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The Electronic Healthcare Record

The First Attempt to a National Strategy

- why it failed and how it developed into today's situation

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Abstract. This paper begins with a short historical overview showing important steps in the ICT development in Danish healthcare with emphasis on the Electronic Healthcare Record (EHR), the most discussed application in the Danish healthcare sector. In 1996 the Ministry of Health, based on a Danish governmentally launched ICT-program, created a vision and a strategy for the development of the EHR. The process resulting in this strategy is described, and the main lines of the strategy are outlined. Unfortunately, the following activities were characterized by uncoordinated development governed by local political or technical strategies in the different counties leading to lack of standardization. The last part of the paper describes how the technology development calls for a new way of thinking collaborative systems and it shows the impact of the development of central national repositories and discusses the current implementation problems.

1 Introduction

From an ICT point of view the development of ICT-support in the healthcare sector has followed two lines:

- Infrastructure and shared services being offered to all parties (GPs, hospitals, laboratories, pharmacies etc.) and
- Local ICT-applications targeting local departmental needs and local hospital needs.

The development of the infrastructure, i.e. a national healthcare data network, is covered in another conference paper: *The journey towards a national healthcare data network in Denmark*.

This paper discusses the development of the most disputed ICT-application in the Danish healthcare sector since the 1990s: the *electronic healthcare record* (EHR) in hospitals.

2 Short Historic Overview

The ICT-development in the healthcare sector has been long and troublesome. Changing of work-flows, roles and responsibilities, demarcations between different public bodies and missing political support have been some of the influencing factors in the development. Some of the most important milestones are shown in figure 1.

In the 70s the most widespread applications in Danish hospitals were laboratory systems and patient administration systems in hospitals. The latter was due to the fact that The Danish Medical Association demanded statistical data on patient treatments from all hospitals in the early 70s. The primary users of these systems were the administrative and secretary functions in the hospital departments. The systems did not support the clinical process, i.e. did not support doctors and nurses in their daily work.

The patient administrative systems grew with more facilities in the 80s. They developed into information systems in the hospitals and were expanded with facilities to communicate with patients and GPs. Some of the systems also got certain EHR-facilities later.

The first attempts to develop an EHR were actually PC-applications in the GP-area. However, developing a GP application in this field is a relatively simple task because you only need to support the GP, and the need for communication with other systems was very limited. However, the EHR in a hospital needs to support different professions and needs to be an efficient communication tool between departments and - if possible - between hospitals.

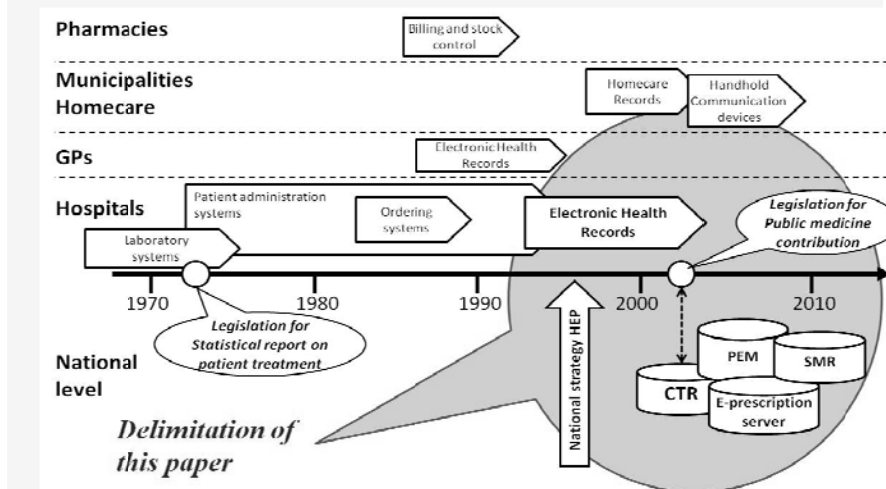


Fig. 1. Milestones in ICT development in the healthcare sector in Denmark

The figure shows a new development after the year 2000 where central national repositories were implemented due to legislation. It started with CTR (central subsidy register for medicine) and was followed by PEM (Personal Medicine Profile), RS (prescription server) and the SMR (shared medicine record).

3 A National Action Plan

In the early 90s some hospitals had initiated experiments with EHR-systems in selected departments. The challenge was to create an efficient tool that supported the clinical processes which, by the way, also implied comprehensive changes in organization and work flows. A few of the experiments can be mentioned.

In 1994 a modified Swedish system had been sold by IBM to the hospital in the city of Vejle. The aim was to show the benefits from an EHR-system and to spread the system to all hospitals in the County of Vejle (and from IBM's point of view, to other counties as well).

In the hospital of Rudkøbing a doctor headed a project where a GP-system was modified and implemented at the Hospital. Later the hospitals of southern Funen formed an EHR-project based on the experiences from this first project.

In other hospitals different departments also conducted experiments.

The experiences from the different projects pointed in many directions.

In march 1996 the Danish government launched an ICT-political program. One of the areas addressed was the healthcare sector where ICT was seen as having the potential to contribute to a better healthcare. In the program especially development and implementation of EHR-systems were seen as an important step to better health services with swift treatments. The expectations were great.

However, one of the problems was the strong disagreement on how to define an EHR-system, but everyone agreed that the situation could be described as seen in figure 3 where 5 blind men are examining an elephant and getting different results of this examination.

An EHR-system was perceived differently by all professions and from every medical group of specialty (surgery, medicine, X-ray, psychiatry, etc.).

Based on the national ICT-program a consulting team in co-operation with the Danish Institute for Health (DSI¹) proposed to The Ministry of Health to establish an initiative to create a national strategy and action plan for the establishment of EHR in Denmark.

¹ DSI was an independent institution dealing with research, analysis and advice on the Danish healthcare.



Fig. 2. Five blind men are examining an elephant

The suggestion was accepted and approved of by the Minister, and the project *An Action Plan for Electronic Patient Records (Handlingsplan for Elektroniske Patientjournaler – HEP)* was initialized.

The overall objective was to initiate and implement a number of coordinated national initiatives based on a thorough analysis. The aim of the initiatives was to promote the development, implementation and exploitation of EHR-systems in Denmark.

The master plan for the HEP-project is shown in figure 3. The task in the two first phases was given to the consulting team, and in the third phase the hospitals had to be involved.

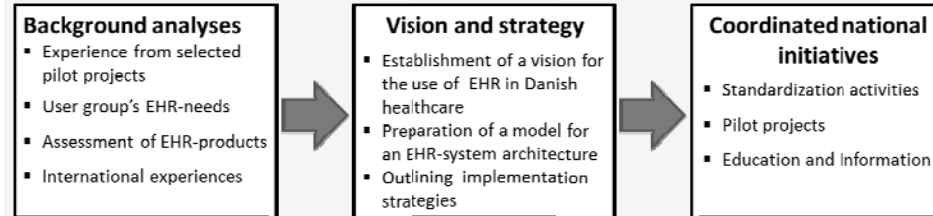


Fig. 3. Master plan for HEP

3.1 Background Analyses

The 4 areas included in the background analyses were implemented in the following way:

- the experiences from 5 selected pilot projects were examined
- 9 different user group's needs were mapped. Every user groups discussed their specific EHR-system specifications and their expected challenges during implementation of EHR-systems
- the existing EHR-system products on the marketplace were assessed
- international experiences and projects were analyzed

Current experience

Despite delimitation of the 5 pilot projects and the fact that there were relatively few clinical employees involved, some forward-pointing experiences were found. Focus was on central work processes pointed out by the project participants as good examples for the use of EHR-systems. A few examples can be mentioned.

Most projects mentioned the *ward rounds*, i.e. the daily visit to all patients where doctors, nurses and secretary together see and evaluate the healthcare status of the patient (in Danish *Stuegang*).

Here all necessary information is present, all actors are assembled with the patient, and immediate decisions on treatment for each patient can be taken. The participants in the pilot projects doubted whether the system should support this process. The ward rounds are highly relevant, when all documentation is available on paper, because this will be the only moment where all relevant information is available. Having an EHR-system where everyone has direct access to all information all the time, means that there is no need for seeing the patients on a specific time of the day. This is one of many examples of changes in old established routines caused by EHR. It indicates that the implementation of EHR demands a huge organizational development effort.

Improved communication was also emphasized as an essential EHR characteristic. One can, for example, request clinical investigations, treatment and other services directly through the system. We know from experience that fewer errors occur when using an ICT-system, while data transfer from one paper medium to another paper medium (and this is done a great number of times in a hospital) easily results in errors.

All pilot projects showed that the EHR-systems affect the daily work greatly. It is impossible to continue with the existing routines, if you want to get benefits from the EHR investment. Another finding from the pilot projects was the lack of clarity about the future roles of the professional groups. For example, which role the secretary will have in the future when the doctors themselves write the medical record - a factor which, incidentally, was considered very controversial.

The pilot projects found the organizational implementation of EHR very resource consuming. And last but not least, strong management support during the whole project is essential.

Future user needs

It was decided to map the future needs and wishes from 9 different user groups (medicine, surgery, X-ray specialists, psychiatrists, department management, etc.). Every group was invited to a one-day workshop, where the needs were mapped as specifications and the benefits of the future EHR-system facilities were discussed and given priority. As shown in figure 4 the technology offered a number of facilities. These facilities could lead to potential benefits for the different groups in a hospital. On the other hand, you could argue that a desired gain from the EHR implementation dictates the technical features needed to achieve the goal.

The figure shows a generalized picture which all could agree on. In the workshops the picture was made operational by discussing the specific benefit for every user group and a prioritized list was prepared.

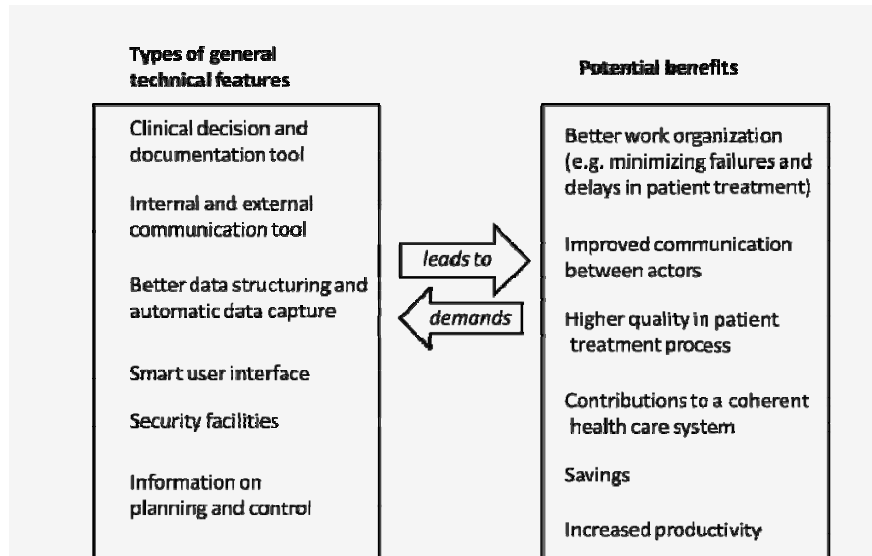


Fig. 4. Main facilities and expected benefits from EHR

Apart from the specifications the implementation challenges were discussed.

A coherent healthcare system cannot be established without standardization in a number of areas. Among others: data interchange formats, security processes, user interfaces, classification of healthcare terminology and semantics. This was agreed on in all workshops and was seen as a major result of the work.

Assessment of EHR-products

A number of vendor products in the area were analyzed. Seen from a technology point of view the time was ripe, but the existing EHR-products were not developed to fit all requirements. The vendors agreed with this conclusion and were looking forward to more comprehensive pilot projects leading to products, which could fit into Danish healthcare organizations in a more perfect way.

International Experiences

The situation in USA, Sweden, Norway, England and Holland were assessed. In the US many hospitals were using systems similar to EHR-systems but with emphasis on patient administration, insurance handling, and economy. In Sweden, Norway, Holland and England there was a very limited use of EHR-systems. Except for England none of the countries had a national strategy in the area.

A number of countries have organized coordinating bodies. Besides this, a number of EU-initiatives in standardization and application development were started during the last few years.

3.2 Vision and Strategy

Based on the described analyses the strategy was expressed along the following lines:

- Together with the owners of hospitals (i.e. the counties) The Ministry of Health forms a forum for planning, implementing and coordinating the EHR-development
- The HEP-project must, as much as possible, involve the regional and local parties in the development
- The HEP-project must contribute to the financing (i.e. most central national funding) of the initiatives and projects which are the results of the strategy
- The HEP-project shall call for project proposals in selected areas
- The HEP-project shall evaluate the initiatives of this action plan and disseminate results.

The contents of the HEP-project were described as 7 targeted themes:

1. Testing of EHR implementation methodology
2. Testing of EHR technology
3. EHR information activities
4. EHR standardization activities
5. Security issues
6. EHR and organizational development
7. Coordination of related areas (like statistical production, clinical databases and a number of specific current activities)

Each theme was concretized in a number of initiatives which could form the basis for local projects and experiments.

3.3 Coordinated National Initiatives – or the Lack of It

The purpose of HEP was to launch national coordinated initiatives to promote EHR development. The third step of HEP needed the direct involvements of the hospitals.

The hospitals were encouraged to launch projects and the motivation was there. The Ministry of Health called for projects, and the hospitals were expected to send terms of reference, i.e. documents which contain all the information that defines the project.

Many proposals were presented, and a reasonable financial support would amount to about 50 mio. Danish kroner.

The Ministry, however, had only about 5 mio. Danish kroner - so the motivation vanished.

The result was that only a few projects were started, and the projects were mostly targeting the local needs.

Every county supported their preferred vendor, and the transversal standardizing activities were lacking.

As one important result of HEP: the EHR-development came on the list of issues in all counties, and most counties developed own strategies and began own development in the area.

Generally, in the following years three different roads were used by the counties:

- The county acquired (and modified) an existing EHR-system on the market, securing a product which also had other customers and was based on proven technology
- The county developed an EHR as an addition to the systems they had already implemented (i.e. a patient registration system)
- The county selected new technology and went into a risky EHR-development project.

One of the outcomes of HEP was also the invention of the so-called *EHR-observatory*, a body which each year monitors and reports progress and penetration of EHR systems in Denmark, presented and discussed at a yearly conference. This contributed to knowledge sharing and some degree of coordination.

3.4 Subsequent Central Initiatives

In the years after HEP the National Health Authority (*Sundhedsstyrelsen*) started a development-project on standardization of EHR-terminology and -datastructure. The idea was to develop a framework which could be used by all counties and ensure seamless exchange of data between involved systems from different parties. The framework was called *G-EPJ*, a generalized EHR. The framework comprised a standardization of semantics and syntax for the terminology as well as a certain standardization of clinical processes around EHR.

This initiative did not materialize. Other initiatives such as the Danish translation of the *SNOMED Clinical Terms* (a systematically organized computer processable collection of medical terms providing codes, terms, synonyms, and definitions used in clinical documentation and reporting) also did not materialize in EHR systems.

The main reason was resistance from the counties (later from the regions). The resistance was partly NIH (Not Invented Here) based and partly 'it is too difficult to implement' based.

3.5 The 12 Counties become 5 Regions

A local authority reform resulted in 2007 in the creation of 5 regions instead of 12 counties, and the prime responsibilities of the regions became the public hospitals and healthcare. But at the same time the new 98 municipalities had to take over more healthcare related tasks, i.e. post hospital treatment, home care, elderly care, and general public health initiatives. The regions were to become more specialized with focus on specialist hospitals.

One of the effects of this organizational change in the EHR development was an improved focus on EHR standardization within each region, causing the number of different EHR products on the market to be reduced from 10+ to 5. But at the same time each region again chose very different products.

The need for standardization and interchange standards (like HL7, DICOM, MedCom EDIFACT and XML) increased. It was a fact that not only data needed to be exchanged between hospitals in a secure way (within regions and between regions). Secure communication and data exchange with GPs and the IT-systems at the

municipalities (Electronic Healthcare Systems) were also demanded as a consequence of the sectorial division of public healthcare between regions, municipalities and GPs.

There is still a need for all actors to be able to share EHR data among sectors.

To address this need, the regions established an EHR repository solution where extracts from the hospital EHR were copied at regular intervals and made available to other hospitals at the admission of patients. This information was also at the disposal of the GPs and other healthcare professionals. However, the information reflected what was available from the hospital EHR and did not properly target the needs of GPs and the municipals.

Another initiative is the Shared Medication Record (SMR), an on-line repository where all parties through legislation are obliged to retrieve and store actual and structured medication information of all patients. The SMR is integrated in all GP systems and in all EHR systems at hospitals, and in 2014 the SMR will be integrated to all municipal healthcare systems.

4 Two Routes and Strategies to follow

The first route is *the repository strategy* where the patient owns the EHR data in the repository. This is an obvious route to follow when more data need to be shared by the professionals. This has the consequence that you add costs when integrating the repository to local solutions.

Another route to take is to mandate all publicly funded actors (hospitals, GPs, municipalities) to use the same *common EHR platform*, forcing them to operate on the same databases.

This route is demonstrated and made technically possible by the co-operation of two of the regions (Capital Region and the Region of Zealand) to join force to acquire a fully SNOMED compatible EHR platform with capabilities to supporting also GPs and homecare tasks.

Both the of the above models and strategies demand a political legislative mandate where the sovereignty of the regions, the GPs and the municipalities to choose their own ICT solution (also mandated through EU tender regulations) is reduced significantly. Moreover, it will certainly require a national governance body to co-ordinate the program.

Unfortunately, due to the present political realities a decision in this direction seems unrealistic.

5 Experiences and Knowledge

Looking back on the development and implementation of the EHR in Denmark the experiences can be resumed in the following important points:

- The EHR implementation was triggered by the technology possibilities – but it showed to be a huge political, organizational and cultural project. As a result EHR was 20 year under development!

- The counties/regions/municipalities have local autonomy. A consequence - national initiatives can only be driven by central legislation and heavy central funding
- From experience we know many actors – coming from different organizations and professions – have various terminology. This leads to the understanding that a common language is necessary in order to understand each other, which requires standardization
- The development until now have had focus on the needs of healthcare workers – the patients' needs for coordinated information have not been met. In the future a new balance between the two points of view has to be found.

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