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ELGA Outpatient Clinic Report and ELGA Telehealth Note: Two HL7-CDA®-Based Modular Electronic Documents

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Abstract. Background: From 2022, the "Outpatient Clinic Report" and the "Telehealth Note" will complement the existing e-Reports in the Austrian Electronic Health Record system ELGA. Objectives: The specification of two harmonized implementation guides with standardized structure for all types of outpatient clinics in hospitals on the one hand and for telemonitoring treatments on the other hand. Methods: With the participation of expert groups, the contents were harmonized, and a data model was created. Template specifications were modelled in ART-DECOR and approved in the course of an HL7 Austria ballot. Results: Two sets of freely selectable building blocks and machine-readable content were created. Conclusion: The "Outpatient Clinic Report" and the "Telehealth Note" are currently being implemented. The use of these documents will be evaluated as well as if additional machine-readable content is needed.

Keywords. Electronic Health Records / standards*, Austria, Outpatients, Hospitals, Hospital Outpatient Clinics, Disease Management, Telemedicine, Documentation / standards*, Health Level Seven, HL7, CDA, Interoperability

1. Introduction

Austria's national Electronic Health Record (EHR) system (ELGA) connects health care providers like hospitals, nursing homes, resident doctors, and pharmacies throughout Austria. Only the patients and health care providers directly involved in the treatment have access to the patients' data [1]. ELGA was put into operation in 2015 as the national health IT infrastructure with two main applications: e-Medication and e-Reports. Hitherto, the application e-Reports hosts the most frequent classes of documents, i.e. "Physician Discharge Summary", "Nursing Discharge Summary", "Laboratory Report" and "Diagnostic Imaging Report" [2] [3].

To enable semantically interoperable exchange of health data, the reports must be provided in a standardized format. For this purpose, ELGA relies on the international

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standard HL7 CDA® (or Health Level Seven® Clinical Document Architecture®, Release 2). HL7 CDA® is an XML-based standard, which can be used for all types of medical reports. CDA can not only transport text and images, but also offers the possibility to embed data in machine-readable form; it enables the recipient to reuse the data without having to re-type or transcribe any of it. These data can further be used for calculations, comparisons and/or statistics or can be used in clinical decision support systems (CDSS), e.g., for warnings [4].

Machine-readability demands the use of harmonized code systems to enable receiving systems to interpret the content of the document. The use of code systems is not feasible in all cases: in case of the lack of existing code systems, a disproportional effort to generate and maintain the code system, or the requirements to report narrative text that lacks typically the structure to be coded. In these cases, traditionally, only human-readable information is available. A new approach in ELGA should extend the classic view of either coded-information to achieve machine-readability or non-coded-information.

In 2022, it will be possible to provide two further classes of e-Reports in ELGA, the "Outpatient Clinic Report" (German: *"Ambulanzbefund"*) and the "Telehealth Note" (German: *"Telemonitoring-Episodenbericht"*). Both are reusing elements from previous e-Reports in ELGA and are defining new ones, thus creating more ways of sharing machine-readable data.

The Outpatient Clinical Report is the first flavor of various outpatient reports that can be expected to become present in the next years. Hence, it specifies building blocks that are subject to be used by further, more detailed, specifications (e.g., outpatient reports for a certain medical domain). In general, the re-use of existing building blocks should be considered and enabled. Existing specifications from the "Patient Summary" as well as from other ELGA implementation guides are going to be reused whenever possible. Based on the outlook that the presented Outpatient Clinical Report is the first of many, a finely tuned repository for reusable building blocks for relevant outpatient report elements was introduced. Implementers shall not be faced with a confusing collection of documents containing ambiguous and/or conflicting information. ELGA thus pursues a similar goal as, for example, "Consolidated CDA" in the U.S., where certain templates may also occur in different document classes, whereby duplicative or conflicting template specifications are avoided by an overarching governance. [5]

The Telehealth Note satisfies the need to share data from telemedicine treatments, where the patient is being treated remotely from a medical practice. Complex vital sign data, medication administration tracking and device information can now be documented in a standardized, machine-readable way and be shared via ELGA. The telehealth note is fully compliant with IEEE 11073 and stabilizes this new way of data sharing. The possibility is given to easily distinct between an ongoing and finished telehealth treatment. [6]

2. Methods

The fundamental content of the Outpatient Clinical Report and the Telehealth Note were harmonized by consensus in 2020 by two multidisciplinary working groups. The working groups aimed to encompass and harmonize all known documentation sections and their sequence of both reports. For this purpose, sample reports from different outpatient clinics and Telehealth Notes were collected and compared.

The tools used to create the CDA implementation guide were ART-DECOR [7] for the data model and CDA template specification, and a Mediawiki for the accompanying text. The sections were defined as building blocks.

The building blocks and the introduced approach were discussed in workshops during the HL7 Austria balloting process and have been approved by the HL7 Austria community.

3. Results and Discussion

The Outpatient Care Report [8] and Telehealth Note [9] implementation guides follow the structure of the other existing ELGA and HL7 Austria implementation guides. They include needed information that is specified in other HL7 Austria guidelines directly into its own specification, so that all required information can be found within. Especially for the *header* of the CDA document (containing administrative information) existing building blocks from the national HL7 *Common CDA implementation guide* (German: *"Allgemeiner CDA Implementierungsleitfaden"*) are reused. [10]

A. Building Blocks

All sections and their corresponding subsections from the Outpatient Clinical Report are displayed in table 1, they appear in the same sequence as in the document:

Table 1. Sections and subsections of the ELGA Outpatient Clinic Report

Section and subsection headings	German section headings
Salutation	Brieftext
Chief complaint+Reason for visit	Konsultations- oder Überweisungsgrund
History of Medication use	Aktuelle Medikation
Allergies and adverse reactions	Allergien und Intoleranzen
History of present illness (anamnestic)	Anamnese
History of past illness	Frühere Erkrankungen und Maßnahmen
Subject-specific anamnesis [a)]	Fachspezifische Anamnese
History of pregnancies	Schwangerschaften
History of medical device use	Medizinische Geräte u. Implantate
Functional status	Beeinträchtigungen
Immunizations	Impfungen
Social history	Lebensstil
Results	Status, Diagnostik und Befunde
Physical findings	Status

Vital signs	Vitalparameter
Subject-specific findings [a)]	Fachspezifische Diagnostik
Pending findings	Ausstehende Befunde
Diagnosis	Diagnose
Problem time course	Verlauf
Summarization of encounter	Zusammenfassende Beurteilung
Procedures	Durchgeführte Maßnahmen
Medication administration	Dokumentierte Einnahme
Nurse procedures	Pflegemaßnahmen
Discharge medications	Empfohlene Medikation
Change of current medication	Änderung der bestehenden Medikation
New medication added	Zusätzliche Medikation
Planned procedures	Weitere empfohlene Maßnahmen
Medical checkup, (re-) appointments	Termine, Kontrollen, Wiederbestellung
Plan of care	Empfohlene Anordnungen Pflege
Planned procedure	Geplante Untersuchungen
Conservative therapy	Konservative Therapie
Surgical procedure	Chirurgische Therapie
Additional clinical information	Weitere Informationen
Advance directives	Willenserklärungen und andere juridische Dokumente
Final remarks	Abschließende Bemerkungen
Supplements	Beilagen

a) Placeholder sections – may later be replaced by specialist content (subject-specific)

Each section above is basically optional. There are two variants of each section: One is exclusively narrative (uncoded) and one must be supplemented with machine-readable information. This is intended to achieve a stepwise approach to highly structured and computer-processable documentation. Two sections, “subject-specific anamnesis” and “subject-specific findings” are designed as “placeholder sections”. Should the need become apparent in practice, the placeholder sections will contain subject-specific coded content, e.g., measurements, scores, or questionnaires.

All sections and their corresponding subsections from the Telehealth Note are displayed in table 2, they appear in the same sequence as in the document:

Table 2. Sections and subsections of the ELGA Telehealth Report

Section and subsection headings	German section headings
Salutation	Brieftext
Chief complaint+Reason for visit	Behandlungsgrund
Diagnosis	Diagnosen
Summarization of treatment	Zusammenfassung der Behandlung
Excerpts from collected data	Auszüge aus erhobenen Daten
Data collected	Erhobene Daten
Vital Signs	Vitalparameter
Results	Messergebnis
Monitored drugs	Überwachte Medikamente
Medication administration	Dokumentierte Einnahme
Devices used	Verwendete Geräte
Supplements	Beilagen

Each section listed is optional, except for the "Chief complaint+Reason for visit" section. All subsections of the "data collected" section, the "devices used" section and the "diagnosis" section are fully machine-readable. The "Chief complaint+Reason for visit", "Summarization of treatment" and "Excerpts from collected data" sections can contain subsections, so that health experts can store their texts in a timeline manner.

For the visualization of ELGA CDA documents in a browser, the use of the "ELGA reference stylesheet" is recommended. To be printed, documents are first converted to PDF/A, with possible file attachments appended at the end. This conversion can be accomplished by the tool CDA2PDF. [11]

B. To code or not to code?

Based on the CDA specification, machine-readability is achieved by the use of various *coded* datatypes (e.g., CE CWE). This datatype is designed to provide at least a *code*-attribute and a *codeSystem*-attribute to enable any software solutions to interpret the transported content.

In cases when coded information cannot be provided (although it would be required to be present), CDA introduces the concept of *nullFlavors*. This allows to present the reason why coded information is not available. NullFlavors are used to bridge the gap between the two classical approaches of providing coded information or non-machine-readable information at all. A newly introduced approach specifies the use of the nullFlavor *OTH* (standing for other) and requests to provide the reference to content that is contained within the human-readable part of the document. By this means, receiving systems can dereference the relevant content and extract it for further use. Considering *nullFlavor* holding the code "OTH" it must be stated that the CDA specification demands information on the code system where no matching code has been identified. In general, this requirement is difficult to meet since CDA implementation guides – which are the source of information for the code systems to be used – normally reference a value set to choose a code from and not a code system directly.

The fact that the Outpatient Clinical Report implementation guide not only explicitly allows the use of uncoded structured information but also completely uncoded building blocks was discussed intensively during the ballot. In particular, the possible absence of coded diagnoses, allergies, and measures was difficult to accept. However, mandatory provision of coded information would have excluded many outpatient clinics from the possibility of providing important information in ELGA. As a compromise solution, a certificate for structural quality has been introduced. "ELGA Interoperability Level Full Support" may only be stated in the metadata of reports that have at least one of the sections diagnoses, allergies, or measures fully coded.

C. Implementation

For Outpatient Clinic Reports and Telehealth Notes to be allowed to be registered in ELGA, a regulation from the Ministry of Health is required, which was enacted in February 2022. [12]

At the time of writing, Outpatient Clinic Reports are already being implemented in five associations of hospitals. Others have reported specific plans for implementation. The Telehealth Note is implemented by two telehealth providers. No problems were reported in understanding or implementing the CDA implementation guide so far.

D. Future Work

The implementation of the Outpatient Clinic Report and the Telehealth Note including their provision in ELGA is basically voluntary. The further use of these documents will be evaluated after the first phase.

IAdditional machine-readable content could be needed or desired for the placeholder sections of the Outpatient Clinic Report. First inquiries exist from trauma surgery and oncology.

Another milestone for the Outpatient Clinic Report would be to expand the use of the guide to include private practice medical specialists. This was commented and strongly demanded during the HL7 ballot process. For this purpose, harmonization meetings with the professional groups' representatives of the medical chamber are intended.

Further developments regarding the Telehealth Note will cover the needs for upcoming, specific telehealth solutions. The combination with other e-Reports will enable new opportunities for sharing health data, i.e., enabling closed loop medication.

These two new record types are broadening the possibilities to share medical data and simplify the specification of upcoming new and enhanced e-Reports.

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