MINERVA: Metadata for Data Discoverability and Study Replicability in Observational Studies

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DISCLOSURES

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OBJECTIVES

- Define a set of metadata and provide detailed information on source, spectrum, and quality of data sets and pilot metadata collection in a proof-of-concept (POC) catalogue.
- Provide recommendations on a sustainable metadata collection process and use of metadata for identifying real-world (RW) data sources for specific regulatory use cases.

BACKGROUND

- Identification of RW data sources for valid and relevant pharmacoepidemiologic research requires comprehensive assessment of their characteristics and contents.
- Identifying appropriate RW data sources and defining a set of metadata information are increasingly needed for regulatory decision making. This European Medicines Agency (EMA)-commissioned project (EUPAS39322) stemmed from the Heads of Medicines Agencies (HMA)–EMA Joint Big Data Task Force recommendations.[1]

METHODS

- MINERVA was a partnership/consortium of 18 ENCePP research centers and collaborators in 12 European countries covering 15 heterogeneous RW data sources, including electronic health records and patient registers.
- A list of candidate metadata was derived from information gathered from 57 publicly available documents and 8 structured interviews with external experts from European and international real world evidence (RWE) research networks. The list of metadata was finalized after EMA's feedback and input of stakeholders during a public technical workshop in April 2021.[2]
- A POC catalogue was built based on the Findability, Accessibility, Interoperability, and Reusability (FAIR) principles using the open-source software MOLGENIS.
- The POC catalogue aimed to provide an interactive environment for exploring and interacting with recommended metadata for several use cases and applied examples of use.
- The POC catalogue population was piloted following two processes: (1) import of metadata from a preexisting catalogue and (2) collection using an interview tool. Pilot results informed a set of recommendations for future metadata collection, use, and sustainability.
- Retrieval of quantitative metadata (age and sex distribution of the underlying population of a data source) was tested using a mock-up dataset mapped to four different common data models (CDMs) (OMOP, IMI- ConcePTION, Nordic and TheShinISS) through a programming script that could run on multiple CDMs.

RESULTS

- The final proposed metadata list included 436 variables; 241 variables labelled as priority for regulatory purposes were collected in the pilot.[3]
- The POC metadata catalogue comprised 6 highly interconnected domains: Institutions, Data Sources, Data Banks, Common Data Models, Networks, and Studies (Figure 1).
- 11 data access partners (DAPs) collected a subset of metadata in a compatible way in previously used catalogues; the data models of those tools were mapped to the MINERVA metadata list and transferred into the MINERVA POC catalogue. Missing values could be added manually. The remaining 4 DAPs had no preexisting metadata available. Metadata were collected using a process developed initially for the IMI-ConcePTION project. The process for retrieving preexisting metadata and entering new metadata is displayed in Figure 2.
- Metadata use cases included: (1) a DAP provides expertise throughout the cycle of a study; (2) an investigator uses the catalogue throughout the life cycle of a study; (3) a programmer programs a study; (4) a consumer of evidence assesses reproducibility and quality of evidence generated by a study; (5) a FAIR process launched by an external organisation, including a data originator, populates the catalogue; and (6) an institution with research capabilities becomes a DAP for a data bank and/or a data source.
- Considerable resources and pharmacoepidemiologic expert knowledge were required for entry and review of qualitative metadata to ensure that metadata concepts and terminology were interpreted consistently across contributors to the catalogue entries.
- For the quantitative data, the 4 output result data sets were proven to be the same for age and sex distributions. This exercise is available on GitHub (https://github.com/ARS-toscana/MINERVA_samplescript).
- The 15 RW data sources included a variable number of data banks ranging from 1 to 16. Completeness of qualitative metadata varied across data sources. Recommendations were compiled in a guidance document available in the EU PAS register.[4]

Figure 1. Structure of the MINERVA POC Catalogue

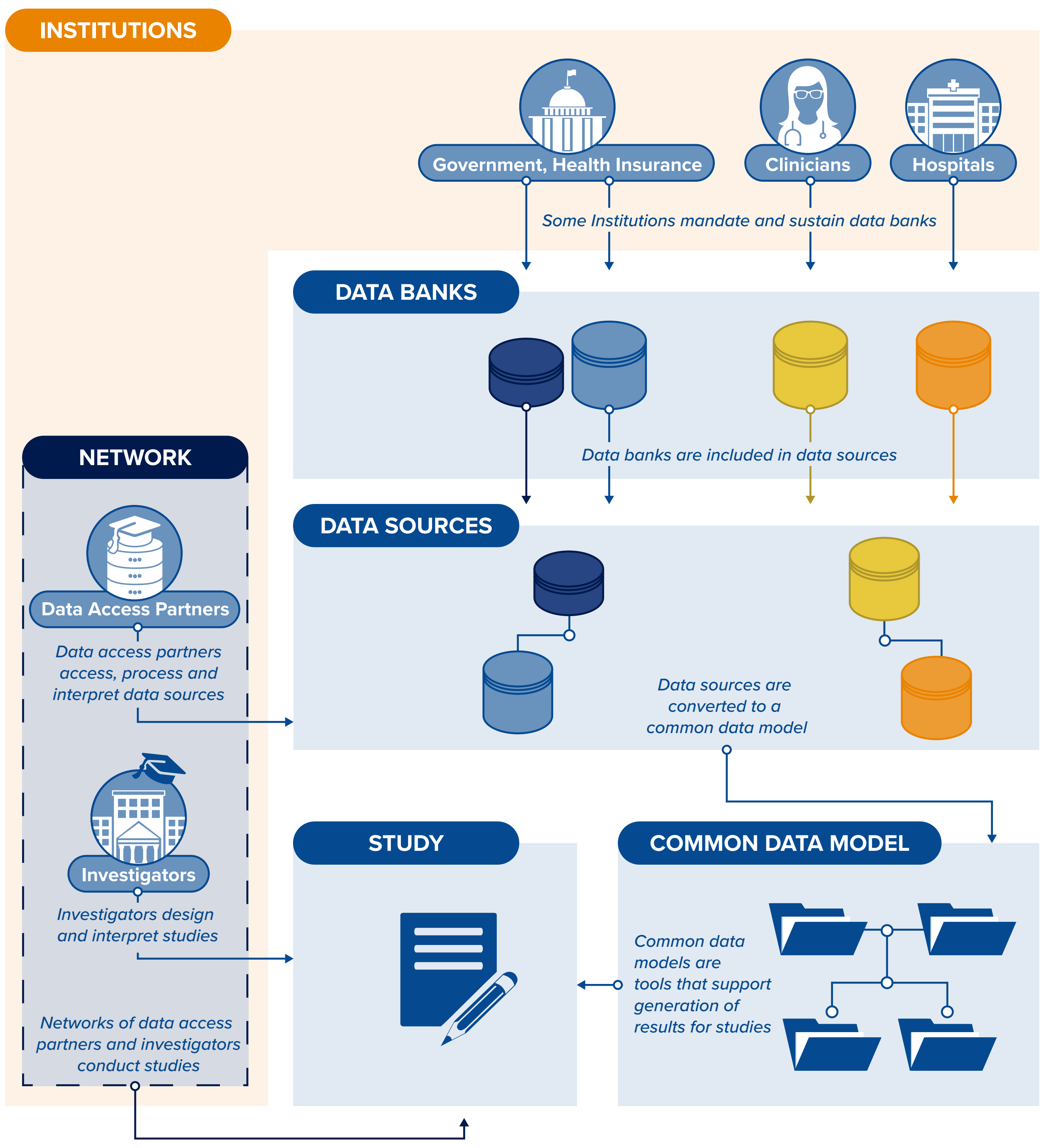
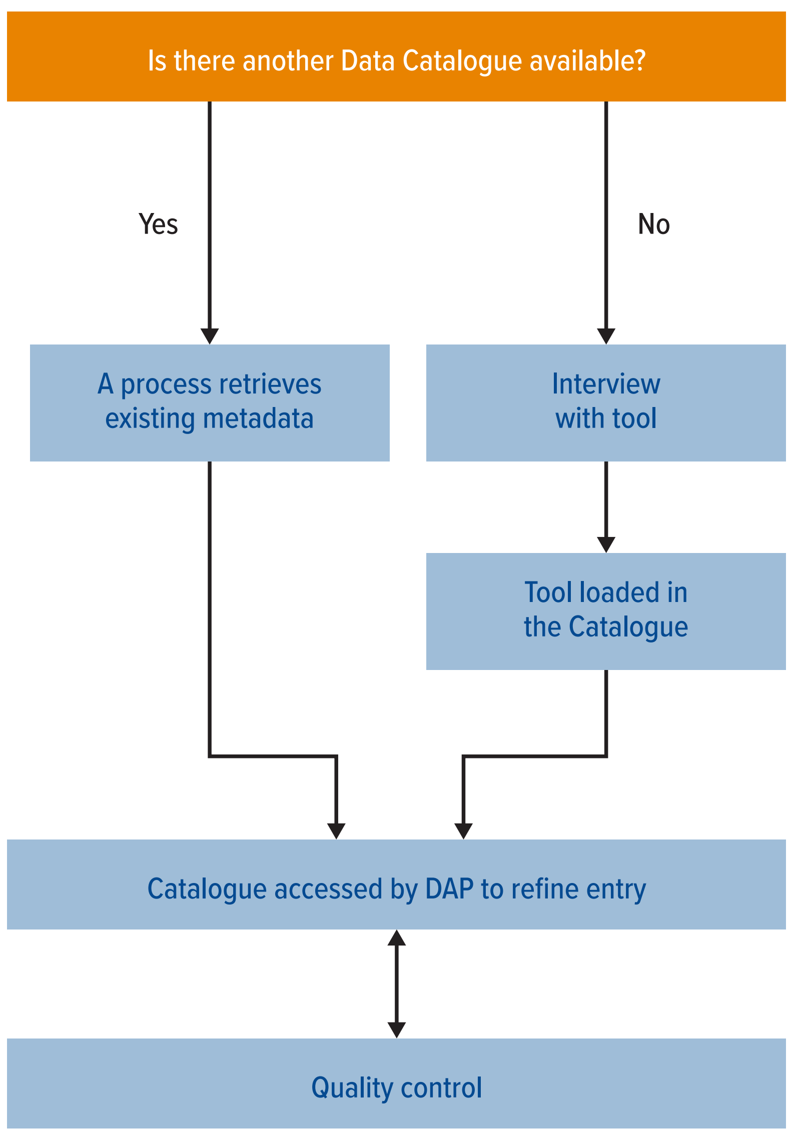

INSTITUTIONS
Government, Health Insurance
Clinicians
Hospitals
Some Institutions mandate and sustain data banks
DATA BANKS
Data banks are included in data sources
NETWORK
Data Access Partners
Data access partners access, process and interpret data sources
Investigators
Investigators design and interpret studies
Networks of data access partners and investigators conduct studies
DATA SOURCES
Data sources are converted to a common data model
STUDY
COMMON DATA MODEL
Common data models are tools that support generation of results for studies

Figure 2. Retrieval of Preexisting Metadata and Entry of New Metadata


Is there another Data Catalogue available?
Yes
No
A process retrieves existing metadata
Interview with tool
Tool loaded in the Catalogue
Catalogue accessed by DAP to refine entry
Quality control

CONCLUSIONS

- The MINERVA pilot showed the value of piloting major metadata catalogue processes and a need for data curation.
- Based on the MINERVA pilot, setting up and maintaining an operating metadata catalogue on real-world data sources require substantial effort to implement FAIR principles, adhere to data protection rules, and effectively support discoverability of data sources and reproducibility of studies in Europe.
- The MINERVA pilot proposed list of metadata is publicly available through the EU PAS Register (see QR code).[3]
- Recommendations for future implementation are publicly available in a guidance document.[4]

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OTHER PRESENTATIONS ON MINERVA AT ICPE

Data source heterogeneity in multidatabase pharmacoepidemiologic studies: an ISPE-sponsored scoping review. DIVERSE Symposium, August 26, 2022.

Rosa Gini, Olga Paoletti, Romin Pajouheshnia, Patrick Souverein, Nicolas Thurin, Vera Ehrenstein, et al. (on behalf of the MINERVA project Consortium). Study scripts supporting multiple common data models. Poster no. 137, Publication 1182, Poster Session C, Sunday, 28 August 2022.

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