitnews.com/news/lessons-uk>

Baden-Württemberg: German Government starts the initiative "Health - Made in Germany"; <http://www.bio-pro.de/standort/index.html?lang=en&artikelid=/artikel/06972/index.html>

Denis Protti, Steven Edworthy and Ib Johansen "Adoption of Information Technology in Primary Care Physician Offices in Alberta and Denmark, Part 1: Historical, Technical and Cultural Forces" Electronic Healthcare, Vol. 6 No. 1 2007