A standardized message for supporting Shared Care

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ABSTRACT

As health care becomes more complex, interest in the benefits of coordination of care has increased. Especially patients that are being treated jointly by more than one physician (shared care), are vulnerable to adverse effects resulting from inadequate coordination and communication. We describe a study in which care providers support shared care by using computer-based patient records for data storage, and structured electronic data interchange as a means of communication. In this study, we are aiming at the development and implementation of protocols for shared care.

1. INTRODUCTION

Shared care is a situation in which physicians jointly treat the same patient. Patients requiring shared care are, for example, patients suffering from chronic disorders, such as diabetes mellitus, obstructive pulmonary diseases, and cardiological disorders. To be effective, shared care requires coordination of activities. Fletcher states that: "*When many different providers are involved in a patient's care, it is possible that the process will not be integrated into a meaningful whole; such care is subject to failures of communication*" [1].

For a number of health problems, shared care protocols have been developed, involving allocation of tasks between health care providers from different disciplines [2]. Optimal communication is considered to be a vital aspect of shared care, both from medical and cost effectiveness points of view [3]. Previous studies, however, have indicated that paper-based information exchange between care providers needs to be improved, both in terms of content of information exchange [4] and in timely deliverance of this information [5,6].

Nowadays, new technologies are emerging that have considerable potential for supporting physicians in delivering shared care. Computer-based patient records, which in recent years have penetrated Dutch health care, are gradually replacing paper records: physicians themselves use these systems to store textual data during consultations. In addition to recording medical data, computer-based patient records also assist the physician in monitoring risk profiles, screening of patients, and conducting follow-up [7]. These systems are able to exchange information using computer-to-computer communication. This communication is known as Electronic Data Interchange (EDI), and is defined as "*the replacement of paper documents by standard electronic messages conveyed from one computer to another without manual intervention*" [8]. In the Netherlands general practitioners judged the use of EDI favorably for medical care [9].

Current EDI implementations, however, focus on small segments of the medical record. An example of such an implementation is the laboratory test report, with which laboratories can transfer test results electronically to general practitioners. To support shared care, not only limited subsets of the medical record may have to be transferred, but the whole medical record, including the structure of it.

In this paper we describe the implementation of a procedure for EDI-based communication between physicians jointly treating diabetes mellitus patients. We also describe the evaluation study that we are presently performing.

2. DESIGN CONSIDERATIONS

In this section we describe the present state of computer-based patient records in the Netherlands, message syntax standards used, and the user interface requirements of the EDI message handler.

2.1 Patient Records

In the Netherlands, several computer-based patient record systems, designed using specifications formulated by professional organisations of general practitioners, are available [7]. These systems allow the general practitioner to replace the paper patient record with a computer-based patient record. The overall structure of such a computer-based patient record supports problem-oriented and episode-oriented recording of information, and SOAP coding [10,11]. Using SOAP-coding, the physician divides the information in Subjective information (the complaint of the patient), Objective information (findings like blood pressure), Assessment by the physician, and Plan (e.g. medication or referral). Using that overall structure, the physician may code detailed content of the patient record, such as reasons for encounter, diagnoses, medication, referrals, laboratory tests, and risk factors. The physician uses the system during patient consultations to inspect and record clinical data.

2.2 Message Standards

Several message standards are available for electronic communication. The HL7 standard, used for example in the United States, provides common data segment and message definitions, for communication across various systems within hospitals [12]. In Europe, the ISO syntax standard EDIFACT has been adopted as the standard for defining messages [13]; each message consists of a number of segments. Each segment starts with a segment tag (e.g. UNH), contains a number of data-elements, and ends with an apostrophe. Segments that logically belong together may be grouped and thus form a segment group. Data elements, segments, and segment groups may be conditional or mandatory.

In The Netherlands, coordination of the standardization of health care messages is performed by a national organization. At present, several standardized messages are available for a variety of purposes. One is a message for data exchange between physicians [14]; in this message, however, only physician-, patient- and hospital identifying data are structured, and all medical data is transferred as free text. Consequently, using this message, the receiving system is unable to integrate the data into the computer-based patient record. In order to support shared care, a message is needed that can also transfer the structure of the data in a computer-based record in order to allow integration of records from multiple sources.

2.3 User Interface Requirements

With EDI, messages can, in principle, be sent and received without human intervention. For patient-related communication, however, the physician has to match incoming messages with the patients in his practice, because in the Netherlands there does not exist a unique patient-identifying number. The computer-based patient record assists the physician by matching patient-identifying data (e.g. name, date of birth, gender) in an incoming message with known patient records; verification of the proposed match is subsequently performed by the physician.

In addition, fully automated data exchange is not desirable for several other reasons. First, in order to prevent an excessive growth of the amount of data in the computer-based patient record, the receiving physician needs to be able to select data from the message that can be discarded. Second, when composing a message, the sending physician may want to exclude from a message information that he considers to be irrelevant for the receiving physician, or a threat to the privacy of the patient involved.

3. IMPLEMENTATION

As discussed in section 2.2, currently available messages do not allow transferral of structured data. Therefore, we developed a new message, called MEDEUR, using the EDIFACT standard and already existing segment definitions. In this section we describe the structure of MEDEUR and the implementation of this message in the computer-based patient record system Elias.

3.1 MEDEUR message standard

MEDEUR, is designed for integrated patient data exchange between computer-based patient records. The message can contain both administrative and medical data. It can be used for transmission of a complete medical record, or sections of it. Table 1 shows the sequence number of the different segment groups (first column), whether it is mandatory or conditional (second column) and a short description of contents (third column). In total, 12 segment groups can be distinguished:

Segment group 1 contains identification (such as name, address, i.d. number) of sending physician (first occurrence) and receiving physician (second occurrence).

Segment group 2 contains identification (such as name, address, i.d. number, insurance data) of the patient involved (first occurrence). If required,

Table 1 - Contents of MEDEUR message

Segment group	Mandatory / Conditional	Description
1	M	Physician identification
2	M	Patient identification
3	C	General medical characteristics: sequence number
.. 4	C	.. Description
.. 5	C	.. Procedures planned
6	C	Patient encounter information - Type (e.g. consultation) - Date and time
.. 7	C	.. Free text lines
.. 8	C	.. Measurements (coded)
.. 9	C	.. Diagnoses (coded)
.. 10	C	.. Medication (coded)
.. 11	C	.. referrals (coded)
12	M	Authentication data

identification of persons related to the patient can be included in the next occurrence(s) of segment group 2.

Segment groups 3, 4, and 5 contain general medical characteristics of the patient, such as risk factors (e.g. smoking), and medical problems (e.g. diabetes mellitus). It also specifies the procedures planned by the physician in relation to the risk factors or medical problems (e.g. kidney function checkup in case of a diabetic patient). Every medical characteristic has a sequence number, described in segment group 3: segment groups 4 and 5 are nested within group 3 and describe the medical characteristic. The description may be coded, in which case also the identification of the code list used (e.g. ICPC or ICD-9) is included.

Segment group 6 contains the patient-encounter-oriented medical data. It specifies type of encounter (consultation, home visit, medical procedure), date and time of the encounter, and identifies (if needed) the physician involved in the encounter. The message contains one occurrence of segment group 6 for every patient encounter: each message may contain descriptions of up to 99 encounters. Segment groups 7 to 11 are nested within segment group 6: The data in these segment groups can be linked to a specific problem, already specified in segment group 3.

Segment group 7 contains that part of the data from the consultation that is in free text format.

Segment group 8 contains measurements that were performed (e.g. blood pressure, cholesterol etc.). Measurements may be specified with a code and the name of the code list used. Other data items include the date that the test was performed or the date that the test result became available, the result of the test, the unit, and the normal value range.

Segment group 9 contains diagnoses: these diagnoses may be coded, and the code list used (e.g. ICPC or ICD-9) can be specified.

Segment group 10 contains details about the medication prescribed by the physician during the consultation. It specifies identification of the medication (if desired coded according to e.g. brand name or chemical components), amount, dosage, for which diagnosis it was prescribed, and the specialism of the prescriber.

Segment group 11 contains details about other specialisms that the patient has been referred to, and data about outcomes of these referrals.

Segment group 12 contains information that can be used for authentication procedures.

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<1>  UNB+UNOA:1+500011774+500003170+940731:2127+1
     08E'UNH+2100+MEDEUR:1:1:IT'BGM+UPD'DTM+13
     7+1994:07:24'NAD+EMP+123456+Dr. Sending'
     NAD+EMP+654321+Dr. Receiving'PNA+PAT+999999+
     Patient name'
<2>  SEQ+P+1'DTM+194+1989:10:22'CIN+DI+T90.1+ICP++
     Insulin dependent Diabetes Mellitus'
     SEQ+P+2'DTM+194+1991:03:27'CIN+DI+K86.0+ICP++
     Primary hypertension'
<3>  GIS+C'DTM+007+1994:08:08'INV+LM+102:LOC:Gluco
     se'RFF+G3:1'RSL+N+17.2+mmol/l'RNG+NRM+:3.5:4.5
     'DLI+O+0'CLI+MED+13617893:KMP::Ins mixt 10/90
     novolet 3M'RFF+G3:1'DLI+P+0'CLI+MED+13180789:
     KMP::Capoten 25MG Tablet'RFF+G3:2'DLI+P+0'
<4>  AUT+1234+4321'UNT+2100+27'
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Figure 1 - Simplified example of a MEDEUR message, describing a patient consultation. The message can be divided into four parts: **part <1>** contains E-mail numbers (UNB), name and i.d. number of sender (NAD, first occurrence) and receiver (NAD, second occurrence), and patient and i.d. number (PNA); **part <2>** Contains problems the patient is suffering from, with a sequence number (SEQ), starting date (DTM), ICPC code, and a description (CIN); **part <3>** contains the data gathered during the consultation, such as lab tests (INV), the problem the test relates to (RFF, in this case to diabetes mellitus), the test result (RSL), and the normal value range (RNG); prescribed medication (CLI), the problem the medication relates to (insulin for the diabetes, and capoten for the high blood pressure); **part <4>** contains the authentication data and the message trailer.

Where possible, the use of code lists is supported: diagnoses, referrals, measurements, reason for encounter, and medication can be coded. In addition to this coded data, there is ample space to include free text. This free text can be used for data that cannot be placed in dedicated segments, or for additional data that is collected for research purposes. Figure 1 gives an example of a MEDEUR message.

3.2 MEDEUR Message handler

The computer-based patient record system Elias already contains a communication module that allows it to exchange EDIFACT messages with other information systems, via telephone lines and e-mail services [9]. We designed a user interface that enables the physician to send and receive MEDEUR messages.

To send a MEDEUR message, the physician first specifies the patient and the period about which he wants to report. Elias then creates a MEDEUR message, based on the information stored in the computer-based patient record. The physician can, before the message is actually sent, edit the message by specifying what data to discard, and add text to the message.

The patient data in received MEDEUR messages can be stored directly into the computer-based patient record, with exactly the same structure as that of the patient record the data came from. Prior to storing the data, the physician can select and subsequently discard the data from the received message he considers to be irrelevant.

4. PRESENT STATE

To evaluate the benefits of EDI for the support of shared care, we are conducting studies in which general practitioners and internal medicine consultants share data about patients with diabetes mellitus.

In the Netherlands the general practitioner functions as a gatekeeper between primary and secondary care. Typically, patients first consult their general practitioner. If considered necessary, the general practitioner refers the patient to a specialist. The specialist will report the results of the treatment back to the general practitioner. Therefore, the general practitioner is the central physician and the ideal person to coordinate shared care.

In a number of Dutch cities, we are introducing electronic communication between physicians. In the city of Apeldoorn, 64 general practitioners provide care for approximately 120,000 persons. Of these 64 general practitioners, 40 use the computer-based patient record system Elias. Apeldoorn has one hospital, with 10 internal medicine consultants. Two of these consultants provide medical care for 80% of all diabetics referred to the outpatient clinic. An electronic communication network is available, and is already used by physicians to transmit data, such as laboratory reports and admission/discharge reports [9].

We installed the MEDEUR message handler at the practices of 25 general practitioners. At the outpatient clinic of one of the two diabetes mellitus treating consultants, we installed an Elias system, tailored to the information needs of that consultant, and the MEDEUR message handler. Starting January 1994, this consultant and the 25 general practitioners exchange data about consultation outcomes, using MEDEUR messages. Code lists are used for coding reasons for encounter, measurements, diagnoses, referrals, and medication.

Using the implemented inter-physician communication, we are conducting studies to evaluate the benefits of EDI for shared care; these studies consist of two phases.

Phase 1: Prior to the intervention, we study 260 (randomly selected) medical records of diabetes mellitus patients that both treated by general practitioner and internal medicine consultant. We evaluated (1) the type of information routinely collected; and (2) communication frequency with the co-treating physician. Furthermore, we investigated patterns in laboratory test ordering and medication prescribing of general practitioner and consultant.

Phase 2: Starting after the introduction of the MEDEUR message handler, we receive a copy of each transmitted MEDEUR message. This copy does not contain patient or physician identifying data. From these message flow measurements we can deduct (1) which information is routinely collected by the physician; (2) which information is considered relevant for the receiving physician; (3) which information from a received message is considered relevant by the physician.

The results of these studies may lead to the definition of a communication protocol between primary and secondary care providers, specifying frequency and content of communication.

5. DISCUSSION

Computer-based patient records, installed in general practices and used during consultations, have become a widely accepted component in the Dutch health care process [9]. These systems are able to assist the physician with recording medical data in a structured manner.

Using computer-based patient records and EDI, we have created an environment which enables the efficient exchange of information [9]. Moreover, using the standard message MEDEUR, it is possible to exchange patient information between computer-based patient records in such a manner, that the semantic structure of the information can be rebuilt in the receiving system. By doing this, physicians can share the information about patients that are jointly treated.

Previous studies have shown that existing paper-based communication is insufficient [4-6]. With the introduction of computer-based patient records and EDI, the opportunity to exchange all patient data is available. This could, however, lead to an information overload, especially when different care providers fail to agree on their role in the delivery of care and the information requirements of that role.

In the Netherlands, at present, no protocols exist that explicitly specify the role of co-treating physicians. Ideally, such a protocol should include a description of (1) the division of tasks; (2) guidelines for record-keeping; (3) guidelines for communication, both in terms of frequency, content, and a definition of consultation outcomes that should trigger communication activities. The use of these protocols should not only prevent medication conflicts and duplication of diagnostic tests, but should also guarantee that necessary procedures (like yearly checkup of the kidney function in diabetic patients) are being performed. We expect that EDI will facilitate the development of shared care protocols. Future studies will have to evaluate the impact of EDI and shared care protocols on the delivery of care.

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