An electronic registry for physiotherapists in Belgium

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Abstract. This paper describes the results of the KINELECTRICS project. Since more and more clinical documents are stored and transmitted in an electronic way, the aim of this project was to design an electronic version of the registry that contains all acts of physiotherapists. The solution we present here, not only meets all legal constraints, but also enables to verify the traceability and inalterability of the generated documents, by means of SHA-256 codes. The proposed structure, using XML technology can also form a basis for the development of tools that can be used by the controlling authorities. By means of a certification procedure for software systems, we succeeded in developing a user friendly system that enables end-users that use a quality labeled software package, to automatically produce all the legally necessary documents concerning the registry. Moreover, we hope that this development will be an incentive for non-users to start working in an electronic way.

Keywords. Electronic Health record (EHR), Physiotherapy, Registry, XML

Introduction

During the past decade the healthcare industry has evolved from paper-based storage of clinical data into the digital era. Electronic healthcare records play a crucial role to meet the growing need for integrated data-storage and data communication [1,2]. Since 1998 for the software systems for general practitioners and since 2002 for software systems for physiotherapists (and other healthcare providers) the Belgian Ministry of Health, Food Chain Safety and Environment is issuing quality labels to systems that meet the well specified quality criteria, with an ultimate goal to improve the electronic record keeping for all healthcare workers in Belgium. In this context of improved record keeping, the KINELECTRICS project must be situated.

According to a new law issued on December 7th, 2005, physiotherapists (but also nurses and speech therapists) are required to keep an electronic version of the registry, which contains all physiotherapeutic acts, starting from January 1, 2007. Up until that day, a paper version of the registry had to be created every month. This hand written (or printed out) paper version had to be provided in a bind and page numbered booklet containing all the acts carried out by the physiotherapist, sorted by date. This
The physiotherapist’s registry cannot be confused with the classical form of registries, like e.g. national cancer registries [9], where the goal is to collect, consolidate and classify data from different hospitals or institutes and link them to data within other registries or medical record systems. The physiotherapist’s registry is a legal obligation that can be compared with the summary records accountants have to provide, which contain summarized information about the produced invoices over the past year.

The goal of the KINELECTRICS project was to come up with a suitable electronic version that could replace the old paper one. But electronic data storage is threatened by the same basic hazards as paper storage. Data can disappear; integrity can be lost, together with the ability to understand its content.

The project succeeded, after an in dept analysis of the legal context and a with particular attention to the reporting habits within the field of physiotherapy, to come up with a new structure for the electronic registry. This new structure was tested during the certification procedure of November 2006, by means of six additional test criteria and a specially adapted test scenario.

1. Material and methods

The KINELECTRICS project consisted of three different phases. In a first phase, taking into account all legal aspects, a model for the normal flow of registered data as well for physiotherapist using a quality labeled software package as for those without, was worked out. In this stage the data-structure was firmly defined. In the second phase, a study was performed on two key aspect of the project namely the traceability and the inalterability of the registered data. In a third and final phase the test criteria and scenarios were developed, including the elaboration of a basic control mechanism that was used during the certification procedure and can be used as a basis for more advanced inspection tools.

1.1. Phase 1: flow of registered data and data-structure

According to the current legal requirements, the content of the electronic version of the physiotherapy registry does not differ too much from the paper-based format. Following items were considered to be sufficient to be able to verify the process of the acts of a physiotherapist (for every act performed):

- Date of the act
- Name of the patient
- Nomenclature number of the act

As a data-structure for the registry we opted for an XML-message. XML has already proven its benefits as an electronic language for the communication of medical data [3,4,5]. Furthermore Kmehr-Bis¹, an XML messaging schema, is already used as a standard in Belgium for the exchange of medical documents, such as discharge letters, lab results and medical prescriptions. An example of a structured Kmehr message for the registry is provided in figure 1.

Figure 1. An example of a kmehr-bis message for the physiotherapy registry
1.2. Phase 2: Traceability and inalterability

One of the major concerns of the project was that the rationale behind the electronic registry would conform well to the common practice of the physiotherapist. Therefore we opted for a periodic recording of a standardized “image” of the controllable data, in the patient database of the software-system, into the kmehr registry messages. This recording is done in analogy with accountancy systems where the same method is used at the moment of the production of an invoice. This recording still leaves room for the possible corrections to the physiotherapists act within a practical time frame of 12 weeks after the act.

These periodic recordings consist of all the acts, the physiotherapist executed over the past 12 week and are automatically generated every week, starting with the first use of the software package. Besides those automatically generated messages, it is possible to manually create a new recording of the registry at any given moment, which permits the controlling authorities to check whether these messages are created in the correct way.

While in the past, when a paper version was used, changes to the registry were fairly easy to notice. Solving the problem of inalterability of electronic files is not such an easy operation. To overcome this problem we decided to use the SHA-256 hash code as a secure fingerprint of the different files to check if the original message was altered. This hash code which is calculated for each message, each time it is produced, is then stored into a variable, together with a time stamp, within the software package itself. In a later stage this code could be sent automatically to the controlling authorities, to fulfill complete security.

The concept of traceability was fixed by incorporating the SHA-256 hash code of the previously created recording into the new registry file. This procedure is illustrated in figure 2. In this way two time series containing hash-codes appear, one as a variable within the software package, the other in the registry files itself. These two series have to be the same and can at every given moment be tested by manually creating a SHA-256 hash code using freely available software. This procedure makes it possible to trace modifications:

- Justified modifications to the saved data concerning acts of the physiotherapist by making use of the content of the messages
- Possible fraud within a registry message via inconsistencies between the time series of the SHA-codes within the messages on one hand and the variable containing the saved (or in the future transmitted) SHA-codes on the other hand.
1.3. Phase 3: test criteria and control mechanism

The implementation of this procedure was realized by the formulation of test criteria that were used within the certification procedure [7,8] for software packages for the management of physiotherapy records, issued by the “Belgian Ministry of Health, Food Chain Safety and Environment”, organized in November 2006. The following test criteria were used:

- Registry messages must be generated weekly on an automatic basis, but can be generated manually whenever suitable
- Registry messages must be stored separately for each physiotherapist using the software package
- The variable that contains the SHA-256 code of the last generated registry message, is stored for each physiotherapist and a timestamp is added
- Starting from the registry messages, the software package must be able to generate a list (show on the screen and print) of all acts of a specific day sorted by patient name or all acts for all patients sorted by date for any give time period.

The software packages were evaluated on the basis of (amongst others) these criteria by making use of a test scenario that consisted of a number of fictitious patients that had to be entered into a blank system. At certain intervals a registry message had to be generated. Making use of a specially developed XSLT schema, these messages were tested on consistency of content as well as for accuracy of the SHA-256.

2. Discussion

With the KINELECTRICS project we developed a system that, in a fairly easy way, made the transition from a paper based to an electronic registry for physiotherapists possible. Special attention was given to the user-friendliness of the method, making sure that physiotherapist that are using any of the eighteen certified software packages will not have to worry about producing their monthly registry, this works automatically. This corresponds with almost 5000 physiotherapists (30% of total) who are generating the registry messages automatically. On the other hand, this initiative can be an
incentive for the non-users to start using a certified software package. Or else they must make the effort to comply with the digital registration requirements themselves.

The end result is a clearly outlined method for generating an electronic registry, that meets all the legal constraints, as well as enabling to control the traceability and the inalterability of the produced documents. At this moment the controlling authorities are able to check the integrity of the generated registry messages, possibly together with the history of the SHA-variable. Besides that the software systems are able to present a list of all acts per date and a list of the acts of one patient for a certain period, with standard XML tools. A history of all legitimate adaptations within a certain period can also be produced. The methodology was thoroughly checked within a test environment and during the homologation sessions. The next step is to perform an in-the-field analysis of the produced messages and compare the results with the data found in the physiotherapist’s records.

The provided XSLT schema together with the freely available source-code of the SHA-256 hashing procedure form a basis that can allow the controlling authorities to create additional programs that will allow them to track if each the SHA-256 code in each produced message corresponds with the hash code of the previous message. This will also allow them to put together a list of SHA-256 codes originating from the registry messages and in a simple way check their correspondence to the history of the SHA-variable within the software package.

References