MEDINFO 2010
C. Safran et al. (Eds.)
IOS Press, 2010

doi:10.3233/978-1-60750-588-4-381

Diffusion and use of Electronic Health Record Systems in Norway

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Abstract

This paper sums up some of the findings from a national survey on the diffusion and use of Electronic Health Record (EHR) systems in the Norwegian health sector. The survey shows that almost all hospitals and GPs use their EHR systems on a daily basis, while the municipalities are lagging behind, All three view costs and missing functionality as the most important challenges. The GPs are very concerned with the complexity of the daily operation of the systems, while the hospitals are mostly concerned with costs of daily operations, maintenance and further development of the systems. Better integration with support systems is requested. User involvement and ownership seem to have contributed to the development and diffusion of the most successful EHR systems. National diffusion processes require good planning and are time consuming. It has taken 15 years from the first EHR systems were introduced until 90% of the actors used the systems. This has to be taken into account in national strategy processes in the health sector.

Keywords:
Electronic health record, Shared care, Survey, Benefits, Diffusion, Strategy

Introduction

The Norwegian Directorate of Health did a strategic study on EHR strategies in the Norwegian Health Sector 2005. The study pinpointed the need of "a better decision base for further development of EHR systems". More documentation on the diffusion of existing EHR systems and also their usage and potential benefits in comparison to paper based systems was requested.

An increasing focus on shared care that involves health workers from different organizations, leads to more transfer of a patient's health information across organizational boarders. This extensive information exchange will also imply new requirements and challenges regarding further development of the EHR systems that are used by the collaborating actors.

So far, data about clinicians' use of EHR systems in Norway have only been gathered and analyzed in relation to hospitals by Lærum et al [1], Ellingsen and Monteiro [2] or at a local level by Christensen [3]. Examples of documentation regarding EHR diffusion in other countries are Castro's report on leadership in Health IT [4], Protti and Nilsson's comparison of IT in general practice in ten countries [5] and Nøhr's analysis of development, implementation and diffusion of EHR systems in Denmark [6, 7] and Gans et. al [8]. In order to get a better overview of the Norwegian status, the Directorate of Health initiated the EHR Monitor project. The project will monitor the implementation and use of EHR systems each year. Data will be retrieved by surveys. This paper sums up some of the findings from the first survey, and also sees some of the findings in relation to existing research related to diffusion of EHR systems.

Method

The questionnaire

The purpose of the first survey in 2008 was to collect quantitative data as a basis for further study based on a set of indicators. Examples of indicators are the number of hospitals, GPs or nursing homes that use EHR systems and the number of actors that plan to implement such systems within a fixed number of years. The researchers have found it necessary to use both open questions where the user can answer quite freely, and questions that require quantitative input.

Four different types of questionnaires were developed, one per type of actor in the survey: GPs, municipal health stations, nursing homes and hospitals. The questionnaires were developed through workshops, expert feedback and pilot testing.

It was assumed that the informants had little time available for paperwork, and it was thus decided to use questionnaires that could be filled out with limited use of time. The questionnaires were also intended for reuse in order to provide comparable data over a period of two or more years. It was decided that the number of questions should be held within the limit of 4 pages. It was assumed that several reminders would be required to get the forms returned or until a negative answer to the request would be given. The GPs received compensation

comparable to a patient consultation as a compensation for loss of income.

Selection of informants: The survey was directed towards GPs, municipal care and hospitals. 180 municipalities were selected based on size and geography in such a way that they could be regarded as representative for the national average. 150 GP practices were included. 130 of these were selected based on a random pick among the selected municipalities. In addition 5 practices from each of the four largest cities were included. The questionnaire was sent to all the hospitals.

The response rate was: 43% from the municipalities, 62% from the GPs and 83% from the hospitals. The number of forms returned from the GPs and hospital were quite high, but a better response from the municipalities had been appreciated. The fairly low response from the municipalities might be due to the fact that a more general survey on ICT use had been sent to the municipalities not long before the her Monitor survey.

Results

The most visible indicators for dissemination of EHR systems in the health sector are the share of actors that use these systems. This is illustrated in figure 1. The survey shows an almost full coverage among GPs and hospitals. It has been 20 years since the first EHR installation in a hospital until full dissemination. The same process started earlier among the GPs, and their adoption curve was even steeper. The use of EHR systems in municipal care (nursing homes and maternal and child health centers) is more limited, but seems to follow the same trend. The smaller municipalities are slower to introduce new ICT-solution than the larger ones.

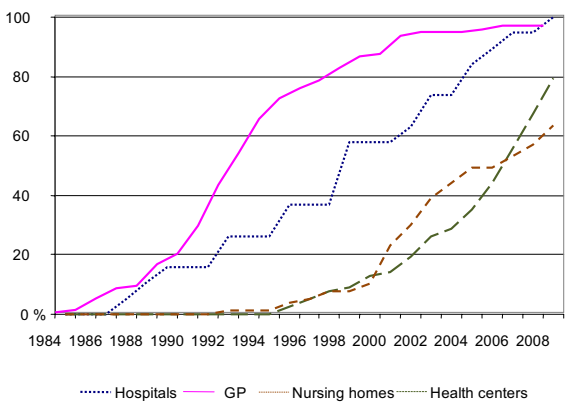

Figure 1- Planned or fulfilled implementations of EHR systems

The GPs do not keep paper records any more, but only 25% of the hospitals have a completely paper free record. Some of these hospitals scan selected parts of the record that have been preexisting in paper form when the patient is admitted. 65% of the hospitals use the electronic record as the main source for medical information. There are also regional differences in the use of paper free EHR. 75% of the hospitals in Mid-Norway do only use the EHR, while 70% of the hospitals in South-Eastern Norway still use the paper record as the main archieve.

83% of the municipalities reported to use some kind of EHR system. EHR systems are used in nursing homes (82%), home-care services (56%), school health services (39%), community habilitation services (34%) and maternal and child health centers (65%). The smaller municipalities with less than 2500 inhabitants are the slowest ones when it comes to adopting new systems. This can be related to relatively high cost for both buying new systems and daily operating cost for the systems.

6% of the municipalities were using PDAs with access to the patients' EHR in the home care services. Another 12% reported that they were about to implement PDA systems the following year.

The informants in the survey were also asked what they saw as the main challenges in relation to future EHR use.

Table 1- The hospitals reported challenges regarding further diffusion and development of EHR systems

	All answers	Most important	Sec. most important
High costs	80 %	44 %	15 %
Missing functionality	50 %	13 %	15 %
Complexity in daily operation and maintenance	28 %	3 %	3 %
Resistance against change among users	10 %	5 %	-
Missing standards	35 %	8 %	9 %
User education	40 %	5 %	3 %
Missing integration	63 %	5 %	30 %
Realization of benefits	53 %	8 %	9 %
New government requirements	20 %	3 %	0 %
Vendors that do not deliver as promised	55 %	5 %	12 %

Both groups saw rising costs and missing functionality as the most important challenges. The GPs were particularly concerned with the complexity of the daily operation of the systems. Integration between the main EHR system and other clinical and administrative systems at the hospital is also a great concern. Improved functionality is highly requested by all actors. Further, it has proven to be difficult for the hospitals to realize the expected gains and benefits from the new systems, and vendors do often not deliver their new version on time.

The hospitals were less satisfied with their vendors than the municipalities and the GPs.

Table 2 - The GPs reported challenges regarding further diffusion and development of EHR systems

	All answers	Most important	Sec. most important
High costs	54 %	34 %	7 %
Missing functionality	36 %	9 %	13 %
Complexity in daily operation and maintenance	52 %	13 %	22 %
Resistance against change among users	8 %	-	3 %
Missing standards	29 %	4 %	10 %
User education	18 %	3 %	4 %
Missing integration	44 %	11 %	16 %
Realization of benefits	28 %	3 %	4 %
New government requirements	15 %	3 %	4 %
Vendors that do not deliver as promised	27 %	10 %	4 %

The hospitals were also asked about their possibilities for electronic message exchange. It is important to emphasize that it is a gap between possibilities for use and actual use of electronic message exchange. This is both due to the fact that not all collaborating actors have EHR systems that can communicate, and that not all organizations are ready to use the collaboration possibilities. 59% of the hospitals have systems that can receive electronic referrals, 100% can send electronic discharge summaries, and 91% can send laboratory reports.

24% of the General Practices send electronic referrals, but more than 50% of these referrals are sent with paper referrals in parallel. More that 90% of the discharge summaries and laboratory reports are received electronically by the GPs, but paper is also sent in parallel with 55% of the discharge summaries and 45% of the laboratory reports.

Discussion

The diffusion curves of the Norwegian EHR systems all seem to follow the same s-shape. The starting point differs (Figure 1), but the norm is that it takes at least 15 years from the first systems are introduced until 90% of the actors use the system. In an evaluation of ten European projects [9] it was shown that the factors that influenced the diffusion time most, were dependencies to existing software and infrastructures. A break/even point for costs and benefits would in most projects be reached after five years. This is a challenge when it comes to realization of ICT strategies because the planning horizon is too short. Our finding are in line with Bower's suggested adoption rate for EHR [10], where he compares diffusion of EHR with diffusion of ICT systems in other industries.

Diffusion of EHR systems among General Practitioners

The first EHR systems for Norwegian GPs were in use as early as in the late 1970ties. This was the PROMED-system [11]. Another system was installed in Balsfjord in 1980 [12]. The development of the Balsfjord system was financed by research grants and government funding. The system did only have a limited number of users in Northern Norway. The GPs outside the Balsfjord-project did not get any subsidies or incentives from the government when the new EHR systems were introduced. They had to buy the systems themselves, but found the new systems so useful that they were worth the investment. Later EHR systems in general practice have all been developed without any subsidies or incentives.

The first systems were based on use of the operating system MS-DOS. The market leader during the first decade was Infodoc [13]. When new systems that used MS-Windows were introduced, many of the users did not only change version of their system, but also vendor. This process is illustrated in the figure below. This shift took place in the period 1999-2001.

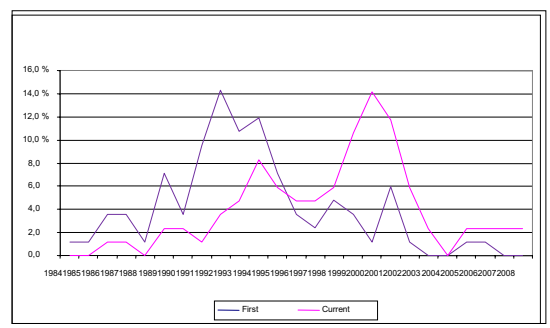

Figure 2 – GPs' purchase of EHR systems

An international survey in 2007 [14] showed that 98% of the GPs in Finland, Denmark, Norway, United Kingdom, the Netherlands and Estonia use ICT-systems to support their daily work processes. An American survey [15] from medical group practices in the USA showed that adoption of EHR systems progressed slowly, at least in smaller practices, although a number of group practices planned to implement an EHR within the next two years. The process of choosing and implementing an EHR system appeared to be more complex than first expected.

Tom Christensen [3] has in his doctoral thesis analyzed how GPs use EHR systems and how they can be developed further in order to better support the GP's work processes. The GPs reported that they generally believe that using the computer saves time, and observations showed that they used even less time than reported in front of the computer. On the other hand they also tell that the introduction of EHR has transferred

workload from the secretary to the GP. They are generally satisfied with their system, but need better decision support and support for communication with other systems even if possibilities for message exchange have been made available in most of the systems. They also reported that it had become more difficult to get the overview of the patients' earlier health-history. The clinician-patient relationship is of great concern GPs, but they denied that the use of an EHR system drew the attention away from the patient.

Diffusion of EHR systems in Norwegian hospitals

The diffusion of EHR systems in hospitals has been much slower than in primary care. Ellingsen and Monteiro [2] stated that establishing EPRs in hospitals, especially the larger ones, has been notoriously difficult. The increase in organizational, institutional, political and technological complexity was seriously underestimated during the first years. Before the introduction of EHR systems in hospitals, patient administrative systems had been available in hospitals for a decade.

The benefits have not been equally visible when it comes to health record systems that can support the clinicians' daily work-processes [3], [15]. The clinicians in hospital often move over long distances during their workday and uses EHR systems only a few minutes at a time. It has been shown that information resources must be easily available in the clinicians' workspace in order to be used [16] In the EHR Monitor survey 80-90% of the hospitals agree that there are big potential quantitative and qualitative benefits related to the introduction of EHR systems, but only 20-30% agree that these benefits already have been achieved. It is common that it takes some time from the ICT-systems first are introduced until the benefits can be achieved. It is however surprising that the survey showed that less than 50% of the hospitals had a plan for realization of benefits related to the introduction of new systems.

In comparison to the development of EHR systems for the GPs, the government has provided significantly more funding for the development of hospital's EHR systems. Still the diffusion time has been much longer. This is probably due to the complexity of hospital organizations, and the large amount of work required for integration with many different information systems at the hospitals. Another difference is that the GPs have been planning, ordering and using the new systems themselves. They have not bothered to invest in systems that could not provide them with obvious benefits neither in terms of reduced cost nor as support for their daily work processes. On the hospital side, most of the procurement processes have been managed by the administration. The health workers have often been involved in the requirement specification processes, but their possibilities to grasp how these specifications would influence on their work processes have often been limited, simply because many of these systems are very complex.

Three major EHR systems are in use in Norwegian hospitals today, of which one is on the way out of the market. One vendor has a significantly larger market share than the others. This system originated from a small Norwegian hospital and the first version was developed in close collaboration with the users at the hospital. This contributed to the making of a system that to a high degree supported the health worker's daily work processes. From being a system that should support a limited number of users, the system is now in use at many, both large and small, hospitals. This can be a challenge when it comes to user involvement in the design process and flexibility to satisfy diverse requirements. The study showed that 67% of the users of this system were dissatisfied with the functionally of systems with the largest market share versus 33% of the users of one of the other systems that have been used by the same hospitals for a long period of time.

The company has now started to use agile software development. Agile software development refers to a group of software development methodologies based on interactive development, where requirements and solutions evolve through collaboration between self-organizing cross-functional teams. Agile methods are also used by at least one of the vendors of EHR systems in primary care.

EHR systems in municipal care

The first EHR systems were introduced to municipal care as late as in 1995. The municipalities have the responsibility for a diverse set of ICT-services in order to serve schools, technical offices, administration and health care. Benefits related to introduction of ICT-services in other sectors than health care may have been more obvious, and may have led to a reduced focus on the EHR systems.

The diffusion curve for EHR systems in nursing homes and at health stations now seems to follow the same pattern as for the hospitals and GPs.

The municipalities seem to be very optimistic regarding future benefits of mobile solutions, but research [17] also indicates that at least in the introduction phase, the nurses will spend significantly more time using electronic mobile solutions than paper.

Conclusion

Costs, both related to purchase and maintenance are important for all actors. Expectations of possible future qualitative and quantitative benefits of the systems seem to be high, but cost/benefit analyses are to a large extent lacking.

User involvement and ownership are important for the success or failure of EHR systems. The GPs have been closely involved in the design of EHR systems from the beginning. The most successful EHR system for hospitals did also originate from a hospital setting. This is likely to have contributed to the making of a system that worked well in a real life hospital setting.

The installed base of EHR systems is growing, and this is also a challenge when functionality is lacking and new extensions and functions need to be added to the existing system. EHR systems are not static, and even if many of the modules will remain stable over time, new and innovative modules needs to be developed. New health reforms and technology changes will also put pressure on vendors for further development of the systems. More extended user involvement, use of agile

system development methods and reusable components may make this process easier in the future. The large existing installed base of software, however, can also be a challenge potentially limiting for rapid development.

A diffusion process of systems that shall be used on a national basis requires good planning and is time consuming. This has to be taken into account in national strategy processes for the health sector.

The EHR Monitor survey gives an indication of how many actors in municipal care that use today's EHR systems, but not necessarily of how they use them. Further work is needed in order to get a better understanding of how the systems are used as support for daily work processes.

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