

The fate of clinical department systems at the dawn of hospital-wide Electronic health records in a Norwegian university hospital

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Abstract. Objective: a) To document the presence and use of clinical department systems (CDS) in a university hospital that implemented a hospital-wide electronic health record (EHR) in 1999 and b) To compare clinical use of the CDS with that of the EHR. **Method:** Identification of CDSs in use by contacting leaders and senior physicians at clinical departments at the hospital. Identification of key properties of each CDS by interviewing users. **Results:** We identified a total of 60 CDSs, of which 53 fell in one of four categories; Journal or documentation system tailored to a department or medical specialty (19 systems), Software bundled with electronic medical equipment (control/ storage/ presentation) (14 systems), Logistics/ administration/ planning/ appointments (10 systems) and Database for medical research (10 systems). Many CDSs were described to outperform the EHR system with regard to ability to provide better patient overview and better support for registering patient data. CDSs are not integrated with the EHR and thus contain islands of data. **Conclusion:** CDSs continue to fill important roles and there is no tendency towards that the hospital-wide EHR makes CDSs obsolete. **Keywords:** Electronic medical record systems. Clinical departmental systems.

1. Introduction

Hospitals are highly complex organizations established to meet the needs of patients with potential or manifest diseases in need of specialty care. Due to the nature of diseases, combined with the risks associated with the actions health personnel take to combat disease, the situation of a hospital patient is that of a person who is exposed to threats. Accordingly, the situation of hospital workers is that of experts assigned a mandate to explore, analyze, and subsequently manage diseases as risks to the health and well being of their patients.

Due to the multitude of medical conditions and the diverse repertoire of methods that has evolved and must be mastered, the work force in hospitals has grown diverse and highly specialized. This proliferation of diagnostic and therapeutic methods and the corresponding work force diversity is perhaps what has contributed most to the impression that hospitals are highly complex organizations [1]. Furthermore, the

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increase in number of health care actors that comes with increased specialization has made the service appear less continuous. This has accentuated the demand for better coordination of care [2].

With the vision that the use of Electronic health record (EHR) systems can simplify coordination, planning, performance, documentation and evaluation of care, many countries and hospital organizations have implemented and started to use such systems. The extent to which hospitals have an EHR varies however greatly. In Europe, hospitals in the Nordic countries, Belgium and the Netherlands rank among those with the highest EHR system implementation rate [3]. Many other countries have drafted plans to develop and implement EHR systems but still lag behind when it comes to implementation. When it comes to clinical use of EHR systems that have been implemented, many investigations have found that EHR systems still lack important functionality and that much remains to be developed if the vision of the EHR system as the central hospital information handling and communication system shall be achieved [4, 5].

In parallel to efforts aiming at developing hospital-wide EHR systems, many clinical departments and specialist groups have taken initiative to development and implementation of smaller clinical department systems (CDS), typically tailored to the needs of one particular group of patients or specialists. Examples of CDSs are local quality registers and databases that are integrated with medical technology. With the assumption that CDSs are in widespread use and still occupy central roles in hospital departments we have identified and here describe the flora of CDSs in a hospital that implemented a hospital-wide EHR system back in 1999. We find that CDSs present at the time when the hospital-wide EHR was introduced still perform functions essential to patient care in the departments using them and that the CDSs outperform the EHR system with regard to ability to provide better patient overview and better support for registering patient data.

2. Materials and methods

The study was performed at St. Olavs Hospital, a 930-bed university hospital located in Trondheim, Norway. Its' EHR system (Doculive EPR, developed by Siemens Healthcare), which was implemented in 1999, now is used to document the activities of doctors, nurses and physiotherapists. Also, the hospital has implemented a PACS / radiology information system, and the hospital has had a laboratory information system since before the EHR. The core functionality of the EHR system consists of support for the production and view of health record text, and for workflow around health record documents, i.e. exchange of referral letters and medical discharge summaries. Also the EHR system supports ordering (of imaging analyses, laboratory analyses and other laboratory tests) and writing prescriptions. The hospital has not yet taken the step to remove the paper-based medical record and thus still update the paper-based medical record along with the EHR.

Data were collected between June 2004 and May 2005. The definition of a CDS used for acceptance of a system was "software made for use in performing or evaluation of health service in a medical speciality not generally available across the hospital as the EHR". Systems were identified by visiting the different wards at the hospital asking for systems fitting our definition because no complete updated database of such systems existed. Our material includes 60 CDS identified by this method as of

May 2005. Nine systems come from department of ear, nose and throat & eye, eight from surgery, seven from cancer & dermatology, seven from laboratory medicine, six from medicine, six from cardiac medicine, four from anaesthesia & ER, three from paediatrics, two from radiology & imaging, two from obstetrics & gynaecology, two from neurology, two from orthopaedics and rheumatology, one from physical medicine and one from lung and occupational medicine.

Data for each CDS were collected using a structured questionnaire. The questions were developed after an initial study of a selection of CDSs and general literature of medical informatics. We attempted to identify key variables in different categories of properties. A total of 65 variables were collected for each system regarding classification, development, availability, users, population, patient data and functionality.

Registration of a particular CDS typically included a brief demonstration of both everyday use as well as more advanced functionality by either an end user or someone with administrative responsibility for the system. After getting a comprehension of the use and purpose of the system, the researcher and user filled out the questionnaire in collaboration. Definition of terms and use of clarifying examples ensured that the user felt confident about selecting the correct value to each question. If the user felt uncertain of a specific value, the question was then later addressed to someone with administrative responsibility for the system. All records were made by the same researcher.

The forms were entered into Microsoft Access 2002. SPSS 12.0.1 for Windows were used for the analysis.

3. Results

3.1. Categorisation of CDSs identified

For the purpose of classification, we described 12 categories in which we asked the respondents to group the principal function of the CDS. By this method, 53 of the 60 CDSs identified were grouped as belonging to one of four categories (table 1). Most CDSs are considered a health record tailored to a particular department / clinical specialty.

Table 1. Categorisation of CDS classification

<i>Classification</i>	<i>Frequency</i>	<i>Percentage</i>
Journal/ documentation system tailored to a department/ medical specialty	19	31,7
Storage/ register for biological numbers (symptoms, findings)	1	1,7
Software bundled with electronic medical equipment (control/ storage/ presentation)	14	23,3
Computer assisted real-time patient monitoring	1	1,7
Medication: Search/ dosage/ interaction/ prescription	1	1,7
Logistics/ administration/ planning/ appointments	10	16,7
Communication with public health service	0	0
Communication between patient and public health service	0	0
Database for medical research	10	16,7
Tool for medical diagnostics	2	3,3
Tool for selection/ planning of intervention	2	3,3
Tool for follow-up of treatment in progress	0	0
SUM	60	100

3.2. Use of CDSs to get patient overview

For 30 % of the 60 CDSs, users reported that their system was able to “Present patient and case history (incidents) in a more suitable or better adapted way” compared to EHR or the paper-based health record. Users of 50 % of the systems reported that their systems were able to “Perform computation/ interpretation on the collected patient data”, thus enabling more efficient access to a synthesis of patient data.

3.3. Use of CDSs for registering patient data

For a medical specialty, a custom-made system can be felt more attractive compared to EHR. In 36,7 % of the CDSs, the system was able to “Ease the work of making notes by offering templates or presenting list of commonly used words and phrases”. This property was seen more often in departments who performed highly specialized diagnostic or therapeutic procedures or at outpatient clinics responsible for following up on patients suffering from a particular disease or undergoing special treatment. However, more effective registration and storage of patient data did not necessarily imply that the availability of these data had improved accordingly.

3.4. CDS-EHR integration

41,7 % of the CDSs could retrieve data from other databases and thus deserving the characteristic of being an integrated system. However, only 21,7 % of the systems was able to “export their data to other patient databases”. For most systems “integration” meant that data on patient demographics were obtained from the Patient administrative system. The most common means of “exporting” patient data from a CDS was to use the “copy and paste” function in the Windows™ operating system. Even more archaic, cumbersome and error prone, doctors would update the hospital-wide EHR manually by writing a summary and conclusion of the relevant data in the CDS. Hence, patient data stored in a CDS could only be reached from workstations equipped with the CDS and were beyond reach from other systems or from workstations outside the department.

3.5. Use of CDSs to generate reports

Outcome measures can be considered indicators of quality of the care given at the department. Quality improvement is the process of obtaining and analyzing data on treatment outcomes and efficiency and using these data to identify areas of possible improvement. We found that 38,3 % of the CDSs were used to create “Reports for use in quality improvement” in the ward. Furthermore, 50 % reported that their system generated “Reports being used by management and administration of the department”. Reports were also used to give early alerts on possible loss of quality of care i.e. increased complication rate of given anaesthesia.

3.6. Installation of CDSs before and after the hospital-wide EHR

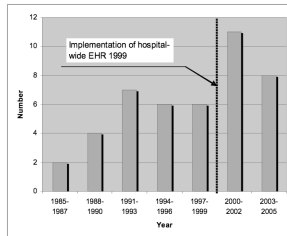


Figure 1. Year of installation. 44 of 60 CDSs

Figure 1 shows the year of installation for 44 of the 60 CDSs. The distribution ranges from 1985 until the year of registration in 2005. We found a tendency towards more systems of newer dates based on the systems in use at the time of registration in 2005. We found no tendency towards a decreased rate of new CDSs after the implementation of a hospital-wide EHR in 1999. 19 of the 44 CDSs were installed after 1999.

4. Discussion

In this report, we have described the characteristics of 60 CDSs that co-exist with the hospital-wide EHR in a 930 bed Norwegian university hospital. This flora of CDSs includes systems that have been in use and carefully upgraded for 20 years as well as CDSs recently implemented. The continued existence of CDSs that were implemented long before the EHR system and the seemingly continuous implementation of new CDSs indicate that the departments' and specialists' needs for storing and processing patient data not are met by the hospital-wide EHR system. Some of the newer CDSs have however been introduced because they accompany a digital medical imaging modality that has been purchased by the department.

For a clinical department, the care for patients with a particular disease or other patient groups depends on the ability to obtain, store, retrieve and process specific patient data. The department needs to process patient data both to document and to continuously improve the care given and for research purposes, to be able to contribute to the build up and maintenance of the knowledge base of the specialty. As of today, the EHR system meets neither of these needs. The EHR presents itself as an electronic copy of the old paper-based health record, and the EHR system seem better suited for creating documents describing care rather than a tool for support of the care provider when providing care, or evaluating care that has been provided. Facing an IT-department with an agenda to implement a hospital-wide EHR system, the particular needs of one clinical department often are ignored. In this situation, some departments have taken the initiative to development or purchase of a CDS. Compared to waiting for an update of the EHR system, this alternative gives the department better control over configuration, user interface and functionality of the final solution.

The description of the CDS as a system that can be obtained more easily than an hospital-wide EHR is in accordance with that of Ellingsen, who states that development and implementation of a complete EHR system is highly complex and time demanding and that acquiring or development of a CDS may be a less challenging alternative [6]. The department have better control on technical solution, user interface and functionality of a CDS in the pipeline. This is in great contrast to the top-down implementation of an EHR where the end-users might perceive having little or no influence. Owned and sometimes administered by the department, CDSs may be continuously developed to fit the changing needs. A CDS that has been developed

locally, either by computer-savvy doctors or other staff at the department has higher chances of being followed with enthusiasm. The feeling of ownership and having a system presenting a limited but highly useful set of functionalities seems like a strong factor for the survival of many CDSs.

The existence of a diverse flora of CDSs does however also involve some undesirable effects. As the EHR becomes the legal health record, relevant patient information needs to be documented in the EHR. Parallel storage is labour intensive and the possibility for human errors is present. In a technical perspective, the diverse flora may be a great challenge for the hospitals IT department. Some smaller systems may also not meet the high standards of reliability as the hospital-wide EHR. Even though there are drawbacks concerning the co-existence of many CDSs and the EHR, the CDSs certainly continue to serve an important role in modern specialized health service. As the health services will continue to specialize and the amount of patient data will increase, the demands for more suitable systems will become stronger. If the hospital-wide EHR systems shall meet these demands, they must evolve from merely systems to support the production of documents to systems to support the production, quality control and continuous improvement of care.

5. Conclusion

We found no tendency towards the implementation of a hospital-wide EHR system makes CDSs obsolete. CDSs in use today have true qualities not yet to be found in the general EHR. Combined with an increasing need for specialized documentation in modern hospitals, we believe that CDSs will be of great importance in many years to come. Further analysis of the factors making CDSs successful should be considered when designing and developing successful EHR systems.

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