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# Integrating the Hospital Information System (HIS) into the Austrian Electronic Health Record ("ELGA") Using the Example of the Health Care Facility "Breitenstein"

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**Abstract.** The health care facility "Breitenstein" makes use of a hospital information system to coordinate clinical processes and document medical health data. So as to comply with novel Austrian legislation and fit the "ELGA" architecture, the system has to be adapted. This paper is based on a literature research and gives answers to technical and legal aspects of "ELGA". The introduction of an IHE connector and a CDA manager are the main changes to the current hospital information system. The implementation of interfaces that allow an integration of further "ELGA" features possible are the next step of the project.

**Keywords.** hospital information system, Austrian electronic health record, ELGA, interoperable architecture.

## 1. Introduction

### *1.1. Motivation*

Physician needs information which, at least partially, will have to be provided by the patient himself and that patient may or may not know about the most important details of his or her condition (patients might not be able to recall details of their medical history, recall them erroneously or biased or might consciously omit some factors which they themselves do not deem to be relevant to their current situation) [1].

In order to document any previously acquired patient information to be used for subsequent hospitalisations many hospitals and general practitioners keep records with the aid of electronic systems [2].

If this information (patient's medical history, such as previous therapies and illnesses dispensable) is documented and saved in an adequate data format it pays off by making possible fast and accurate anamnesis [3].

The insurance provider for Austrian railways and mining ("*Versicherungsanstalt für Eisenbahnen und Bergbau*", *VAEB*) recognized the tremendous potential lying in the patient-centered data and introduced an SAP based electronic documentation

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system for all their facilities and health care advisory centres. The system helps to organise and accelerate the examination process at health facilities and at the same time documents the collected data in an electronic health record. This procedure makes the required information immediately visible for authorised personnel.

### *1.2. General Requirements for the Austrian Electronic Health Records ("ELGA")*

An unresolved problem of the current practice of data collection is the incompatibility of the gathered information due to the variety of systems in use: Each system uses a different storage format and is (typically) based on an interface which is incompatible with other systems [3].

In order to evaluate the requirements of a nationwide implementation of an electronic health record (EHR) in Austria ("ELGA") a comprehensive feasibility study was ordered by the Federal Ministry of Health which was subsequently released in 2006 [3].

Based on the 2006 feasibility study and the expertise of various specialists the federal act on Data Security Measures concerning the use of Electronic Health Data (Health Telematics Act 2012 – HTA 2012) was enacted in December 2012. The act determines a consistent set of definitions and specifications for the communication of patient oriented health care information and lays out a general legal framework for the development of health care telematics in general and "ELGA" in particular [4].

The structure of "ELGA" includes a basic component that stores the uniquely identifying patient and healthcare provider indices, along with the access control management and logging systems [5]. Use of the patient index allows the verification of a unique identity in the context of "ELGA" and other e-health applications [4].

Via the access control centre standard access authorisations for different types of users (such as physicians from different specialisations) can be configured, as well as detailed individual customised patient requests, such as extend or reduced access time. All these access requests are stored by the logging system, which allows the patient to check who has activated any of his or her health status files [4].

These basic components allow a nationwide security standard and help to increase confidentiality so as to avoid the abuse of data on one hand and to provide a solid basis for the development of e-health applications on the other [4]. In addition to the basic components the "ELGA" architecture includes core applications. In the first implementation phase laboratory and radiology report, e-physician's letters, and the e-medication will be introduced [6].

Independent of these main parts of the "ELGA" architecture, decentralised "ELGA" applications ("ELGA" compliant Integrating the Healthcare Enterprise (IHE) Affinity Domains) provide local applications, such as an internal patient index, registry, repository, etc. These affinity domains include the communication infrastructure needed to connect the basic components, further affinity domains and other e-health applications, which are provided in a safe and shareable network [5].

Every affinity domain user works across an interoperable architecture gateway, based on IHE components, to exchange documents throughout the "ELGA" or to upload new information to the register of the platform. This affinity domain feature is the key feature needed for the integration of the different components of hospital information systems [5].

Furthermore implementation guides define what the layout of a health care document should look like. Currently different medical report types are already defined

technically in terms of content and legal terms: including clinical discharge reports (by physicians and nursing staff), lab reports, radiology results and results of diagnostic imaging [7].

In the future medical reports will be shared in the digital format "Clinical Document Architecture, Release 2.0" (CDA). CDA is an international XML-based standard used for the secure management and transmission of data in the health sector [8]. CDA offers different levels of interoperability, CDA Level 1 to 3. As CDA level 1 simply inserts plaintext or PDF files into a document, the coding in CDA Levels 2 and 3 increases the semantic interoperability [9].

To define a clear timetable for each implementation level the Federal Ministry of Health will publish an enactment with the new specifications, the current interoperability level called "EIS structured" is the on-going implementation. This level defines a set of guidelines found in the content structure of CDA levels 2 and 3 [7].

The structure and content of CDA documents are clearly defined so as to make a simple integration into EHR possible. Another very attractive feature for physicians is the easy retrieval of reports. While on the one hand EHR reports are designed to be read on a computer screen, on the other hand they are also optimised for printing (fitted to standard print formats). Important data is highlighted and the unified structure of content across the platform makes the whole information much more readable.

This feature can enable a better understanding of the given data and help to achieve a lower error probability, helping to increase patient security [10].

### *1.3. Problem and Objective*

To fulfil the guidelines of the HTA of 2012 and to profit from the potential benefits of "ELGA" the health care facility "*Breitenstein"* (on the border of lower Austria and Styria) has to make several adjustments in its own hospital information system (HIS). In this context the paper will show different ways to link the HIS, already in place, to the "ELGA" based on its clearly defined architecture, which makes use of IHE profiles to display the content. The interfaces should provide data but also the possibility to display such content in a format that can easily be read by users.

## 2. Methods

This paper is based on the research and work done in the last couple of years towards making the necessary adjustments in the mentioned health care facility "*Breitenstein"*.

Ever since its announcement years ago the "ELGA" has caused repercussions throughout the health care community. The introduction of applicable standards made it a concern for health care engineers to get to know the details of this new centralised approach, due to the fact that it will have an impact on current medical documentation systems and communication of electronic health data.

The chosen topic was approached by first conducting a literature research regarding the technical and legal aspects of the new standard for personal electronic Health Data in Austria. The result of this research makes up the core of the current paper, as these specifications have to be taken into consideration for the implementation of the HIS in the health care facility "*Breitenstein"*. Furthermore a timeline of the different aspects of the implementation process is presented, focusing

on those crucial steps at which different HIS modules were initiated to fit the "ELGA" architecture.

## 3. Results

### *3.1. Medical Documentation in the Health Care Facility "Breitenstein"*

The specialisation of the health care facility "*Breitenstein"* lies in its programs for diabetes and other metabolic diseases as well as vegetative dysregulation and stress reduction. The organisation uses the SAP based integrated clinical workstationsystem "i.s.h.med" by Siemens Healthcare to document its data.

The system is split into a logical administrative unit, the ERP system provided by SAP (IS-H) and the clinical workstation system (i.s.h.med) responsible for all clinical concerns [11].

The i.s.h.med hospital information system combines flexibility with a wide range of functions and supports processes at various levels of the Health Care Facility in which it is implemented: Starting with bed-planning, administrative management of the stay, documentation of the basic medical treatment (initial and final physical examination) and record keeping of the vital parameters, up to the preparation of the e-physician's letters.

The hospital information system secures the permanent availability of medical data such as diagnoses, risk factors, reports and laboratory findings. Another huge step towards a complete "ELGA" integration is the consistent way of handling patient information (unified patient recognition) and the already implemented authorisation profiles for data security.

### *3.2. "ELGA" Architecture of the Health Care Facility "Breitenstein"*

To make use of the aforementioned basic "ELGA" applications, the VAEB has to make sure it fulfils the requirements needed to provide basic "ELGA" services for internal data input as well as around-the-clock external data queries.

In the process of setting up such a domain the VAEB cooperates with the Austrian Workers' Compensation Board ("*Allgemeine Unfallversicherungsanstalt", AUVA*) so as to implement a joint affinity domain. Advantages of this cooperation are a unified implementation of "ELGA" documents, the "ELGA" repository and the local patient index, as well as the fact that the required 24 hour availability of the technical infrastructure is made use of by a larger number of users.

The component will be connected to the HIS using an IHE connector, which allows the integration of a given HIS structure into the affinity domain.

Further all necessary information for data or patient searches is synchronised and an automatic profile query is performed. Consequently it's possible to fetch or update data from the peripheral repositories of the "ELGA" [3].

To make documents generated with the HIS comply with CDA standards a tool called CDA manager is used. These documents will not only be read by users but will also be integrated into the IT system to be automatically processed. To achieve this goal the international standard for storing and dissemination of health care data CDA Release 2.0 is applied [8]. The complete documentation of medical data is already implemented in the HIS, nevertheless some documents, such as the treatment progress

report or any supplemental advisory documentation aren't documented in a structured way. Such documents can remain unchanged as they are intended for internal use only. Prior to the present adaptation of regimen data are the in the HIS already used clinical discharge reports and the laboratory findings (There is no radiology unit in the health care facility "Breitenstein", so the third document of the first implementation phase the radiology report isn't recorded.)

In this case the Health Telematics Act of 2012 refers to the already finished implementation guidelines, because of the essential importance these documents have for therapy, assistance and the guarantee of the continuity of supply a balanced, high-quality health service [4].

As CDA level 1 simply inserts plaintext or PDF files into a document, the VAEB decided to directly implement a CDA manager. It groups content into sections by metadata and allows each CDA levels 2 and 3.

This clear mapping of the existing HIS document structure onto CDA content makes the documents readable for the backend of different systems. After the implementation it's simple to retrieve and flag the metadata such as the type of the document, the patient ID, the author, the signing organisation or the medical content of a document [8].

Clinical discharge reports as well as laboratory findings, gathered during a stay at the health care facility "*Breitenstein"* are already stored in the HIS as a structured document. Instead of typing plaintext, from now on diagnosis, therapies and medical values are brought into the system by standard entry masks.

These Entry masks in use have to be adapted to the "ELGA" standards in order to separate clinical discharge reports into different content-related sections, as recommended in the implementation guidelines. Considering that the HIS already uses different tab pages to separate its contents in one document, only a content-based comparison with the CDA sections is needed. Such adaptations also have to be redone for laboratory findings / results.

The CDA standard defines in which parts plaintext is permitted and where only defined values can be entered into a document. This ensures an easier readability and should yield a large benefit for the patient.

These sets of values are required to fit the LOINC code system (Logical Observation Identifiers) included in the CDA guidelines, because there are many ways to identify the same test or treatment [8]. The LOINC code includes the standardised terms for all kinds of observations and measurements which enable the exchange and aggregation of electronic health data from several independent systems. By using the LOINC code all local codes can be stored consistently in one "language" and an interoperable data exchange is possible [12]. To get started the current document structure has to be mapped to the EHR guidelines, with every subsequent change being mapped automatically in the background at the release of each document.

This mapping has to be done for each type of document separately, but can be redone whenever a new implementation guideline is released, in which case already existing components can be reused on a modular basis.

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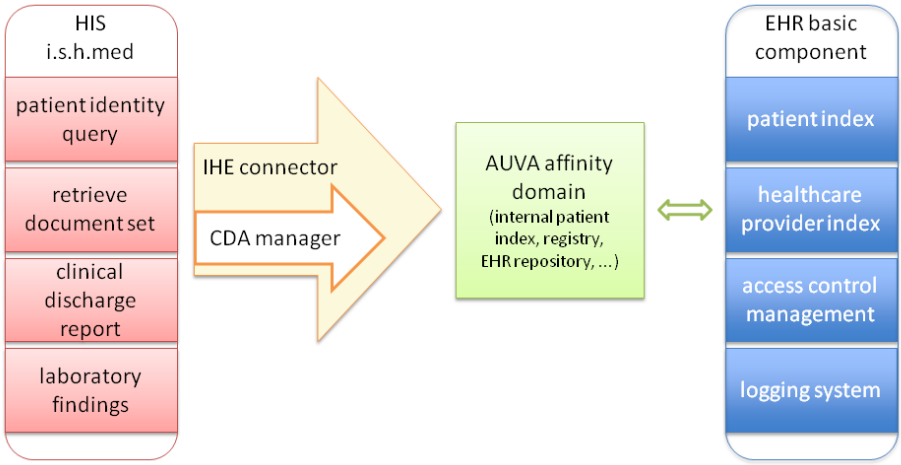


**Figure 1:** "ELGA" architecture of the health care facility "Breitenstein"

This simple HIS extension runs entirely in the background, making it even more user-friendly. Moreover, the data input in the HIS already includes different sections and tables to be prepared for the "ELGA" launch, therefore it doesn't cause a big change in the documentation workflow.

As a result (shown in Figure 1), at the discharge of a patient from the hospital the collected HIS data and constant data given by the "ELGA" CDA standards are automatically refactored to a new format by the CDA manager. This new CDA document will be integrated by the IHE connector, via the AUVA affinity domain into the "ELGA" and can then be read by users with the required authorisations.

### *3.3. Timeline of the Process of Integration*

The following figure (Figure 2) shows / depicts the main topics and milestones of the process of integration, such as ELGA related acts and enactments, are visualized.

## 4. Discussion

The necessary interfaces and adapters for a complete integration of a HIS into the "ELGA" are identified and the implementation is already in progress. In the near future clinical discharge reports and laboratory findings documented by healthcare professionals in the health care facility "*Breitenstein"* can be registered in "ELGA" in order to enable other authorized healthcare professionals to get access to these documents. Additional online access to the existing "ELGA" information can be realized with the HIS.

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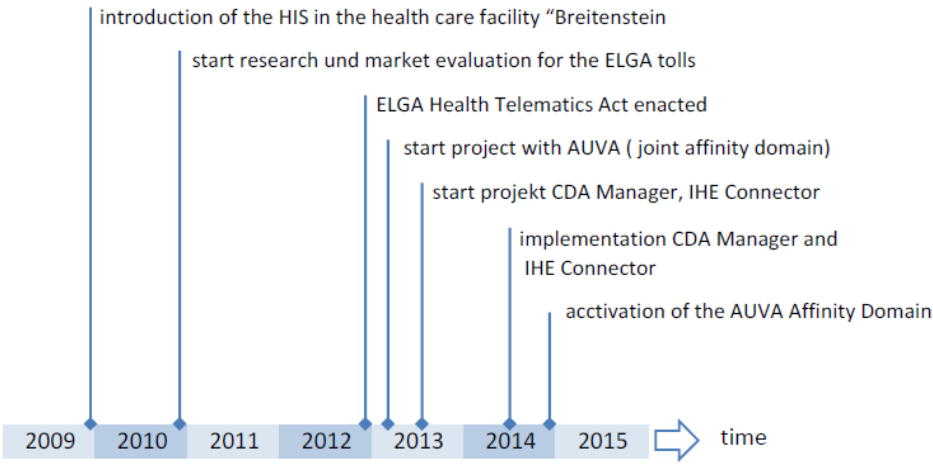


**Figure 2:** Timeline of the Process of integration

Patients commonly have a high frequency of seeing general practitioners in a short period of time immediately before beginning a regimen, as part of the allowance (referral) process which usually also requires a number of medical reports. Accordingly, medical facilities have a high usage of the "ELGA" system. The doctor will have an easy access to anamneses data over a common HIS, which will make the process easier for both, doctor and patient. A doctor shouldn't have to deal with various medical systems and interfaces and should benefit from a single-sign-on and user-friendly platform.

What shouldn't be forgotten is that currently only standardised documents can be integrated into the "ELGA", these have to be extended by means of other document types and an advanced content structuring. According to the Health Telematics Act of 2012 profound codification of data is only required to be in place as of 2018. Until then the different health care providers and the VAEB have time to implement a profession specific dynamic view.

This and several further aspects are the reason why the VAEB is considering a predecessor project where all documents have to fit the standards of CDA level 3 in order to already be prepared for the next extension of the "ELGA" introduction.

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