



Integration and analysis of heterogeneous big data for precision medicine and suggested treatments for different types of patients.



<http://project-iasis.eu>



@Project_IASIS

iASiS: Big Data to Support Precision Medicine and Public Health Policy

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SC1-PM-18-2016: Big Data supporting Public Health policies

iASiS Basic Facts

- Title: Integration and analysis of **heterogeneous big data** for **precision medicine** and suggested **treatments** for different types of patients
- Topic: H2020-SC1-PM-18-2016 - Big Data supporting Public Health policies
- Contract No.: 727658
- Budget: € 4.3M



Motivation

- Epidemiological data analysis is not sufficient for public health policies in the era of personalized/precision medicine
- We also need explanations, e.g. why a treatment ought to work better for one type of patient than another
- Therefore, we need to combine **breadth** (across a population) with **depth** (e.g. personal genome) in the analysis
- Big data analysis can address both breadth and depth, under the appropriate framework. **That's iASiS!**



Vision and Objectives

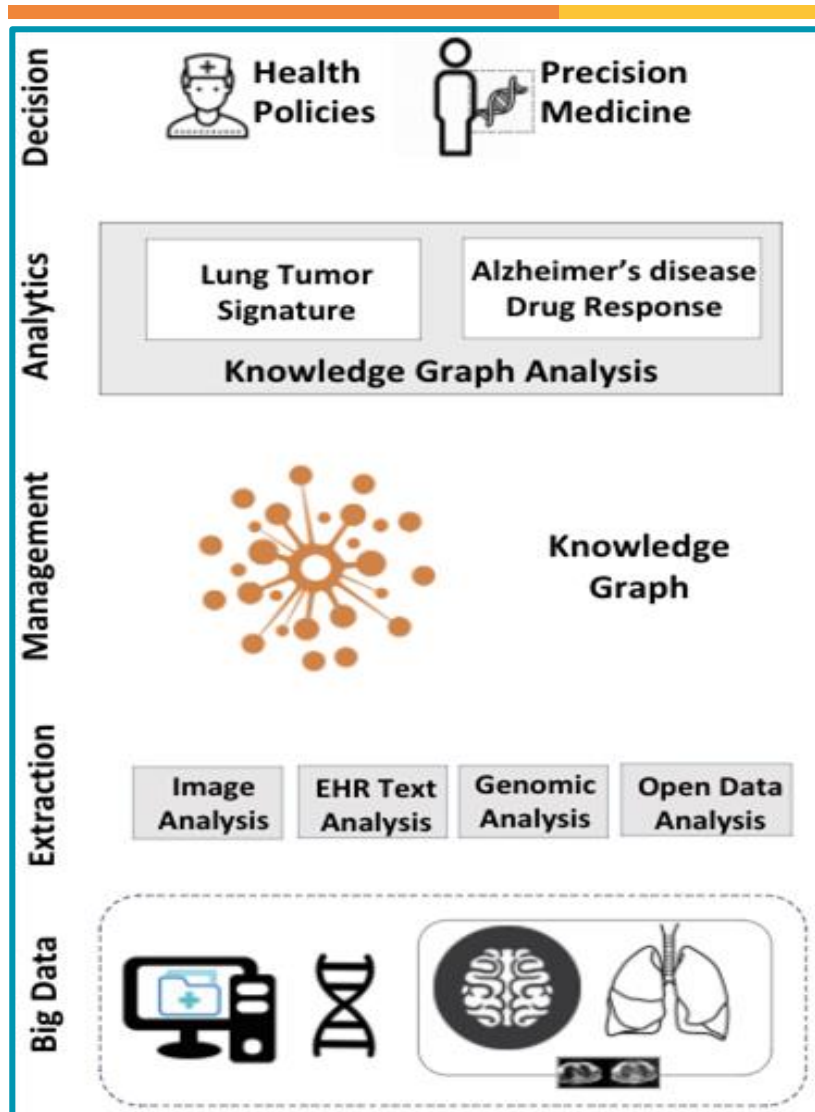
iASiS Vision:

Turn clinical, pharmacogenomics, and other **Big Data** into **actionable knowledge** for personalized medicine and health policy-making

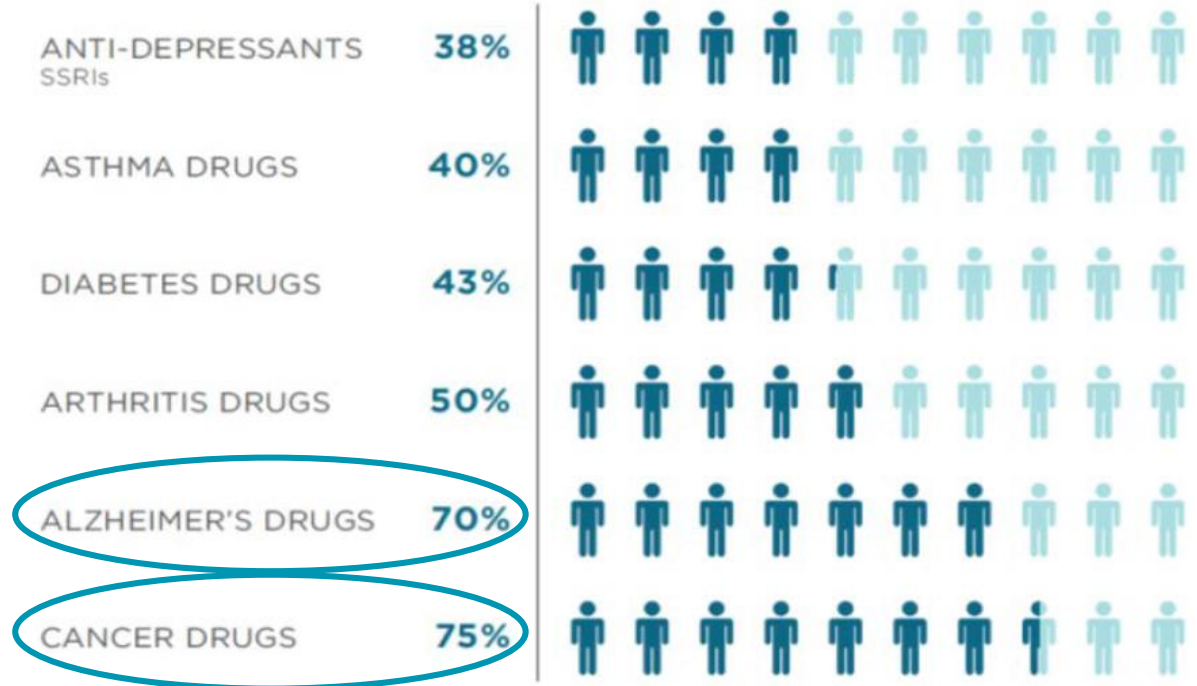
iASiS Objectives:

- Integrate automated **unstructured** and **structured** data analysis, **image** analysis, and **sequence** analysis into a **Big Data** framework
- Use the iASiS framework to support **personalized diagnosis and treatment**

The iASiS Framework

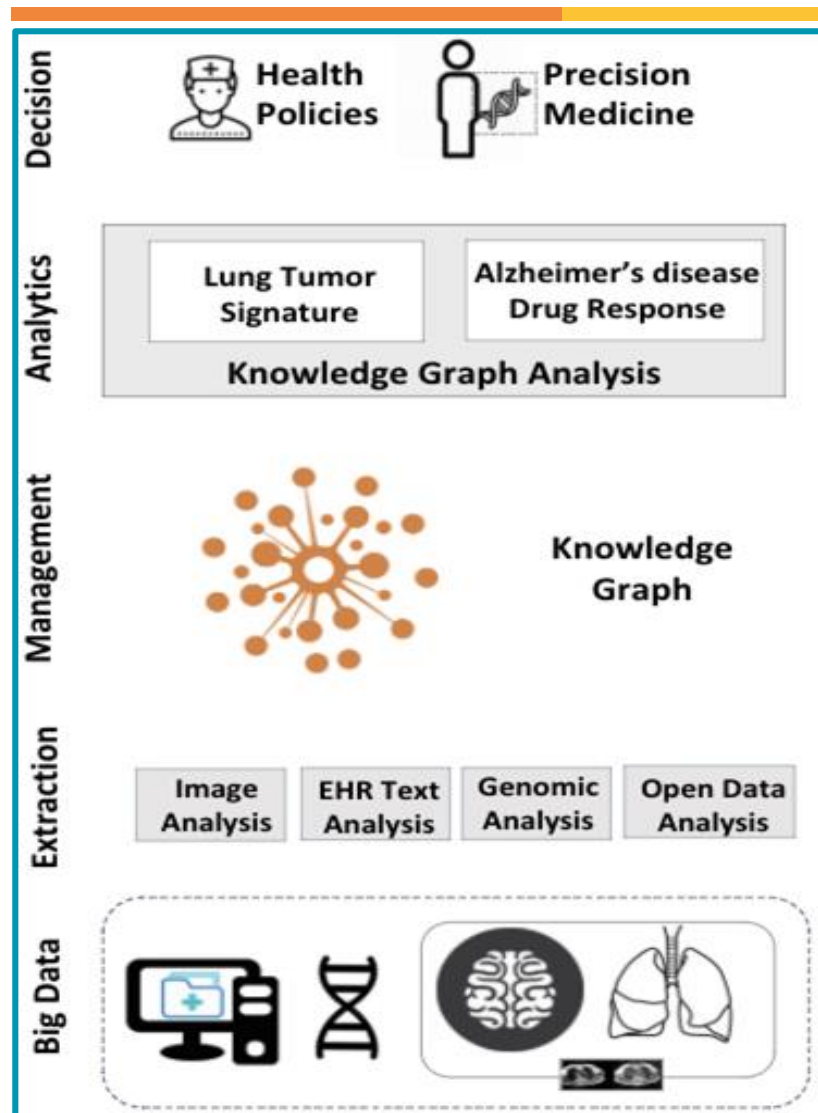


- General-purpose drugs are often ineffective



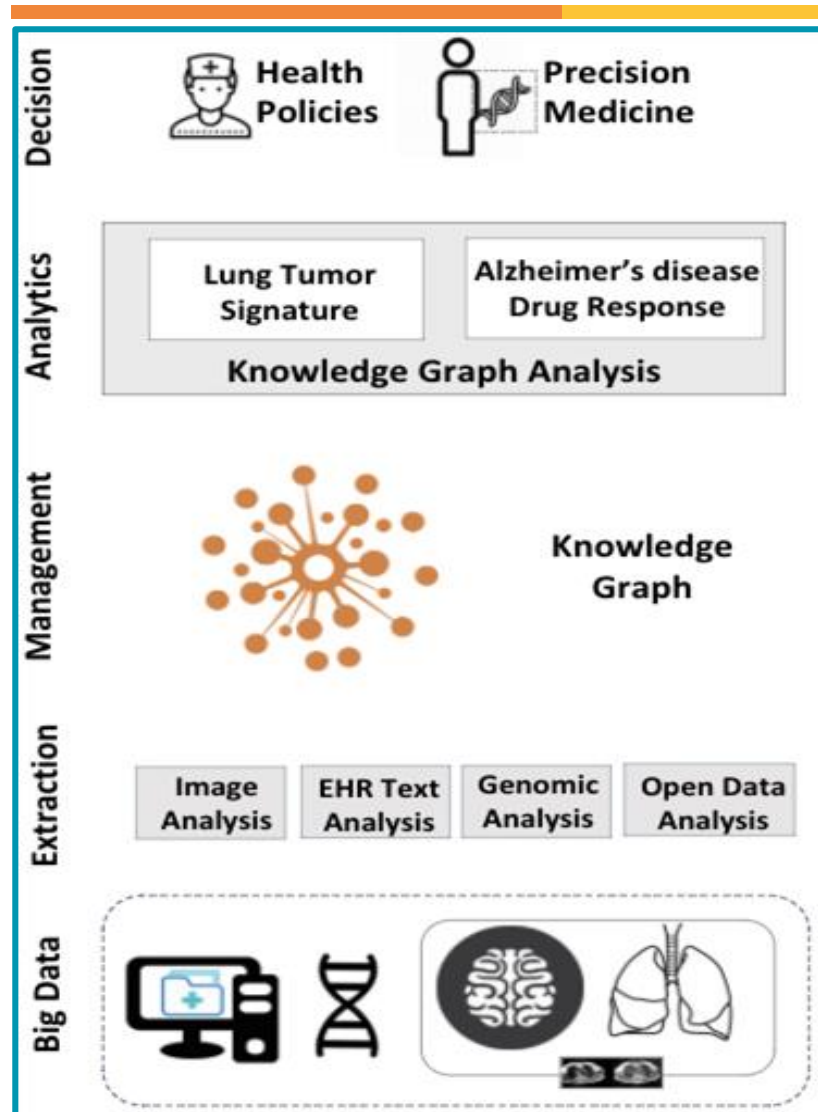
- iASiS will enable clinicians, medical researchers and health policy makers to deliver **personalized treatments** to patients

The iASiS Framework



- iASiS **analyzes:**
 - EHRs (English & Spanish)
 - MRI & PET/CT images
 - Genomic data (e.g. liquid biopsy samples, GTEx)
 - Related bibliography (e.g. PubMed)
 - Biomedical databases (e.g. DrugBank)
 - Biomedical ontologies (e.g. Do, GO, UMLS)

The iASiS Framework



- Extracted knowledge is fused in the iASiS **knowledge graph**
 - Unified semantic schema
 - Linked data
 - Machine-processable knowledge
- iASiS **end-users can:**
 - Receive answers along with justifications
 - Identify patterns in patient populations
 - Make informed decisions
- All steps of data management and analytics enforce **privacy** and **access control**

Lung Cancer Pilot

Motivation:

- Lung cancer among the **most**
 - common and **deadly** diseases
 - **costly** cancers
- Lung cancer is a **heterogeneous** disease. Characteristics differ among
 - **patients**
 - **tumor regions**

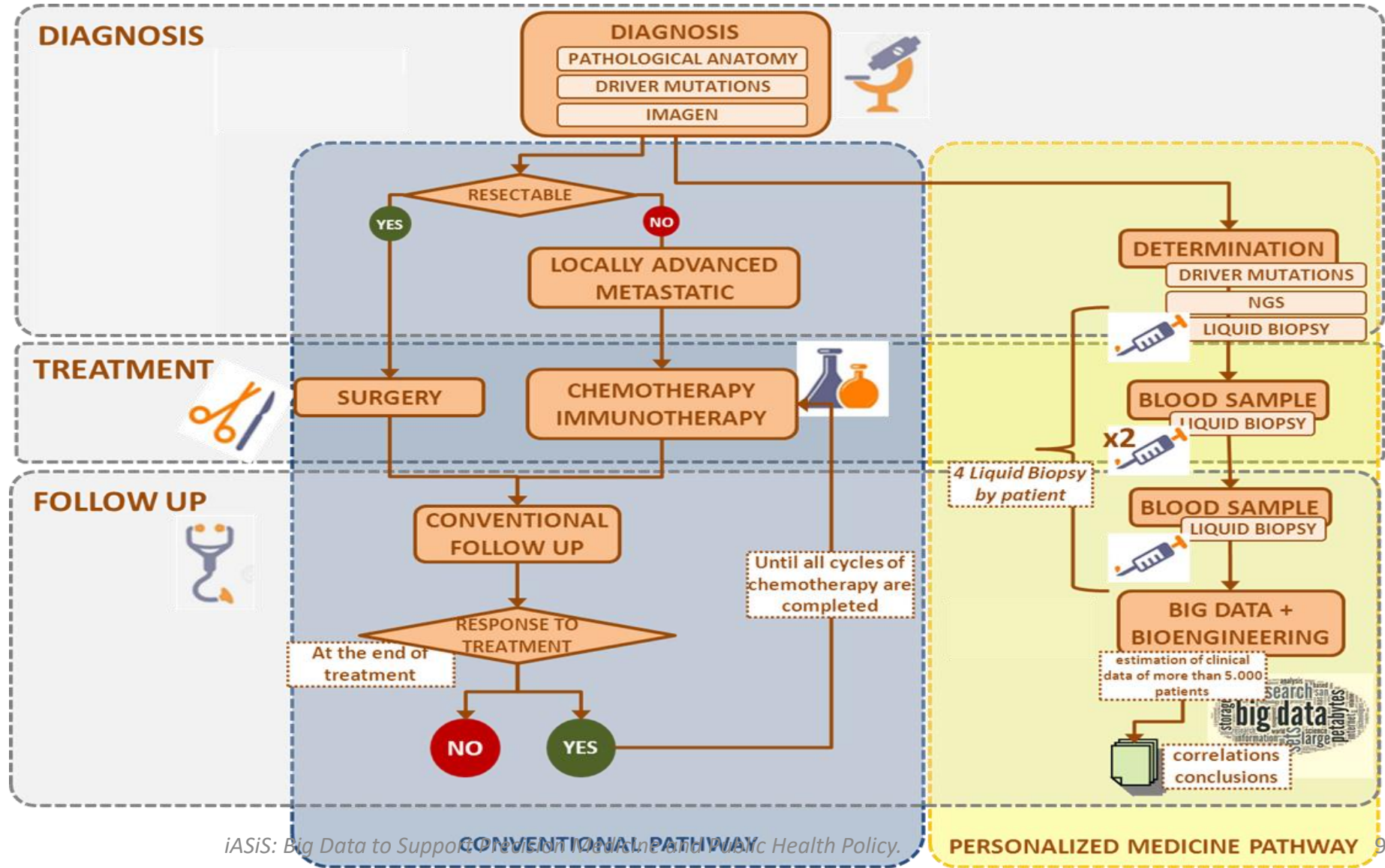
iASiS will enable:

- **Discovery** of correlations among **tumor** spread, prognosis, response to treatment
- **Unraveling** molecular mechanisms that predict response to different **tumor types (signatures)**

iASiS Usage for Lung Cancer

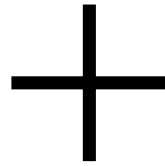
AIM - Rapid translation of findings into clinical practice in order to aid:

- Early detection
- Detection of sensitive populations
- Development of new therapies with less toxic effects
- Prediction of developing secondary malignancies and toxicities

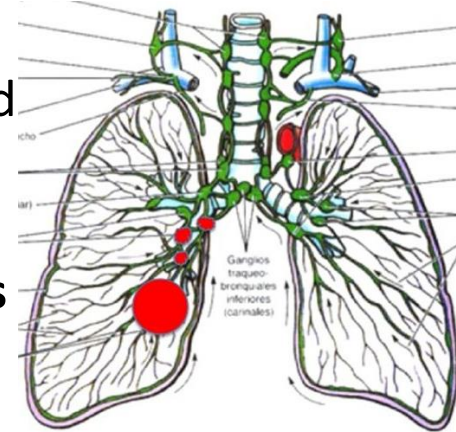


Lung Cancer Pilot Data

- EHRs in Spanish
- PET/CT Images
- Genomic Data/Liquid Biopsy Samples



- Pharmacological knowledge extracted from **publicly available datasets**
- **Biomedical ontologies and taxonomies**
 - terminology standardization
 - semantically describing the EHRs



iASiS: Big Data to Support Precision Medicine and Public Health Policy.

Alzheimer's Disease Pilot

Motivation:

- Approximately, **10% of people** over 65 suffer from Alzheimer's
- **Heterogeneity** of the symptoms **impedes** accurate diagnosis and treatments

iASiS will enable:

- **Discovery** of patterns **associated with** prognosis, outcomes and response to treatments
- **Association** of **medical** and **lifestyle** advice to Alzheimer's **risk** and stages of **severity**

iASiS Usage for Alzheimer's Disease

- iASiS users ask:
 - How many Alzheimer's patients have genetic maternal/paternal family history?
 - Are there comorbidities in the context of family history and genetic determinants?
- Heterogeneous data get integrated and analyzed
- Support is provided for the correlation of Alzheimer's with family history and comorbidities
- Users plan procedures for the earlier diagnosis of Alzheimer's disease



Alzheimer's Disease Pilot Data

- EHRs in English
 - MRI Brain Images
 - Genomic Data
- +
- Pharmacological knowledge extracted from **publicly available datasets**
 - **Biomedical ontologies and taxonomies**
 - terminology standardization
 - semantically describing the EHRs



CRIS
NETWORK



Beyond Data Analysis

- iASiS handles **sensitive patient data** from hospitals: EHRs, MRI and PET/CT images, blood and liquid biopsy samples
- Ethics Committee led by **external advisor** to oversee the adherence to rules, regulations and patient consent per data source
- Data management plan using **FAIR principles** and corresponding tools
- Data **access control**, including anonymization, hardware and software protection, regulated access

How the Community can contribute?

- **Datasets** about Lung Cancer or Alzheimer's patients
 - **Clinical record** data, **images** related to clinical records, and **genomic** data
- **Vocabularies/Terminologies** to annotate the data
- **Data analytics tools** to semantify the data and uncover patterns related to Lung Cancer and Alzheimer's disease
- **Related efforts**

iASiS Partners



iASiS: Big Data to Support Precision Medicine and Public Health Policy.

iASiS Organizes...

Big Data for Precision Medicine Symposium

When: 11 July 2018

Where: NCSR Demokritos Campus, Athens, Greece



NATIONAL CENTRE FOR
SCIENTIFIC RESEARCH "DEMOKRITOS"

Thank you!

