Webinar 20 November 2023

Real-world data in medical research: harnessing their potential and addressing challenges with MES-CoBraD, RE-SAMPLE, and RETENTION

RE-SAMPLE
Iterative process of RWD collection

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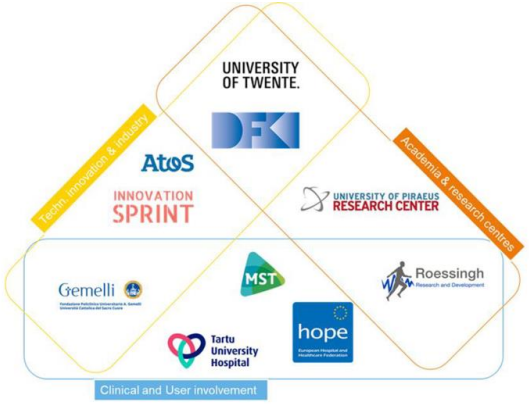
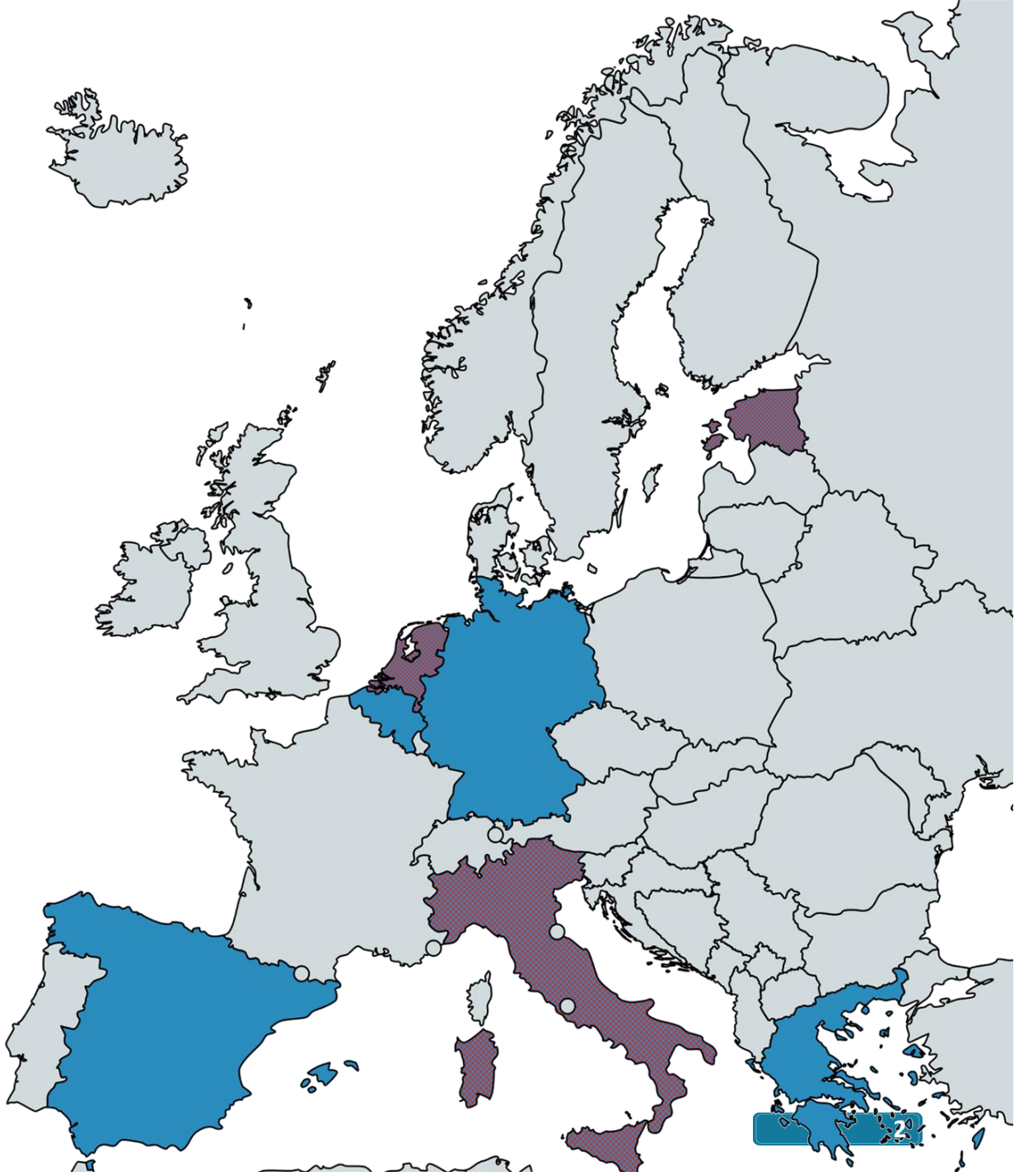
RE-SAMPLE has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 965315. SC1-DTH-12-2020: Use of Real-World Data to advance research on the management of complex chronic conditions. This result only reflects the author's view and the EU is not responsible for any use that may be made of the information it contains.

RE-SAMPLE

- 4 years: 01.03.2021 - 28.02.2025
- **Multidisciplinary consortium**
  10 partners (7 EU countries) specialising in respiratory medicine, RWD, artificial intelligence, privacy, ethics, data protection, and health policy



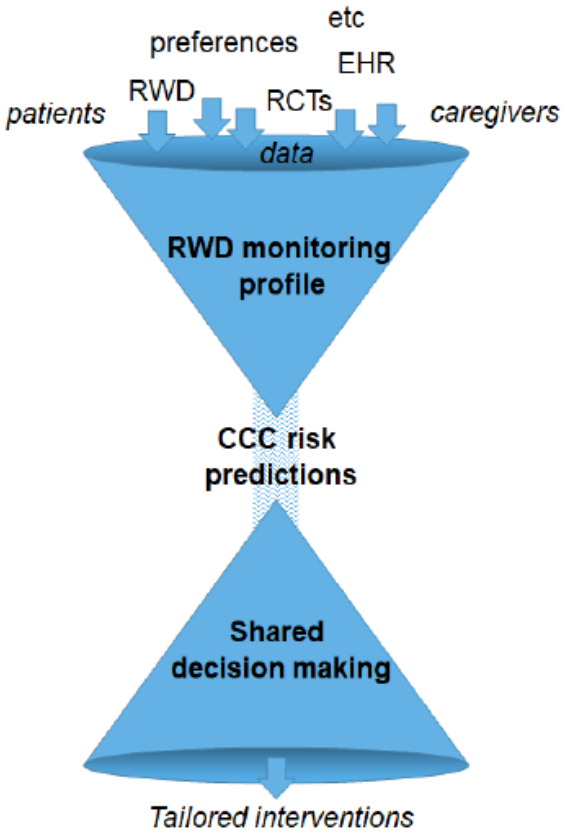


RE-SAMPLE OBJECTIVES

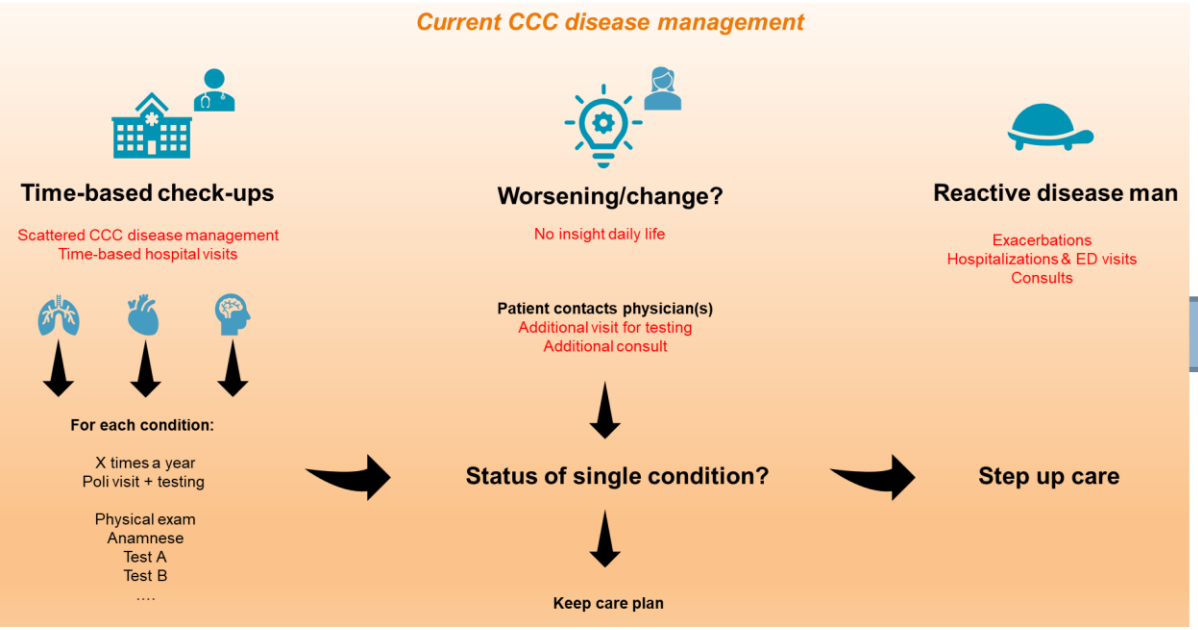
- More (complex) chronic conditions
- COPD high-impact disease (3rd cause of death, exacerbations)
- Long-term complex care, exacerbations detection
- Progression: focus on prevention and lifestyle

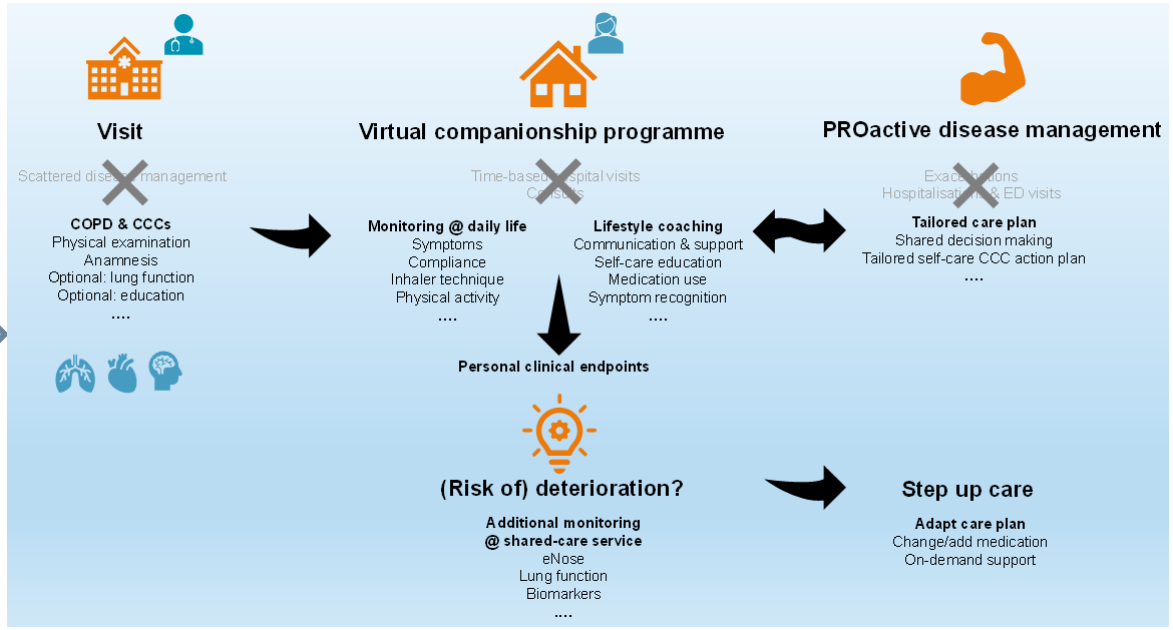
Adaptive, predictive, personalised (self) care needed

To ***identify individual multi-morbid CCC exacerbations and develop tailored referral to a multidisciplinary, adaptive virtual companionship programme*** for patients with COPD and CCCs (i.e. diabetes mellitus, chronic heart failure, ischaemic heart disease, atrial fibrillation, anxiety and/or depression)



EXPECTED IMPROVEMENTS IN CLINICAL WORKFLOW





RE-SAMPLE CONCEPT

1. RWD monitoring ecosystem from heterogeneous, multimodal and changing data sources
2. Real-time personalised prediction of multi-morbid exacerbations
3. Secure and privacy-preserving user data management platform for tailored decision making
4. Virtual companion for personalised interventions in self-care and tailored coaching
5. Cross-care path integrated care system in healthcare

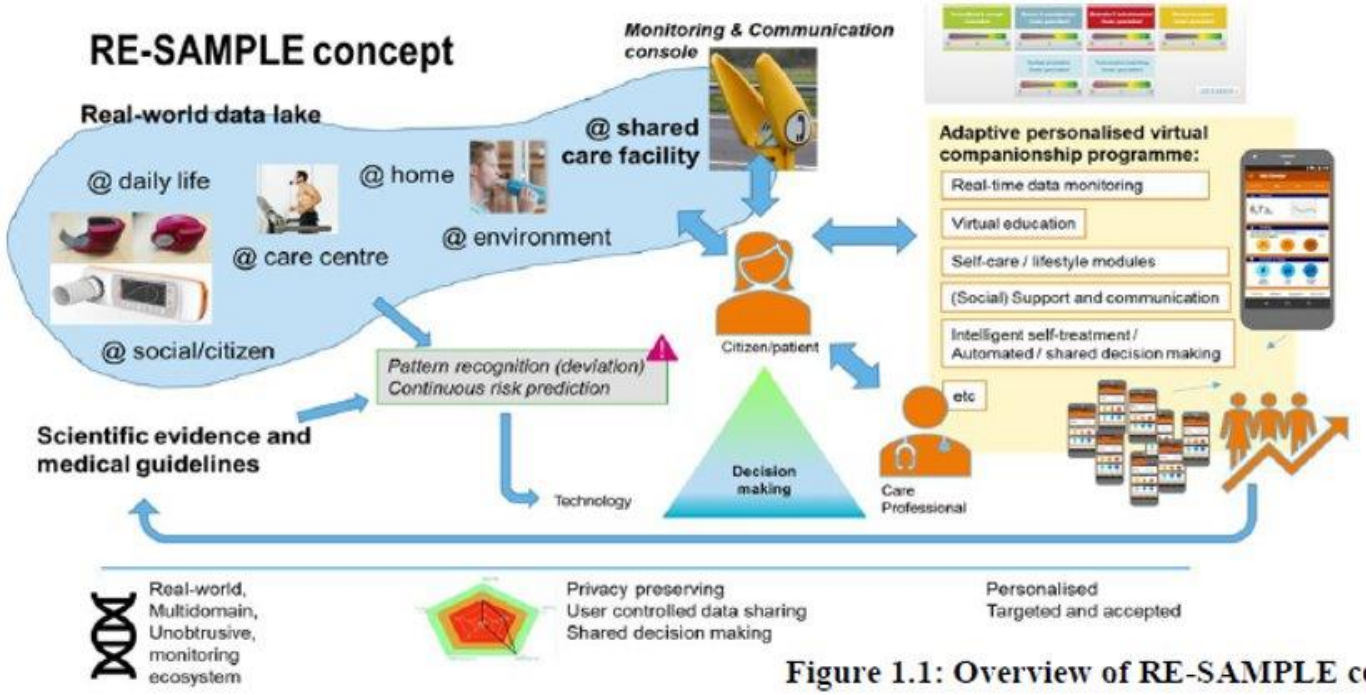


Figure 1.1: Overview of RE-SAMPLE concept

RE-SAMPLE SOLUTIONS PROPOSED

1. RWD monitoring ecosystem from heterogeneous, multimodal and changing data sources
2. Real-time personalised prediction of multi-morbid exacerbations
3. Secure and privacy-preserving user data management platform for tailored decision making
4. Virtual companion for personalised interventions in self-care and tailored coaching
5. Cross-care path integrated care system in healthcare

- Cohort (Prospective multimodal data gathering)
- Secure and privacy-preserving platform
- ML approach to derive clinical endpoints and predictions (federated learning)
- Privacy-preserving ML (multiparty computation)
- Phenotypes of patients for personalized treatment decisions
- Shared-decision-making approach
- Layered approach for tailored lifestyle coaching

RE-SAMPLE RWD COLLECTION

Identify important predictors of exacerbations of COPD patients with comorbidities to improve tailored disease management

1. Knowledge base
   - What is known? (clinical guidelines, literature reviews, **retrospective data**)
   - Who are our users? What are the (clinical) needs? (end-user walkthroughs, interviews, workshops, iterative testing)

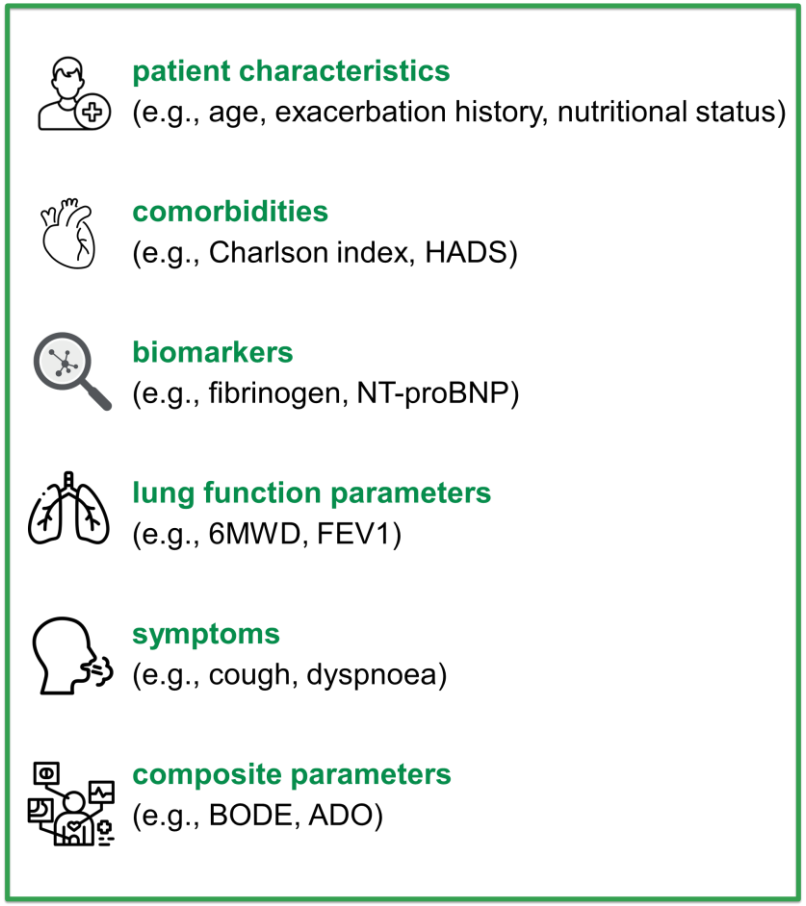
RE-SAMPLE COHORT

2. Multi-center observational monitoring cohort 710 patients in 3 pilot sites

- Healthentia app and cloud used by all patients in all pilot sites
- Multi-modal multi-source data (baseline, daily, deterioration)
  - Questionnaires (Healthentia)
  - EHR (hospitals)
  - Activity (Garmin)
  - Environmental data
- AI service for all patients
- Privacy-by-Design

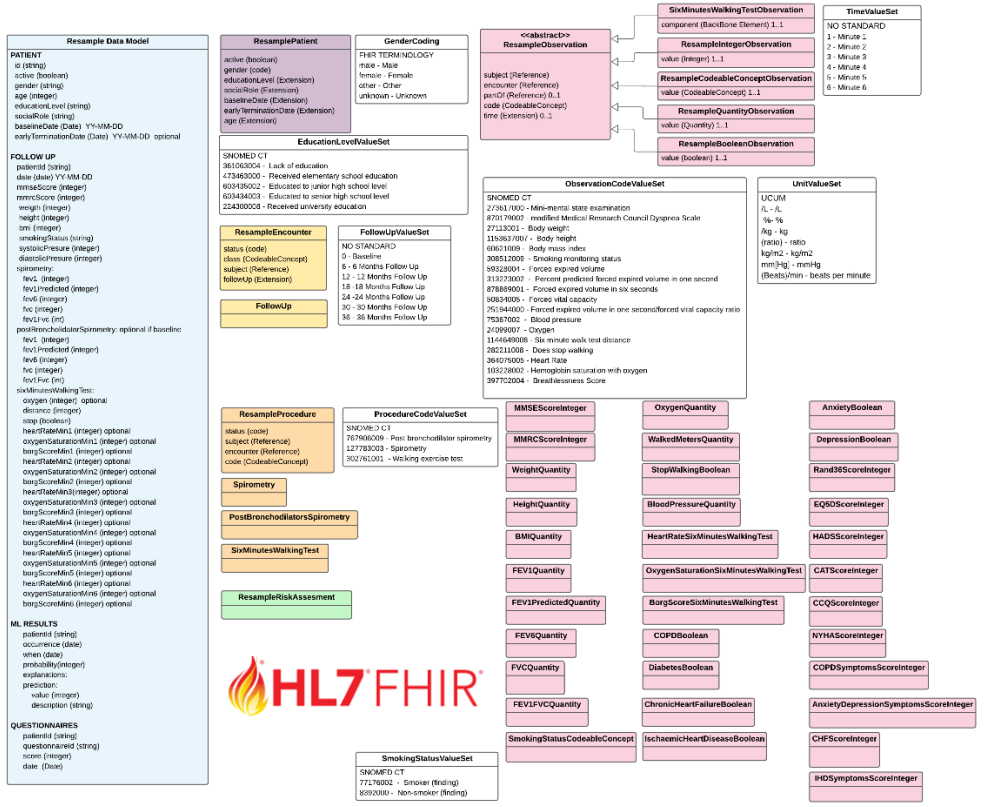
CONTINUOUSLY EVOLVED RE-SAMPLE COHORT

- Multi-disciplinary and iterative approach in focus groups with patients and healthcare professionals from 3 pilot sites
  - Patients and healthcare professionals proposed additional parameters (e.g. fatigue, body temperature)
  - Due to a high participant burden, the number and frequency of questionnaires were reduced



RE-SAMPLE DATA AND DATA FORMAT

- Retrospective Datasets
  - Data previously collected at all 3 pilot sites
  - Alignment and mapping of different formats
- Prospective Datasets
  - Collected during cohort studies at pilot sites
  - Hospital Information System, Healthentia, air quality databases
  - Aggregated in pilot site RE-SAMPLE edge nodes
  - Uniform HL7 FHIR compliant data format



WEBINAR: MeS-CoBraD, RE-SAMPLE, RETENTION

RE-SAMPLE Project Privacy Challenges

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RE-SAMPLE DPO

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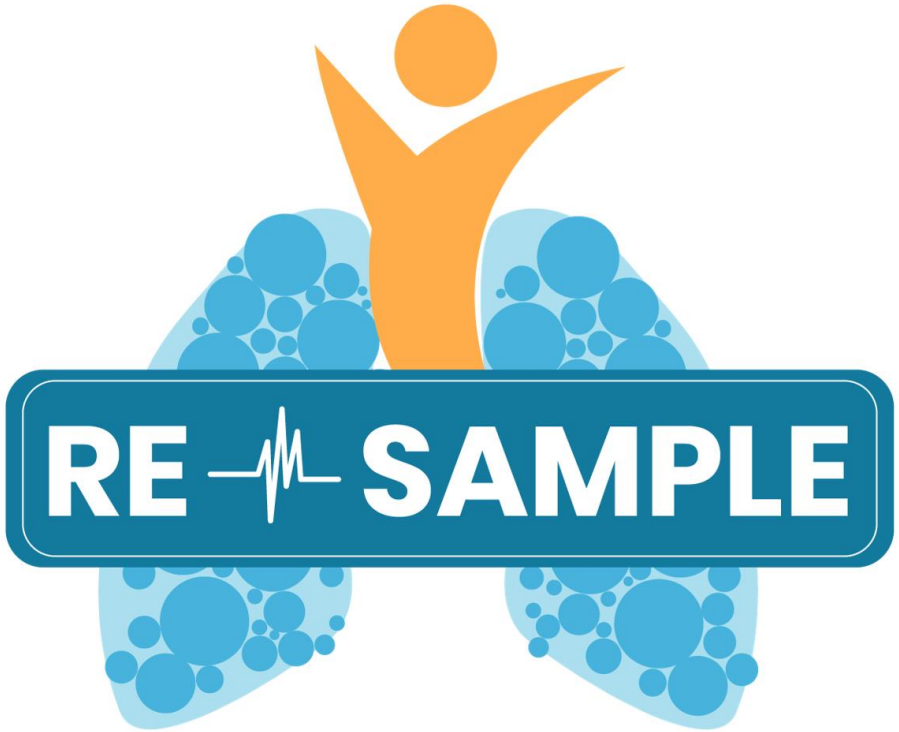

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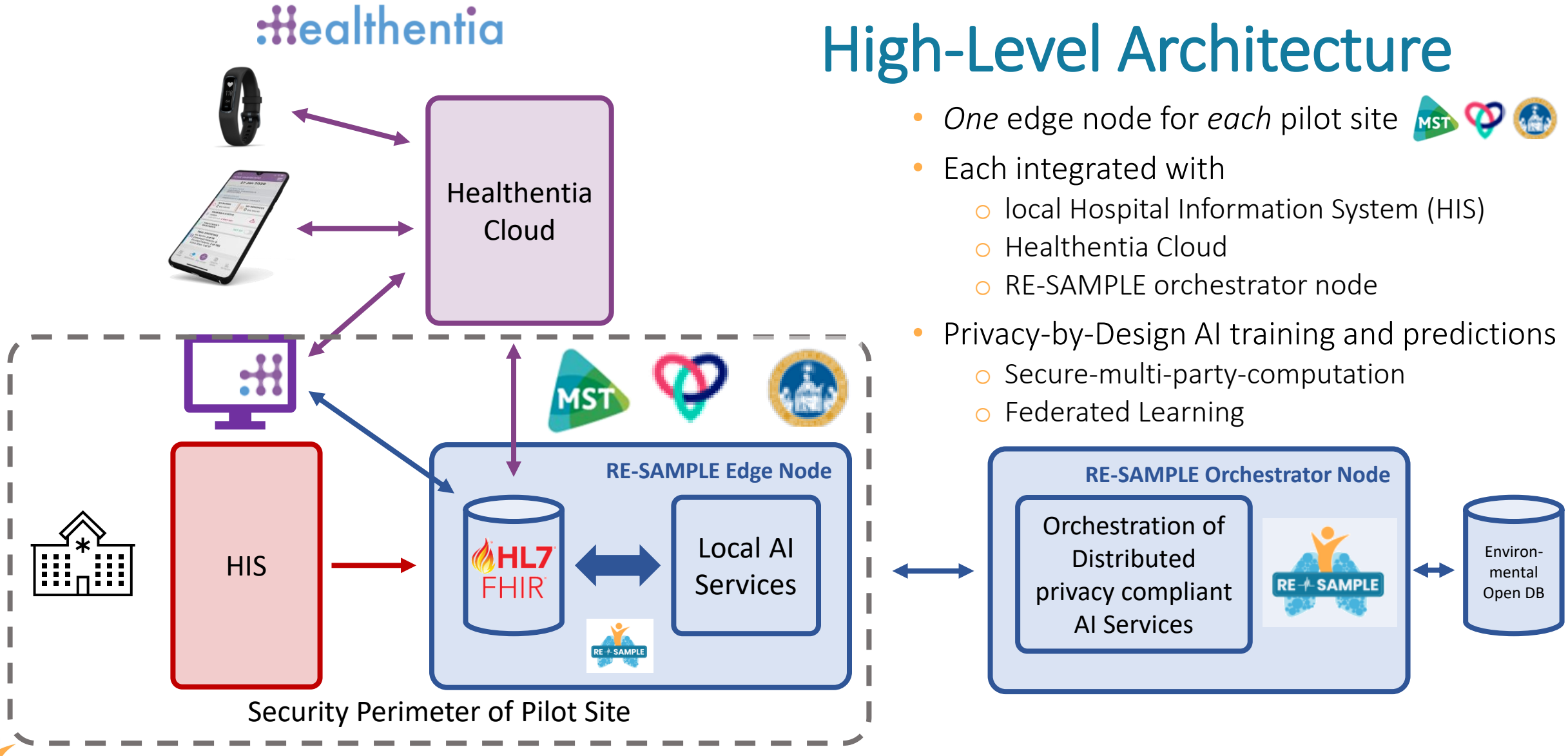
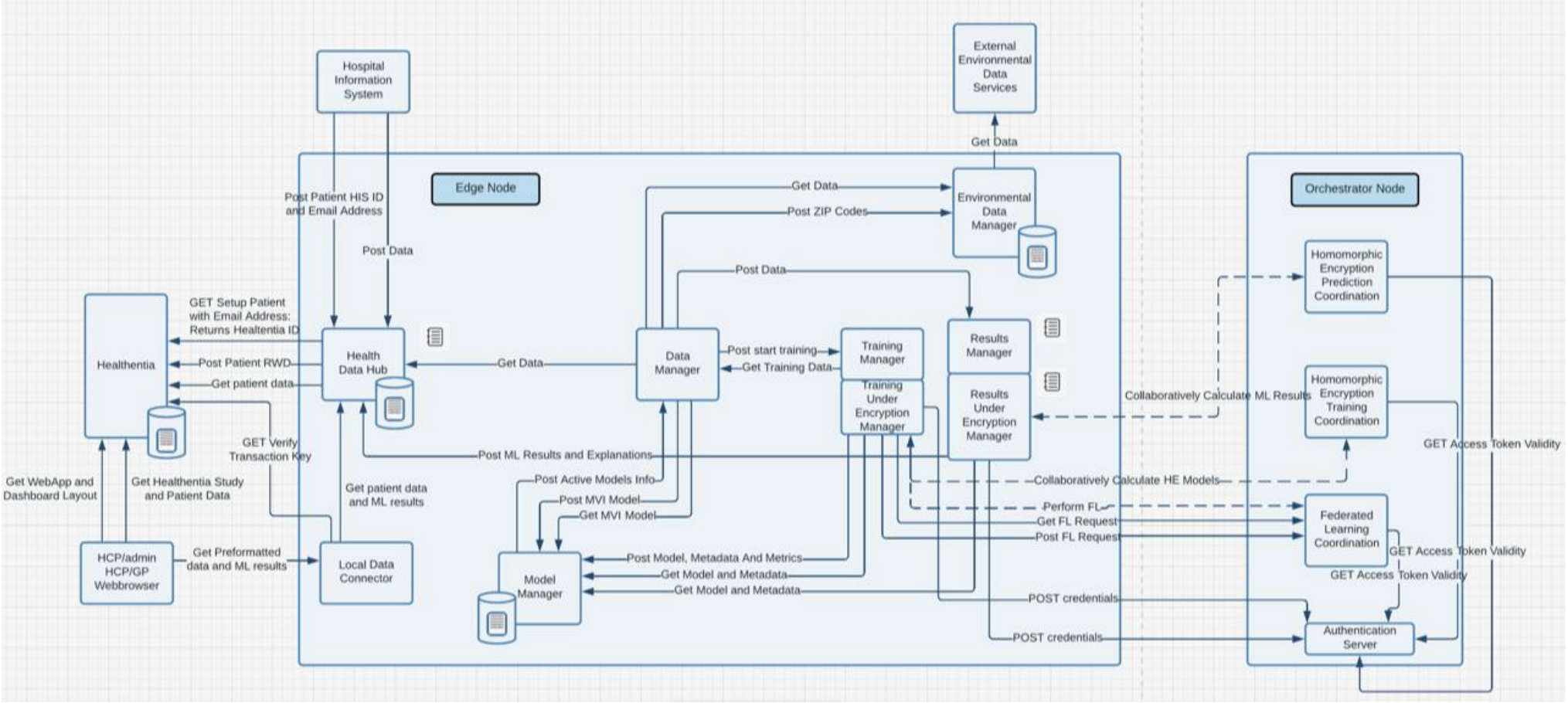
High-Level Architecture

- *One* edge node for *each* pilot site
- Each integrated with
  - local Hospital Information System (HIS)
  - Healthentia Cloud
  - RE-SAMPLE orchestrator node
- Privacy-by-Design AI training and predictions
  - Secure-multi-party-computation
  - Federated Learning

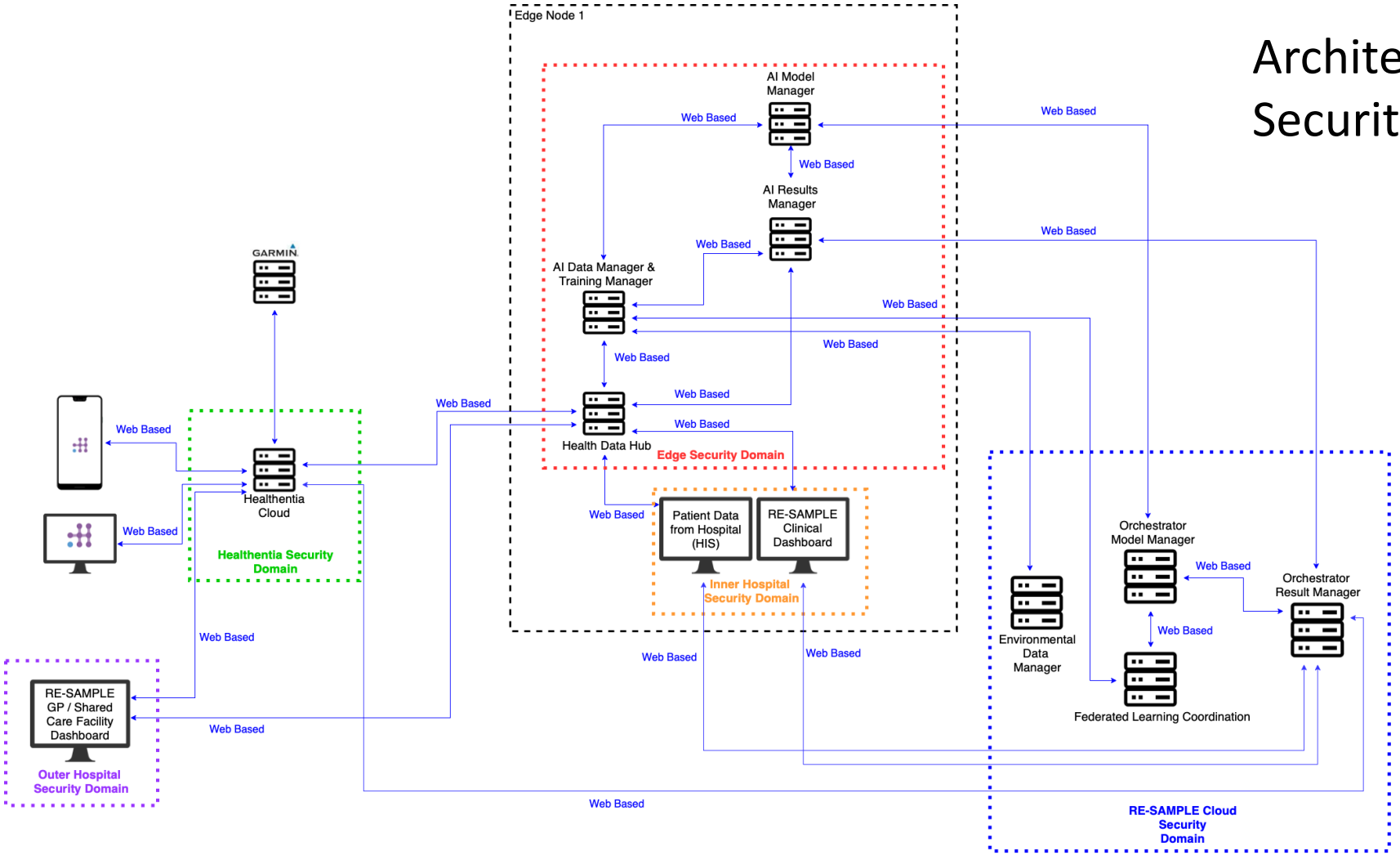


RE-SAMPLE Assets



RE-SAMPLE Security Model

Architecture with Security Domains



RE-SAMPLE Security Model

- Authentication and authorization mechanisms
  - Machine-2-Machine, User-2-Machine
  - Based on the **Oauth 2.0 and OpenID Connect (OIDC) protocols**
  - Development of a **RE-SAMPLE Role Based Access Control policy**
- De-identification: objectives
  - Patients' pseudonyms (HIS, Healthentia) visible at the interfaces of the Edge Nodes are never stored in the data in the Edge Node
  - Patient pseudonyms and location-related information never part of training datasets
- Hospital Security Perimeter Compliance
  - No incoming connection requests into hospital security perimeters
  - Only outgoing connection requests from edge nodes to Healthentia / Orchestrator node

Facts

- Multiple partners collect different types of data
- Data are collected from different sources
- Partners not directly involved in data collection tasks require additional information for training ML models

- Data collected need to pair with:
  - The intended RESAMLE functionality (user requirements, functional requirements)
  - The RESAMPLE architecture
  - The requirements written in the proposal as the minimum goals that RESAMPLE should fulfil
  - What hospitals can offer (data types) in order to satisfy specific requirements

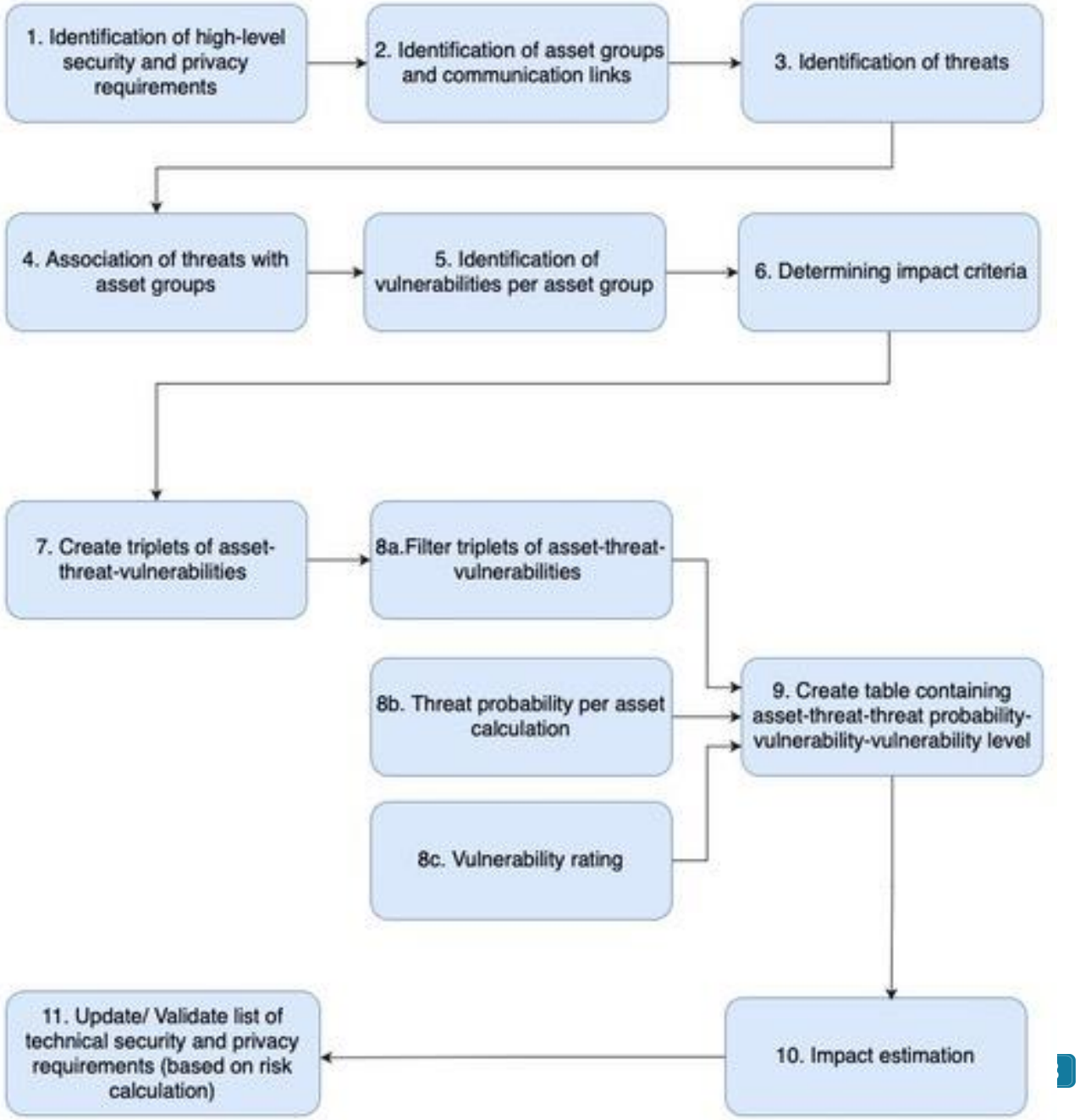
GDPR Compliance – Internal Agreements

- Customised Consent Forms
- Satisfaction of legal, organisational and technical security and privacy requirements during
  - **design and the development stages of all platform components** (GAP analysis, DPIA, Risk Analysis)
  - all intermediate studies with user related requirements (user requirements, retrospective data analysis, cohort study)

Currently 3 signed agreements

- Purpose of Processing:
  - Identify predictors and parameters of COPD and CCC progression and multimorbid CCC exacerbations
  - ***Retrospective*** data of patients with COPD w/o CCC
  - A Joint Controllership Agreement (JCA) between the clinical partners
- Purpose of Processing:
  - Identify predictors and parameters for COPD and comorbid disease progression and multimorbid exacerbations
  - ***Retrospective*** patient data and ***prospective*** data from real-world data collected with questionnaires, diaries, and sensoring, clinical data
  - Data Processing Agreements (DPA) between the clinical partners and Technical Partners
- Purpose of Processing:
  - Identify predictors and parameters for COPD and comorbid disease progression and multimorbid exacerbations
  - ***Prospective*** real-world data collected with questionnaires, diaries, and sensoring
  - Data Processing Agreements (DPA) between the clinical partners and Healthentia

Risk Analysis



Open Data – Paths suggested

- **We offer anonymized data for a specific purpose of processing ONLY!** In this case we must have informed consent from each patient that allows us to CONDUCT the anonymization and OFFER the anonymized data for the specific purpose of processing. For safeguarding even more the patients' privacy rights, we can grant access to the anonymized data after an access request in the sense that every request is examined and fulfils the defined purpose of processing!
- **We offer anonymized data upon request.** In this case we don't have a specific purpose of processing but we examine each access request individually. In that case we need to take the informed consent of every patient before we conduct the anonymization and grant access of the data to the interested parties. As you understand in this case, we need a separate informed consent from every patient for every access request!

Open Data

- To our understanding **each Hospital will decide what data will provide** (as open data) **and for what purposes**. As such, each clinical partner should go ahead and define the "purposes of processing" for which the anonymized data can be provided to a third party (this set of purposes may be different for each clinical partner).
- **Each clinical partner will be responsible for conducting the anonymization** of the data that will offer.
- **Each clinical partner will be responsible to include a statement** (regarding anonymization and open data) **in the informed consent for the patients** (if all the above are correct and agreed, we will help preparing this statement).
- **The technical partners should neither provide any open data nor should be involved in the anonymization of the data.**

Thank you for your attention!

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