



SYNDERAI – European Synthetic Data for the European Health Data Space

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HL7 Europe / HL7 Germany



SYNDERAI

Synthetic Data Examples – Realistic – using AI



SYNDERAI

Synthetic Data Examples – Realistic – using AI



Synthetic Data? Why?

PHASE
I

- Synthetic Data: Examples – Realistic – using AI (SYNDERAI) pronounced /'sɪndərəɪ/
- Synthetic Data Examples seen in
 - **testing** and **validation** (e.g. industry proofs, connect-a-thons etc.)
 - in **education**
 - in further **implementation support** for vendors

PREAMBLE

Embracing the
Foundation



SYNDERAI and the xShare Project

PHASE
I

- xShare Project Work Package
 - Project funded by the European Commission (7.8 Mio €)
 - Contributed to the advancement of HL7® FHIR® Implementation Guides (HL7 EU realm)
 - Toolbox supports proper implementation of the European Electronic Health Record exchange Format (EHRxF)

PREAMBLE

Building the
Foundation



European Health Data Space (EHDS) Priority Categories



European
Patient
Summary



Laboratory
Report



(Hospital)
Discharge
Report



Medication
Prescription +
Dispense



Imaging Report



HL7® FHIR® Implementation Guides – hl7.eu/fhir

SYNDERAI Foundational Design

- SYNDERAI datasets are designed to ...

**represent
realistic clinical
scenarios**

including medications,
allergies, problems,
encounters, vital signs,
depending on the
covered use case

**be conformant
with HL7 FHIR
Implementation
Guides**

including IPS/EPS, EU
Laboratory Report,
Discharge Summary,
Medication Prescription
and Dispense, Imaging

**use realistic but
not real patient
data**

ensuring safety in both
development and
demonstration
environments

SYNDERAI

Synthetic Data Examples – Realistic – using AI



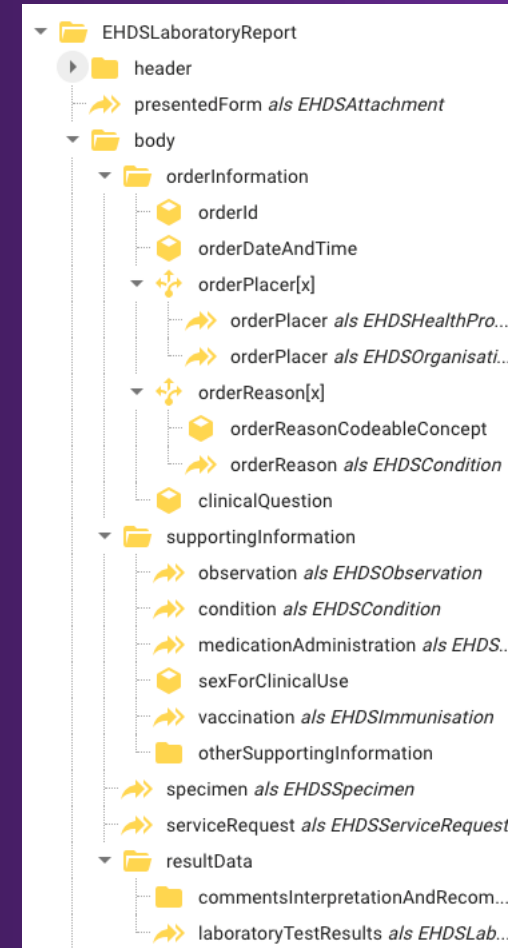
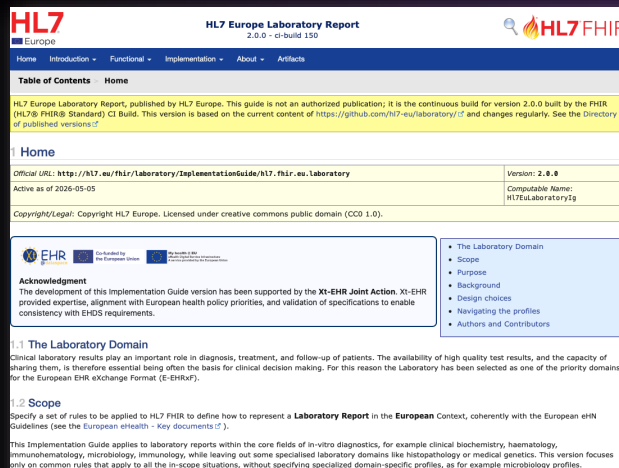
#1 Artifact: EU Laboratory Report

PHASE
II

- EHDS Lab Reports were the first synthetic artifacts
- Starting October 2024, one per “fake” patient

START

Starting with
Lab Report



Generating Lab Reports

PHASE
II

- Testing, collecting and pre-compiling meta data
- Pairing clinical stories and demographics data using stratification
- Processing synthetic patient's clinical stories
- Emitting FHIR / FSH



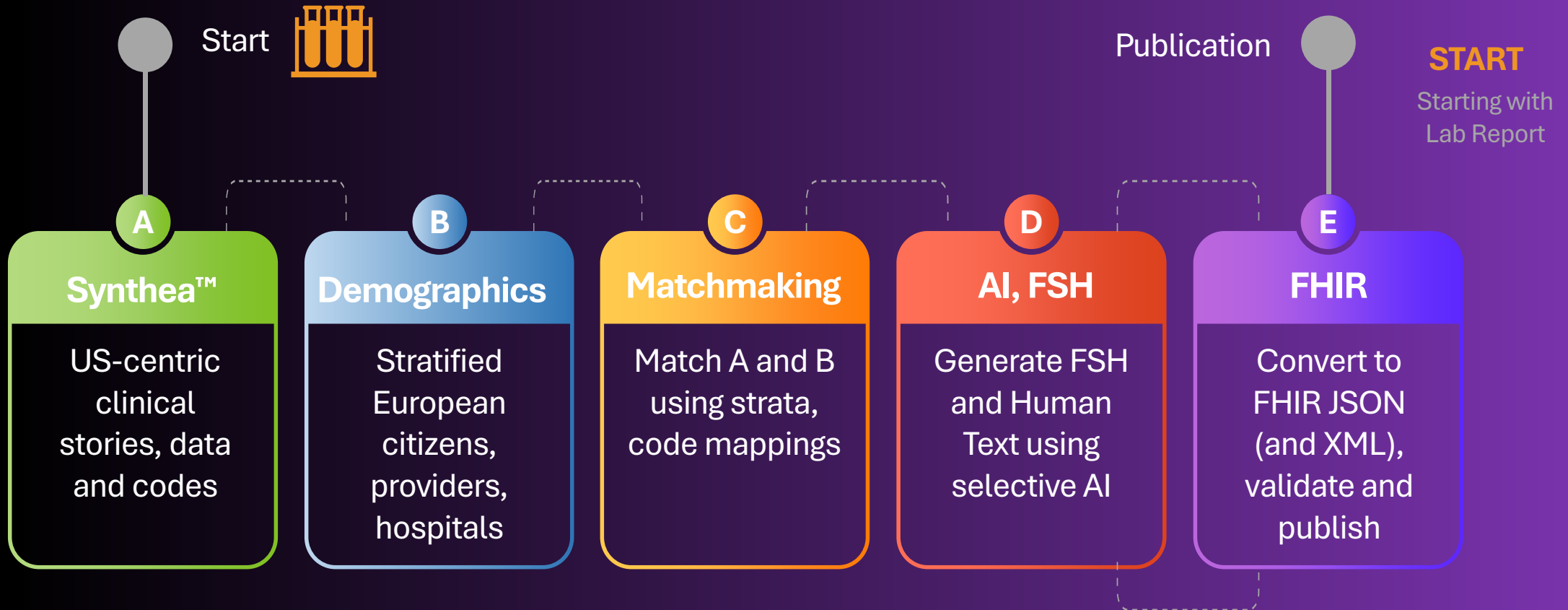
START

Starting with
Lab Report



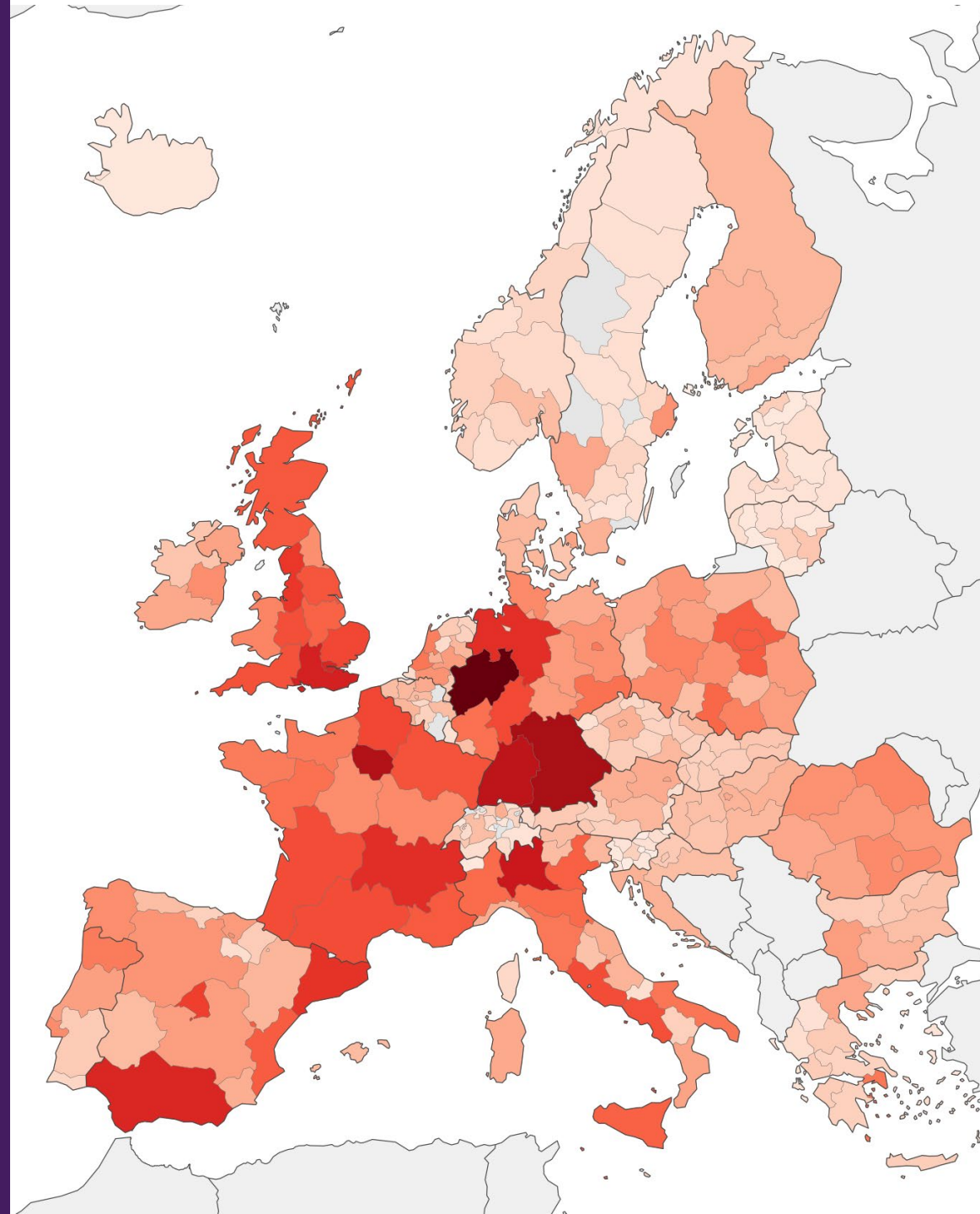
SYNDERAI Synthetic Data Generation

PHASE
II



European Synthetic data

- Synthea™ (Mitre)
 - US American set of synthetic data / clinical stories
 - US coding systems, e.g. RX Norm
- European Citizen Dataset
 - with addresses, contacts, closest primary provider / hospital
 - Stratified with at least gender, age
 - 172 European regions, relative population density



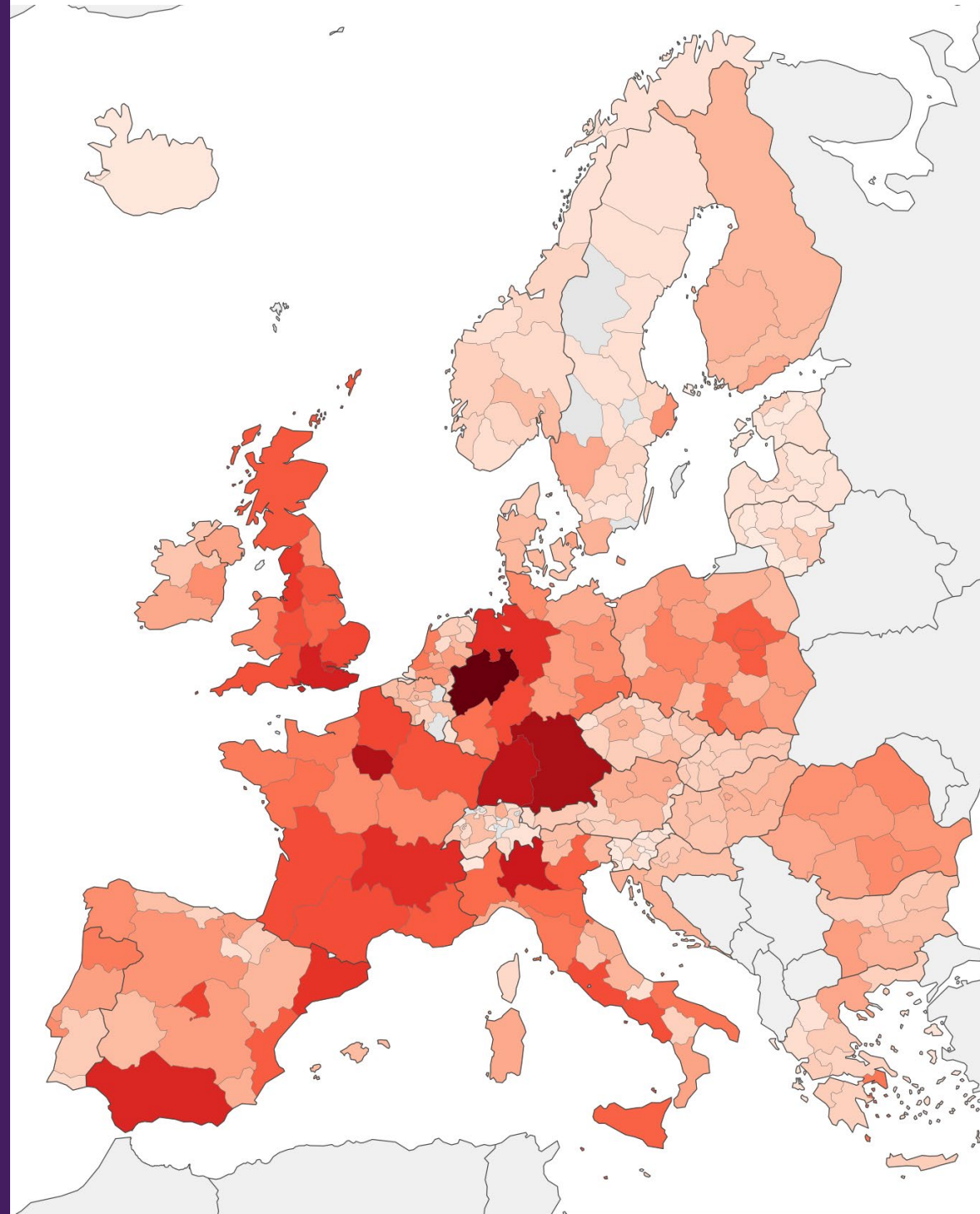
European Synthetic data

- Match Making
 - Find matches of EU Citizen with Synthea set with similar age, same gender etc.
- SYNDERAI geo-location of the synthetic patients + providers
 - Geo-proximity

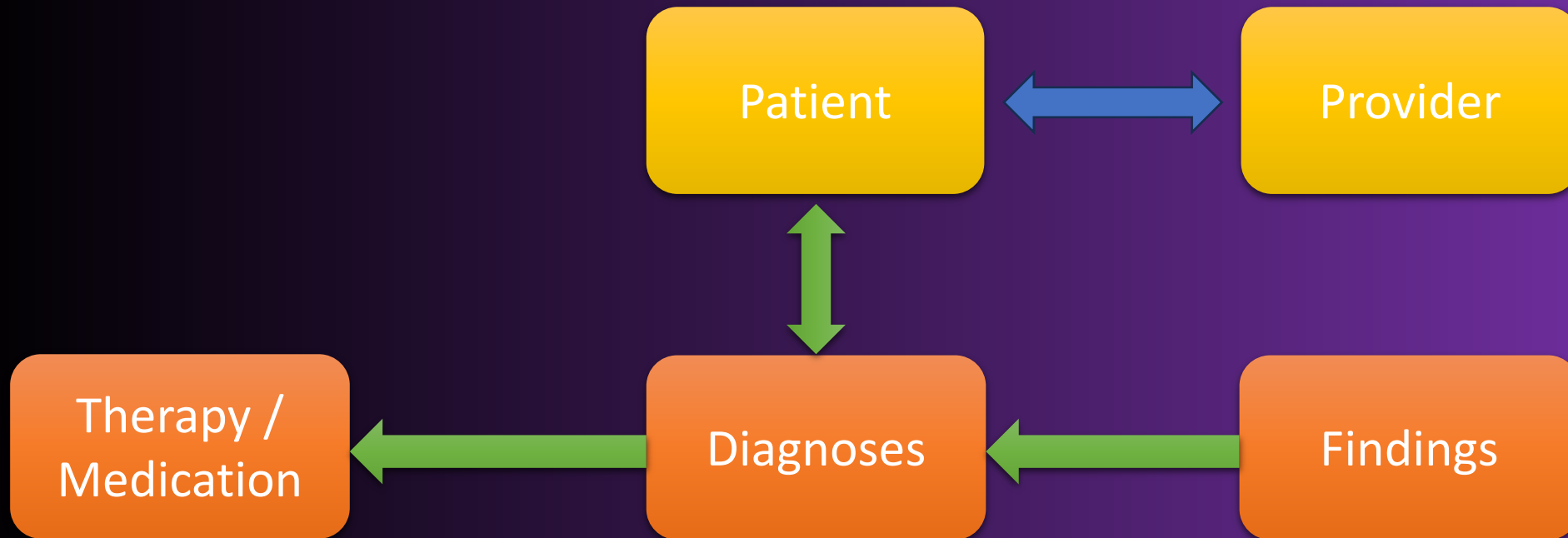
Patient



Provider



European Synthetic data

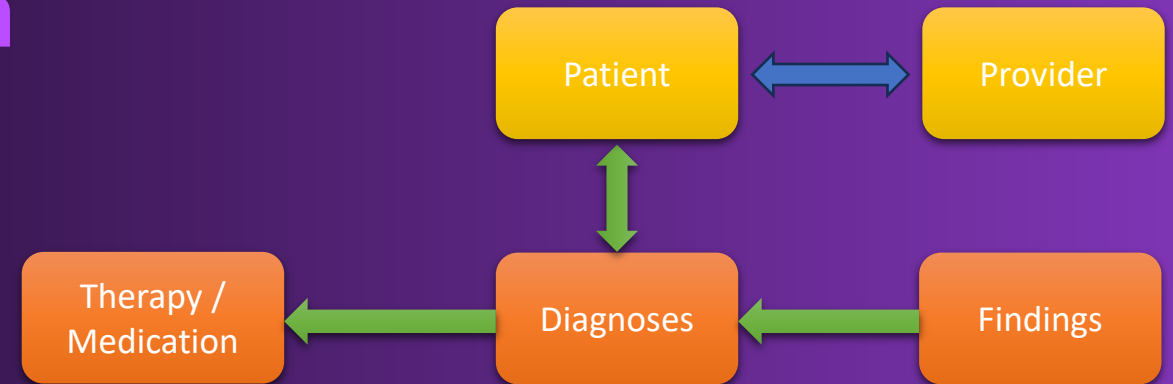


- Demographic stratification, mapping to a clinical “story” or even a Persona



European Synthetic data

- Laboratory Report was first
- Other categories followed
- Example of using AI: generate the stratified, clinically expected, realistic reference ranges for lab values



Chemistry

Test	18 Nov 2024	Reference Range	Unit
Glucose [Mass/volume] in Blood	71.0	70 - 99	mg/dL
Urea nitrogen [Mass/volume] in Blood	16.2	7 - 26	mg/dL
Creatinine [Mass/volume] in Blood	3.0 H	0.9 - 1.3	mg/dL
Calcium [Mass/volume] in Blood	9.3	8.5 - 10.5	mg/dL
Sodium [Moles/volume] in Blood	143.3	135 - 145	mmol/L

Synthetic Data Example Categories



Laboratory Report

**50 synthetic patients with
1432 HL7 FHIR example
instances of the European
Laboratory Report
(LAB)
(Package 2.0.0+20260318)**

...

...

SYNDERAI

Synthetic Data Examples – Realistic – using AI



Patient Summaries and more

PHASE
III

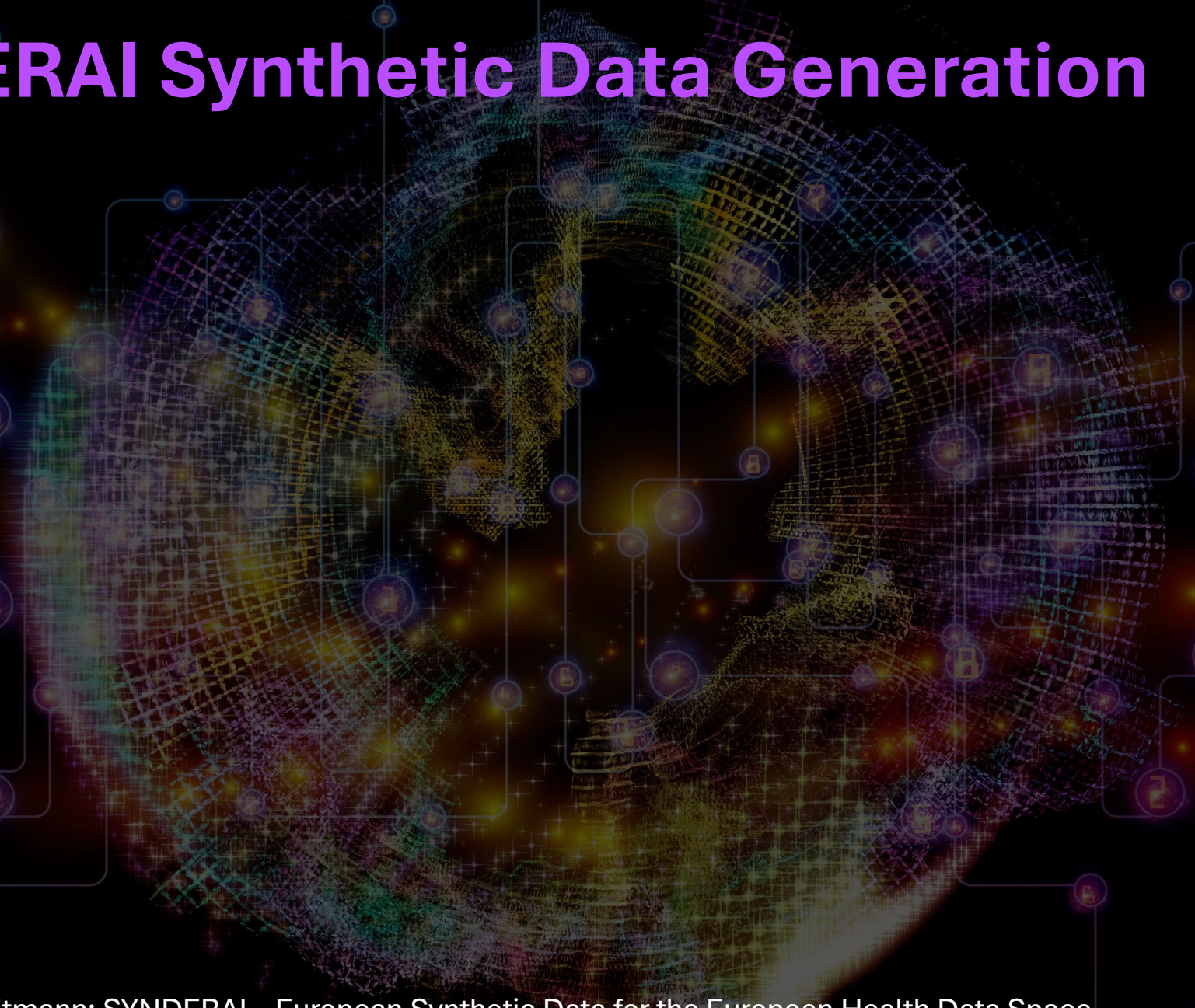
- Extending the generation process to other priority data categories
- Enhanced validation of created artifacts
- Connectathon IHE Europe / HL7 Europe (Plugathon)
- Building the pipeline from compile to publish

ARTIFACTS

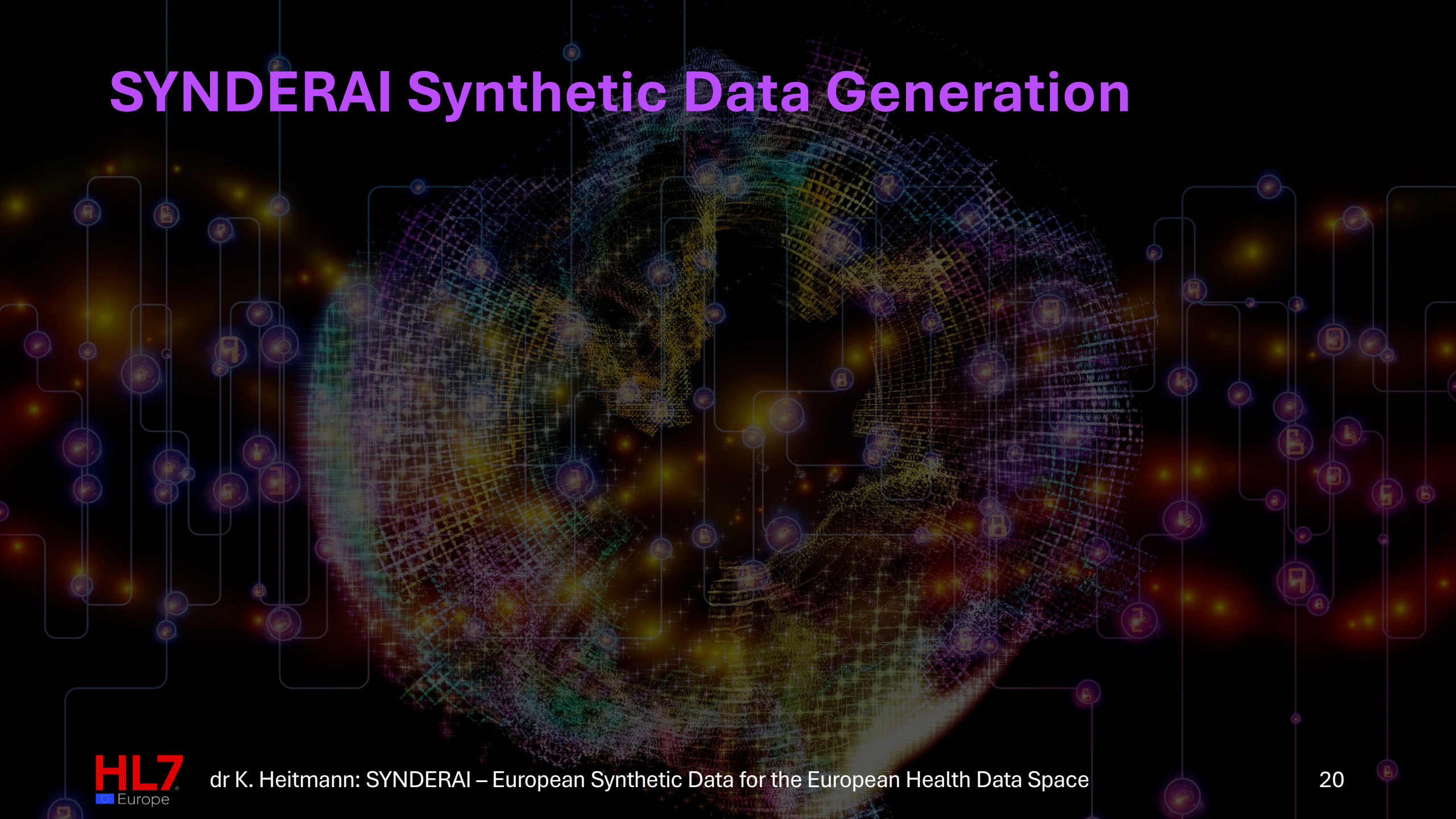
Unveiling Patient Summaries ... +



SYNDERAI Synthetic Data Generation



SYNDERAI Synthetic Data Generation



SYNDERAI Synthetic Data Generation

 EU PS (Bundle)
Franka Grein Groth (34) 
 
25-Sep-2022 [View](#) [JSON](#) [XML](#)

 EU PS (Bundle)
Tom Hayward (51) 
 
17-Jul-2025 [View](#) [JSON](#) [XML](#)

 EU PS (Bundle)
Gioffre Redi (48) 
 
09-Jun-2025 [View](#) [JSON](#) [XML](#)

 EU PS (Bundle)
Mohammed Kronenberg (88) 
 
15-Feb-2023 [View](#) [JSON](#) [XML](#)



Synthetic Data Example Categories

- Per patient one EPS, several to many LAB and some HDR



Laboratory Report

50 synthetic patients with
1432 HL7 FHIR example
instances of the European
Laboratory Report
(LAB)
(Package 2.0.0+20260318)



European Patient Summary

50 synthetic patients with
50 HL7 FHIR example
instances of the European
Patient Summary
(EPS)
(Package 2.0.1+20260514)



(Hospital) Discharge Report

31 synthetic patients with
53 HL7 FHIR example
instances of the European
Hospital Discharge Report
(HDR)
(Package 2.1.0+20260323)

SYNDERAI

Synthetic Data Examples – Realistic – using AI



European Prevalences and more

PHASE IV

- **SYNDERAI uses Synthea™** from Mitre (US-centric)
- Analyzing conditions etc. and their frequency
- Disease prevalences are not comparable to typical European populations (US: “opium-related deaths“)
- Adaptation: replace and remove Synthea™ modules

EUROPEAN

Making the source
funds European



Category	Count
Modules newly added (EU-specific)	39
US modules removed (replaced or deprecated)	53
Modules present in both but modified	~110

European Prevalences and more

PHASE IV

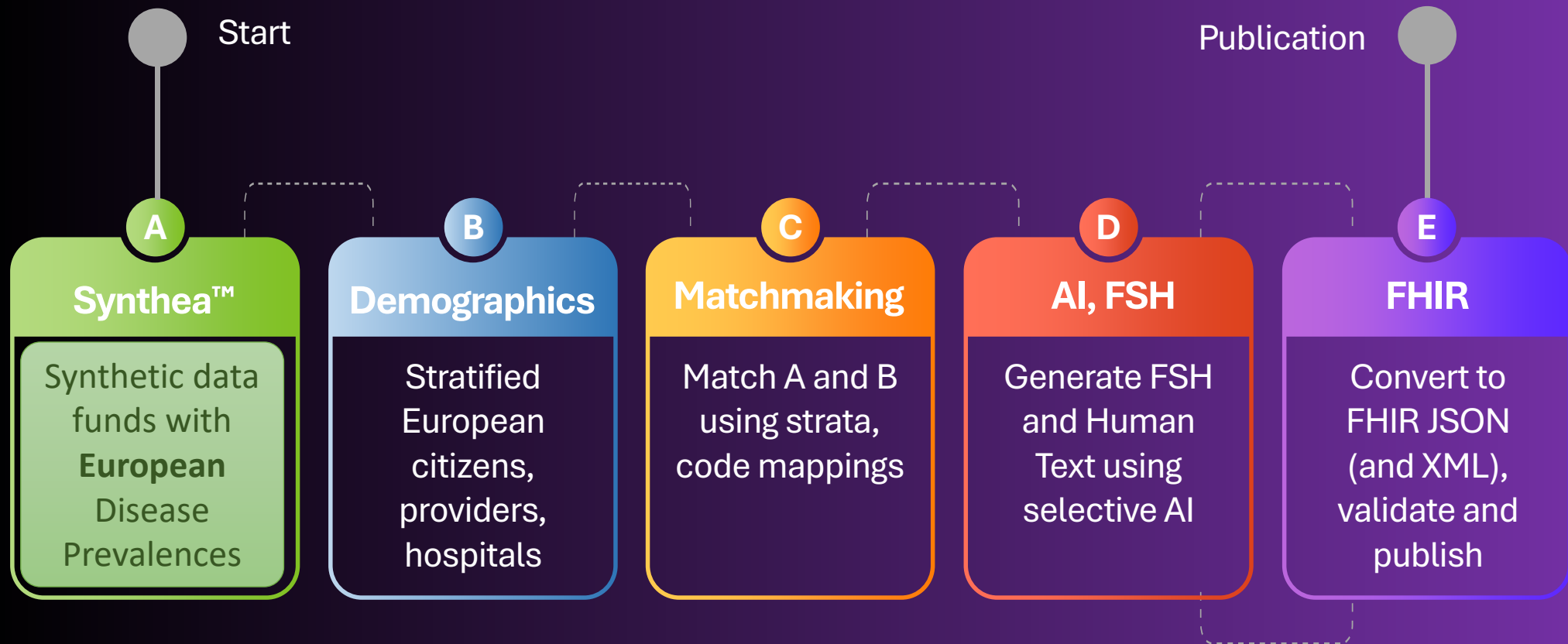
- Hypertension
- Type 2 Diabetes
- COPD
- Asthma
- Stroke
- Myocardial Infarction
- Stable Ischaemic Heart Disease (IHD)
- Atrial Fibrillation
- Congestive Heart Failure (CHF)
- Chronic Kidney Disease (CKD)
- Alzheimer's Disease / Dementia
- Depression
- Anxiety Disorders
- Epilepsy
- Fibromyalgia
- Osteoarthritis
- Rheumatoid Arthritis
- Gout
- Osteoporosis
- Breast Cancer
- Colorectal Cancer
- Lung Cancer
- Prostate Cancer
- Substance Use Disorders / Alcohol
- Sinusitis
- Sepsis
- Hypothyroidism
- Obesity
- Allergies
- Diabetic Retinopathy
- Adolescent Idiopathic Scoliosis (AIS)
- Haematological Oncology / Bone Marrow Transplant
- Also adapted: Medications, Procedures

EUROPEAN

Making the source
funds European



SYNDERAI Synthetic Data Generation



SYNDERAI Dashboards

- Conditions
- Medications
- Care Plans

SYNDERAI · EUROPEAN PATIENT SUMMARY · PACKAGE 2.1.0+20260514

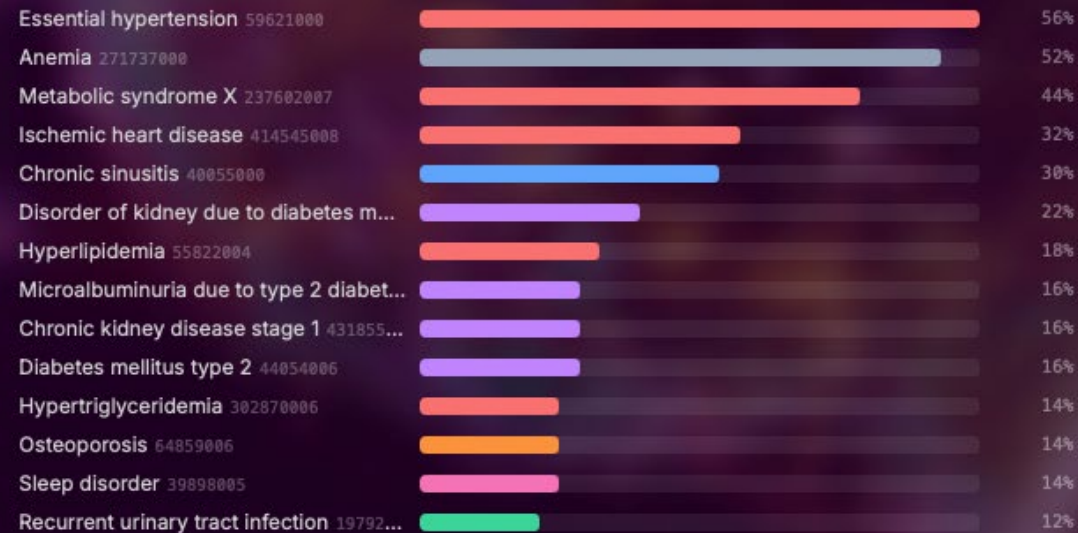
EPS Cohort — Condition Statistics



Lifetime Diagnoses · 47 condition types · 267 active entries

Lifetime diagnoses by patient prevalence % of N=50 patients · active clinical status

All Cardiovascular Infectious / Urological Mental / Neurological Musculoskeletal
Other Renal / Diabetic Respiratory



Domain distribution

265 active entries



Cardiovascular	35%	92
Renal / Diabetic	24%	63
Other	14%	37
Respiratory	10%	27
Mental / Neurological	8%	20
Musculoskeletal	6%	16
Infectious / Urological	4%	10

Synthetic Data Example List for EU LAB

 EU LAB (Bundle)
Timothy Smith (84) 

19-May-2025	View	JSON	XML
03-Feb-2025	View	JSON	XML
31-Jan-2025	View	JSON	XML
30-Jan-2025	View	JSON	XML

[Show 33 more](#)

 EU LAB (Bundle)
Hortense Gallet (58) 

15-Apr-2025	View	JSON	XML
28-Jan-2025	View	JSON	XML
09-Apr-2024	View	JSON	XML
06-Feb-2024	View	JSON	XML

[Show 9 more](#)

 EU LAB (Bundle)
Iva Kratochvílová (61) 

23-Mar-2025	View	JSON	XML
02-Feb-2025	View	JSON	XML
03-Nov-2024	View	JSON	XML
06-Oct-2024	View	JSON	XML

[Show 33 more](#)

 EU LAB (Bundle)
Meaghan Neary (65) 

16-Jul-2025	View	JSON	XML
17-Jun-2025	View	JSON	XML
20-May-2025	View	JSON	XML
29-Apr-2025	View	JSON	XML

[Show 68 more](#)

 EU LAB (Bundle)
Ludmila Vávrová (85) 

04-Dec-2024	View	JSON	XML
27-Nov-2024	View	JSON	XML
24-Nov-2023	View	JSON	XML
22-Nov-2023	View	JSON	XML

[Show 17 more](#)

 EU LAB (Bundle)
Aniela Pražmo (84) 

05-Jul-2025	View	JSON	XML
16-Jun-2025	View	JSON	XML
16-Jun-2024	View	JSON	XML
17-Jun-2023	View	JSON	XML

[Show 18 more](#)

 EU LAB (Bundle)
Alessio Fanucci (61) 

05-May-2025	View	JSON	XML
29-Apr-2024	View	JSON	XML
24-Apr-2023	View	JSON	XML
18-Apr-2022	View	JSON	XML

[Show 12 more](#)

 EU LAB (Bundle)
Maria Nohlmans (78) 

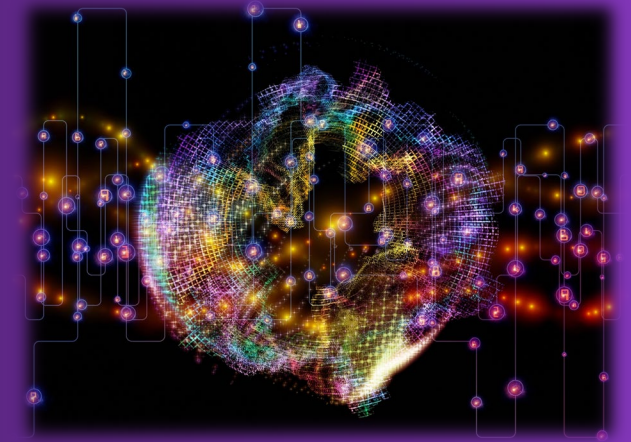
21-May-2025	View	JSON	XML
29-Jan-2025	View	JSON	XML
22-Jan-2025	View	JSON	XML
15-Jan-2025	View	JSON	XML

[Show 70 more](#)

synderai.net

AI in SYNDERAI

Maybe one day AI has learned to create data of this quality all on its own



- “Low dose” AI application
 - Appropriate **dosage** for a specific medication
 - Stratified normal **lab value ranges** based on patient’s conditions
 - **Conclusion** per lab report, based on all prior synthetic lab reports
 - **Synthesis** of hospital treatment episodes, treatment **summary**
 - **Primary Discharge Diagnoses** and **Procedure Lists**
 - **Care Plan Goals** based on patient’s conditions
 - EU prevalence fine-tuning of Synthea modules
 - Validation – GitHub issue pipeline for **iterative refinements**

Human Text in SYNDERAI

- Co-generated by the template-based generation method
- Human readable text with AI assistance
 - Especially for the Hospital Discharge Reports (HDR)
 - HDR sections typically contain text along with granular data such as codes or measurements for medication, results, diagnoses, etc.

Synthesis

Severe aortic stenosis, valve replacement performed

Hospital course note

Dear colleague, I am writing to inform you regarding your patient, an 81-year-old male admitted under our care for severe aortic valve stenosis. Upon admission, echocardiographic assessment confirmed critical aortic stenosis with significantly reduced valve area and elevated mean transvalvular gradient. Given his symptomatic presentation and

Viewing

SYNDERAI is
combined with
Example
Visualization,
supported also
by the Gravitae
Health project,
see vi7eti.net



Laboratory Report

Patient

Name: **Smith, , Timothy,**
DOB: 10-SEP-1941 (Age: 84)
Gender: male
Address: 9 Jeffrey orchard
NWI North Joshuaville (United
Kingdom)
ID: 8029-862360-6 (ECI)

Report

Date: **19-MAY-2025**

Laboratory

dr **Ample, Ex**
Laboratoire Central Européenne
Boulevard du Jardin Botanique 32
1000 Brussels (Belgium)

Requested by

Evelina Children's Hospital
SE1 7 London (United Kingdom)

Specimen

Collected: 19-MAY-2025

vi7eti.net

Chemistry

Test	19-MAY-2025	Reference Range	Unit
Hemoglobin A1c/Hemoglobin.total in Blood	5.5	4.5 - 6.4	%
Glucose [Mass/volume] in Blood	131.1	70 - 140	mg/dL
Urea nitrogen [Mass/volume] in Blood	19.6	7 - 25	mg/dL
Creatinine [Mass/volume] in Blood	0.7	0.6 - 1.3	mg/dL
Calcium [Mass/volume] in Blood	9.1	8.5 - 10.5	mg/dL
Sodium [Moles/volume] in Blood	143.9	135 - 145	mmol/L
Potassium [Moles/volume] in Blood	4.7	3.5 - 5.1	mmol/L
Chloride [Moles/volume] in Blood	102.9	98 - 107	mmol/L
Carbon dioxide, total [Moles/volume] in Blood	26.5	22 - 29	mmol/L
Cholesterol [Mass/volume] in Serum or Plasma	244.9 H	0 - 200	mg/dL
Triglyceride [Mass/volume] in Serum or Plasma	490.0 H	0 - 199	mg/dL
Cholesterol in LDL [Mass/volume] in Serum or Plasma by Direct assay	119.1	0 - 130	mg/dL
Cholesterol in HDL [Mass/volume] in Serum or Plasma	27.8 L	40 - 100	mg/dL

Partner Viewing

Visualization
supported by
Andries Hamster
Founda Health



Chemistry

✓ Acellular blood (serum or plasma) specimen · 26 Jan 2018

TEST	RESULT	REFERENCE RANGE	UNIT
Cholesterol [Mass/volume] in Serum or Plasma	 188.5 mg/dL	125–200	mg/dL
Triglyceride [Mass/volume] in Serum or Plasma	 129.7 mg/dL	0–150	mg/dL
Cholesterol in LDL [Mass/volume] in Serum or Plasma by Direct assay	 105.8 mg/dL	0–100	mg/dL
Cholesterol in HDL [Mass/volume] in Serum or Plasma	 56.7 mg/dL	40–60	mg/dL

Annotation comment

CONCLUSION & RECOMMENDATION

AnnotationConclusion and Recommendations based on this report and previous findings known to usLipid profile shows mildly elevated LDL cholesterol (105.8 mg/dL), while total cholesterol, triglycerides, and HDL are within normal limits. This suggests a slightly increased cardiovascular risk. Recommend lifestyle modifications (diet, exercise) and follow-up lipid monitoring; clinical correlation advised. No acute abnormalities detected.

Document info

Performed by	dr Ex Ample, Brussels, Belgium
Requested by	Södertälje sjukhus
Report date	26 Jan 2018
Collection date	26 Jan 2018
Document title	Laboratory Report
Document type	Laboratory Report (LOINC 11502-2)
Standard	HL7 FHIR R4 · EU Lab IG v0.1.1

ehds.hamster.nl

Partner FHIR Server

High Performance
FHIR Server
supported by Firely



dr K. Heitmann: SYNDERAI – European Synthetic Data for the European Health Data Space

fire.ly

Partner Validation

Fast Continuous
validation
Drift detection
Release evidence
supported by
medvertical



Records • DataOps Control Plane

scan-in-place · validate · evidence-report · drift-detection

The screenshot displays the medvertical.com Records DataOps Control Plane interface. The top navigation bar includes the 'Records' logo and the domain 'medvertical.com'. The left sidebar contains a navigation menu with sections: Overview, Validation Runs, Issues, Triage, Compare Servers, Reports, BROWSE (All Resources, Patient, Encounter, Observation, Condition, Consent, Medication, AllergyIntolerance, DiagnosticReport), and MANAGE (Profiles & IGs, Capabilities, Search Params). The main content area shows a summary of validation metrics: Total Resources (679,999), Validation Coverage (100.0%), Errors (12,847), and Warnings (8,341). Below this is a 'Batch Validation Control' section with a 'Start Validation' button. The 'Select Resource Types' section lists various resource types with their counts. The 'Validation Runs' section provides a table of recent validation runs with columns for Run ID, Status, Started, Duration, Rate, Progress, Score, and Issues.

Run	Status	Started	Duration	Rate	Progress	Score	Issues
#14512	Warn	2h ago	1h 37m	7010/min	679,999/679,999 100%	585,599/679,999 86.1%	12,847 8,341
#14508	Warn	4h ago	1h 41m	6733/min	679,999/679,999 100%	571,199/679,999 84%	14,892 9,456
#14501	Warn	1d ago	1h 39m	6862/min	679,342/679,342 100%	578,444/679,342 85.1%	13,923 8,534
#14498	Warn	2d ago	1h 42m	6655/min	678,856/678,856 100%	563,143/678,856 83%	15,978 9,678

Webinar

SYNDERAI – Synthetic Data for the European Health Data Space

16 July 2026, 14-15

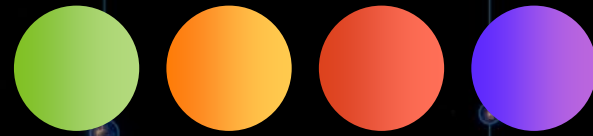
hl7europe.org/category/events/



Summary SYNDERAI

Synthetic Data Examples – Realistic – using AI

- European Priority Categories: Laboratory Report, Hospital Discharge Report, European (+ International) Patient Summary, Imaging
- One Synthetic European Patient Summary per patient, consistent and consecutive reports over time
- Template-driven generation from synthetic funds, “Low Dose” AI application for selected areas
- Combined with Example Visualization Options, FHIR-Server and Continuous Validation



Thank you!

SYNDERAI – European Synthetic Data for the European Health Data Space

dr Kai U. Heitmann

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