Development, implementation and diffusion of EHR systems in Denmark

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SUMMARY

The Danish EHR-Observatory has monitored Danish EHR projects for several years with respect to a number of parameters such as diffusion, diffusion rate, barriers and limitations, and experience gained. The results of the 2002 monitoring reveal that investment in IT is relatively low and the diffusion rate is below the estimated level. The EHR projects gain a lot of valuable experience, but the coordination of evaluation results should be improved.

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1. Introduction

Electronic Health Record (EHR) systems are being implemented in many countries — some of them even following a national strategy (UK). There are a few attempts to follow the progress in this diffusion process [1—4]. In the last decade, Denmark has mainly focused on establishing communication in the primary health care sector and between primary and secondary care. The Danish organisation MedCom monitors the diffusion and use of information technology and the current status shows that [5]:

- 95\% of GPs have EHR of which 85\% communicate electronically with hospitals, pharmacies and health authorities.
- 100\% of pharmacies use IT and communicates electronically with GPs and hospitals.
- 100\% of hospitals have Patient Administration System (PAS), Laboratory Information System (LIS) and other proprietary systems.
- More than 30 million clinical messages are communicated annually.

The development and implementation of EHR systems in hospitals was accelerated with the first national strategy for the development of EHR in 1996. This strategy also initiated the EHR-Observatory. The purpose of the EHR-Observatory is to support the realisation of the national strategy.
by monitoring and assess the development, implementa-
tion and application patterns of HER systems in Danish hospitals. Since 1998, the Observatory has collected data on various aspects:

1. Implementation and dissemination issues:
   • Diffusion and diffusion rate of EHR systems.
   • Experience among the different stakeholders.
   • Factors that increase diffusion and use of EHR systems.

2. Issues related to common frame of reference for EHR systems:
   • Uncover differences and compatibilities between regional data models.
   • Communicate consequences of using incompatible data models.
   • Specify the demand for a common frame of reference.

The analysis of the data and the conclusions have been published in annual reports [6—9] and in conference proceedings [10—12].

2. Methods and material

The survey of the 2002 status used an Internet-based questionnaire directed at two different respondent groups. The first questionnaire was surveying the county administrations (n = 15). The county administrations are the "owners" of the public hospitals, and have the political and administrative responsibility for running the hospitals in Denmark. This questionnaire contained 12 questions that surveyed general aspects of strategy, economy, barriers and identification of specific EHR development and/or implementation projects. Most of the questions have been used in the preceding surveys during the last 4 years, and have been validated through follow-up interviews with county representatives. This has enabled the use of mainly closed category questions. However, some of the questions have the option of adding further issues to the answer.

The strategy aspects were additionally surveyed by classifying the strategy material available by further request from the administrations in the counties [13].

Firstly all the strategies were surveyed and characterized by five different themes:

1. Background: Are there an earlier plan for the area in the county? How does the regional strategy relate to the national strategy? What are the technical and the organisational conditions in the county?
2. Visions: What are the overall objectives for implementing EHR systems? What is the notion of outcome of the implementation?
3. Priority of themes: What themes of effort does the plan prioritize? Are they described as a jointly effort or a successive effort.
4. Plan of action: What is the status for the implementation process? Have they started at all? Have they gone through "Call for tender"? Are they in a pilot/test phase? Have they completed a general implementation? Furthermore, this theme investigates the organisational anchoring. Are there plans for the education of staff etc.
5. Economy: What are the resources set aside to the tasks in the plan? Are additional resources granted, or must the tasks be completed within the ordinary budget for running costs?

Secondly, the themes were assessed and classified according to a 5-scale model of the activity shown. The model were inspired and adapted from [14] and incorporated the following classes:

1. inactive strategy ⇒ "We form the agenda",
2. active strategy ⇒ "We are ahead",
3. proactive strategy ⇒ "We comply with nationwide obligations",
4. hyperactive strategy ⇒ "We have no problems".

3. Results

The questionnaire survey to the county administrations regarding IT strategies shows that the situation from the last years remains unchanged. The majority, 11 out of 15, claim to have a strategy, but only four state that they have an approved budget to implement the strategy. The questionnaire does not investigate further on the content of the
strategies, however, this was done in a separate study [13] showing that 2 counties had an inactive strategy, 5 counties had an active strategy, 2 counties had a proactive strategy and 2 counties had a hyperactive strategy. Four counties were in a transition state at the time of the survey and did not suit any of the categories.

3.1. Economy

The counties were asked about the cost of running the IT systems and the annual investment in IT infrastructure and systems development. The answers indicate that around 0.6% of the total turnover are spend on running the IT systems (1.0% in 2001). Investments in IT infrastructure and systems development are approximately 0.7% of the turnover (0.3% in 2001). The response rate on the questions concerning economy is low, only 53%. One reason might be that the accounting system in public administrations do not easily allow for retrieval of this kind of information.

3.2. Diffusion of EHR systems

The diffusion of EHR systems in hospitals is still very low. Only 7% of all beds in Danish hospitals are covered by an EHR system. The growth in diffusion has been very moderate — in 2001 it was 5%. A great variation among the hospitals and the counties still exists. In one county (Viborg) the coverage is 60% while four counties respond 0%.

3.3. Vendors

Ten different vendors are active on the market in development projects, but only four of the vendors account for more than 90% of the beds covered with EHR.

3.4. Identified projects

The survey revealed a total of 60 EHR projects in the country. The response rate varies from 68% to 75% in the different categories of questions. The projects are managed on different levels and in different phases as indicated in Figs. 1 and 2. Due to the response rate on 75% only 45 projects are presented in the figures.

3.5. Workflow analyses

Workflow analyses are still considered an essential activity in the implementation of EHR systems. The questionnaire survey revealed that workflow analyses are done on a very pragmatic basis without applying formalized methods.

The most common methodological basis for analysis is business process reengineering (BPR), as it was the year before. Only three projects applied the object-oriented "use case" approach. The majority 52% (n = 42) indicated they did not use any specific methods for the analysis.

The workflow analyses are performed in an early stage in the project, and result often in significant changes in the organisation. These changes are implemented immediately after the workflow analyses had been carried out. The relation between the results of the analysis and the time for the completion of the analysis is shown in Table 1. Some projects have contributed with more than one analysis.

<table>
<thead>
<tr>
<th>Analysis early in the project</th>
<th>Analysis later in the project</th>
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<tbody>
<tr>
<td>Minor adjustments</td>
<td>10</td>
</tr>
<tr>
<td>Major changes</td>
<td>13</td>
</tr>
<tr>
<td>New collaborations</td>
<td>6</td>
</tr>
<tr>
<td>New competencies</td>
<td>3</td>
</tr>
<tr>
<td>New responsibilities</td>
<td>3</td>
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</tbody>
</table>

Fig. 1 Level of management of projects.

Fig. 2 Phase of projects (in % of n = 45).
3.6. Evaluation

Evaluation activities have been carried out by 88% of the surveyed projects \((n = 42)\). Evaluation activities cover all kinds of measurement and assessment in relation to choice of system, implementation and application of the EHR system.

In 36% of the projects data have been gathered in the period before implementing the EHR-system to establish a baseline – mainly time measurement of various work processes.

Twenty-three percent of the projects with evaluation activities \((n = 37)\) state that they have changed the data model as a consequence of the evaluation. Although the opportunity was given, the respondents did not elaborate further on what this change of the data model included. Only one project states that they have altered the formulation of the basic aims of the EHR project, and another project states that they only revised their focus during the project implementation.

There is a high degree of participation in the evaluation activities. The staff from the departments are involved in more than 70% of the projects in the initial phases, rising to more than 90% in the final specific evaluation activities.

A number of the projects have reported their evaluation results and made it available on a website (in Danish) \([15]\). Reading the reports leaves the impression that the use of evaluation methodologies is not prevalent among EHR projects. It is characteristic that the evaluations are not referring to explicit theoretical or methodological backgrounds. It remains unclear who has commissioned the evaluation and who has performed the practical tasks: measuring the data, doing the analysis, and writing the report. The aim of evaluating is only mentioned briefly and it is unclear how the evaluation results are going to be applied to the succeeding process. Further analyses of the content and focus as well as formal quantitative analyses of the evaluation reports have not been performed yet.

3.7. Training and education

In more than half of the surveyed projects (66%), the general IT qualification level of the staff has been investigated systematically. It is mainly done by means of questionnaires, but also interviews with the staff or key persons have been used. In 10% of the projects it has not been regarded as necessary to investigate this issue further – it was taken for granted that there was a need for education to raise the general IT skill level of the staff. There is however a great span in the assessment of the training need among the staff. Fig. 3 shows the percentage of the staff that was regarded as having insufficient IT skills to be able to operate an EHR system.

The staff are predominantly trained by means of traditional in-house courses 76% \((n = 42)\). Eleven percent sent their staff on courses out of house, three of these as a supplement to in-house courses, and 17% use e-learning. It has not been investigated what kind of e-learning was applied.

4. Discussion

The majority of the counties in Denmark have a strategy for the development and implementation of EHR systems. This indicates that EHR systems have been considered an important issue by the top management. However, the content of the strategies vary considerably. The two hyperactive counties and the proactive counties have clear visions, a clear priority of themes, a comprehensible plan
of action and investment all approved by the polit-ical level. The active counties include some of the counties known to be very far in the imple-mentation process, but this is not due to a com-prehensible strategy approved by the political level and available for analysis. The investigation of the strategies on county level concludes that it is very dif-ficult for the public — and the other counties — to get information about how far the development and implementation of EHR systems has come, and by what means this has been achieved. To optimise the knowledge transfer between counties and other stakeholders a greater visibility and acuity in the strategic planning efforts are required. If the na-tional strategy is going to be carried out, the follow-up on the county level is essential, as the counties are responsible for providing the necessary funds. Although the resources allocated for investment in EHR systems are still surprisingly low a shift in pri-orities has occurred. The investment in new sys-tems has increased but the amount spent on running the systems has decreased, which leaves the total amount spent on IT remain unchanged. To monitor and assess the shift these issues will be followed up in the years to come.

The latest national strategy for IT in healthcare aims at covering all hospital beds in the county with EHR systems by the end of 2005. The uptake till now has been very moderate — from 5% in 2001 to 7% in 2002, and if the goal has to be reached, there has to be major investment in EHR projects.

The measure (coverage of beds) is, however, not adequate as a strategic goal, mainly because it has not been defined what it means to be covered with an EHR system, and it is indeed difficult to define. Further conceptual work will have to be car-ried out to achieve a measure adequate for trans-forming from a strategic level to an operational level in the specific planning of investments and activities.

The fact that 4 out of 10 vendors account for more than 90% of the market could signal that new companies will enter the market for EHR systems. This also indicates that the situation is becoming mature for market trade of EHR systems. An esti-mate of the market could be that it will grow ex-pONENTIALLY only limited by the vendor’s ability to deliver and implement EHR systems.

The majority of identified projects are now an-chored at the county level. This indicates a change in relation to the year before. It accelerates the last decade’s tendency shifting from departmental pro-prietary systems to systems where integration and communication are indispensable requirements.

The implementation of EHR systems usually in-volves major changes in the organization and work-flow analysis has been one of the most popular ap-proaches to handle organizational change.

The methodological approach to these analyses still has its shortcomings. Business Process Reen-gineering is the preferred framework regardless of the problem at hand, or the character of the work-flow. Although BPR and the “use case” approach are descriptions on different levels they are applied by the projects in different situations and in differ-ent phases of their project. The EHR-Observatory has written a handbook on methods for performing workflow analyses [16] as a contribution to enhance the quality of these activities.

However, an interesting point to note is the fact that the workflow analyses impose significant changes to the organisation — changes that are implemented before the EHR system are imple-mented. This finding suggests that there is a great potential in organisational change(s) regardless of having health records computerized.

Methodology for evaluating IT in healthcare also seems to be hard to manage for the projects. The analysis of the methods used in the evaluations has been performed on a rudimentary basis. It is diffi-cult to do any quantitative analysis of the reports, because they have not been published in any formal way, and it is impossible to state when you have a sufficient sample of reports.

There are, however, several serious methodolog-ical flaws in the evaluations performed and re-ported. The evaluations do not necessarily have to be scientific dissertations, but they face prob-lems if they do not apply approved methods. The results from evaluations should be the building blocks in the accumulation of knowledge, which the succeeding projects shall employ to make progress.

The big variation in the IT skills among the various staff groups indicates that the experiences gained through former activities only are used locally. Hence, there is a need to share the experi-ence in qualification issues. Actually, the Internet and other means of IT could be used to network the different actors, as well as the potential of e-learning should be further explored.

5. Conclusion

The EHR-Observatory is monitoring the develop-ment, implementation and diffusion of EHR systems in Denmark. On the national level there has been an EHR strategy for the last 7 years and the various stakeholders in the field are very busy developing and implementing EHR systems. The diffusion is still very low, and the pace of the diffusion rate has to
increase significantly to reach the goal in the national strategy. To optimise the learning effect between the different projects it is essential that the projects are open and willing to disseminate results currently. And it is essential that workflow analysis and evaluation activities in the projects are performed on a sound and explicit methodological basis.

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References