Towards a FHIR-Based Framework for Analyzing Nursing-Related Data in Smaller Sized Care Facilities

Steffen NETZBAND[a,1], Dominik MÜLLER[a,c], Stefanie MEYER[b], Jeton ISENI[b] and Frank KRAMER[a]

[a] *IT-Infrastructure for Translational Medical Research, University of Augsburg, Germany*
[b] *St. Elisabeth Pflegezentrum gGmbH, Senden, Germany*
[c] *Institute for Digital Medicine, University Hospital Augsburg, Germany*

Abstract. Data-driven decision making can improve the situation for caregivers and residents in nursing homes. However, smaller facilities often lack the technical and personnel resources required to prepare and analyze data. We introduce a conceptual framework to enable data transformation and analyzation in smaller nursing homes. We deployed a prototype pipeline at a German nursing home, where we demonstrated the feasibility and effectiveness of our approach.

Keywords. Nursing, Nursing Informatics, FHIR, Data Analysis

1. Introduction

The use of data warehouses and business intelligence promises to help the management of nursing homes through decision support improving the situation for caregivers and residents [1]. However, in particular small nursing homes face challenges and obstacles as the presence of closed systems, the absence of available personnel and financial resources, or the lack of digitized information. We introduce a conceptual framework based on the FHIR standard to enable data transformation and analyzation from various source systems in a platform-independent manner in smaller nursing homes.

2. Methods

We developed an architecture framework (see fig. 1) and identified essential software components for analyzing nursing-related FHIR datasets from various sources, focusing on data modeling and storage, ETL processes, and data analysis and visualization. We determined nursing related FHIR profiles suitable as data model, implemented a semi-automatic ETL pipeline with Python, and utilized tools like Power BI and FHIR QR Vis for data analysis and visualization [2].

---

[1] Corresponding Author: Steffen Netzband, IT Infrastructure for Translational Medical Research, Alter Postweg 101, 86159 Augsburg, Germany; E-mail: steffen.netzband@informatik.uni-augsburg.de.
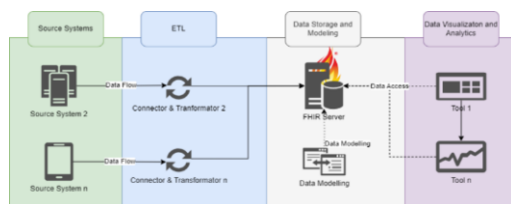
Figure 1. Architecture Framework.

3. Results

An exploratory study was conducted to test and deploy a prototype at St. Elisabeth nursing home in Senden, Germany. The objective was to connect information from a staff survey among the nursing staff with resident information to find out the correlation between the perceived workload of nurses and the amount of care required by residents. The nursing information system database stored information on 108 residents across four wards, including the standardized assessment form used in Germany to determine care level. A FHIR model was developed to meet the information of both staff and residents.

4. Discussion

By utilizing existing systems and tools, smaller care facilities can provide data for analysis and gather insights for effective management. Except for the ETL process, plug and play solutions such as FHIR servers, data models, and analytics tools are available.

However, it has several limitations. Importantly, the data records to be imported must be digitally available, which is not yet the case in many facilities where documentation may still be partially or completely paper-based. Furthermore, it is necessary for data from source systems to have corresponding interfaces for data export, e.g. REST API. In our study, the nursing information system did not offer an interface, so data had to be exported as PDF files and an additional scripting to transfer the data into structured format was necessary.

5. Conclusions

The approach presented provides opportunities for smaller care facilities to streamline their operations without requiring major IT resources or extensive investment in additional software components. Our results demonstrate the feasibility and effectiveness of this approach in real-world settings.

References

[1] Wouterse B, Bakx P, Wong A. Measuring Nursing Home Performance Using Administrative Data. Medical Care Research and Review. 2023;80(2):187-204. doi:10.1177/10775587221108247
[2] Frei J, Auer F, Netzband S, Ignatenko Y, Kramer F. Web-based Prototype for Graphical Exploration of FHIR® Questionnaire Responses. AMIA Annu Symp Proc. 2024 Jan 11;2023:351-358.