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Building a Comprehensive Clinical Data Repository Using FHIR, LOINC and SNOMED

Achim MICHEL-BACKOFEN[a], Thomas PELLIZZARI [c], Jochen ZOHNER[a], Romina BLASINI[b], Kurt MARQUARDT [a]
[a] *University Hospital of Gießen*
[b] *University of Applied Sciences, Giessen*
[c] *AKEDIS GmbH, Innsbruck*

Abstract. In 2018 the University Hospital of Giessen (UHG) moved its hospital information system from an in-house solution to commercial software. The introduction of MEONA and Synedra-AIM allowed for the successful migration of clinical documents. The large pool of structured clinical data has been addressed in a second step and is now consolidated in a HAPI-FHIR server and mapped to LOINC and SNOMED for semantic interoperability in multicenter research projects, especially the German Medical Informatics Initiative (MII) and the Medical Informatics in Research and Care in University Medicine (MIRACUM) consortium.

Keywords. FHIR, LOINC, SNOMED, hospital information system, interoperability

1. Introduction

The University Hospital of Gießen (UHG) operates a HIS on all wards since 1992. In 2018 the in house developed HIS and document archive have been replaced by the MEONA HIS from the German vendor MEONA GmbH and the Synedra-AIM universal archive from Austrian vendor Synedra. To unlock the vast amount of structured clinical data from laboratory, intensive care and anesthesiology for future clinical research, the scope of the Synedra-AIM repository has been widened to include it as a semantic network of FHIR-Resources.

2. Materials and Methods

Structured clinical information within the UHG network resides primarily within 3 main departmental subsystems from laboratory, anesthesiology and intensive care medicine. All systems communicate via HL7 version 2 standard with the Orchestra communication server of UHG. The inherent capability of the FHIR data model to build a semantic network of clinical objects was realized by using HAPI-FHIR server as a clinical data repository (CDR). Together with AKEDIS GmbH we developed an extension of the Synedra-AIM to transform HL7-Version 2 data streams into a HAPI-FHIR CDR. A common structure for business identifiers has been established for the FHIR resources that allows for controlled replication, interoperability and object historization at an

atomic information level. During this transformation, all resources are annotated with LOINC and SNOMED codes for sematic interoperability. For research purposes parts of this CDR are pseudonymized and replicated into project specific HAPI-FHIR servers. Standardized tools transform this data into target environments like i2b2 or csv-files. This allows for fine grained control according to the rules of the european data protection legal framework (Fig. 1).

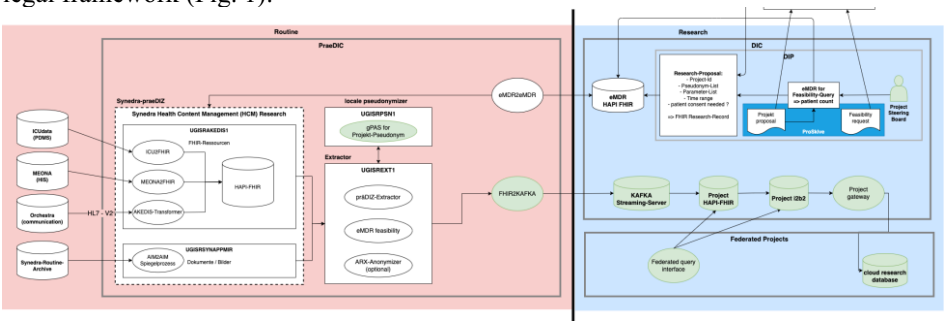

Figure 1: Data flow within the FHIR based research environment at the UHG

3. Results

Starting in 2019 data structures from 4 critical subsystems (HIS, LIS, PDMS and AIMS) have been mapped onto FHIR resources and the clinical data imported into the CDR.

4. Conclusion

Whereas the approach to transform structured clinical data into MII core data set compliant FHIR resources is used within the overall community of the German medical informatics initiative (MII) hospitals, the UHG approach differs in that it builds on an existing HL7-V2 infrastructure without changes to existing subsystems and utilizes the FHIR CDR for both the production and research environment. The benefits have been realized within multicenter research frameworks like the MII and MIRACUM [1].

References

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