

# **Health Information Technology and the Electronic Health Record**

*Implications for Healthcare*

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## Introduction

Information Technology (IT) in healthcare has made great progress in diagnostic and therapeutic applications; next is Electronic Records.

Using computers to assist in imaging, surgery, and critical life support has meant lives are being saved that as recently as five years ago were being lost.

Now, the burden of healthcare costs is increasing due to population aging and continuous introduction of more costly treatments.

As a result, healthcare leaders in hospitals and governments alike are now beginning to realise the next use of technology will be targeted increasingly on efficiency, patient safety and reducing medical errors. They consider electronic health record (EHR) and health information systems (HIS) which can have a significant impact on reducing medical errors and removing delays due to paper record handoffs and missing information to be among the most important applications their organisations will need to invest in over the next two years. The objective is to enable delivery of the right care, in the right setting, at the right cost.

Unfortunately, confounding the progress of integrated EHR/HIS implementations is the reality that none of the disparate solutions currently in the market are capable of communicating with each other in any but the most rudimentary ways, if at all. The lack of integration has negative clinical and patient-oriented impacts. For example, a recent study by the National IT Institute for Health Care in The Netherlands (NICTIZ) reported that 5% of the Dutch population reported lack of information transfer between healthcare professionals during their visits. One third of these resulted in serious medical errors, sometimes leading to permanent disabilities and death. The total preventable cost on a society of 16 million people is calculated near €1.4 billion per year. A recent report by Kerr et al underscored the need to advance system solutions to disseminate knowledge and information for healthcare. This study suggested that there is a significant disconnect between best practices in treatment, and the clinical care that is actually delivered.

Successful implementations at a local level are characterised by creating new ways of working for the clinical community which are enabled by the new EHR/HIS solutions. Unfortunately, many of today's EHR/HIS programmes appear to focus solely on the software, technology and data aspects of the solution.

Whilst the potential benefits of EHR/HIS seem intuitively obvious to many, actual quantification remains elusive, and the barriers to implementation obscure the vision for many. As a result, broad deployment of EHR/HIS has been slow and many unanswered questions remain. For example:

- How will HIS applications be integrated to EHRs solutions and by whom?
- What is the right governance model for the patient data?
- Are patient owned smart cards part of the solution and how does one incent their use?
- What data constructs should be used? Should it be centralised or distributed?
- Where will the money required for development and implementation come from?
- What are the implications for clinicians, hospitals, community care providers, social healthcare, and even insurance companies?
- What, if anything, do these stakeholders need to do to respond to their governments' initiatives?

How can stakeholders mitigate risks, plan contingencies and adhere to reasonable timelines to ensure a successful, adoptable, and streamlined implementation?

All have some element of government ownership of the initiative, or outright control, and all are relying heavily on national standards for the record and the communication of information between healthcare provider settings.

# EHR Implementation in Europe

Currently, numerous private hospital operators and national healthcare services across Europe are attempting to answer these questions and implement national and regional EHR solutions.

The EHR implementations underway or being considered in Europe can be viewed as fitting into one of three general models defined below. The solutions combine the plans for Electronic Health Records and, inevitably, the integration of Healthcare Information Systems Solutions. Key HIS solutions include patient administration, computer-based practitioner order entry (CPOE), ancillaries (laboratory, maternity, theatre/OR), GP practice management, waiting list management and appointment booking:

## Centralised Single EHR Data Repository & Standard HIS Solutions

This model is typified by the National Health Service (NHS) England National Programme for IT (NPIIT) which is already well documented. This the model calls for a single repository of patient information (for example, demographics, medical conditions, allergies). The data is pushed to this national record repository (Care Record Service) via a 'Spine' using HL7 v3 messages from standardised and certified EHR and HIS applications residing across all care settings including GP practices, community facilities, mental health facilities, and acute hospitals.

## Centralised EHR Data Repository(ies) with Interface Standardisation and HIS Choice

This model is being considered by many where the ability to mandate a standard set of applications is limited by either the structure of the local healthcare industry (for example, privately owned hospitals), lack of control. The concept is based on one or more central patient record repositories which are linked to new or existing applications via a standardised and certified messaging (for example, HL7). The care setting is responsible for sending and receiving the standard messages. Several of the countries are planning to utilise electronic health cards as an initial entry into an EHR implementation. Wales, France, Sweden and Germany are currently considering this model.

## Distributed EHR Data Repositories with Centralised EHR Index and Messaging Standards

This third model offers a strikingly different alternative a peer-to-peer networking approach, in which one EHR system directly communicates with another (peer) system or makes its patient data available directly to the clinician through a web browser. Much like the file-sharing phenomenon that has occurred in recent years for MP3 music files, clinical users and local EHR systems will be able to locate other systems that have pertinent clinical information and access it on an as-needed basis via a central index. This philosophy is behind the infrastructure design being considered or developed in countries such as Scotland, Ireland, The Netherlands, Denmark, and Austria.

The diagram below provides a view of where these models are being used or considered (currently) across Europe. We have also provided a general status of where each country stands with its EHR/HIS programme. It is worth noting that due to the complexities of the design and implementation work as well as the phasing approaches being employed, this portrayal is a simplification of highly complex programmes that are continuing to evolve.

Some basic observations can be made when viewing the varied approaches being taken:

- Few believe that a single national electronic health record along with far reaching, large scale replacement of legacy applications is a desired approach this may reflect concern over risk or the ability to attract funding;
- Many are moving to an electronic version of the paper patient record, often with an electronic health card, as a fundamental step to creating a centralised electronic health record;
- Stringent controls for security and confidential access to patient information are part of all EHR/HIS strategies and designs.

### Key Phases of National/Regional EHR Implementation

1. Agree Current State (paper based, non-standard, non-integrated, inconsistent automation & technology, lack of clinical information when needed)
  2. Define Shared EHR Vision & Architecture (Why, Who, What, How, When)
  3. Standardise Patient Identifier, Medical Coding, Messaging, clinical data capture, security access
  4. Secure EHR Funding (How much, What benefits, Financing)
  5. Planning and Procurement (Requirements & Approach definition, Resource acquisition)
  6. Develop EHR Solution (Design, Build, Test, Integrate, Migrate selectively, Validate)
  7. Integrate & Copy Local HIS Data to Secure EHR Solution
  8. Transform Health & Social Care Delivery Processes Across Care Settings
  9. Enable Patient Access and Maintenance of Personal EHR Information
- All struggle with pragmatic approaches to address the supply and demand of patient data from disparate legacy healthcare systems; and
  - Despite the challenges, all are making progress with value being realised in some of the pilot or path finder initiatives.
  - Unfortunately the challenges are real and have impeded the kind of progress that patients, politicians, and healthcare executives would like to see.

The challenges can be categorised into four areas of focus: data, technology (infrastructure and application functionality), funding, and process/operational. Whilst none of the challenges are insurmountable, successful national or regional adoption will need to address these items in a structured and well coordinated manner. Understanding these challenges is the first step to properly accounting for and planning for the solutions.

# Key Challenges and Issues to Implementing EHRs

Whilst progress is being made, there are barriers and challenges facing these EHR/HIS implementation programmes.

What follows is a high level discussion of some of the more significant challenges to be considered.

## Data Challenges

There are four key data issues to be addressed in any national approach to adoption of the EHR: patient identification, data quality, governance and privacy/security (i.e., ownership and access controls), and access to historical data. These challenges will need to be addressed in order for EHR to access the right medical information about the correct patient, when that information is needed, in a format that can be quickly prioritised and assimilated by only the authorised care givers (i.e., maintain strict medical information privacy).

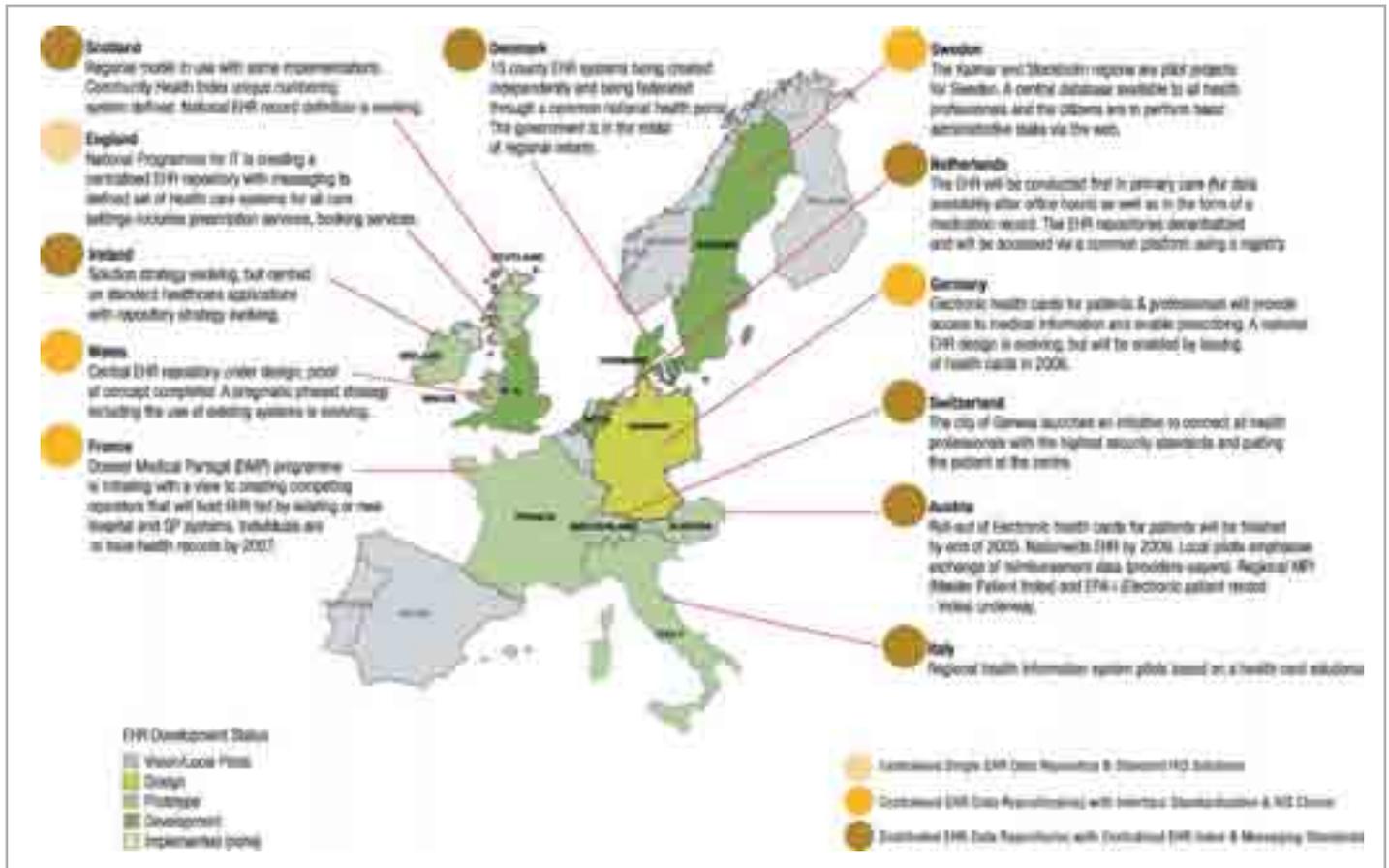
## Patient Identification

The challenge of identifying the patient is perhaps the most significant one that a

national EHR initiative faces. For a truly national EHR, it would be vastly easier and ultimately safer if a national patient identifier was in use at each local care facility and in all existing patient databases. Unfortunately even where National Patient Identifiers are available they are not commonly in use in local systems. EHR programmes must carefully consider the distribution of national patient identifiers AND create the indices that map the national identity numbers to the current local identifiers.

Care providers will be disinclined to use information from a shared EHR when making critical clinical decisions if that data contains a known risk of error due to patient misidentification of even less than 1% (and most experts expect more). In order for EHRs to succeed, regions and countries will need to resolve the issue of patient identifiers and identify a workable approach to connect

## EHR Development Status



clinical information at the patient level and account for the needs of a complex Master Patient Index (MPI) structure.

#### **Data Quality and Standardisation**

The quality of data can also be a concern in the creation and population of patient information in a national or regional EHR. Given the historical lack of data standards and general lack of data quality measures across many healthcare organisations, data quality should be a headline work stream in any EHR implementation. Without a rigorous and well structured plan for establishing data standards (for example, clinical coding and messages) and improving data quality, EHR implementations will fail to achieve the essential support and buy in from the clinical community.

#### **Data Governance and Security**

Data governance is a very complex issue because of the number of stakeholders using and updating a shared source of data. Each stakeholder will want to control the pieces of information they consider important to their part in the delivery of care. In addition, the data will often have implications on financial remuneration for services provided and the outcomes of the care delivered. Further complicating the issue is the trust each stakeholder will have in the data that is not under their 'control'. For example, will the general practitioners trust the data entered by the acute hospital? Many express concern that the hospitals have any ability to change the patient record at all. As such, any national or regional EHR implementation must develop governance policies that include the opinions of multiple stakeholders-including the patient.

#### **Managing Historic Data**

One of the major issues faced by all EHR projects is how much data to migrate into the new systems. The scope of patient information covers existing patients and former patients for as long as medical records have been in place. All this information is important and valuable, but how it is migrated (if at all) can have serious implications on clinical outcomes. The decision must be taken whether to work only with new data or whether to take on the complex and expensive task of moving all (or a proportion) of historic data to the new system. It is worth noting that many organisations have successfully used data strategies that avoid the high risk proposition of migrating clinical data by retaining access to the data in its original format/content solely as reference data. Indexes can be provided centrally to describe the data available in local systems rather than transferring the content.

#### **Technical Challenges**

First and foremost, EHR adoption will require standards to facilitate easy exchange of data from one computer system to another, and from one healthcare professional to another. Put differently, standards should enable both technical and functional interoperability. In addition, the technical infrastructure must be able to deliver a flexible security model that can be managed by role and function with scope for granting access to data by patients and relevant clinicians. The security model must have the diversity to support granting broad access to the patient record to applicable users as well as the ability to restrict access to "sensitive" data within the record to these same users as specified by a user's data access rights.

Technical challenges are the most obvious and the most abundant. They range from well understood problems such as the lack of standardisation of clinical data and messages, to more subtle challenges such as the need for extremely flexible and easy to support configuration management for IT environments that must support extreme environment variability across healthcare settings. Indeed, this one issue alone is responsible for many implementation failures (partial or full) that we see of Healthcare Information Systems in general in the health marketplace today.

Other examples of technical challenges include:

- **Scalability:** The ability to cope with the massive volume of data generated by the exercise of recording even a minimal amount of data about all the patients in a region or country. In some cases this issue has led to the development of regional models to cope with the management of these volumes.
- **Reliability:** The need to provide highly available systems supported 24x7 that justifies the replacement of the paper chart.
- **Accessibility:** To enable the flexible model of service delivery and provide information to all the clinicians that need it to enable patient care it is necessary to include in the design a varied and ever evolving assortment of devices. Today these include that today include customised computer terminals, laptops, PDAs, pagers, wireless communications, remote diagnostic devices, cell phones, speech recognition, and more.
- **Usability:** Well thought out user interfaces, functionality and performance will make the electronic patient record more (rather than less) efficient to the clinician than the paper chart.

## Near Term Actions

It is not too early to begin addressing EHR and HIS implementations in a proactive manner. Capgemini has identified a number of steps that hospitals and governments can begin to put in place in preparation:

- Begin a community dialogue on EHR involving clinicians, hospital leaders, social and community care providers, commissioning/insurance organisation and patients.
- Develop an IT infrastructure to support the processes of the advanced clinical information system (e.g. ,early evaluation of data quality and cleansing of data, vocabularies and coding standards, messaging infrastructures, data security).
- Engage clinicians and ancillary staff in the process of preparing for EHRs.
- Redesigning workflows by working with clinicians, clinical and ancillary staff.
- Define and establish the service levels that must be met by clinical information systems.
- Estimate the potential clinical and financial benefits by improving patient safety.
- Identify the benefits of improving patient access to systems for appointments and registrations and staff access to real time medical record data.
- Establish a delivery and support model.

- **Standardisation:** The need to support standard underlying reference vocabularies and presentation formats for clinical data as well as local variability and the mapping between the two.
- **Integration:** The need to deliver communication methods between the EHR and local HIS systems with workflow and queuing capability to securely control the delivery of messages.
- **Security:** It is essential that a high quality and yet flexible security system is available to ensure that the right data is available only to the right people.

Technical challenges such as these, and many others, support the need to address common areas of technical concern. This is especially the case in Europe where the EHR industry is very fragmented and several players offer niche capabilities. A set of consistent standards must be developed and widely accepted in order for EHRs to function. Without legislative mandates for standards in HIS, addressing these common concerns requires a critical mass of vendors and customers willing to work together to create viable, working EHR/HIS standards.

### Funding Challenges

Whilst funding is an obvious challenge, it is clear that how the funding is provided is equally as important as how much funding is required. As stated earlier, an integrated EHR/HIS solution offers the ability to deliver the right care, to the right people, at the right time, for the right cost. When we consider the implications, we must evaluate the extent to which the transformation will cause shifts in the volume of care being provided in the different settings. As the volume shifts, historic cost control and performance metrics will no longer be valid. Executive and/or political leaders must anticipate this shift and prepare for it.

In a fully funded centralised scheme, a rigorous business cases needs to be developed to incorporate the views and support of the clinical and management community. The resulting financial models and business case would clearly identify how the entire healthcare delivery system improves through the availability of EHR/HIS solutions. In addition, the models would represent the implications for the various care settings and the financial requirements needed to support the transformation in these care settings, including identifying how and when funding will be provided for each initiative and by whom. In the end, the central funding mechanism enables the programme to continue when localised business cases would not support the necessary investments.

For successful adoption of integrated EHR/HIS solutions, where government funding falls short, organisations will need to find ways to self-fund part of the implementation through tactical successes. Quick results may be cost savings or increased revenue due to improving clinical or administrative processes prior to automating them. These can provide the initial funding necessary to secure momentum and adoption of EHRs.

Organisations will also need to look beyond financial results to more qualitative types of benefits. There are at least four additional goals that can be defined and measured. The first is clinical outcomes, including reduced medical errors, improved access to care, improved clinical outcomes, and improved patient satisfaction. The second benefit is improved satisfaction by those in the care delivery process, including patients, clinicians, and technicians who are often frustrated by inconsistent or unavailable information which slows the process. The third type of non-financial ROI is medical progress, including advances in research, and diagnostic and therapeutic interventions (for example, accelerating the clinical trial process through better access to quality data). These qualitative benefits can drive cost out of the overall healthcare system, but quantification across the system is a difficult task.

### Process and Operational Challenges

In working with our healthcare clients, Capgemini has found that by implementing new technologies and redesigning clinical processes with clinicians and operations staff, it is possible to reduce the variations with which diseases are treated, reduce medication errors, improve the use of evidence-based protocol decision support, and dramatically lower administrative paperwork (a total potential savings of 7-9% of operating costs). Unfortunately, many EHR/HIS implementations have not achieved such benefits in the past because they failed to focus on the transformation of core clinical processes, the key to achieving true sustainable value.

Where we have experienced successful EHR/HIS projects, these implementations have changed the way clinicians work. Specifically, the projects redesigned the business operations by utilising patient records and enabling clinicians to focus on high quality healthcare delivery. The changes were then measured across the organisation to reinforce desired performance (quality and efficiency). The redesign effort focused on key business processes including clinical care management, patient management, clinician and staff workflow, clinical decision support, and medication administration.

Examples of where the redesign of clinical care management frequently delivers benefits included increased use of evidence-based medicine, reduced time between key clinical decisions, sustainable standing order sets, real-time medication and allergy alerts, monitoring and alerts for clinical interactions and/or contraindications, enhanced access to new medical discoveries, streamlining care via integrated care pathways, and setting triggers for required clinical documentation. In addition, benefits related to patient care include reduced medical errors, decreased time to develop schedules, enhanced pharmacy and formulary management, better support for ancillary services, and improved staff productivity and retention.

In general, changing the way clinicians work is simple, and requires very different approaches during different phases of activity. The approach is often quite different depending on the location (urban, rural, etc.) and types of individuals involved (for example, general practitioners, academicians, nurses and other primary care-givers, diagnostic technicians, business executives). A deep understanding of how and why clinicians do what they do is necessary for any progress to be made, and a lack of that understanding fosters resistance to change that is perceived as being imposed from the outside with little concern for their unique professional needs.

Both public and private health sectors agree on the need, and if there are differences of opinion as to the specific measures of value, there is no disagreement that the value is significant and positive. Given the massive size of the health care sector in the economy as well as the complexity of the task, there is no short cut; success is likely to take seven to ten years. The challenges are significant, especially in the highly decentralised health systems, and in regions where cooperation is voluntary, not mandatory. However, what have served in the past as insurmountable barriers to success are now seen to be challenges that can be successfully addressed by all of the individuals and organisations affected. Visionary public policy, appropriate resources and strong leadership will result in the EHR being a success story for patients, clinicians and managers.

Ultimately, the widespread adoption of EHR will completely revolutionise the delivery of patient care. It will provide an opportunity to redefine measures of quality and outcomes and on a national level we will be able to assess levels and improvements in disease management and patient safety like never before. There is no doubt that the EHR will come to occupy a central place in our health care system.

The approach that individual regions and countries take to the EHR development in the next 5 years will be the determining factor in the success of the future evolution of patient care.

## Conclusion

After several years of discussion and planning, the forces are now aligned for the successful implementation of integrated EHR/HIS solutions.

Both public and private health sectors agree on the need, and if there are differences of opinion as to the specific measures of value, there is no disagreement that the value is significant and positive. Given the massive size of the healthcare sector in the economy as well as the complexity of the task, there is no short cut; success is likely to take seven to ten years. The challenges are significant, especially in the highly decentralised health systems, and in regions where cooperation is voluntary, not mandatory. However, what have served in the past as insurmountable barriers to success are now seen to be challenges that can be successfully addressed by all of the individuals and organisations affected. Visionary public policy, appropriate resources and strong leadership will result in the EHR being a success story for patients, clinicians and managers.

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### About Capgemini

Capgemini is the global leader in professional services to the health industry, delivering results-driven solutions for today's business challenges. We are the only company with the diversity, dedication, and resources to address all sectors of the health industry, including hospitals and health systems, academic health centres, post acute care facilities, physician groups, health insurance and managed care organisations, community health providers, life sciences organisations, public sector health agencies, and health-related technology companies. We have the pulse of complex issues facing health organisations, and we offer leading practice experience around the world including the United States, Canada, United Kingdom, France, Netherlands, Germany, Norway, Sweden, and Spain.

Industry analysts confirm Capgemini's leadership position in healthcare consulting. Gartner, Inc. recently named Capgemini the #1 Top Consultant and System Integrator, and the #1 Top Outsourcer worldwide in the health provider market. Kennedy Information, Inc. ranked Capgemini #1 in the provider, payer and life sciences categories in a recent report entitled "The Global Health care Consulting Marketplace."



### About Capgemini and the Collaborative Business Experience

Capgemini, one of the world's foremost providers of Consulting, Technology and Outsourcing services, has a unique way of working with its clients, called the Collaborative Business Experience.

Backed by over three decades of industry and service experience, the Collaborative Business Experience is designed to help our clients achieve better, faster, more sustainable results through seamless access to our network of world-leading technology partners and

collaboration-focused methods and tools. Through commitment to mutual success and the achievement of tangible value, we help businesses implement growth strategies, leverage technology, and thrive through the power of collaboration.

Capgemini employs approximately 75,000 people worldwide and reported 2006 global revenues of 7.7 billion euros.

More information about our services, offices and research is available at [www.capgemini.com](http://www.capgemini.com).

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