Mapping Medication Metadata from the ABDA Data Model to an openEHR Medication Archetype: A Qualitative Analysis

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Abstract

Integrating data from various source systems to gain knowledge and meaningful data about patients for care and research is challenging. This work demonstrates how medication knowledge data from the database of the Federal Union of German Associations of Pharmacists (ABDA) can be used for storing and annotating medicinal products in an openEHR medication archetype.

Keywords:

Electronic Health Records, Datasets as Topic, Health Information Exchange**.**

Introduction

Medical data are reused for both, patient care and biomedical research, not only within the boundaries of healthcare institutions, but very often also across multiple sites. However, data are often not Findable, Accessible, Interoperable and Reuseable (FAIR Data Principles [1]), as they are missing common terminologies for semantic interoperability. The German Federal Ministry for Education and Research (BMBF; ger: Bundesministerium für Bildung und Forschung) is tackling these issues with the German Medical Informatics Initiative (MII) by funding university hospitals to implement Data Integration Centers to make data available and interoperable on a national and international level [2]. University Hospital Schleswig-Holstein (UKSH) joined HiGHmed, one of the four MII-projects, and is implementing the HiGHmed use case cardiology [3]. For this use case among other data, medication data need to be integrated.

At UKSH, the management and documentation of medication data is based on names and identifiers of a de-facto-standard database provided by the Federal Union of German Associations of Pharmacists (ABDA) [4].

The objective of this work is to show the extent of overlap between the ABDA metadata and an openEHR medication archetype. Our aim is to provide a first step for storing and annotating medication data in openEHR archetypes using ABDA information.

Methods

ABDA database

ABDA provides a comprehensive drug database with information on all medicinal products on the German market and its contents are constantly updated every 14 days. It comprises particularly details on active and inactive ingredients using different naming conventions, pharmacological classification systems, pharmaceutical and clinical instructions, summary of product characteristics as well as package inserts [4].

openEHR

openEHR describes a platform approach enabling open electronic health record (EHR) architectures using archetypes which are shared nationally and internationally [5].

In order to integrate data of source systems into openEHR-based systems, data need to be mapped and transformed.

Mapping of ABDA metadata items to an openEHR archetype

For the mapping of the ABDA data model the tables ‘medicinal products’ (FAM_DB), ‘substances’ (STO_DB) and ‘names of substances’ (SNA_DB) were considered. In total 79 ABDA metadata items were used for the mapping.

Two medical informaticians (TB and BS) separately analyzed the 79 metadata items and mapped them to an openEHR archetype. Inter-rater reliability for TB and BS was calculated afterwards. Next, they compared their results per item and discussed disagreements to agree upon a mapping per item. In cases where the discussions did not lead to an agreement, a pharmacologist (RB) was included in the discussion and helped resolve the mapping.

Results

The ABDA metadata were mapped to the openEHR medication archetype (namely openEHR-EHR-CLUSTER.medication.v1).

The independent mapping of 79 ABDA metadata items to the archetype leads to initial agreements on 54 out of 79 ABDA metadata items (68.4 %) with disagreements for 25 ABDA metadata items. 26 ABDA metadata items could not be mapped to the archetype. Inter-rater-reliability is $p_o = \frac{54}{79} \approx 0.684$. Dicussions on the disagreements could resolve 23 out of 26.

However, 36 out of 79 ABDA items (45.6 %) were mapped to the generic free-text item ‘description’ of the archetype for integrating structured ABDA information.

Discussion

Mapping structured ABDA metadata items to free-text openEHR items results in loss of information. Therefore, more structured items that fit to structured ABDA items may be necessary in openEHR archetypes.

Instead of integrating ABDA information into openEHR archetypes, openEHR patient medication data could also be linked to the ABDA database by using a unique identifier from ABDA and reference that identifier together with the version of ABDA that was used.

This could be done using a unique identifier from ABDA to identify a specific medicinal product or substance in the openEHR medication archetype item 'Name' as an openEHR DV_CODED_TEXT (e.g. 'Tamoxifen beta 20'). This item is specified by an openEHR CODE_PHRASE (e.g. terminology_id = 'ABDA2016.FAM_DB.Key_FAM' and code_string = ' 3340739900') using a terminology mapping (openEHR TERM_MAPPING).

The pros and cons of that alternative need to be further evaluated.

Related work

Other work has been done using openEHR archetypes to represent medication information before, like Chen et al., who showed that using openEHR archetypes for managing chemotherapy information and representing chemotherapy guidelines in openEHR is possible [6]. Marco-Ruiz et al. built an archetype-based data warehouse, but are focusing their information model on laboratory data [7].

Medication information has previously been transformed and mapped to other data models. E.g. HL7 Fast Healthcare Interoperability Resources (FHIR) was used to implement a system storing structured medication information retrieved via an NLP pipeline from unstructured documentation [8]. Sinha et al. built a clincial decision support system for safe opioid prescription based on FHIR [9].

Limitations

This work has to be considered a preliminary step for integrating medication data in an openEHR environment.

In addition, the ABDA database is specific to Germany. Although it contains both foreign pharmaceutical products and substance names this database might not be sufficient for international purposes.

Since the effort presented in this work has to be conducted once and only future changes of ABDA metadata need to be included, an automated mapping system was not considered. Structural changes to ABDA happen once per one year or every second year. The mapping does not imply regulatory or ethical challenges, due to metadata being mapped and not contents.

Conclusions

The selected metadata items concerning medication information can be mapped from the ABDA data model to an openEHR medication archetype. Based on these results our next steps are the integration of medication information in an openEHR Clinical Data Repository.

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Introduction

- Integrating source system data to gain knowledge about patients for care and research is challenging
- The integration of a German knowledge database containing information about medicinal products into openEHR was analyzed in order to show the possibilities of storing and annotating medicinal products

Method

- We mapped the metadata of the german ABDA database data model to an openEHR medication archetype
- We used a manual mapping method with two reviewers, solving disagreements through discussion

Results

- Most ABDA metadata items could be mapped to an openEHR medication archetype (namely *openEHR-EHR-CLUSTER.medication.v1*)
- 36 ABDA items (45.6 %) could only be mapped to a non-structured, free-text openEHR item (‘description‘)

Discussion

- Mapping structured metadata items to non-structured, free-text openEHR items lead to loss of information
- More structured metadata items are necessary to cover ABDA metadata in openEHR archetypes
- Linking instead of integrating the medication database may be an alternative solution

German ABDA **medication metadata** can be mapped to an **openEHR medication archetype**, however **additional archetypes** are necessary to maintain the full **structured information** of the ABDA catalogue.

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Mapping result

ABDA table	ABDA column	Item of openEHR-EHR-CLUSTER.medication.v1	Comment
FAM_DB	Dispensation category	Description	as free-text
	Period of permitted use at refridgerator temperature (unit)	Expiry	-
	Period of permitted use at refridgerator temperature (number)	Expiry	-
	Period of permitted use at room temperature (unit)	Expiry	-
	Period of permitted use at room temperature (number)	Expiry	-
	Date of product launch	Description	as free-text
	Date of product entry into ABDA	Description	as free-text
	Date of last check of compound	Description	as free-text
	EMA market authorisation	Description	as free-text
	Single use	Description	as free-text
	Moisture guard	Description	as free-text
	Notes on storing the product	Description	as free-text
	Supplier: Short name	Manufacturer	-
	Supplier: Country	n.a.	-
	Supplier: Long name	Manufacturer	-
	Supplier: Place_ZIP	n.a.	-
	Supplier: Place_Delivery	n.a.	-
	Supplier: ZIP_Post office box	n.a.	-
	Supplier: ZIP_Delivery	n.a.	-
	Supplier: Post office box	n.a.	-
	Supplier: Street	n.a.	-
	Supplier: Telefax	n.a.	-
	Supplier: Phone	n.a.	-
	Co-marketing all items (11 items, same as supplier)	n.a.	-
	ATC: Code	Name	as coded value
	ATC: DDD	n.a.	agreed on by discussion
	ATC: Name_German	Name	agreed on by discussion
	ATC: Name_English	Name	agreed on by discussion
	ATCA: Code	Name	as coded value
	ATCA: DDD	n.a.	agreed on by discussion
	ATCA: Name	Name	agreed on by discussion
	Dosage form: Name	Form	-
	Information on pharmaceutical product: Dat_Updated	Description	as free-text, agreed on by discussion
	Information on pharmaceutical product: Dosage	Strength (concentration)	-
	Information on pharmaceutical product: Properties	Description	as free-text, agreed on by discussion
	Information on pharmaceutical product: Storage life	Description	as free-text, agreed on by discussion
	Information on pharmaceutical product: References	Description	as free-text, agreed on by discussion
	Information on pharmaceutical product: Indications	Description	as free-text, agreed on by discussion
	Information on pharmaceutical product: Contraindication	Description	as free-text, agreed on by discussion
	Information on pharmaceutical product: Adverse effects	Description	as free-text, resolved by pharmacologist
	Information on pharmaceutical product: Notes for patients	Description	as free-text, agreed on by discussion
	Main indication: Name	Description	as free-text, agreed on by discussion
	Additional indication: Name	Description	as free-text, agreed on by discussion
	Light protection	Description	as free-text
	Single agent preparation	Single-/Multi-ingredient product	agreed on by discussion
	Product group	Description	as free-text, agreed on by discussion
	Product name	Name	-
	Immediate comsumption	Description	as free-text
	State of market authorization	Description	as free-text, agreed on by discussion
	Veterinary pharmaceutical product	n.a.	EHR meant for humans only
STO_DB	Anthroposophic pharmaceutical product	Description	as free-text, agreed on by discussion
	Controlled-substances law attachment	Description	as free-text
	Chemical	Description	as free-text, agreed on by discussion
	Co_Substance	Description	as free-text, agreed on by discussion
	Excipient	Description	as free-text, agreed on by discussion
	Homeopathic pharmaceutical product	Description	as free-text
	Legal category (ger: ‘Grundverordnung’)	Description	as free-text
	Food additive	Description	as free-text, agreed on by discussion
	Food or lifestyle product	Description	as free-text, agreed on by discussion
	Plant protection product	Description	as free-text, agreed on by discussion
	Prescription requirements	Description	as free-text
	Substance in cosmetics	Description	as free-text, agreed on by discussion
	Agent	Description	as free-text
SNA_DB	Counter	n.a.	-
	Origin	Description	as free-text, agreed on by discussion
	Name	Name	-
	Sort term	n.a.	agreed on by discussion
	Search term	Name	agreed on by discussion
	Preferred term	n.a.	agreed on by discussion

Table 1: Mapping result of ABDA data model columns to the openEHR archetype *openEHR-EHR-CLUSTER.medication.v1* including comments on the mappings.

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Wissen schafft Gesundheit

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