Towards FAIR Patient Reported Outcome: Application of the Interoperability Principle for Mobile Pandemic Apps

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1. Introduction

During the COVID-19 pandemic several individual apps have been developed to collect and track medical data. Although many of them address similar or at least overlapping aspects, due to diverse data models and formats, data items cannot be jointly analysed to increase evidence [1]. The NUM-COMPASS project [2], which is part of the German COVID-19 Research Network of University Medicine (NUM), built a coordination and technology platform as starting point for researchers and app developers. It enables them to collect data compliant to the German Corona Consensus Dataset (GECCO) [3]. This addresses in particular interoperability as part of the FAIR guiding principles [4]. This paper describes the implementation of these principles by NUM-COMPASS, to support joint analyses on shared data collected by various app-based studies.

2. Methods and Results

Interoperability is of particular importance, as research data often comes from multiple sources. It needs to be integrated into existing systems for analysis or processing. The following aspects have been defined for interoperability within the FAIR principles [4]:

- I1: (Meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation

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- I2: (Meta)data use vocabularies that follow FAIR principles
- I3: (Meta)data include qualified references to other (meta)data

In the following, the measures to assure interoperability between pandemic (and further) apps are described. We interpret **I1** as compliance to syntactic interoperability, while **I2** relates to semantic interoperability. **I3** is in particular relevant for the contextual information about the data.

I1: COMPASS apps use HL7 FHIR as language and JSON as interchange format. The GECCO data model itself [3] is defined by the FHIR profiles and the FHIR resources used. Thus, GECCO merges into existing data models, which is also the case for the collected data in COMPASS. These all provide a well-defined (meta)data model structure, which can be validated by an automated conformity check.

I2: To adhere to I2, internationally recognized controlled terminologies, ontologies and thesauri have been used in the underlying FHIR profiles, such as LOINC, SNOMED and ICD-10 GM.

I3: FHIR inherently fulfills this requirement, as links to other FHIR resources and vocabularies are a basic concept in FHIR. The GECCO data model comprises of several interlinked FHIR resources. In Germany, the Medical Informatics Initiative (MII) [5] provides the reference links for the vocabularies as well as for FHIR profiles of the nation- ally consented core data set. For billing in the German health care system, the coding of the ICD-10-GM is mandatory as per Law §§ 301, 295 Sozialgesetzbuch SGB V [6]. However, it is not sufficient for some cases. Therefore, the use of further terminologies (SNOMED CT, ORPHA codes) is encouraged by the MII.

3. Conclusion

The GECCO data model has been successfully integrated into the COMPASS app frame- work to improve interoperability. An automated conformity check is freely accessible to help researchers to assess if the data can be integrated into a common analysis from the beginning on. As a result, a compliance seal is provided. However, with fluctuant research questions, a general process to provide interoperable data beyond GECCO is currently developed.

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