Medical Informatics Europe '99
P. Kokol et al. (Eds.)
IOS Press, 1999

An experimental electronic patient record for stroke patients

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Abstract This contribution describes an electronic patient record for stroke patients at the neurology ward of the Maastricht University Hospital. Daily practice at the ward will be supported with the developed electronic patient record that integrates both the medical and the nursing record, that will provide decision support and it will be connected to the hospital information system. In an evaluation project we will study the effects of the usage of the electronic patient record and additional effects of providing decision support.

1. Introduction

Time is critically important for the treatment of stroke patients. A patient should be transferred to the hospital as soon as possible after a stroke event. Preferably to a hospital with a special unit, a so-called stroke unit, where patients can receive intensive care and be monitored carefully.[1] The neurology department of the academic hospital in Maastricht participates in a special project to improve the treatment of stroke patients. Upon admission, patients are transferred immediately to the medium care unit, part of the stroke unit of the department. At the ward, a multidisciplinary team takes responsibility for the treatment and care of every admitted stroke patient. In this team neurologists and nurses collaborate with physical therapists, social workers, ergotherapists and speech therapists to optimise (diagnostic) treatment and care for each patient. Adequate and timely information exchange is of high importance here. Currently, nurses and physicians document their findings in separate records. Also other care providers maintain their own records. Moreover, they report in the nursing or the medical record on separate forms.

Generally, it is recognised that paper record keeping does not suffice in the complex environment of modern medicine. It is believed that many of the objections of paper record keeping can be overcome by electronic record keeping. Therefore, we developed an electronic patient record (EPR) to study how the usage of an EPR will affect the treatment of stroke patients, and to study what the effects of the addition of decision support.

This contribution describes the EPR that was developed to facilitate the information exchange between all care providers involved. The decision to develop this system is based on the belief that the multidisciplinary team can collaborate better when using electronic record keeping and that the combined EPR can serve better as a means of communication than the separate paper records can. A connection with the hospital information system (HIS) will be established, so all patient data will be accessible at one spot. The EPR will provide reminders and clinical decision support specifically for neurologists and nurses and it will have a connection to the HIS. The latter elements, however, are not discussed in this paper.

2. Design considerations

Our main concern was to develop a system that would support daily practice at the ward of the neurology department of the Maastricht University Hospital. Therefore, we defined what functionality the EPR should offer. In the first place, it should provide a multi-user environment, since all care providers need access to the same records, probably simultaneously. Second, access rights need to differ between different disciplines. Third, information must be presented from different user perspectives. A fourth requirement is ease of use. In an academic setting residents often change and student-nurses come and

go. Therefore, an EPR needs to be easy to learn for novice (computer) users. Clear presentation of data is a fifth requirement. A final aspect that deserves attention is the intended integration of our EPR with the HIS.
The Maastricht University Hospital is adapting its HIS to a more up-to-date system. A new user interface in a Windows 95 environment, Mirador (trademark of Hiscom), will give us the opportunity to connect with the HIS to present all patient data, including laboratory results, in one record.

A crucial element of an EPR is the user interface. [2] As far as possible we adapted our system to the Windows 95 standards in terms of lay-out, screen handling, the usage of right mouse buttons, etc.
Since data need to be entered by care providers themselves, data entry forms have a recognisable format. Furthermore, predefined (multiple) choices are presented wherever possible. Recently, both the medical record and the nursing record were investigated thoroughly to create structured paper forms. Those forms were implemented with only slight lay-out changes.
Presentation of patient data is an important element of the EPR user interface. In a previous research project conducted at our department, presentation of patient data was studied. The contents of the records were ordered in a treestructure according to source and data were presented in a matrix. Physicians were asked to browse the medical narratives that were offered in more or less detailed paragraphs, also described as differences in granularity of data. The results pointed out that both too large and too small paragraphs slowed retrieving relevant information. [3] We based our system on the experimental electronic medical record, developed in that study.

In the design phase of the system we communicated intensively with the future users to obtain their information needs and wishes. In close cooperation with them, we formulated several criteria for the system and its user interface. These criteria were: a) simple data entry forms with predefined (multiple) choices and only limited free text entries, b) data entry forms based on the structured paper record forms, c) clear overview of patient data in data retrieval forms, d) integration of the nursing and medical record. Patient data are oftentimes registered more than once. Integration of the nursing and medical records resolves this inconvenience and eliminates a potential source of errors. Furthermore, discharge summaries and a nursing working list should be easy to compose and print.

3. System Description

We developed an electronic patient record (EPR), consisting of a database containing information about both the structure and the content of de patient record, a user interface, several programming modules, and a research module with a logging function. The system was implemented in a Windows 95 environment. We used a MS Access 97 database and MS Visual Basic 5.0 for developing the system.

3.1. Data entry

Most data entry forms were based on the paper forms already in use at the ward. The medical record captures many data in a structured format, while in the nursing record the daily report was completely structured. At admission, results of medical history and physical examination are registered on one data entry form. Tabs are used to distinguish three different sections. Many questions were formulated as multiple choice items, with an option to add remarks in free text. Figure 1 shows one section of that form. Medical progress notes are divided into eight sections. Three sections (medication, complications and diagnostic tests) support structured data entry. The assessment notes, reports of talks with the patient and his/her family and the notes of consulting physicians are composed of free text entries. All entries are presented chronologically, the most recent entry first. In addition, the list of vital signs filled in by the nurses is presented in a separate section.

Nursing history is registered on a data entry form, presenting some patient data already filled in by the neurologist on medical data entry forms. Most of the remaining entries can be made by choosing from predefined lists. The medium care unit of the ward reports vital signs, motor and sensory functions, consciousness etc. on a 24 hour form.
As mentioned above, the nurses' daily report was already structured in its paper form. Several aspects of the patient's health status are scored on a predefined list and presented in a one week view. In one glimpse a patient's health status can be assessed.

Order communication between nurses and physicians is registered a special form. Unanswered questions and not (yet) completed orders are marked blue and yellow respectively.

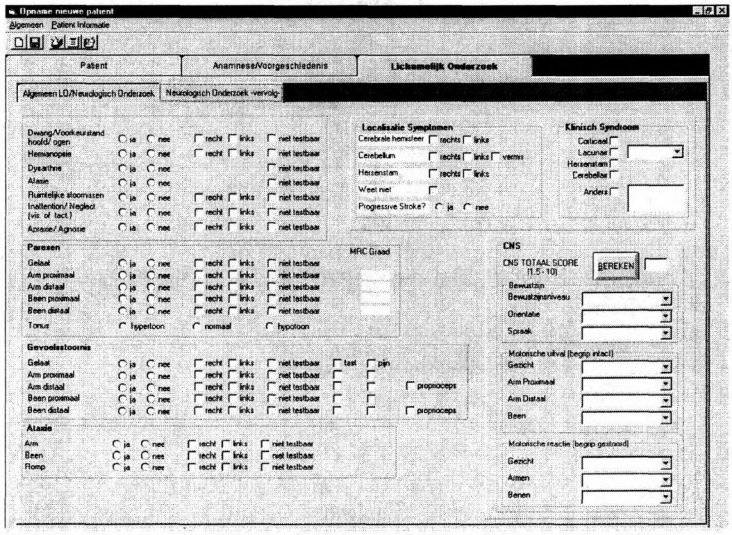

Figure 1. Example of structured data entry form of the EPR. The physical examination (motor and sensibility dysfunctions) is reported in a structured format.

Not only nurses and physicians need access to patient data, also the physical therapist, the social worker etc do. In the current situation they report on a special form adhered to the nursing record. In addition to the nursing and medical record we offer free text entries for other disciplines with separate sections for different disciplines.

3.2. Presentation of patient data

The main data retrieval form contains three sections (figure 2). A left pane with a hierarchical list of the content of the medical and nursing records, comparable with the left pane of the windows explorer containing the folders. The list can described as a tree with branches and leaves. By clicking, branches can be expanded to show subbranches or to show the leaves, called endnodes. Clicking the endnodes presents the patient data in the top section of the right pane. The top section of the right pane shows an overview of the selected data in a day by day or week by week view. Data in the top section can be selected column-wise and row-wise and the complete data are presented in the lower section of the right pane.

4. Future plans

At the moment the EPR is still under construction. Although it does not yet contain all of the required functionality, the system has been assessed positively by the future users. We expect to start the evaluation in daily practice in September 1999. The evaluation will be conducted to answer our research questions. Our principal research question is how the use of an electronic patient record will affect record keeping and the process of care and what effects the addition of decision support will have. In a pre/post designed study we will study several aspects of the patient record itself as well as the process of care. First of all, completeness of the record will be evaluated. We expect a more complete record with electronic record keeping. Secondly, the communication at the ward as a part of the process of care will be evaluated in a qualitative way. [4]
Finally, since the success of the system will depend heavily on the acceptance by its users, user satisfaction and user attitudes will be measured in every phase. For this reason, we developed a questionnaire, based on questionnaires described in the literature. [5-11] Users' navigation through patient data will be recorded in a research database.

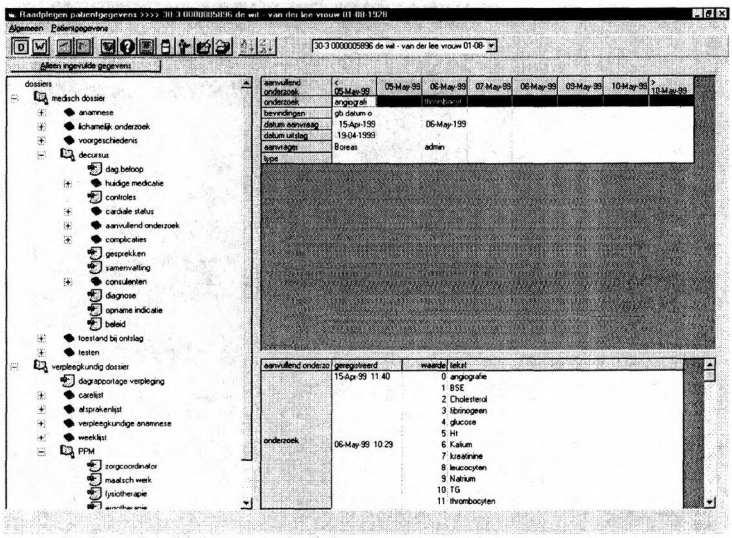

Figure 2. The main data retrieval form. View of both the medical (=medisch dossier) and the nursing records (=verpleegkundig dossier) in the left pane. The upper right section presents an overview of this patient's medical, vascular history. The lower right section presents the complete content of selected items.

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