Integrated National eHealth Ecosystem

REPUBLIC OF CYPRUS
National eHealth Authority

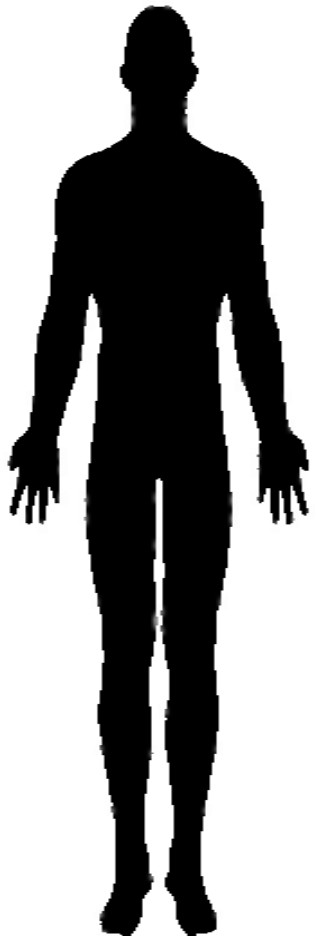
Dr Marios Karaiskakis
President of Association of the Private Hospitals
NEHA Board Member
27/09/2022

Integrated Electronic Health Record (IEHR)

- A collection of fields that describe the citizen's health state.
  - Most of them are given in (mainly) a structured data.

- Which are the parameters that evaluate the citizen's health state?
  - Somatic parameters (e.g. cardiovascular system)
  - Psychological parameters (e.g. depression)
  - Mental parameters (e.g. level of self-preservation ability)
  - Habits – Way of life (e.g. nutrition)
  - Medications and Treatments (e.g. chemotherapy)
  - Exogenous factors (e.g. air pollution)

Citizen - Centricity



Clinical data

Social Data

Demographic data

Epidimiological data

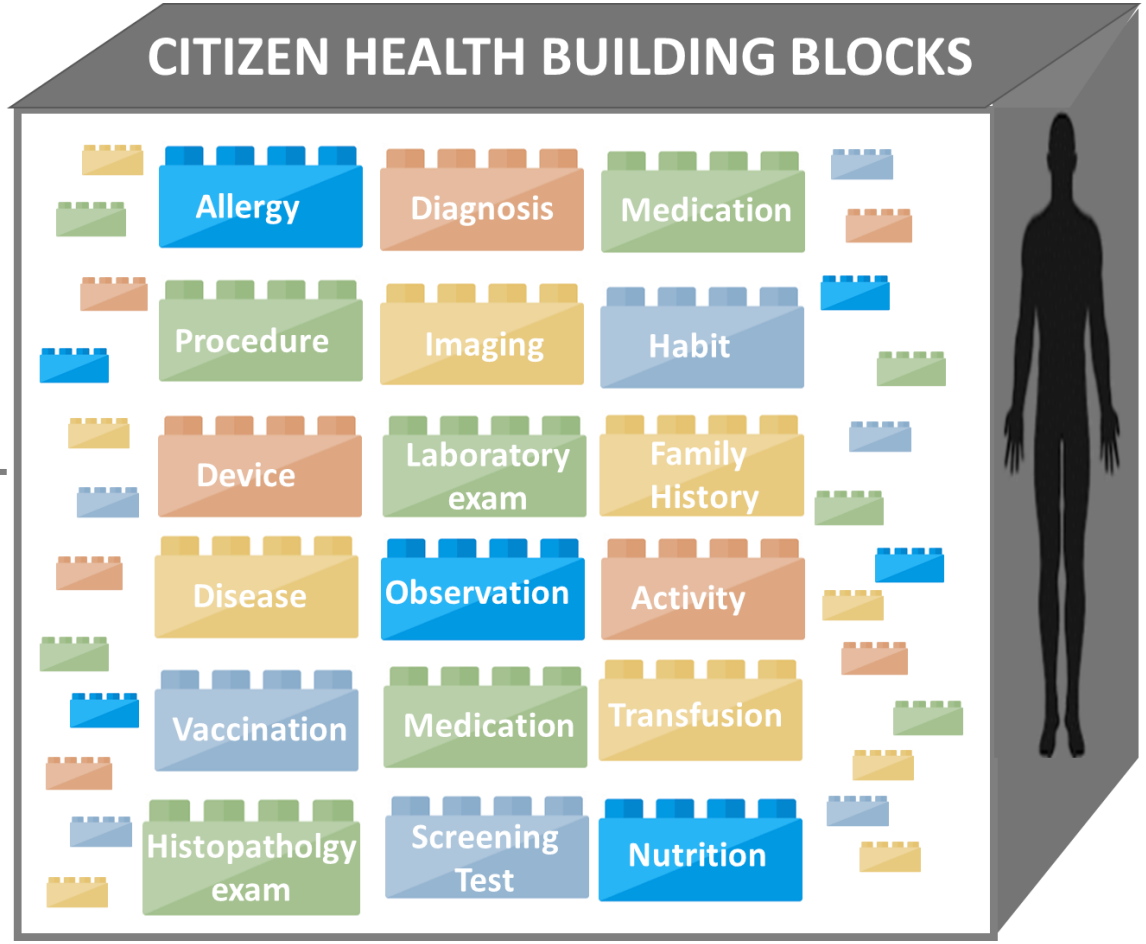
...

Citizen Patient History

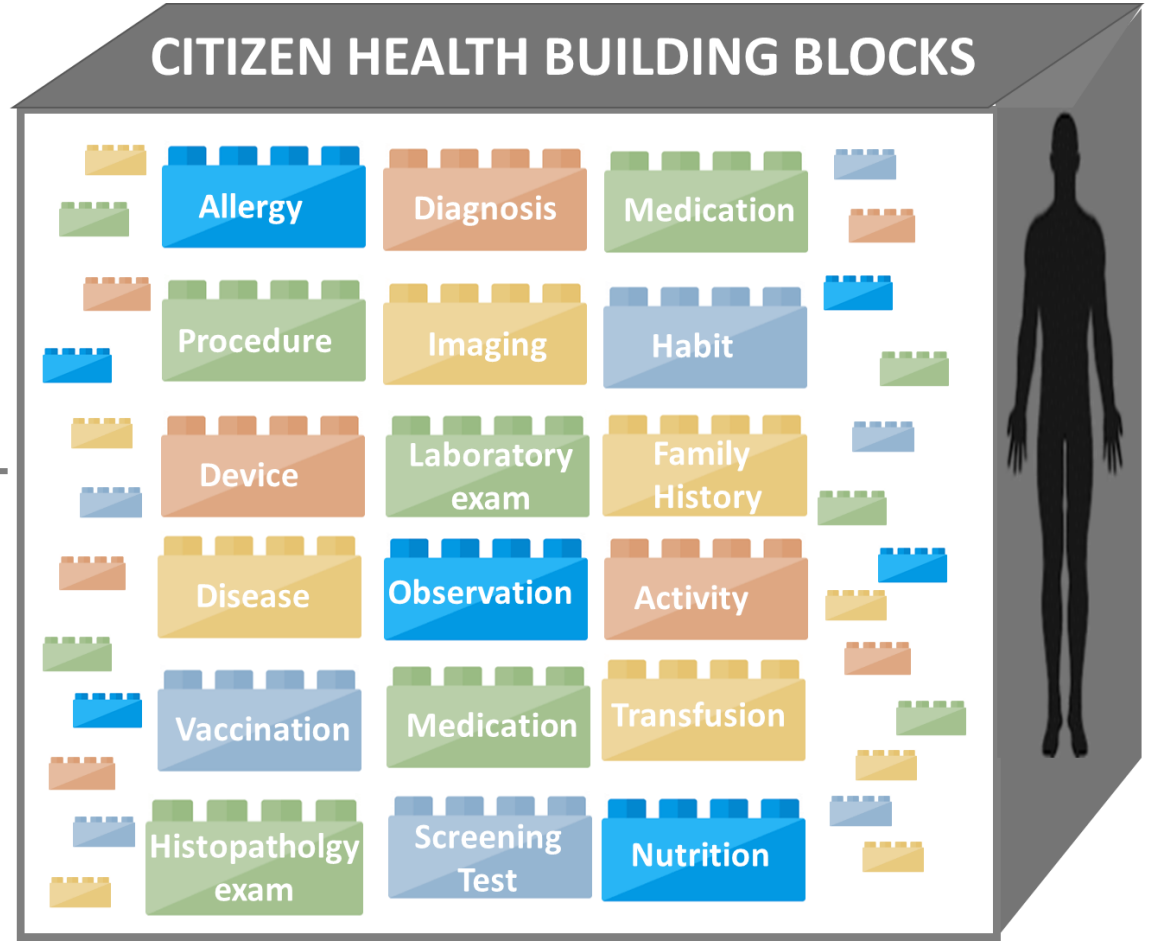
Clinical Examination

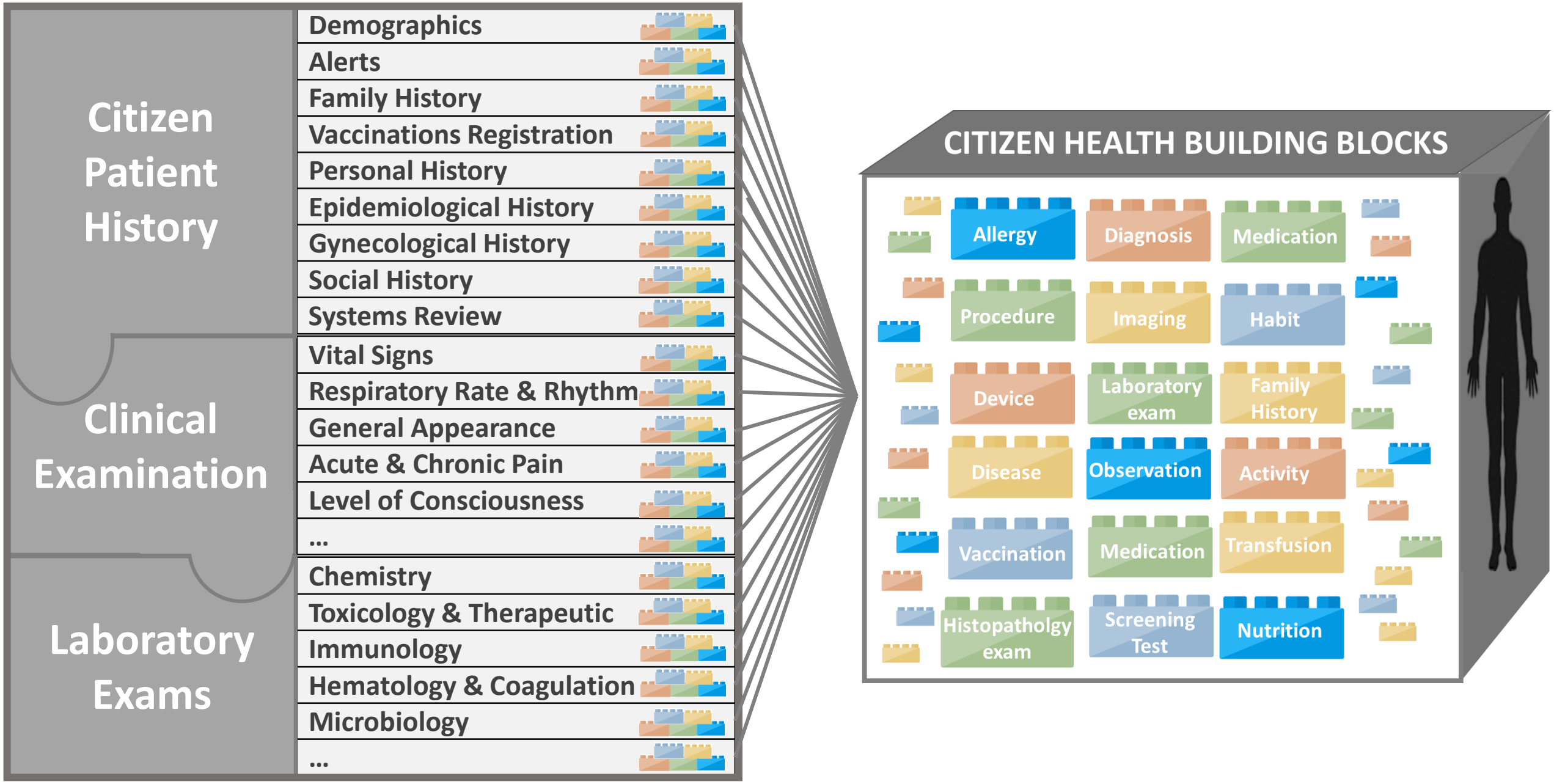
Laboratory Exams

IEHR



Citizen Patient History	Demographics
	Alerts
	Family History
	Vaccinations Registration
	Personal History
	Epidemiological History
	Gynecological History
	Social History
	Systems Review
Clinical Examination	Vital Signs
	Respiratory Rate & Rhythm
	General Appearance
	Acute & Chronic Pain
	Level of Consciousness
	…
Laboratory Exams	Chemistry
	Toxicology & Therapeutic
	Immunology
	Hematology & Coagulation
	Microbiology
	…




Citizen Patient History
Demographics
Alerts
Family History
Vaccinations Registration
Personal History
Epidemiological History
Gynecological History
Social History
Systems Review
Clinical Examination
Vital Signs
Respiratory Rate & Rhythm
General Appearance
Acute & Chronic Pain
Level of Consciousness
...
Laboratory Exams
Chemistry
Toxicology & Therapeutic
Immunology
Hematology & Coagulation
Microbiology
...
CITIZEN HEALTH BUILDING BLOCKS
Allergy
Diagnosis
Medication
Procedure
Imaging
Habit
Device
Laboratory exam
Family History
Disease
Observation
Activity
Vaccination
Medication
Transfusion
Histopatholgy exam
Screening Test
Nutrition

EHR >> Analysis of a Complex Parameter

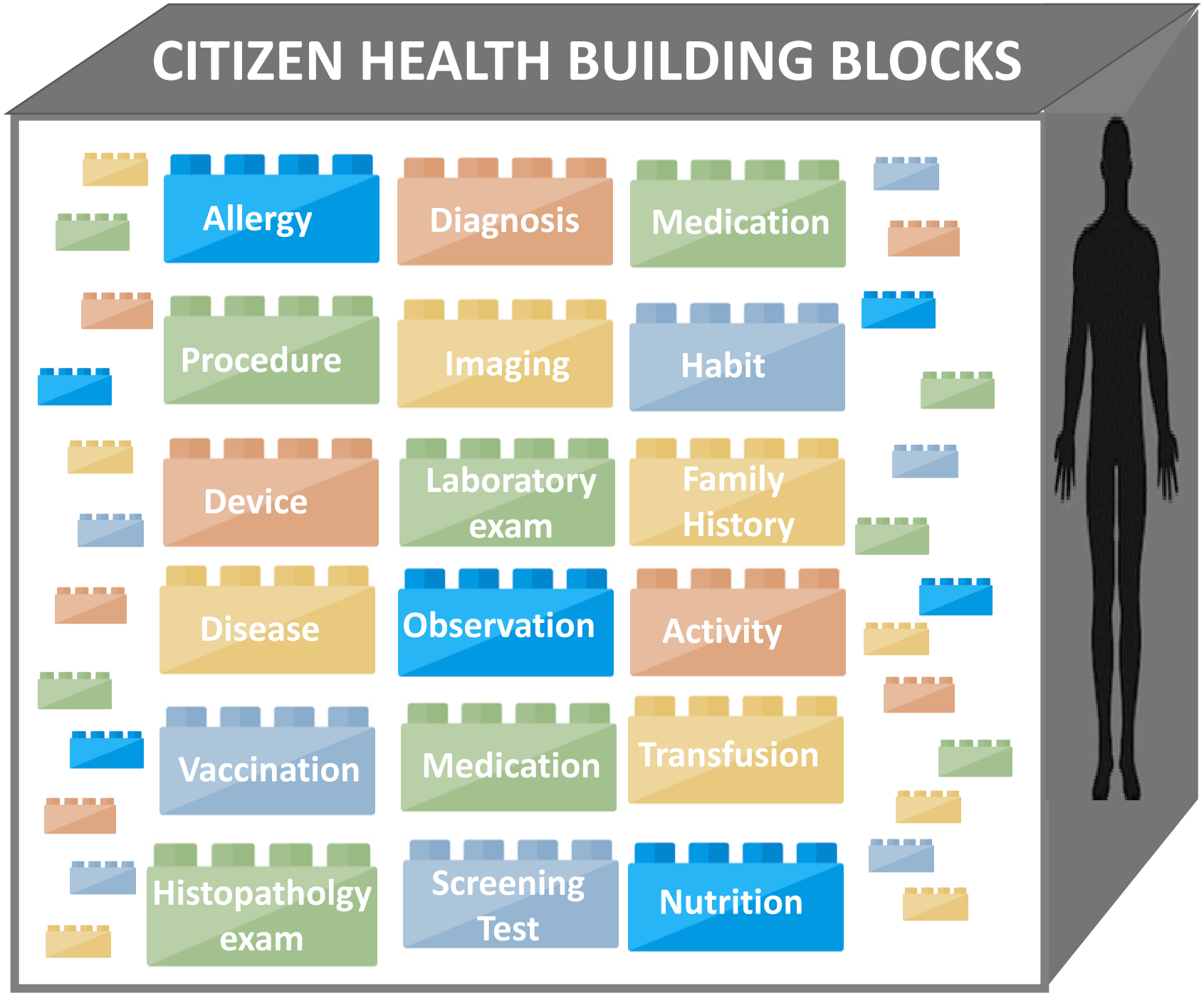
- **To describe the EHR for a citizen, we need to construct the Citizen Health Building Blocks "box":**
  1. Identify the EHR general sections.
  2. Gather clinical requirements per each section (from doctors).
  3. Identify the complex parameters.
  4. Analyze them in depth into a set of "simple" parameters and their set of values.
  5. Package related parameters into complex building blocks which will be available for use to construct any requested profile for the patient's health status.

EHR >> Complex Parameters

EHR >> Analysis of a Complex Parameter

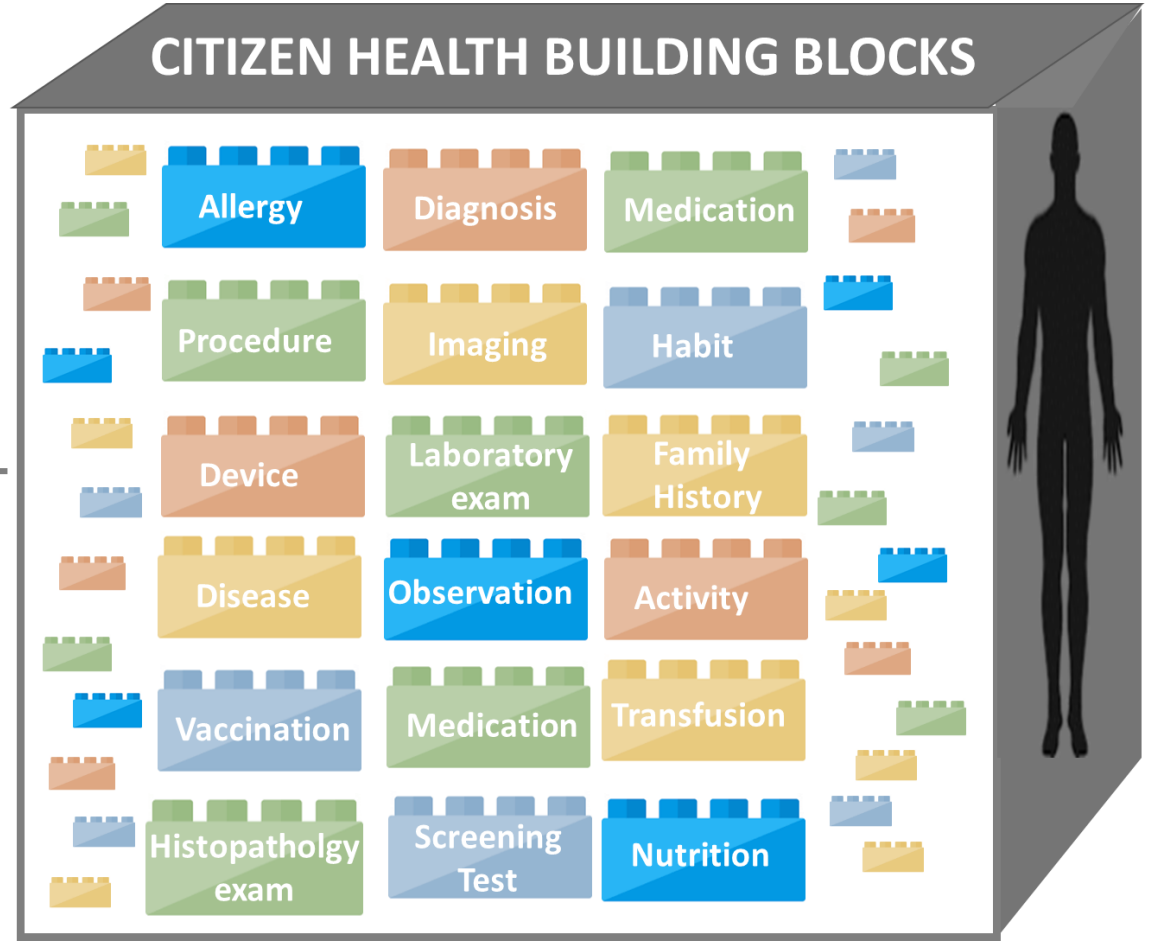
- Adverse Event Type
- Agent
- Reaction
- Severity
- Diagnosis Date

EHR >> Built by Citizen Health Building Blocks



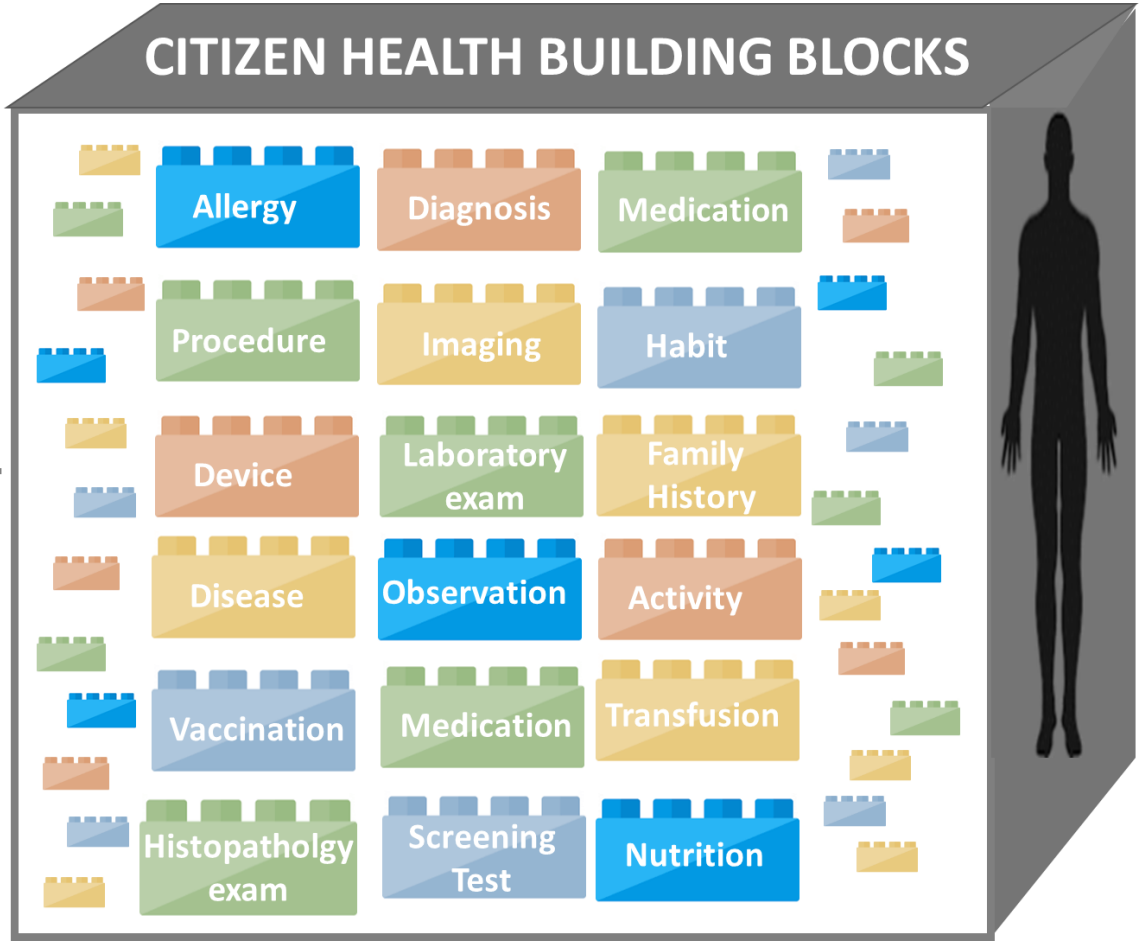
(Integrated Electronic Health Record)

IEHR

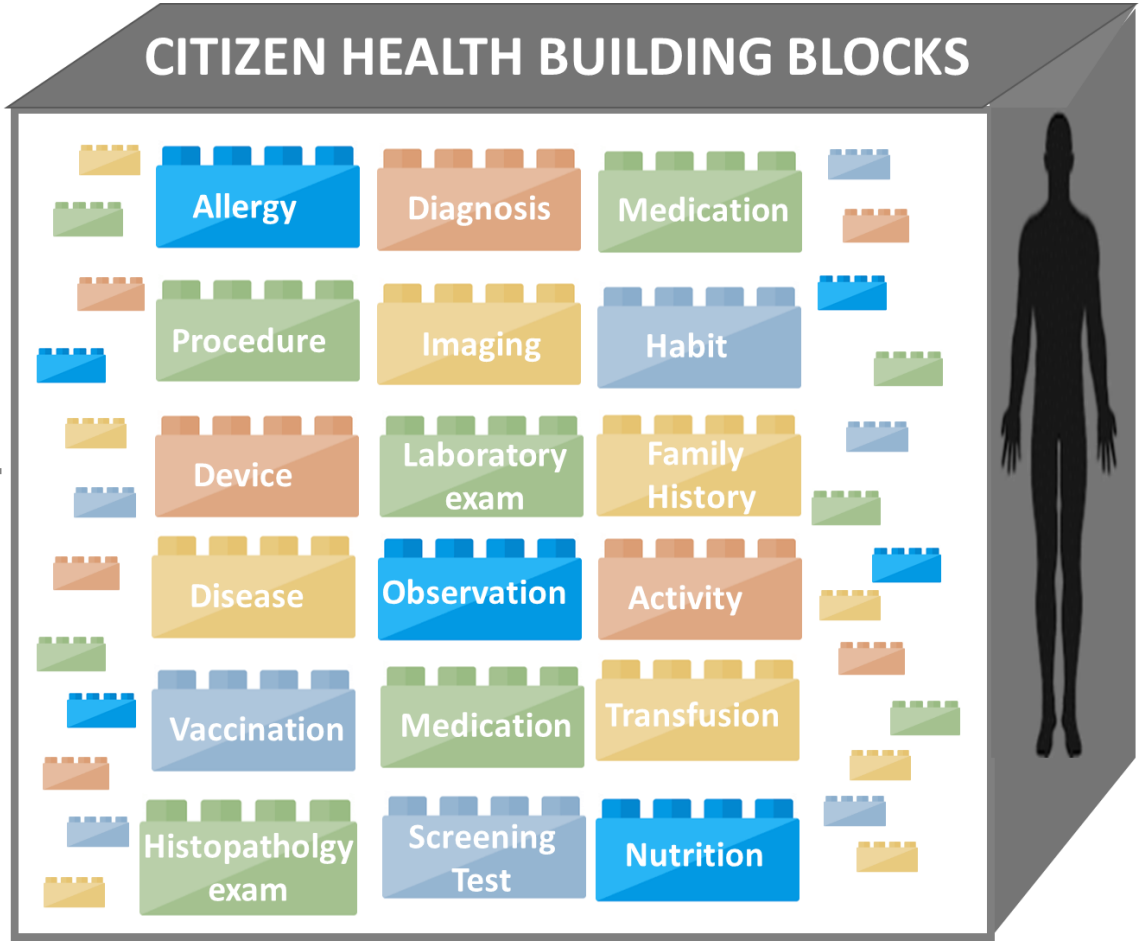


(Integrated Electronic Health Record)

IEHR




IEHR


CITIZEN HEALTH BUILDING BLOCKS
Allergy
Diagnosis
Medication
Procedure
Imaging
Habit
Device
Laboratory exam
Family History
Disease
Observation
Activity
Vaccination
Medication
Transfusion
Histopatholgy exam
Screening Test
Nutrition

National Integrated EHR in Cyprus (prototype)

- **So far…**

  To describe EHR (Patient History + Clinical Examination + Laboratory) content extracting requirements from the Internal Medicine area we use:
  - **~2000** unique fields for all citizens.
  - **~500** unique fields for all citizens with age < 18 years old.
- **In the next phase…**

  Analyse requirements from other medical specialties and identify new simple and complex parameters to enter the “citizen health building blocks box”.
  - **~100** unique fields for gynecology?
  - **~50** unique fields for cardiology?
  - **~50** unique fields for ophthalmology?
  - …
- **At the end…**

  The national integrated EHR (IEHR) will be consisted by thousands of unique fields used in many ways to describe citizen’s health! Even more to describe encounters, care plans, etc.

National Integrated EHR in Cyprus (prototype)

- **So far…**

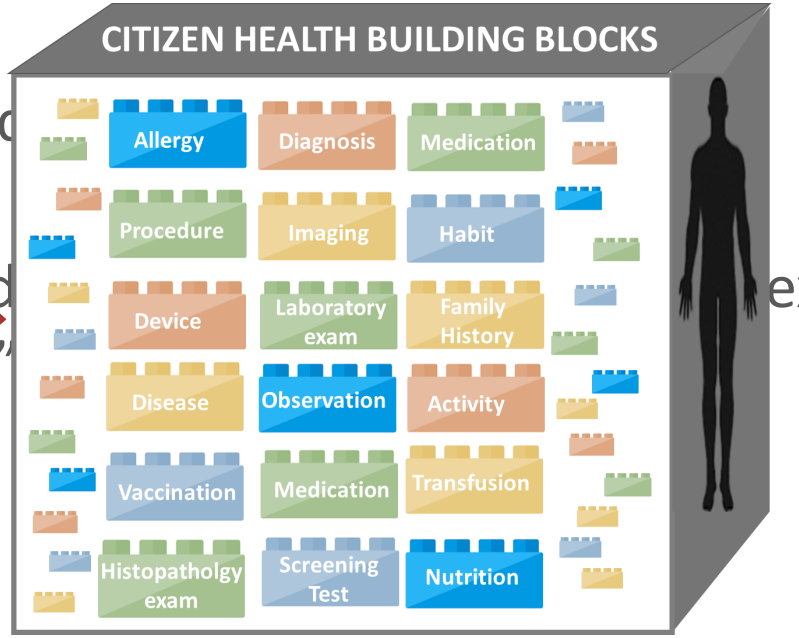
  To describe EHR (Patient History + Clinical Examination + Laboratory) content extracting requirements from the Internal Medicine area we use:

  - **~2000** unique fields for all citizens.
  - **~500** unique fields for all citizens with age < 18 years old

- **In the future…**

  Analyse requirements from other medical specialties and id… ex parameters to enter the "citizen health building blocks box"

  - **~100** unique fields for gynecology?
  - **~50** unique fields for cardiology?
  - **~50** unique fields for ophthalmology?
  - …



- **At the end…**

  The national integrated EHR will be consisted by thousands of unique fields used in many ways to describe citizen's health! Even more to describe encounters, care plans, etc.

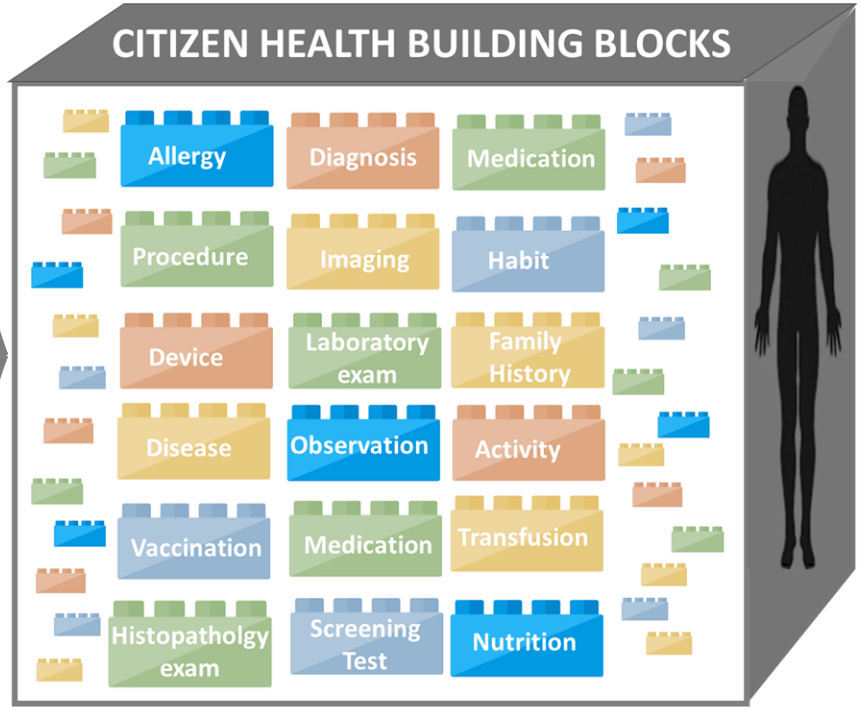
National Integrated EHR in Cyprus (prototype)
>> Track Citizen's Health

Visit / Encounter

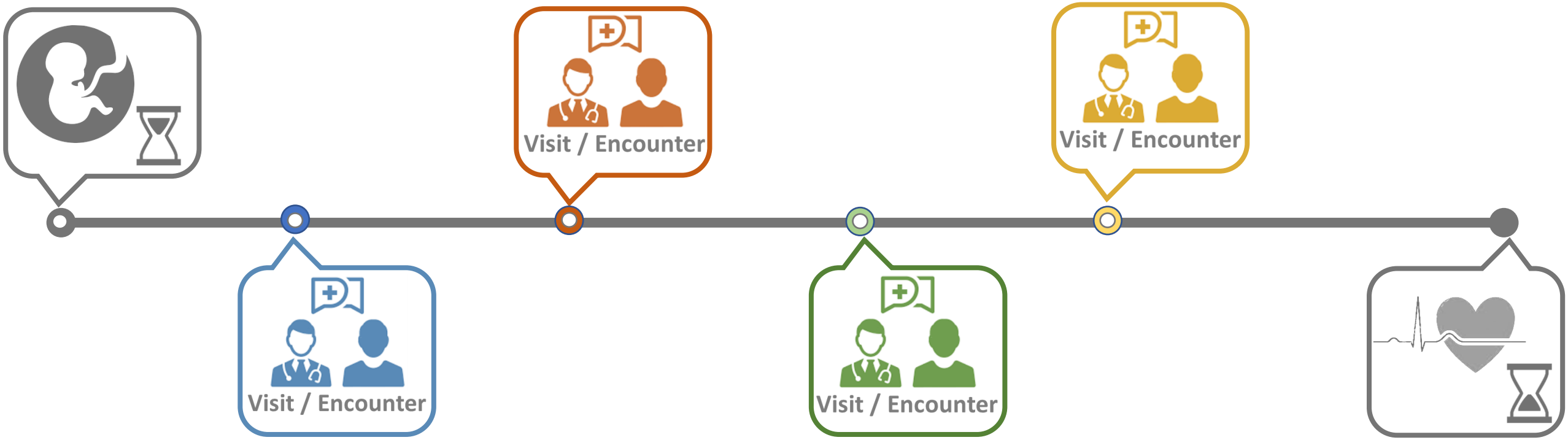
Patient History
- Demographics
- Alerts
- Family History
- Vaccinations Registration
- Personal History
- Epidemiological History
- Gynecological History
- Social History
- Systems Review

Clinical Examination
- Vital Signs
- Respiratory Rate & Rythm
- General Appearance
- Acute & Chronic Pain
- Level of Consciousness
- ...

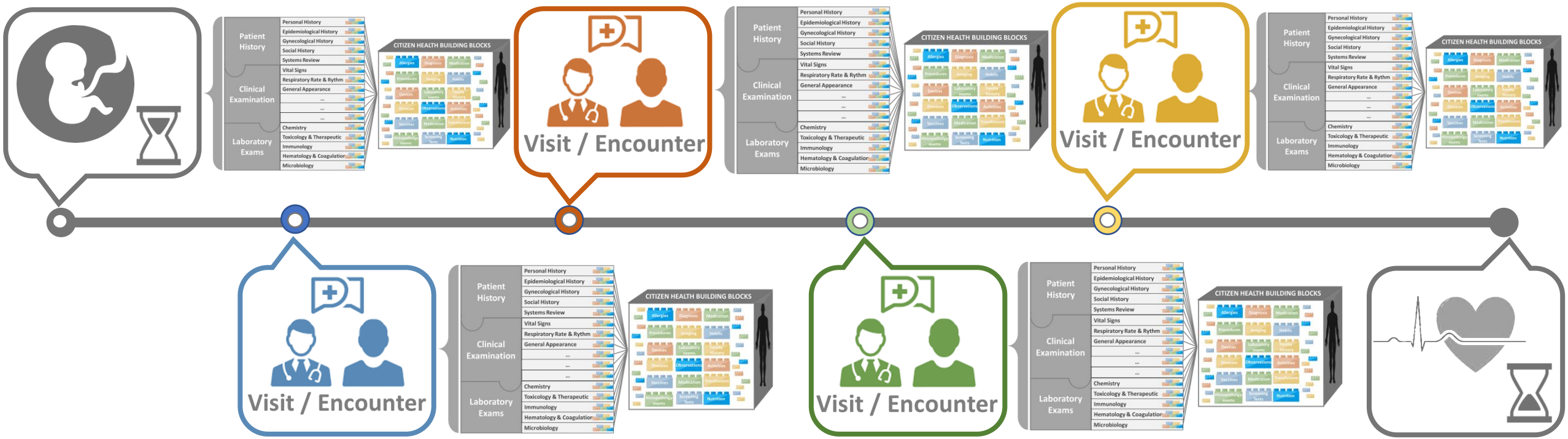
Laboratory Exams
- Chemistry
- Toxicology & Therapeutic
- Immunology
- Hematology & Coagulation
- Microbiology
- ...



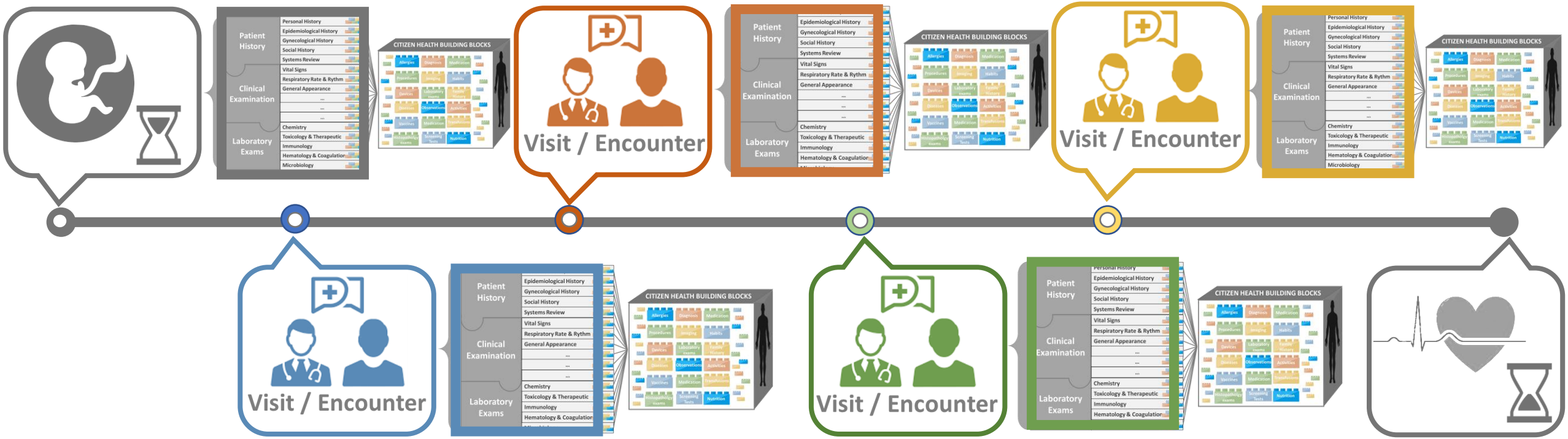
National Integrated EHR in Cyprus (prototype)
>> Track Citizen's Health



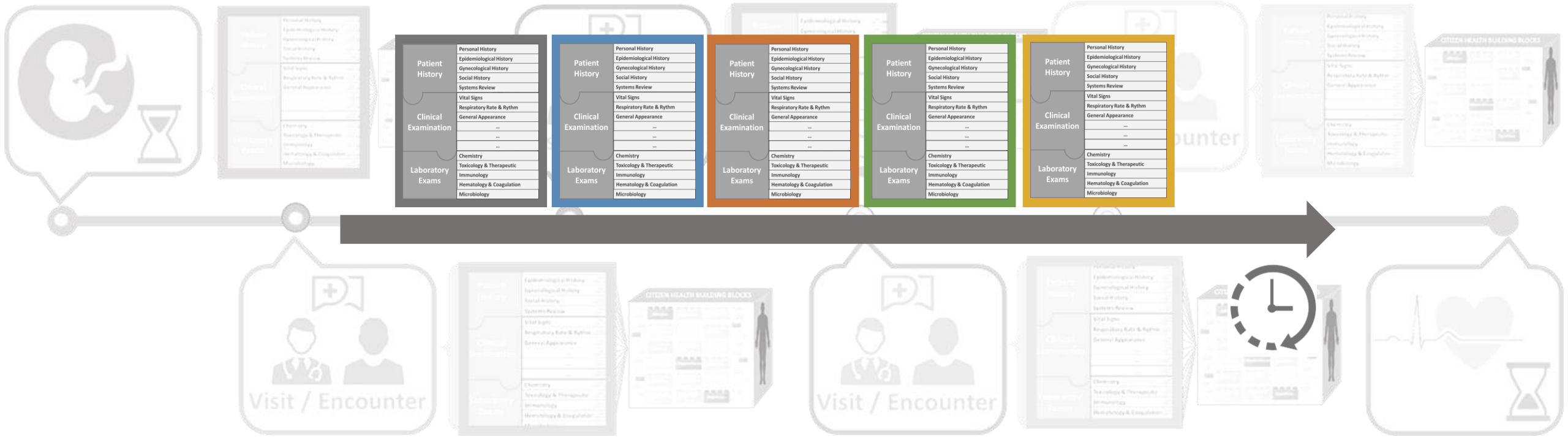
National Integrated EHR in Cyprus (prototype)
>> Track Citizen's Health



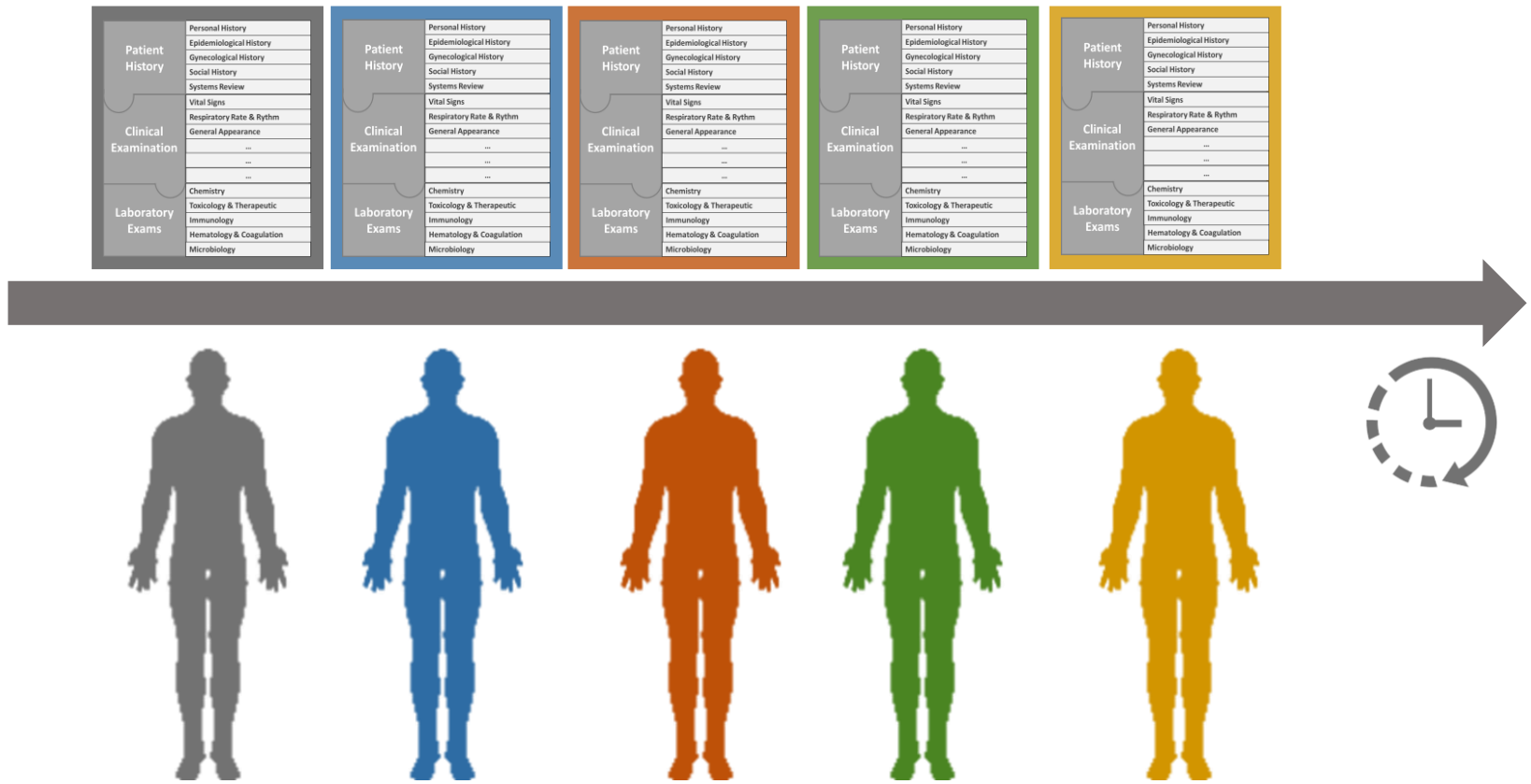
National Integrated EHR in Cyprus (prototype)
>> Track Citizen's Health



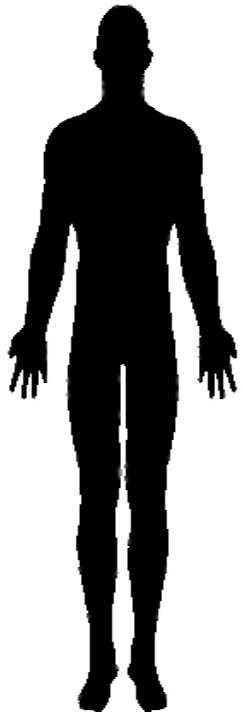
National Integrated EHR in Cyprus (prototype)
>> Track Citizen's Health



National Integrated EHR in Cyprus (prototype)
>> Track Citizen's Health



National Integrated EHR in Cyprus (prototype)
>> Describe the Health Status of the Citizen



National Integrated EHR in Cyprus (prototype)
>> Describe the Health Status of the Citizen

Citizen EHR and Practitioner

- Practitioner is the main contributor to a Citizen's Integrated EHR (IEHR).
  - View citizen's healthcare data.
  - Create new healthcare data.
  - Update healthcare data.

- When can a Practitioner access a Citizen's IEHR?
  - Access to all data?
  - For how long?

The health provider has by default access to the EHR in the provider's databank

Consider changing practitioner to provider!

Citizen IEHR and Practitioner >> Consent Framework

- By default, **no** Practitioner has any kind of access to a Citizen's IEHR profile.
- To gain access, the Citizen first has to grant the Practitioner with explicit access rights.
- This happens by providing a **consent** defining:
  - The consent content:
    The type of the access rights given to the Practitioner (what healthcare data can be accessed and what can't).
  - The lifetime of the consent:
    The duration of the access rights. When this period expires the Practitioner has no access to the specific Citizen's EHR.

Citizen IEHR and Practitioner >> Default Consent

- The default consent (between Citizen and Practitioner) proposed by the National Integrated EHR system in Cyprus:
  - Consent Content:
    - ✓The Citizen authorizes the Practitioner to have full access to his entire EHR content.
    - ✓The Practitioner will be available to view all the past content included in the Citizen's EHR.
    - ✓The Practitioner will be available to add new data in the Citizen's EHR.
    - ✓The Practitioner will be available to create a new Encounter with the Citizen.

Citizen EHR and Practitioner >> Default Consent

- The default consent (between Citizen and Practitioner) proposed by the National Integrated EHR system in Cyprus:
  - Duration:
    - ✓The Consent between a Citizen and a Practitioner is characterized as **Active** for the time period that the Practitioner has some type of access to a Citizen's EHR.
    - ✓A consent turns into the **Active** mode when both parties (Citizen and Practitioner) have given their consent (steps are described later).
    - ✓Consent duration differs between Personal Doctors (PD) and Specialists.
      - Personal Doctors should have consent for the whole time being the PD of the Patient.
      - Specialists should have consent for the time curing a Patient.

Default Consent >> Multiple related events

- A Practitioner might need multiple encounters, laboratory exams or consultation with other doctors when curing a patient with a particular health issue.
  - The Practitioner needs access through the whole time period that the events take place to study and monitor the ongoing health issue.
  - The Citizen has to provide the same Practitioner with a consent for every related event
  - Not efficient or practical!

- Solution:
  - The Practitioner needs long time consent from the Citizen.
  - Duration: Time needed to perform all the events for a specific health issue of the Citizen.
  - Time needed to deal with different health issues varies therefore it is difficult to set one rule for all.
    - ✓Easier to group the related events under one super-event.
    - ✓Give consent to the Practitioner that participates to that super-event for as long as it lasts.

Default Consent >> Multiple related events >> Episode of Care

- **Episode of Care**
  - A grouper of the events taking place under a certain health issue/condition.
  - Any resource can be referenced or refer to an Episode of Care (encounter, lab result, referral, etc.) and then it becomes part of the group.

- CareManager and CareTeam of the Episode of Care:
  - When a Practitioner creates an encounter he can choose:
    - Create a new Episode of Care for the Patient (and be the CareManager of it)
    - Contribute to an existing Episode of Care of the Patient (and be participant of the CareTeam of it)

Default Consent >> Multiple related events >> Episode of Care

- Main purpose of **Episode of Care** in the National Integrated EHR system of Cyprus:
  - Allow the Practitioner who is the CareManager and the Practitioners that participate to the CareTeam to monitor the patient's progress for a specific health issue/problem.

- Actions allowed under one Episode of Care:
  - The initial encounter and all other follow-up encounters will be linked together.
  - All the referrals used for these encounters will be tagged by the related Episode of Care.
  - An encounter which is created as a result of a referral is also tied with the related Episode of Care.
  - There are no financial dependencies for Episode of Care. Its use is strictly for medical use.
  - Episode of Care is not for grouping all the encounters (throughout the patient's lifetime) under one condition **but** to group the encounters under one condition coordinated by a specific Practitioner (CareManager) and a specific CareTeam.

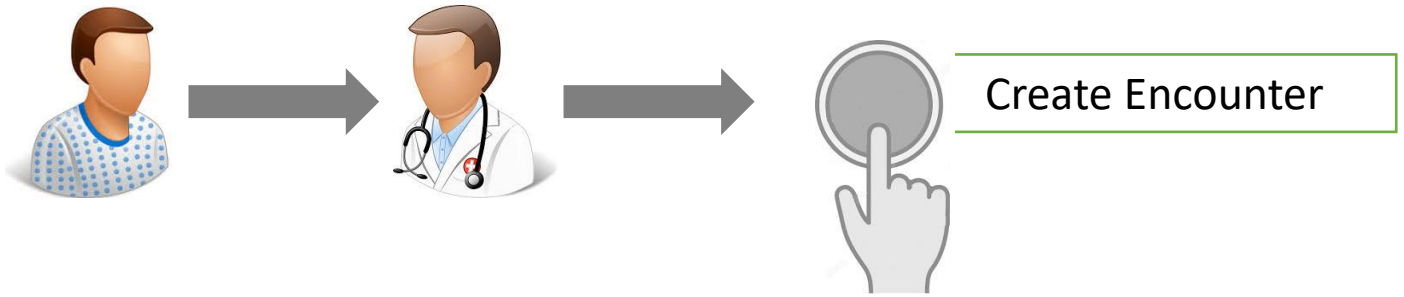
Citizen EHR and Practitioner >> Default Consent

Active Consent	Starts when:	Ends when:
To Personal Doctor	The Citizen requests from a Practitioner to be his/her PD and the Practitioner accepts.	• The Citizen revokes the consent from the PD. • The Citizen selects a different doctor to be his PD.
To Specialist	An appointment is set between the Citizen and the Practitioner.	• The Citizen revokes the consent from the Practitioner. • The Citizen cancels the appointment and there is no active episode of care between the Citizen and the Practitioner. • The EpisodeOfCare is cancelled and there is no active episode of care between the Citizen and the Practitioner. • The EpisodeOfCare is finished and there is no active episode of care between the Citizen and the Practitioner.

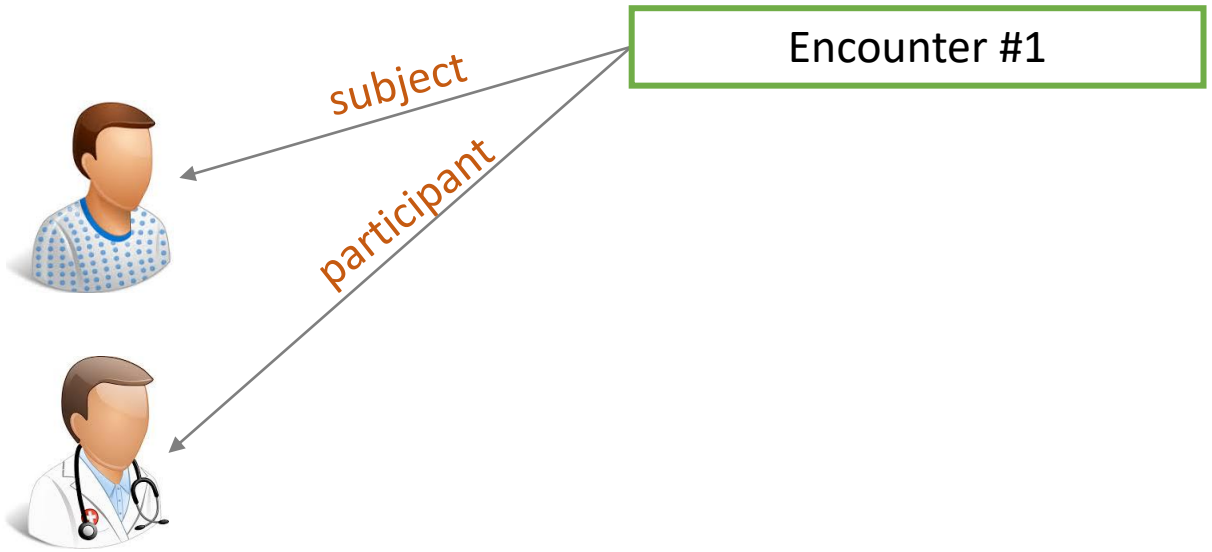
Citizen EHR and Practitioner >> Default Consent

- Other unexpected conditions that can revoke a consent between a Citizen and a Practitioner:
  - The referenced Citizen dies (and a specific time period has passed).
  - The referenced Practitioner dies.
  - The Practitioner is not an active user of the system (e.g. inactivated by Cyprus Medical Association).

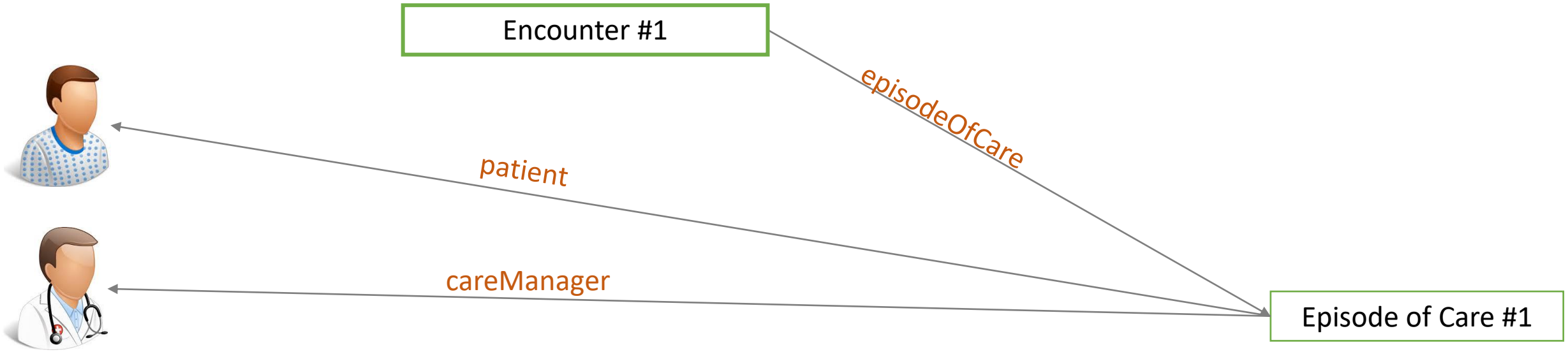
Episode of Care >> A Simple Use Case



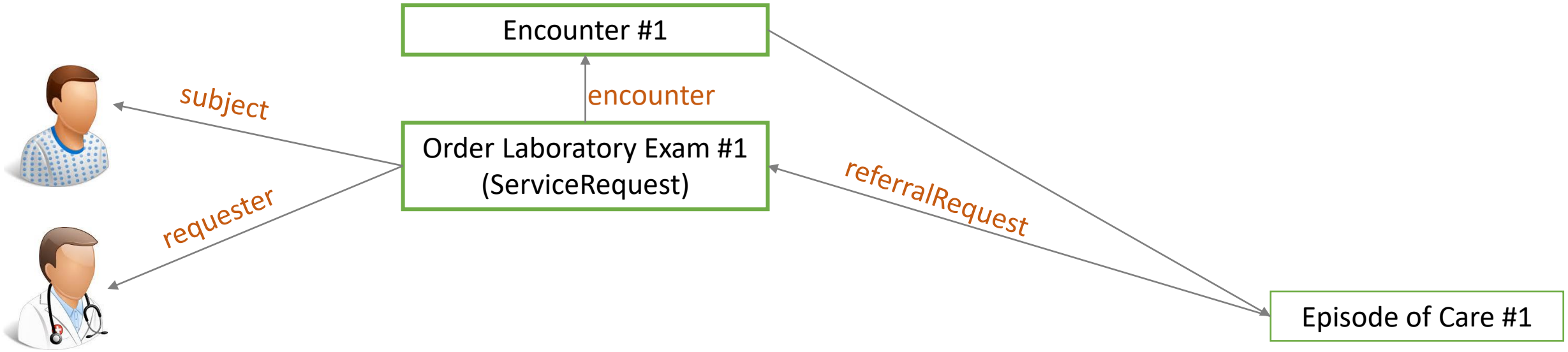
Episode of Care >> A Simple Use Case



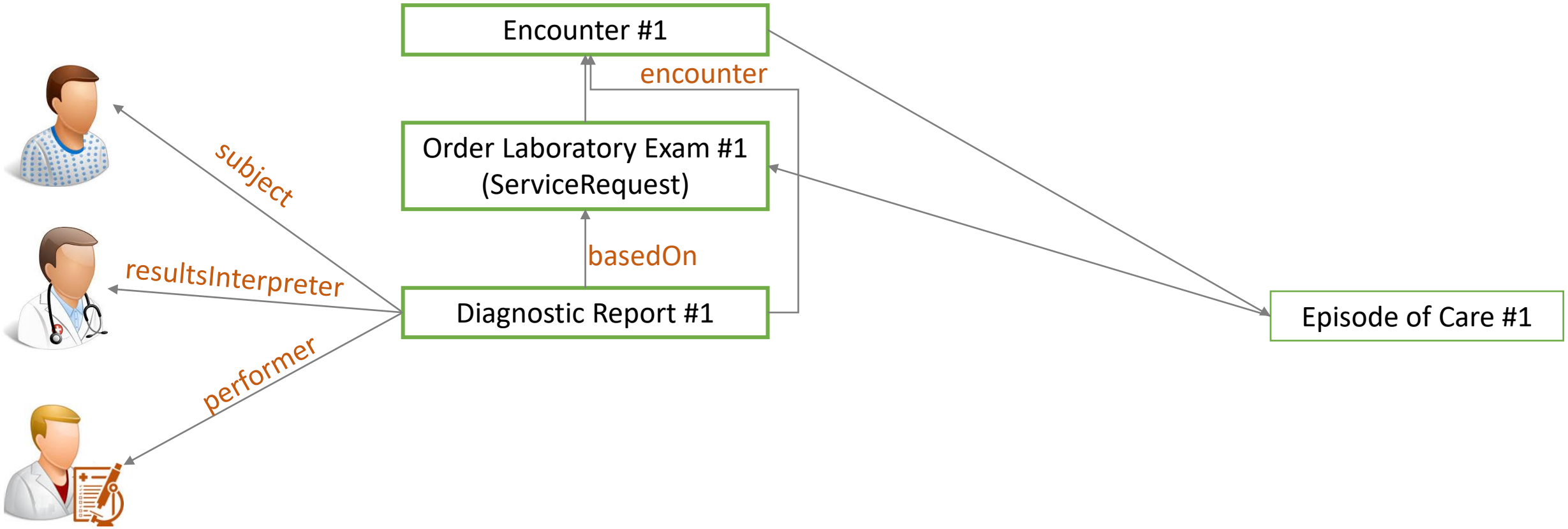
Episode of Care >> A Simple Use Case



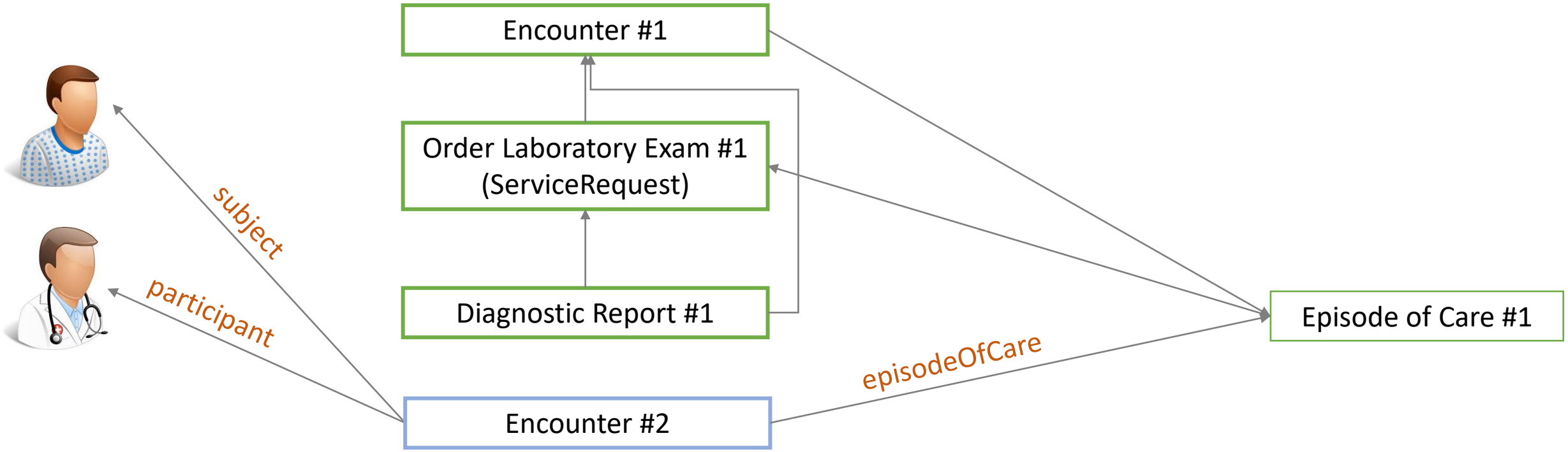
Episode of Care >> A Simple Use Case



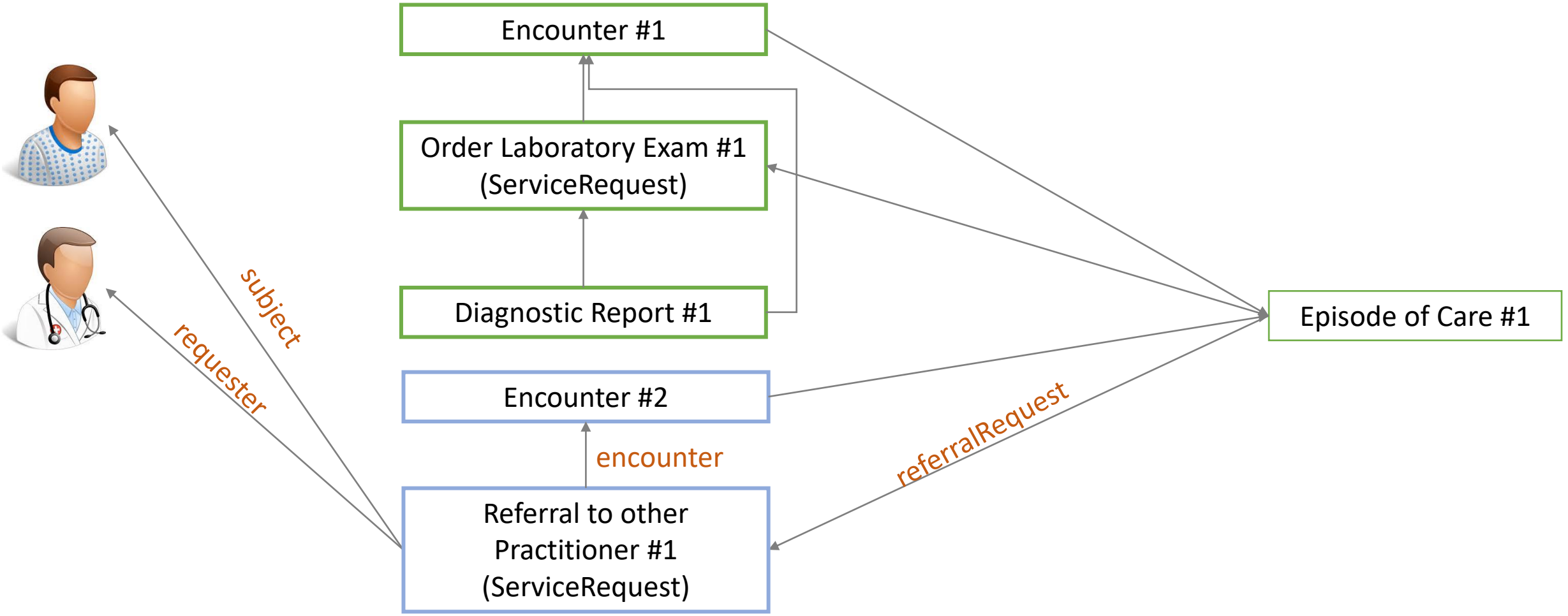
Episode of Care >> A Simple Use Case



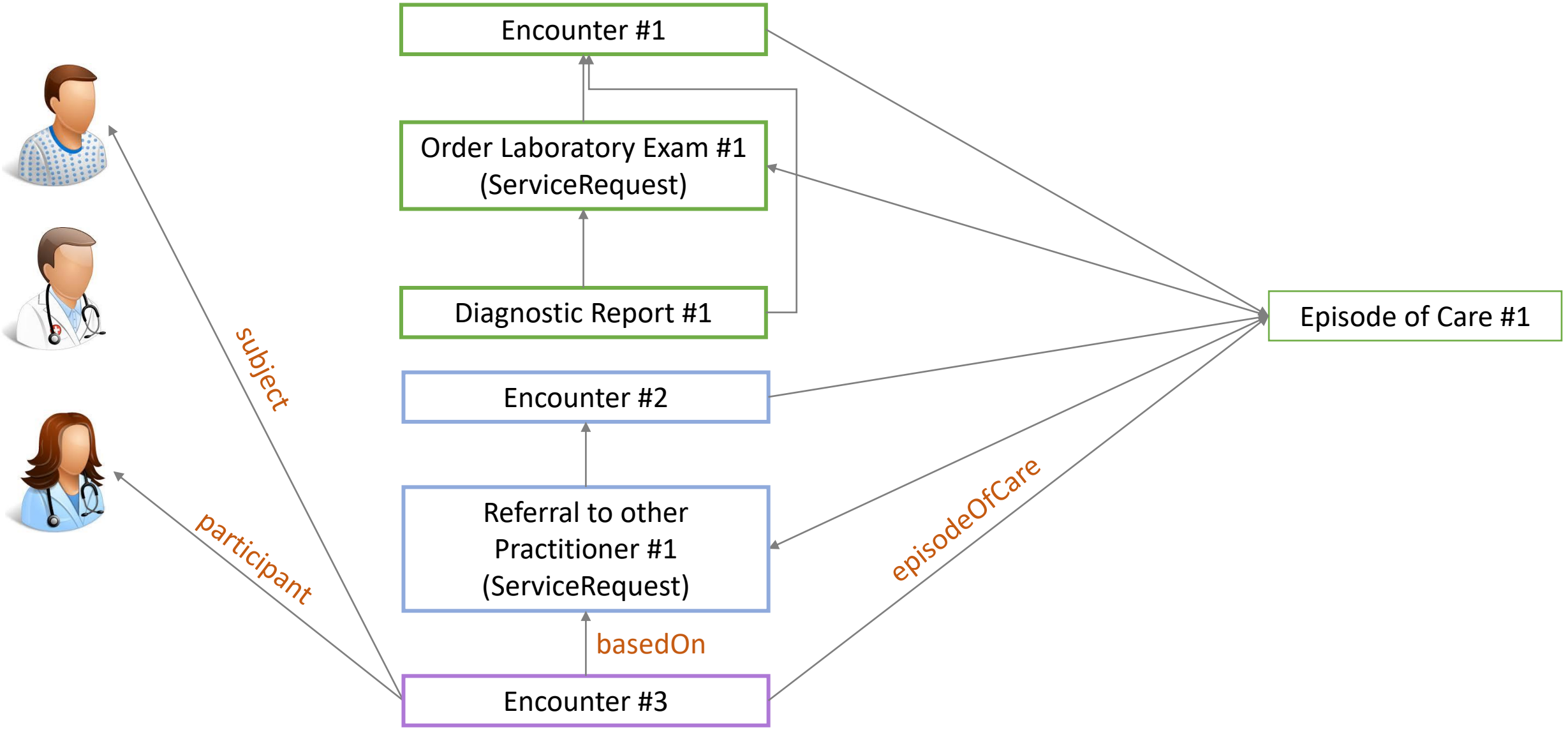
Episode of Care >> A Simple Use Case



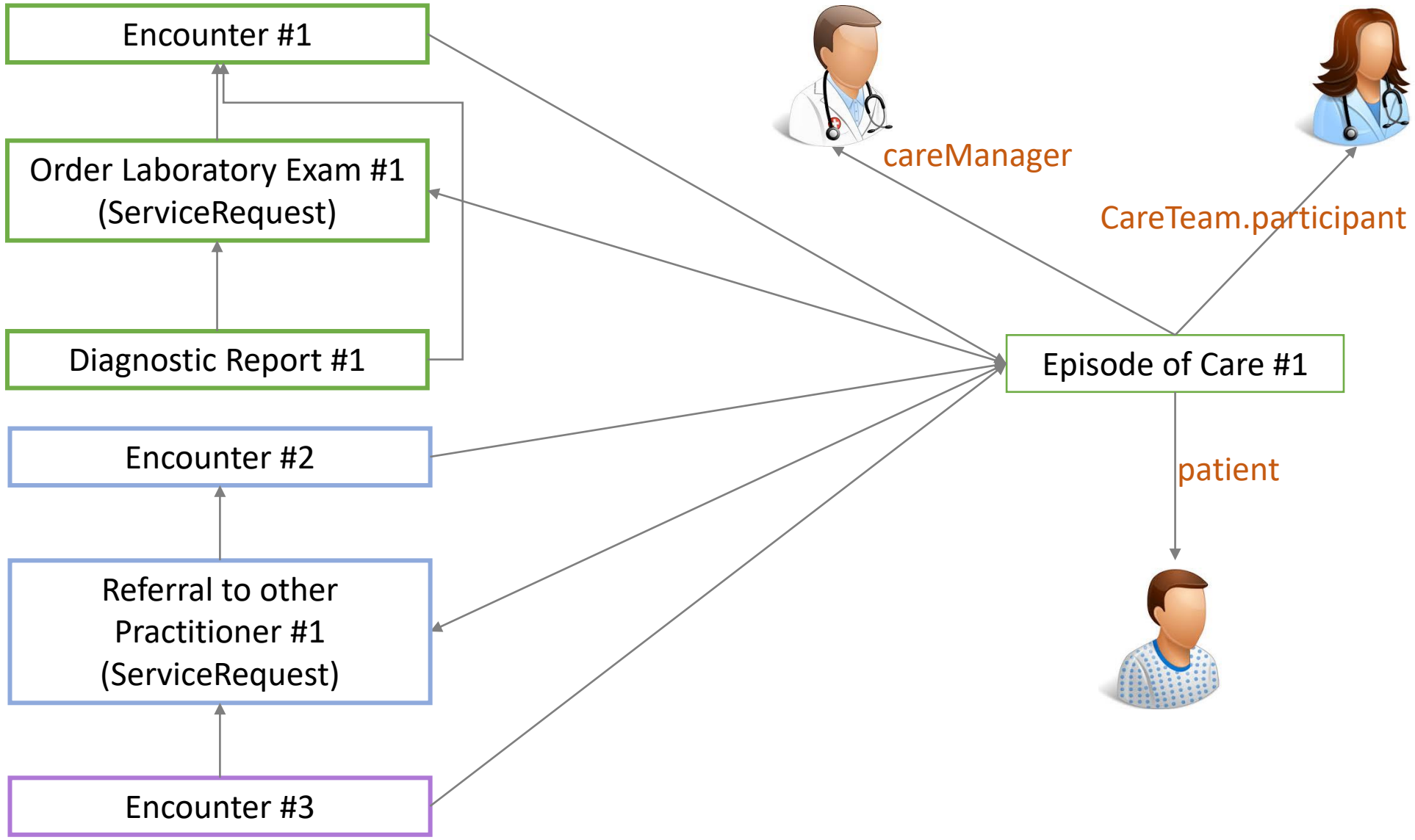
Episode of Care >> A Simple Use Case



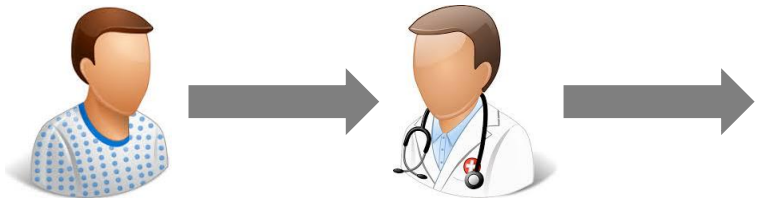
Episode of Care >> A Simple Use Case



Episode of Care >> A Simple Use Case

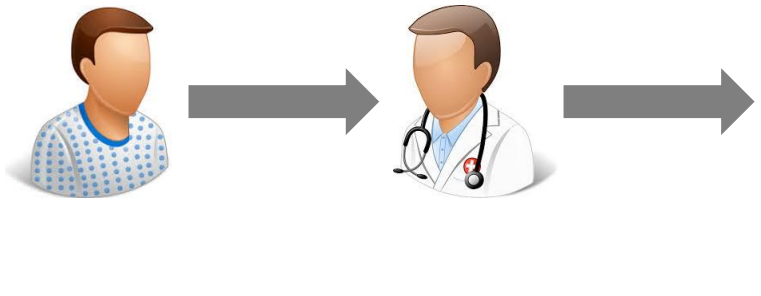


Episode of Care >> A Simple Use Case



Create Encounter	Episode Of Care #1 (the title)
	Episode Of Care #2 (the title)
	New Episode Of Care

Episode of Care >> A Simple Use Case >> Consent

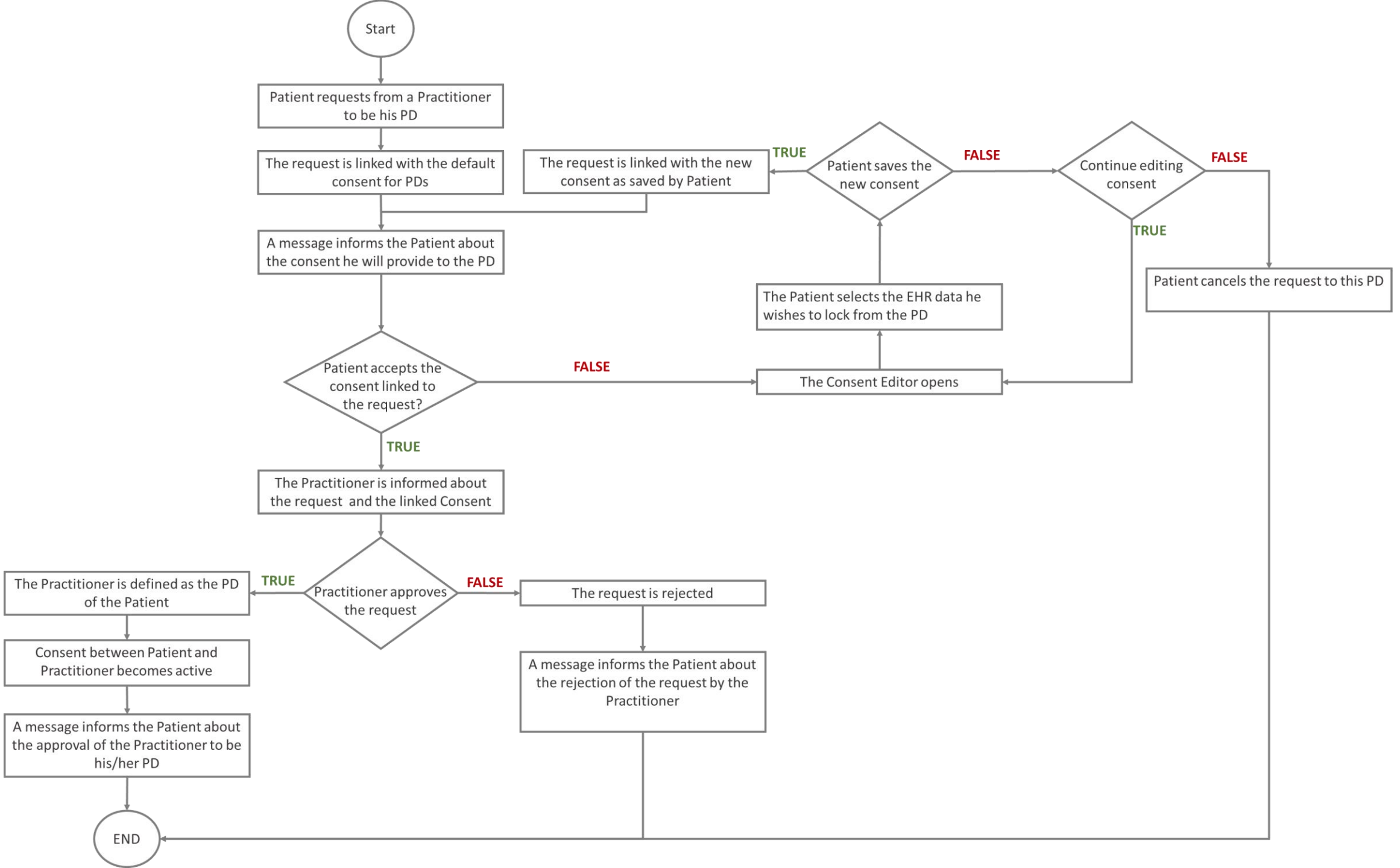


Create Encounter	Episode Of Care #1 (the title)
	Episode Of Care #2 (the title)
	New Episode Of Care

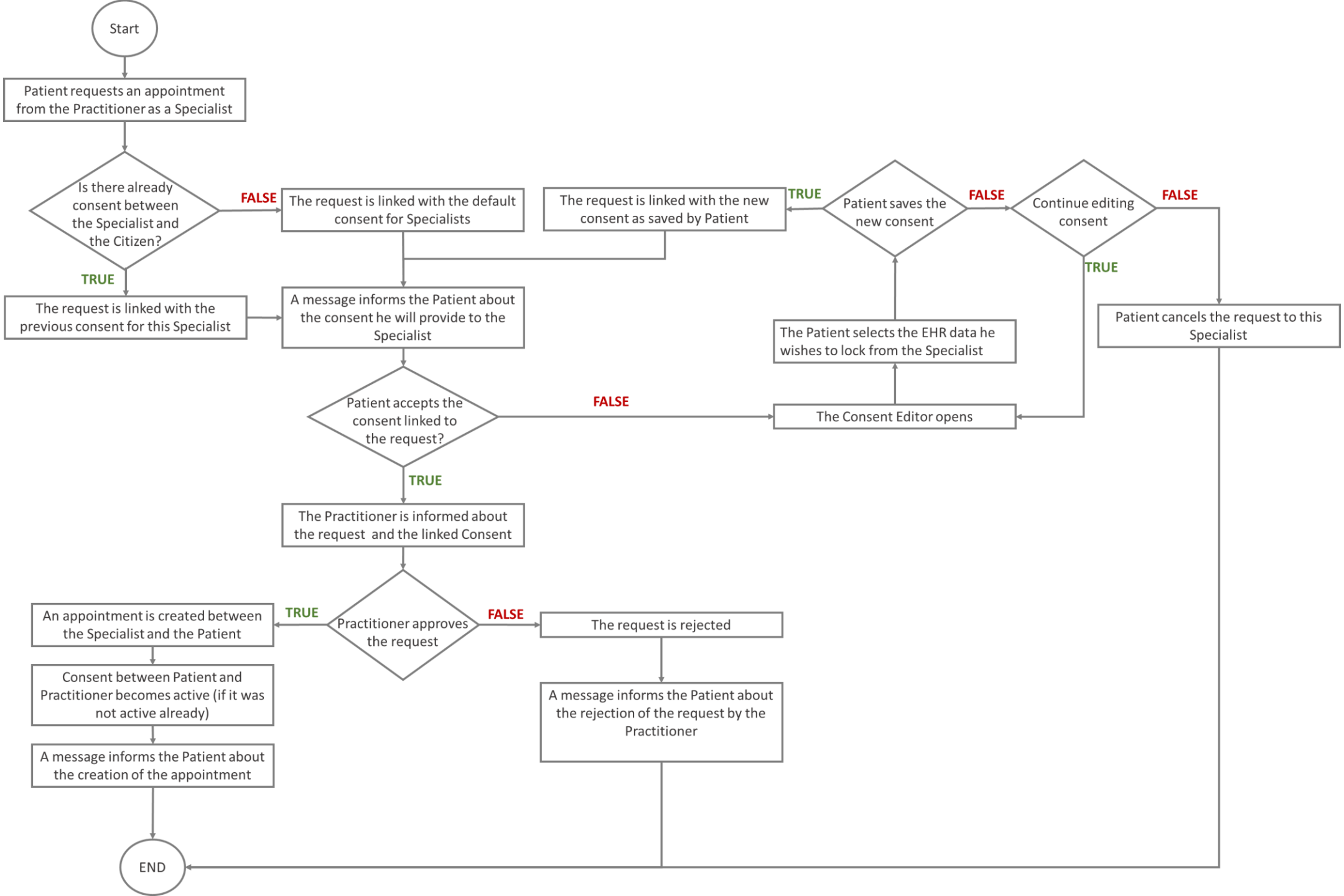
- When creating a new encounter, the Practitioner must define if he/she wishes to include the encounter as part of an existing Episode of Care or create a new one.

- The CareManager and the CareTeam of the Episode of Care need to have consent during the whole life of the episode of care.

Create Consent to a Personal Doctor

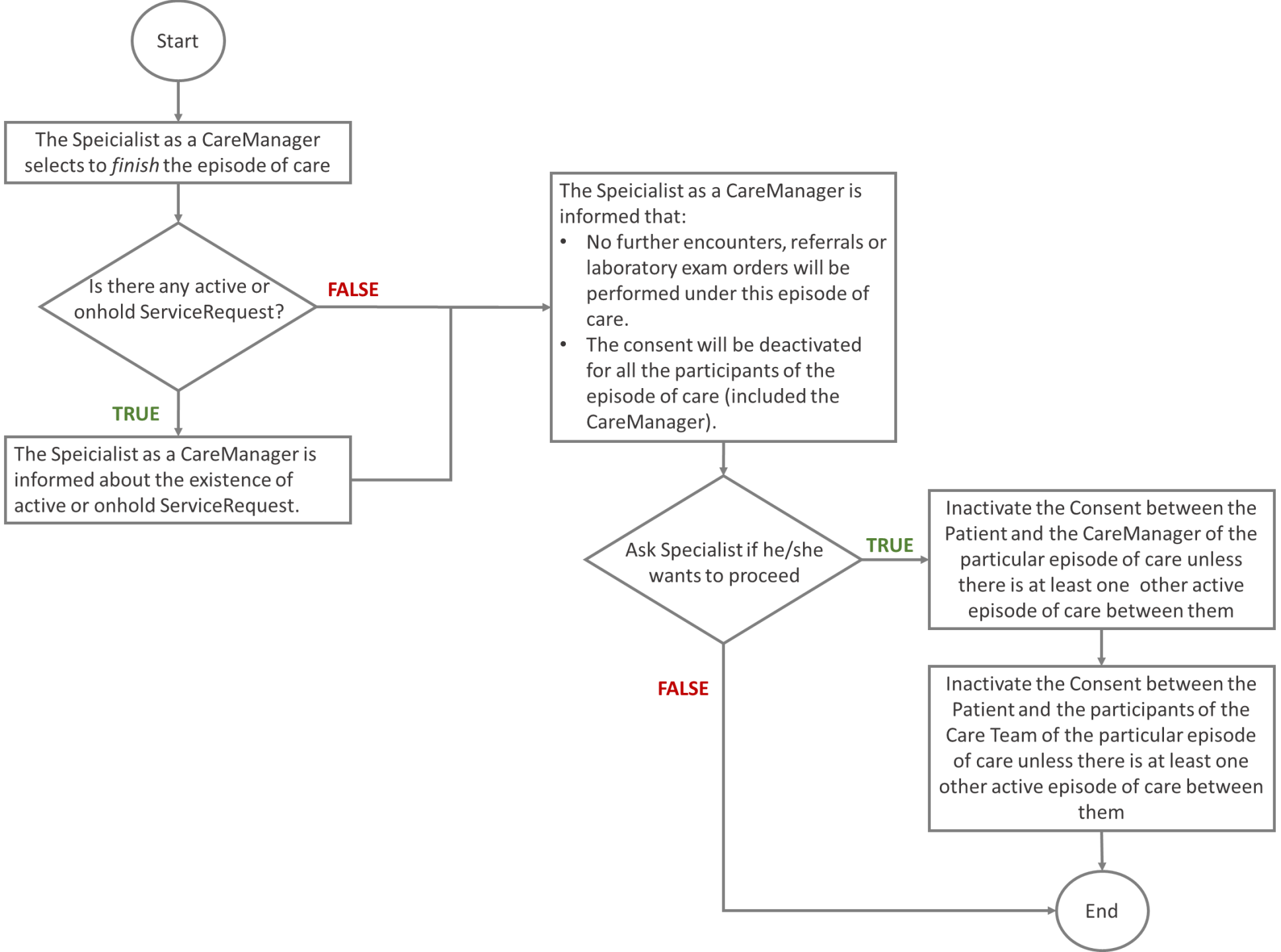


Create Consent to a Specialist



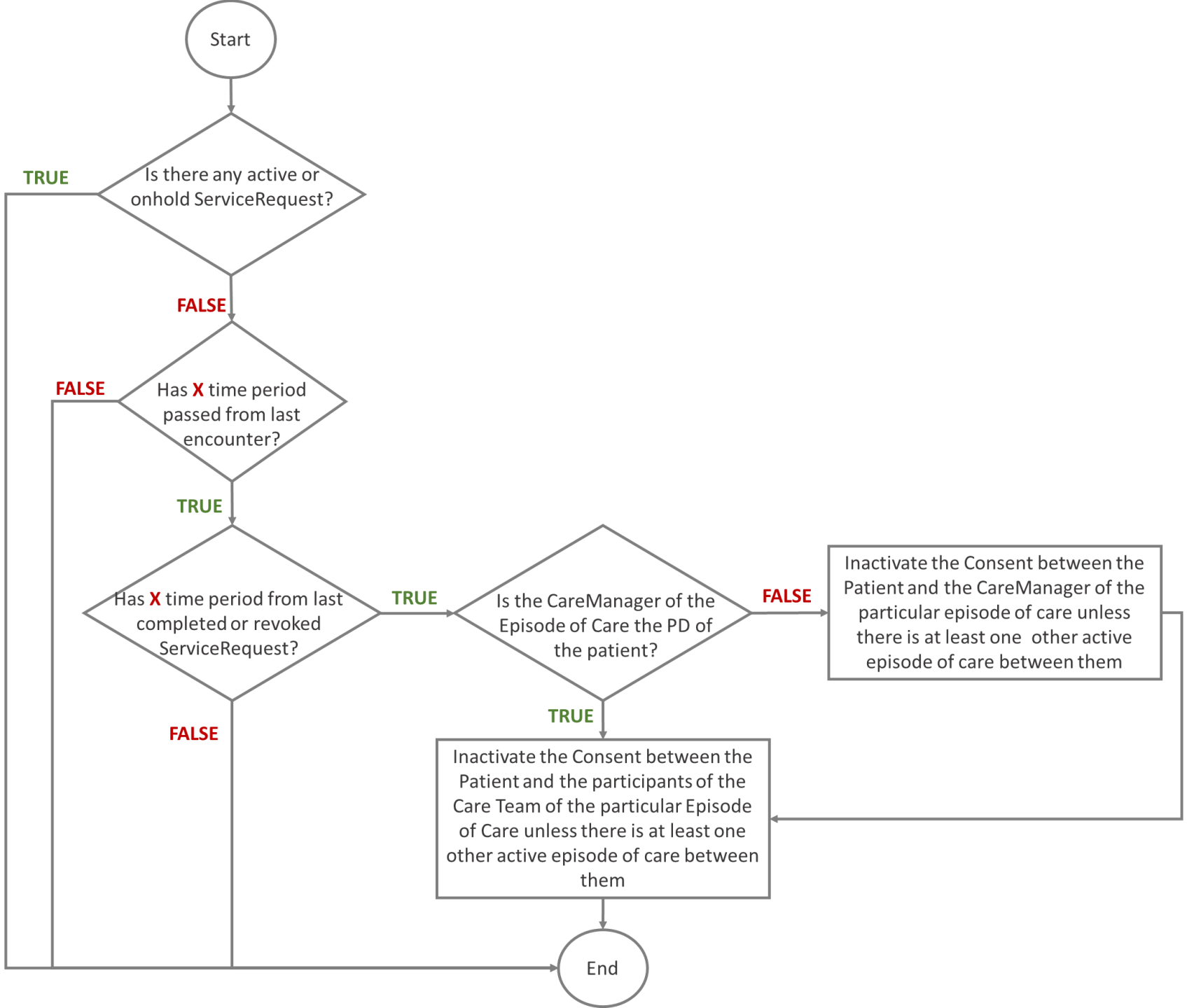
Consent lifetime for Specialists

Inside an expected workflow of an Episode of Care (Manual)

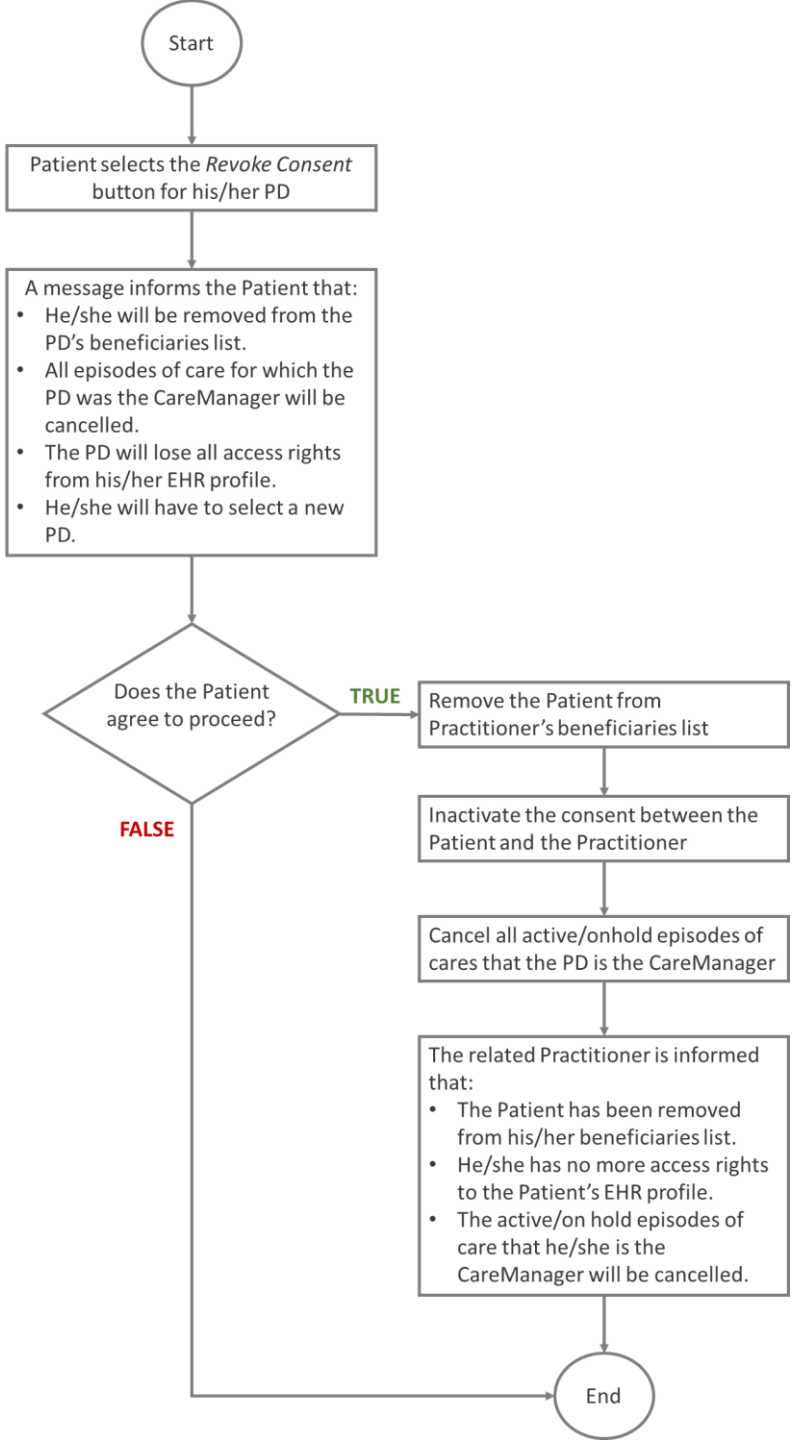


Consent lifetime for Specialists

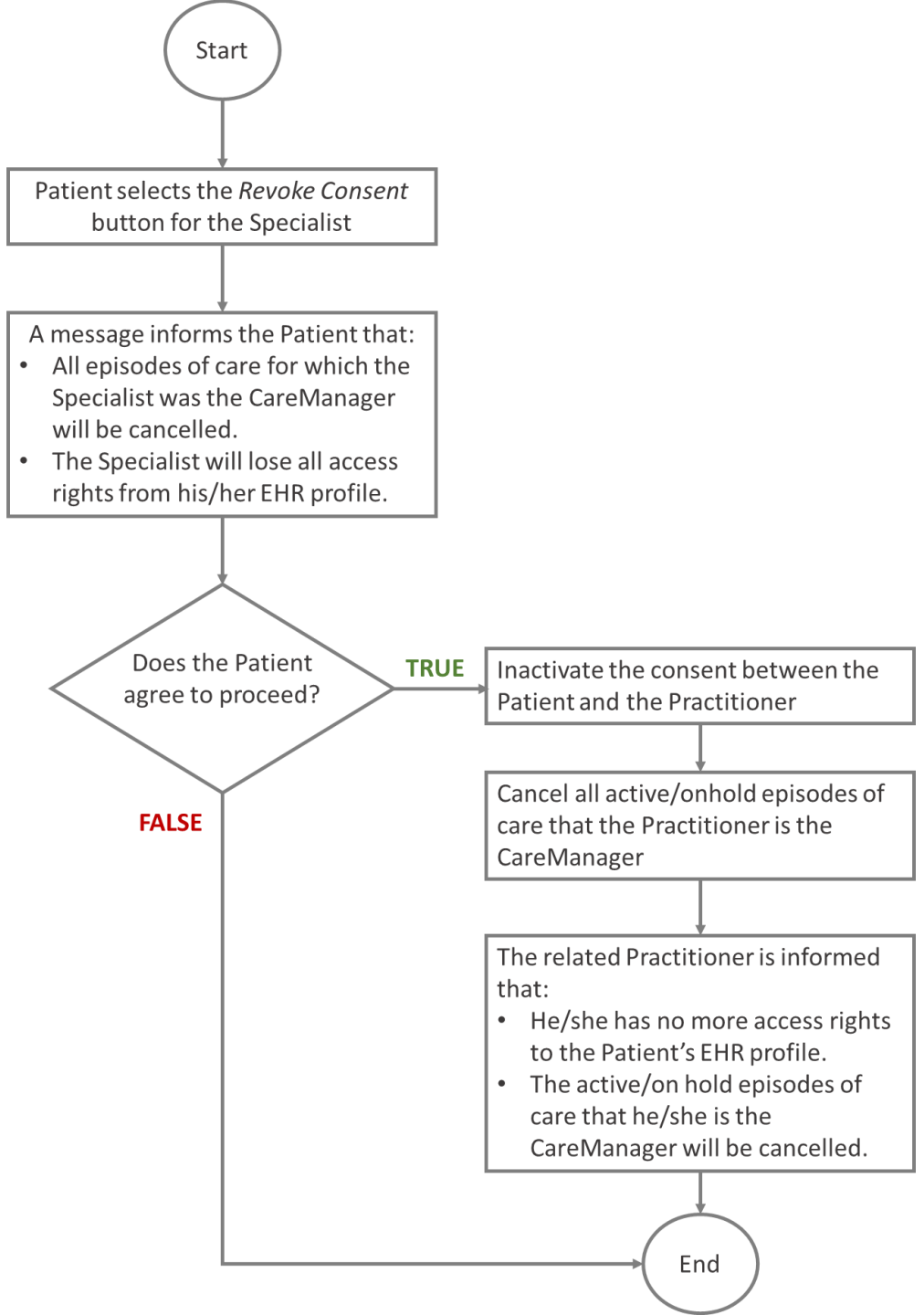
Inside an expected workflow of an Episode of Care (Automated)



Consent Removal from the Personal Doctor



Consent Removal from a Specialist



NEHA

- NATIONAL
- ELECTRONIC
- HEALTH
- AUTHORITY

NEHA - LAW

- Development of a strategy for the implementation of the legislation of the eHealth Law of 2019 (59(I)/2019)

ELECTRONIC HEALTH LAW

CLASSIFICATION OF ARTICLES

Article

STRATEGIC PLAN

- Creation - establishment and operation
- of a Single Data Bank for Electronic Health Records
- under the legislation of the Authority

NEHA - National eHealth Authority

Strategy on implementation and operation of a Single Data Bank for Electronic Health Records under the legislation of the Authority

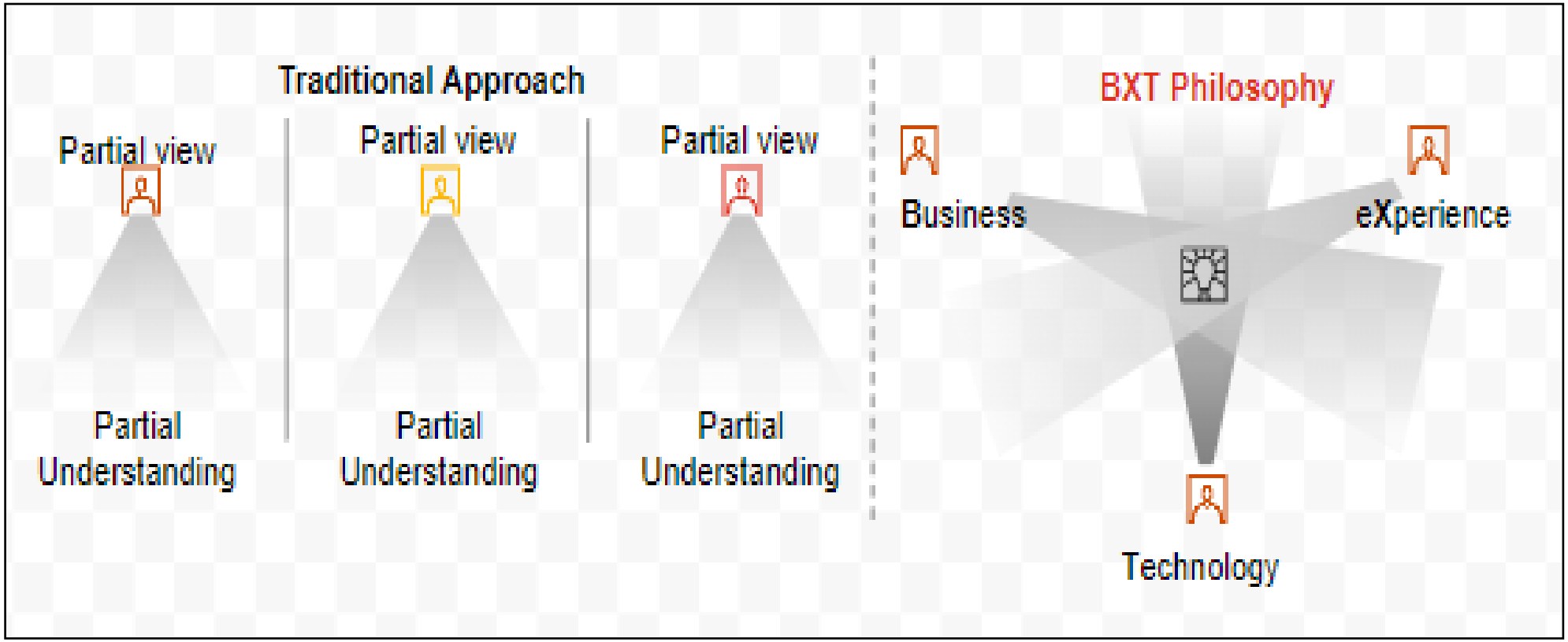
Cost and Benefit

Specifications for the creation / establishment and operation of a Single Data Bank for Electronic Health Records

Vision, purpose and objectives of the National eHealth Authority - NEHA

- The health care provider, whether a member or not of the GHS, but also any provider who may perform his duties in another European country, treats a patient who receives medical care during a planned or non-scheduled medical visit.
- Through the services of the NEHA-EHR, this health provider will be able to identify and use the available medical history of the patient to provide medical care based on medical evidence.
- This ensures that any medical care given to the patient will be the best possible, and the doctor's decisions will be aligned with the patient's medical history minimizing the need to repeat medical examinations that have already been carried out by another doctor elsewhere.

Methodology and actions for the implementation of the project



B X T PHILOSOPHY

Business

eXperience

Technology

BUSINESS

- The business lens that considers the functions of the health bodies involved, the policies and legislation related to the field of e-health such as
  - the ***existing health laws***,
  - the ***existing medical data*** that the various stakeholders collect (wherever they exist)
  - the organizational understanding of their operating systems.

eXperience

- The eXperience lens which considers the needs of users of a single electronic health record management bank, is important in terms of clarifying issues such as the encouragement to ***avoid duplication of information and the use of common standards of medical terminology.***
- The implementation of these needs in the early stages of the design of a single bank of electrical health records ***will allow the creation of a widely accepted system, with trusted medical content and automated absorption of information***.
- At the same time, ***understanding how patients feel about sharing their medical data*** can help create a citizen - centred system.

Technology

- The Technology lens, which examines the systems and the underlying infrastructure of the systems of the health institutions involved, ***wanting to make it clear whether medical systems such as***
- ***the HIS - Health Information System (OPSY) or***
- ***the Health Insurance System of the Health Insurance Organization (HIO)***
- ***can be used for the implementation needs of NEHA.***

Project implementation actions

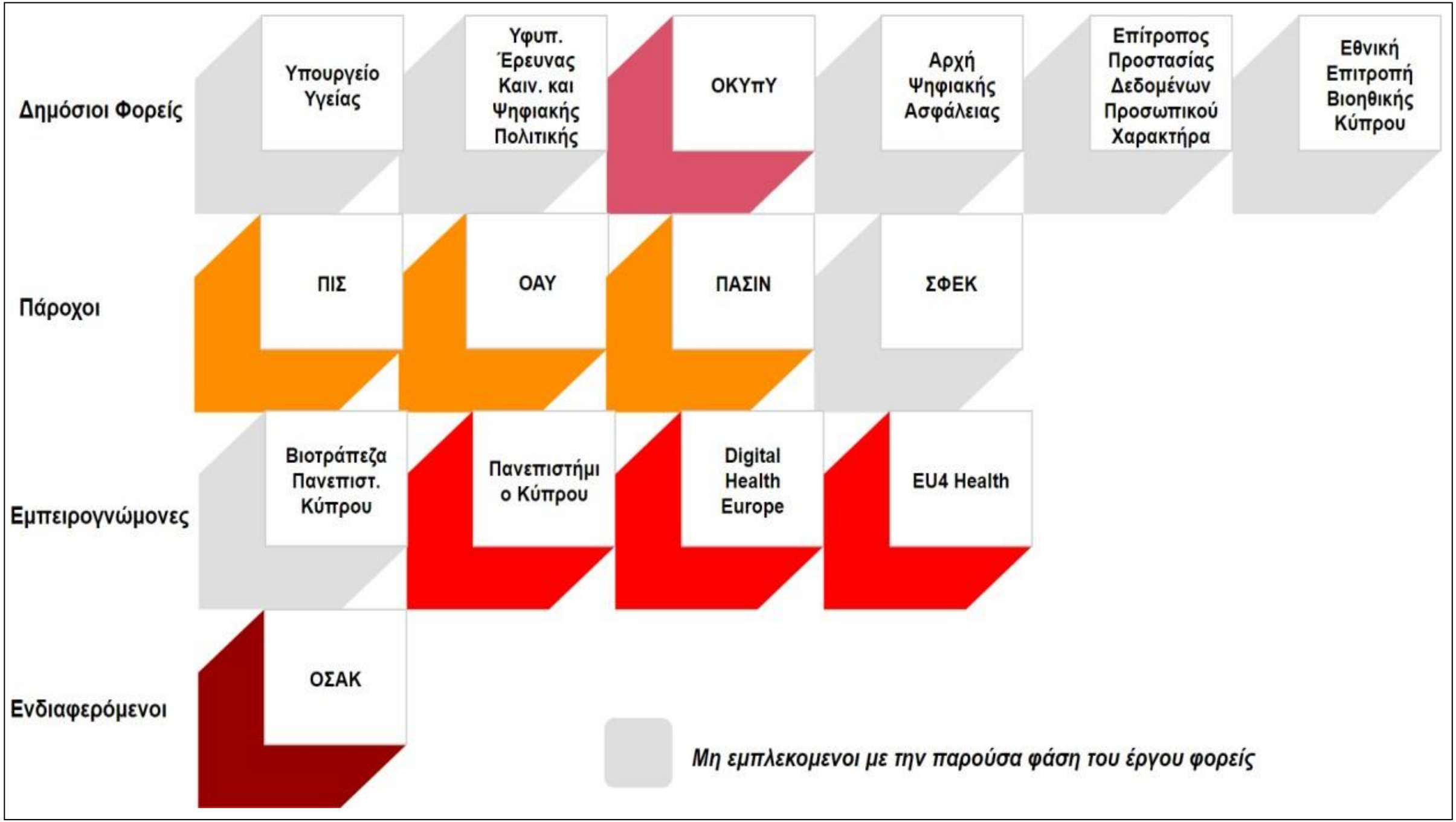
Analysis of the current situation

In order to understand the current health situation and the challenges that need to be addressed in the creation of the single EMR database, it was considered necessary to initially carry out a ***first collection of data from various stakeholders of the domestic health sector***

Through the interviews,

qualitative and quantitative data were collected and analyzed,

as well as the main ***views and suggestions*** about the study.


Δημόσιοι Φορείς
Υπουργείο Υγείας
Υφυπ. Έρευνας Καιν. και Ψηφιακής Πολιτικής
ΟΚΥπΥ
Αρχή Ψηφιακής Ασφάλειας
Επίτροπος Προστασίας Δεδομένων Προσωπικού Χαρακτήρα
Εθνική Επιτροπή Βιοηθικής Κύπρου
Πάροχοι
ΠΙΣ
ΟΑΥ
ΠΑΣΙΝ
ΣΦΕΚ
Εμπειρογνώμονες
Βιοτράπεζα Πανεπιστ. Κύπρου
Πανεπιστήμιο Κύπρου
Digital Health Europe
EU4 Health
Ενδιαφερόμενοι
ΟΣΑΚ
Μη εμπλεκομενοι με την παρούσα φάση του έργου φορείς

Stakeholders

Because there are many stakeholders involved, we recognized that their alignment was a challenge for this study in terms of data collection and analysis. For this reason, discussions focused on the following topics:

1. ***General information concerning the participating organization*** (e.g., range of services covered).

2. ***The degree of inter-operability*** of the electronic systems used, with emphasis on whether they act in a whole or in a fragmented manner.

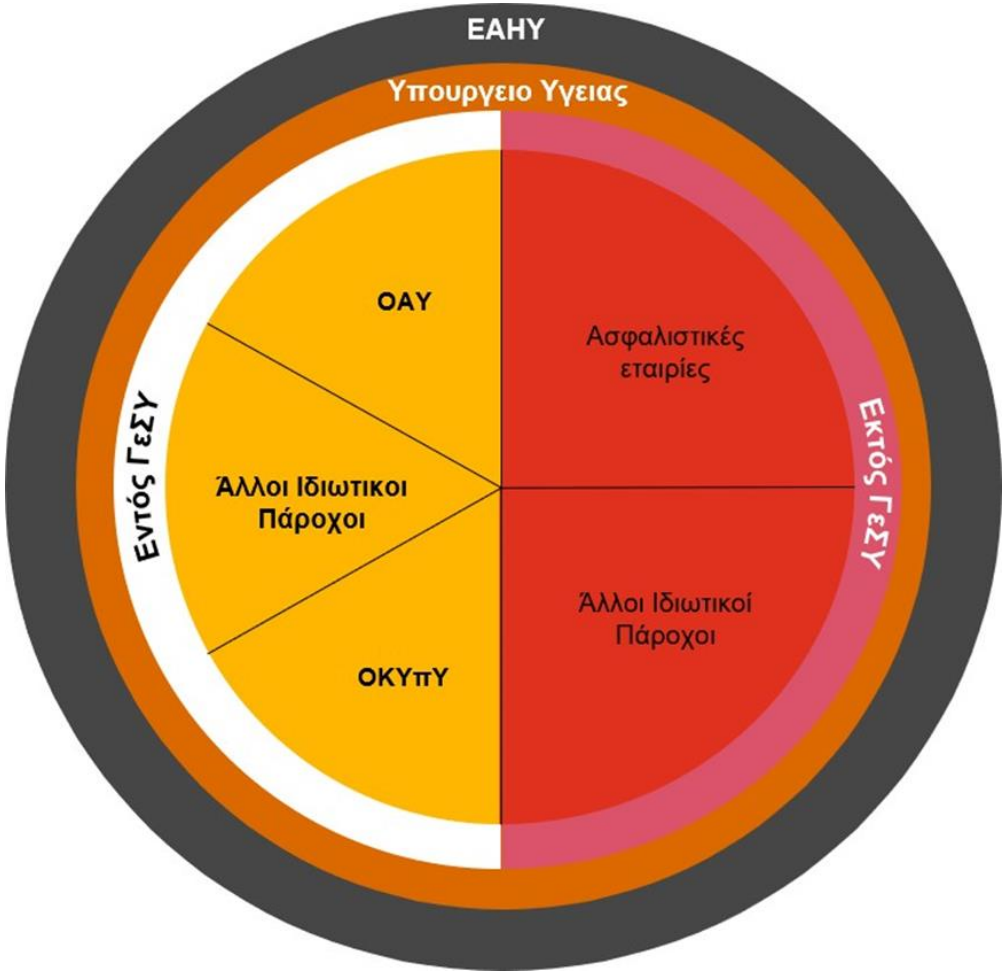
3. ***Details on the type of medical data stored*** in their respective systems.

4. ***Any views, assessments, suggestions and concerns about the NEHA – PLAN for the creation and operation of a single medical information collection database.***

Current Situation Analysis

Overview of the health sector in Cyprus

- Health insurance organization – HIO
- State health services organization – OKYPY
- Association of Private Hospitals
- National contact point - NCP



H I O

Today, the HIO supports most of the health sector in Cyprus by having the largest and most centralized projection of medical health data in Cyprus. ***This is the result of data generated for the purpose of paying healthcare providers***.

Quantitatively speaking, more than 90% of beds and ~95% of pharmacies and clinical laboratories have joined the GHS.

H I O

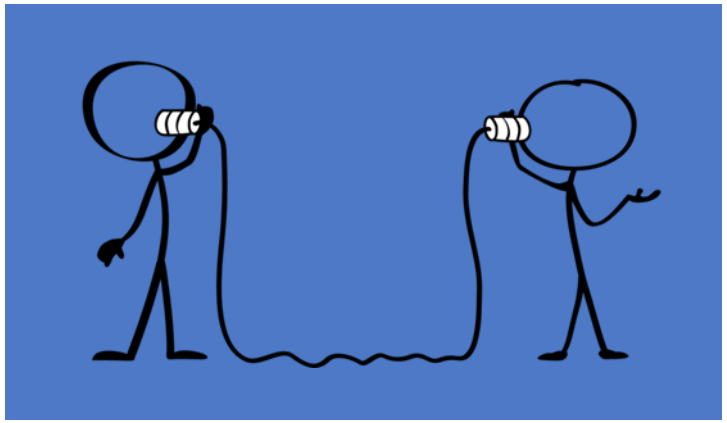
Today, the HIO supports most of the health sector in Cyprus by having the largest and most centralized projection of medical health data in Cyprus. ***This is the result of data generated for the purpose of paying healthcare providers***.

Quantitatively speaking, more than 90% of beds and ~95% of pharmacies and clinical laboratories have joined the GHS.

HIO

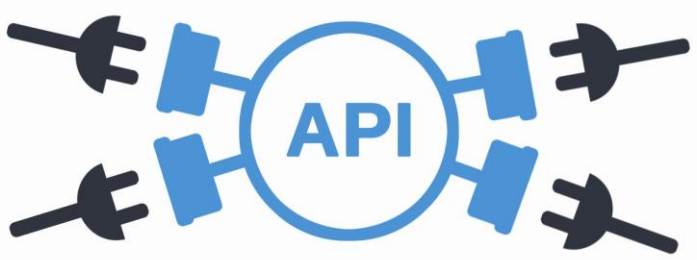
- The current IT solution, ***although it has managed to unify a large percentage of the public and private sectors*** in terms of the use of a single information and communication technology system,
- ***continues to lag behind in terms of interoperability regarding the exchange of available medical information within and outside the GHS.***

HIO



- The current IT solution, ***although it has managed to unify a large percentage of the public and private sectors*** in terms of the use of a single information and communication technology system,
- ***continues to lag behind in terms of interoperability regarding the exchange of available medical information within and outside the GHS.***

HIO



Many providers found themselves at a ***disadvantage position compared to those who did not use any IT system in the past***

To use their own information systems, and to prevent the ***time-consuming process of duplicating information between their own IT solutions and that of the GHS,*** the HIO has already taken steps to upgrade its operating system, through the integration of software applications (API),

HIO

The existing system was designed and operates as an insurance system.

It was not made to store valuable clinical and medical information

For example, medical information is entered in the HIO system only when the attending physician carries out any medical referral.

This can be done up to 30 days after.

State Health Services Organization - SHSO

Has 42 different software systems

That can not talk to each other

There is very little or NO meaningful medical information

A new system the OPSY – 2 system has just been announced 2 weeks ago. (48 millions !!)

One of their aims declare to be to work with NEHA on building a Patient Medical Record solution and SHSO wants to be the owner and be responsible for any change to this Universal Unified Electronic Medical Record.

Cyprus Association of Private Hospitals

52 different hospitals of all sizes

From small clinics to large private hospitals

Most of this hospitals run different HIS systems

Some have some RIS and PACS systems

Around 100 different systems are in use

None can talk to each other.

National Contact Point - NCP

The Ministry of Health of Cyprus has proceeded to the fulfillment of the obligation arising from Article 6 of Directive 2011/24/EU with the establishment and operation of a National Contact Point (NCP) for cross-border care.

At the same time, a website has been created in order to provide information to Cypriot citizens and citizens of EU Member States on "Directive 2011/24 / EU of the European Parliament and of the Council of 9 March 2011 on the application of patients' rights in cross-border health care.

National Contact Point - NCP

- According to the eHealth Law of 2019 (59(I)/2019), the NEHA is called upon to act in Cyprus and as the NCP for eHealth, ensuring the continuity of cross-border care and patient safety, through the provision of cross-border electronic health services.

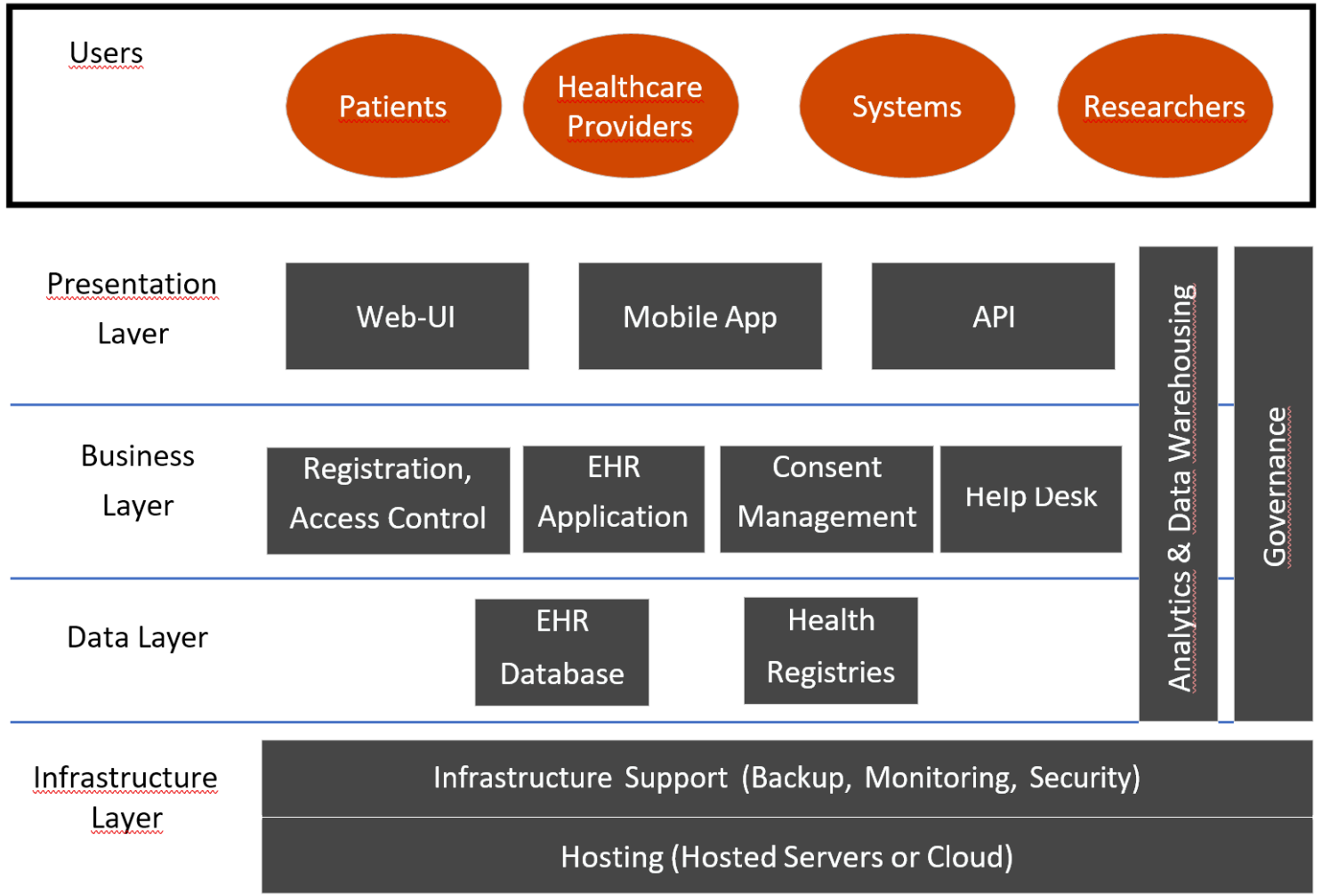
EUROPE

COUNTRY			Finland	Belgium	Luxembourg	The Netherlands	Malta	Denmark
ORGANISATION RESPONSIBLE			KANTA	The Brussels Health Network	eSante Luxembourg	Landelijk Schakelpunt (LSP)	myHealth	Sundhed
PURPOSE			To **enable** the storage of citizens' data in a national centralised service.	To **ensure** electronic and secure sharing of health data **by** and **between** health care providers and patients.	To **promote** optimal care and facilitate coordination in case of an emergency.	To **provide** a care infrastructure where providers are connected to allow consultations on patient medical data.	To **provide** a single medical electronic patient record available to all medical providers and patients.	To **bring** the entire health care sector together and enable citizens and health care professionals to meet and exchange information.
INFORMATION	EHR Content Data	Patient Summary	✓	✓	✓	✓	✓	✓
		ePrescription/Dispensation	✓	✓	✓	✓	✓	✓
		Laboratory results	✓	✓	✓	✓	✓	✓
		Genomic data	☐	☐	☐	☐	☐	☐
		Medical Imaging	✓	✓	✓	☐	✓	✓
		Medical consultations	✓	✓	✓	✓	✓	✓
		Wellbeing data	✓	☐	☐	☐	☐	☐
		Vaccinations	✓	✓	✓	✓	✓	✓
	Historicity of data		From date of implementation	Unknown	From date of implementation	Unknown	From date of implementation	From date of implementation
INTEROPERABILITY	Standards & Frameworks		• HL7 FHIR • IHE for medical standards	• HL7 FHIR • KMEHR medical standards	• HL7 FHIR • IHE	• HL7 FHIR • SNOMED CT • Cliq	• HL7 • WHO Standards	• HL7 • Danish Standards
ACCESSIBILITY	Access to the medical data		Every patient including every healthcare service provider	Every healthcare service provider including pharmacists	Access to the contents of the EHR can be given to everyone. However, certain EHR fields can be withheld according to doctor speciality (i.e., Physiotherapists do not have acess to biological data)	GP and your pharmacists can share important information about your health with other healthcare providers. Certain EHR fields can be withheld according to doctor speciality	Every patient including every healthcare service provider	Every patient including every healthcare service provider
	Security	Patient consent	Consent is given once, for all healthcare professionals all over Finland. Without consent, data can only be used by the healthcare service provider who has recorded it.	Data becomes available to medical providers only if the patient has given concent	Data becomes available to medical providers only if the patient has given concent.	Only with explicit consent other healthcare providers (other than the GP and Pharmacist) may view the medical data if it is necessary for the patient treatment	Acess to the data occurs only after the patient has given consent - the whole process is granular	The patient must approve health personnel access to his data
		Access Log information	✓	✓	✓	✓	✓	✓
		Patient right to restrict information	☐	✓	✓	✓	✓	✓

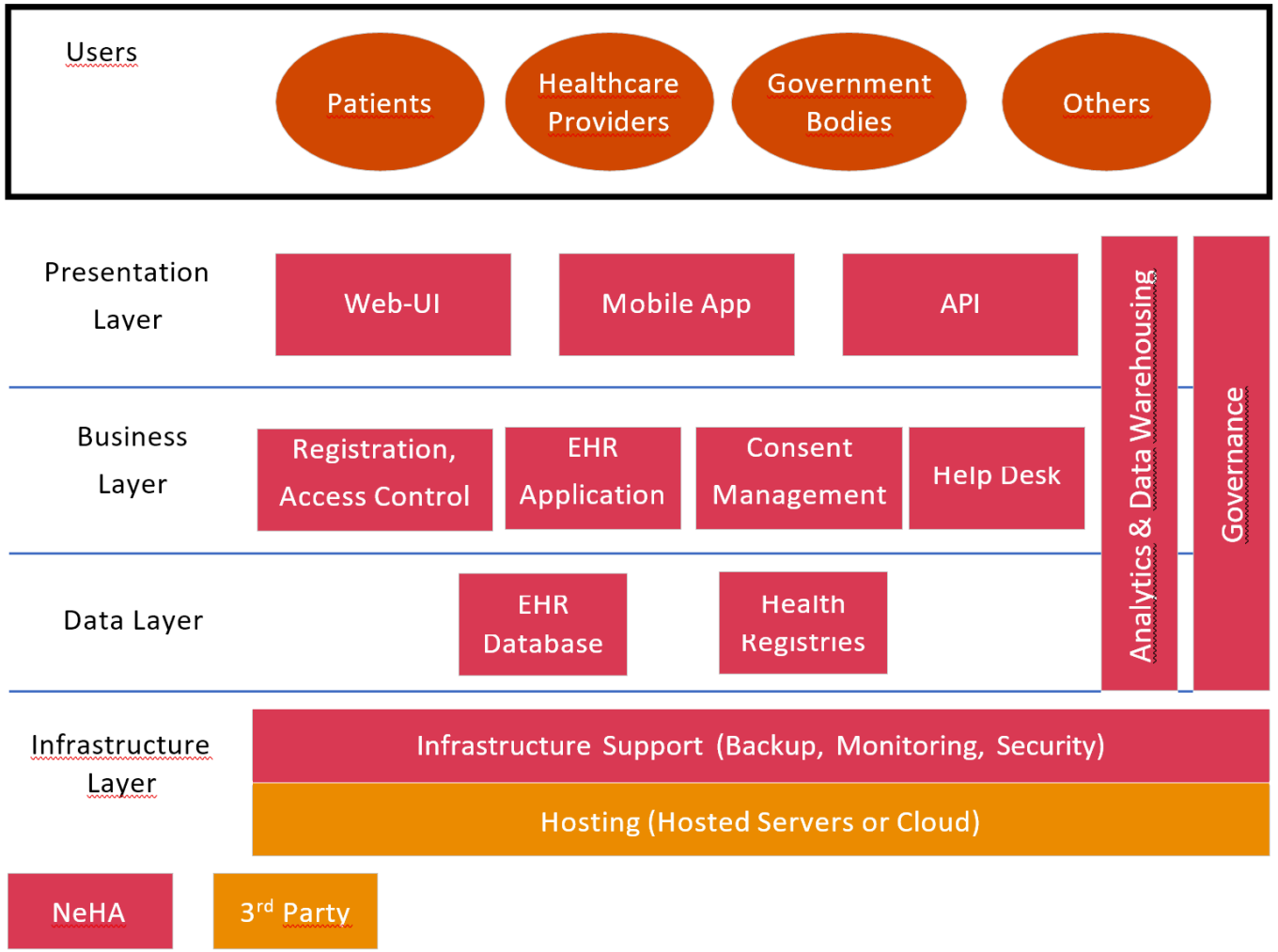
Conclusions

- It is of great importance to ***use international standards for coding medical terminology***
  - (ICD-10 OR ICD-11, SNOMED CT, CPT-4, ATC etc)
- The architecture of the system and the implementation should use the ***most "mature" Technologies***
- Countries such as Denmark have set up terminals for the storage of electronic health records, using a wide variety of integrated data collection circuits from the various health providers. The complexity of the integration and data transfer created several problems. This is something we want to avoid. ***AVOID COMPLEXITY***.
- Emphasis should be placed on the **quality of medical data rather than on the quantity of data**. The quality and ***completeness*** of the data is crucial for the doctor to trust the information within the file to provide medical care.
- Any solution implemented, should not force health providers to record anything, through two different systems. ***INTEROPERABILITY OF THE SYSTSEMS IS A MUST***.
- It is important to consider the ***scalability*** of the solution to be built. The scalability of a system will allow for the future to come. ***Any solution must therefore follow a modular architecture that will facilitate the implementation of future changes or updates.***

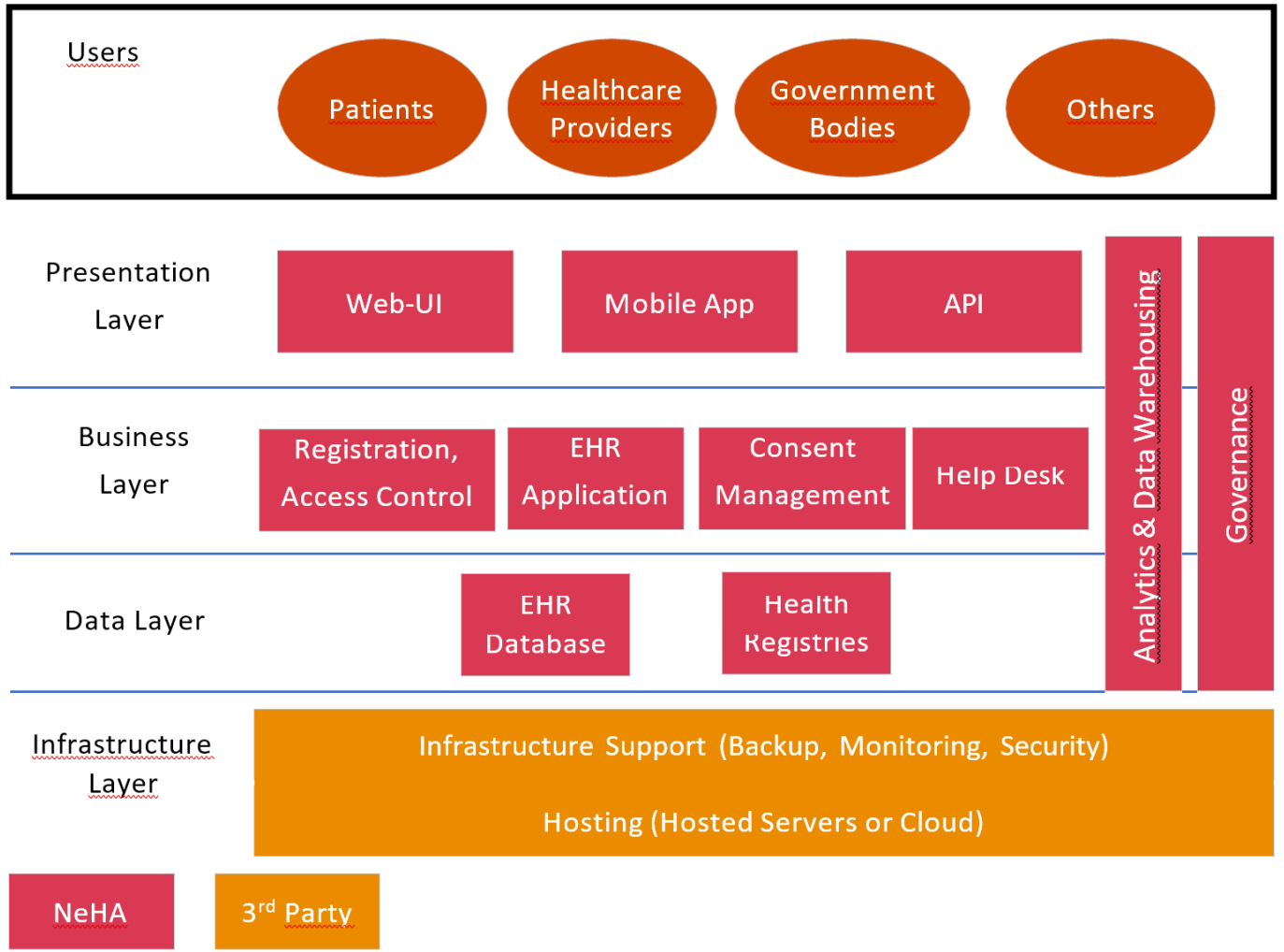
SYSTEM PLAN


Users
Patients
Healthcare Providers
Systems
Researchers
Presentation Laver
Web-UI
Mobile App
API
Business Layer
Registration, Access Control
EHR Application
Consent Management
Help Desk
Data Layer
EHR Database
Health Registries
Analytics & Data Warehousing
Governance
Infrastructure Layer
Infrastructure Support (Backup, Monitoring, Security)
Hosting (Hosted Servers or Cloud)

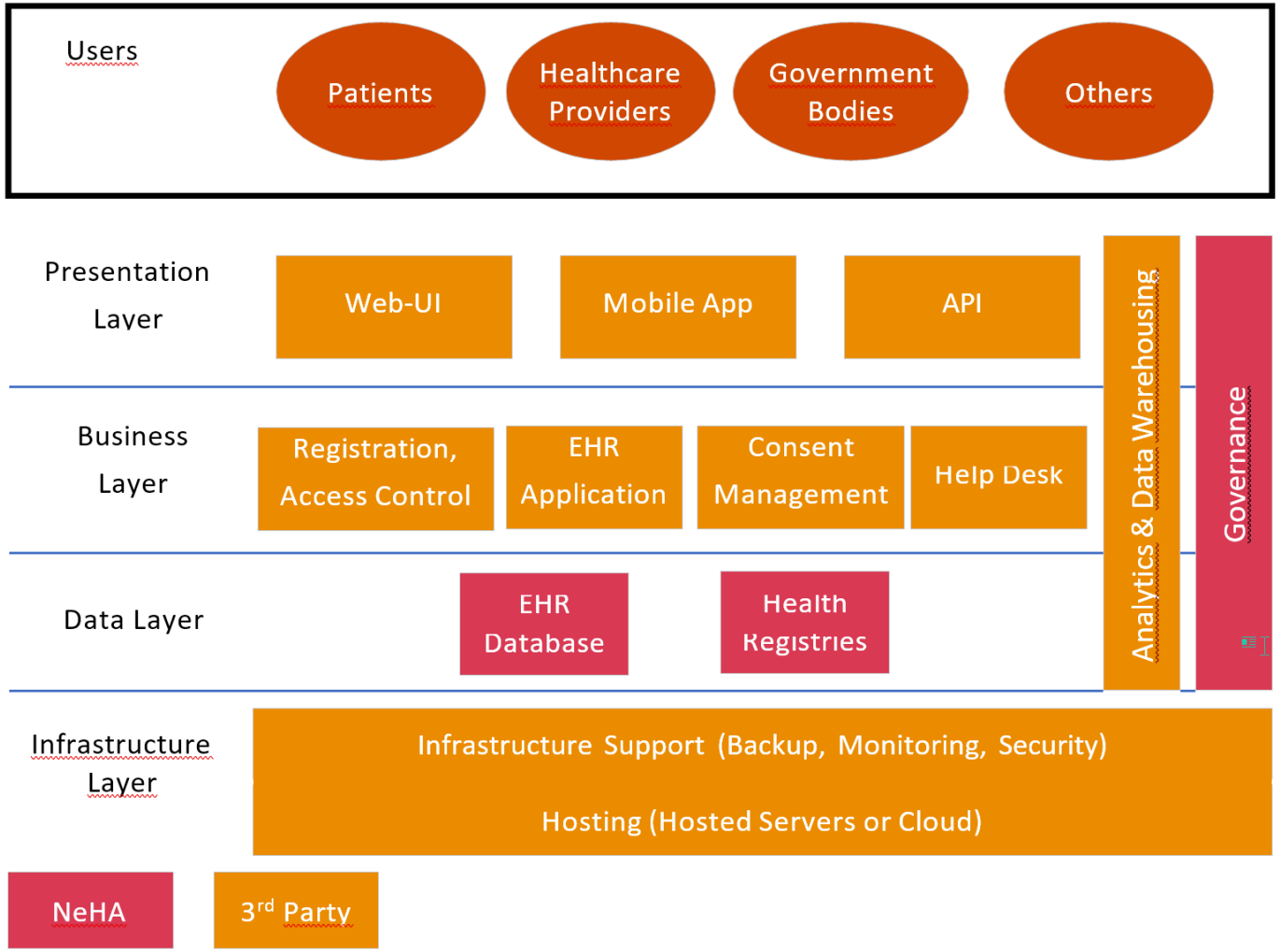
AUTONOMOUS MODEL NEHA



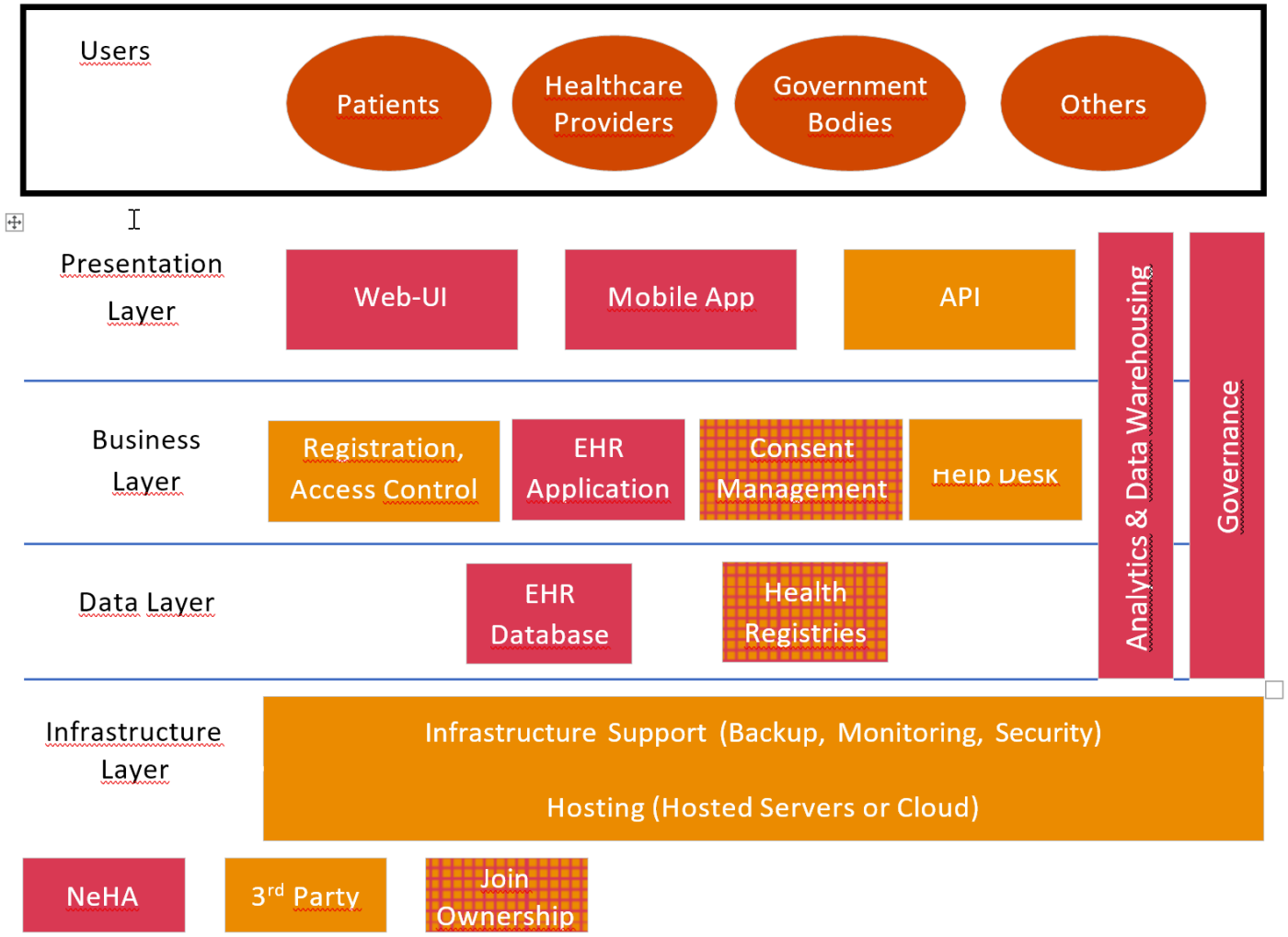
MODEL OWN BY NEHA

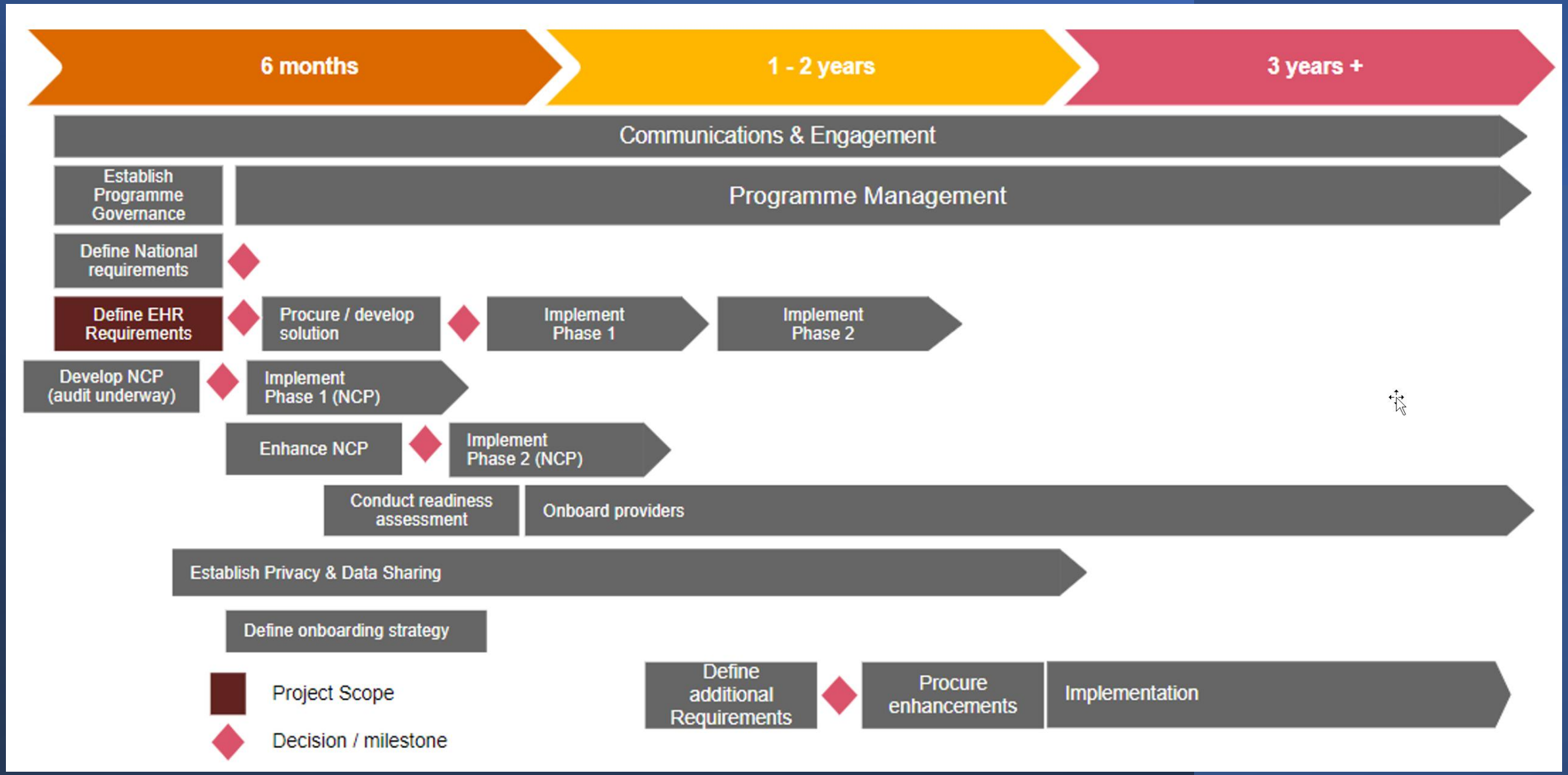


MODEL AS A SERVICE

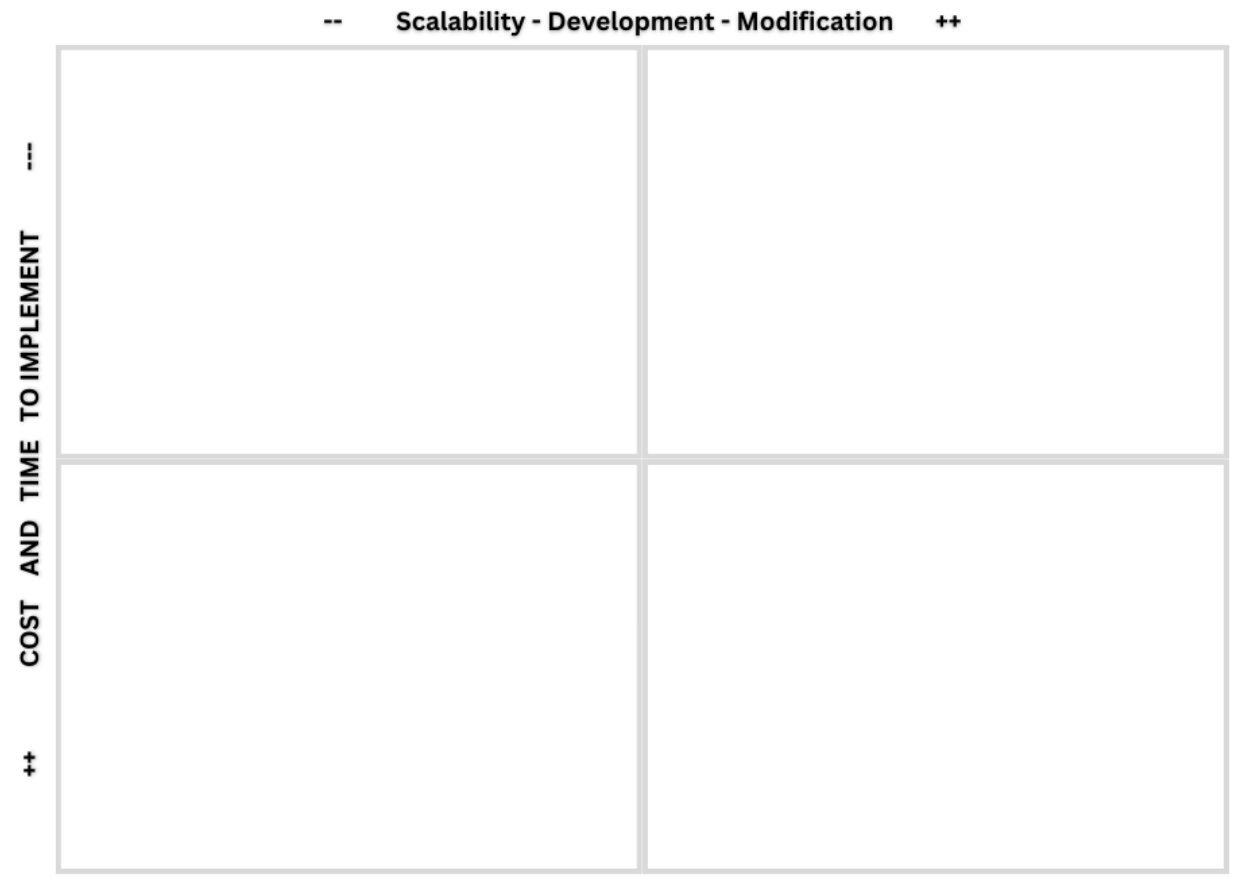


MODEL AS CO PARTNER

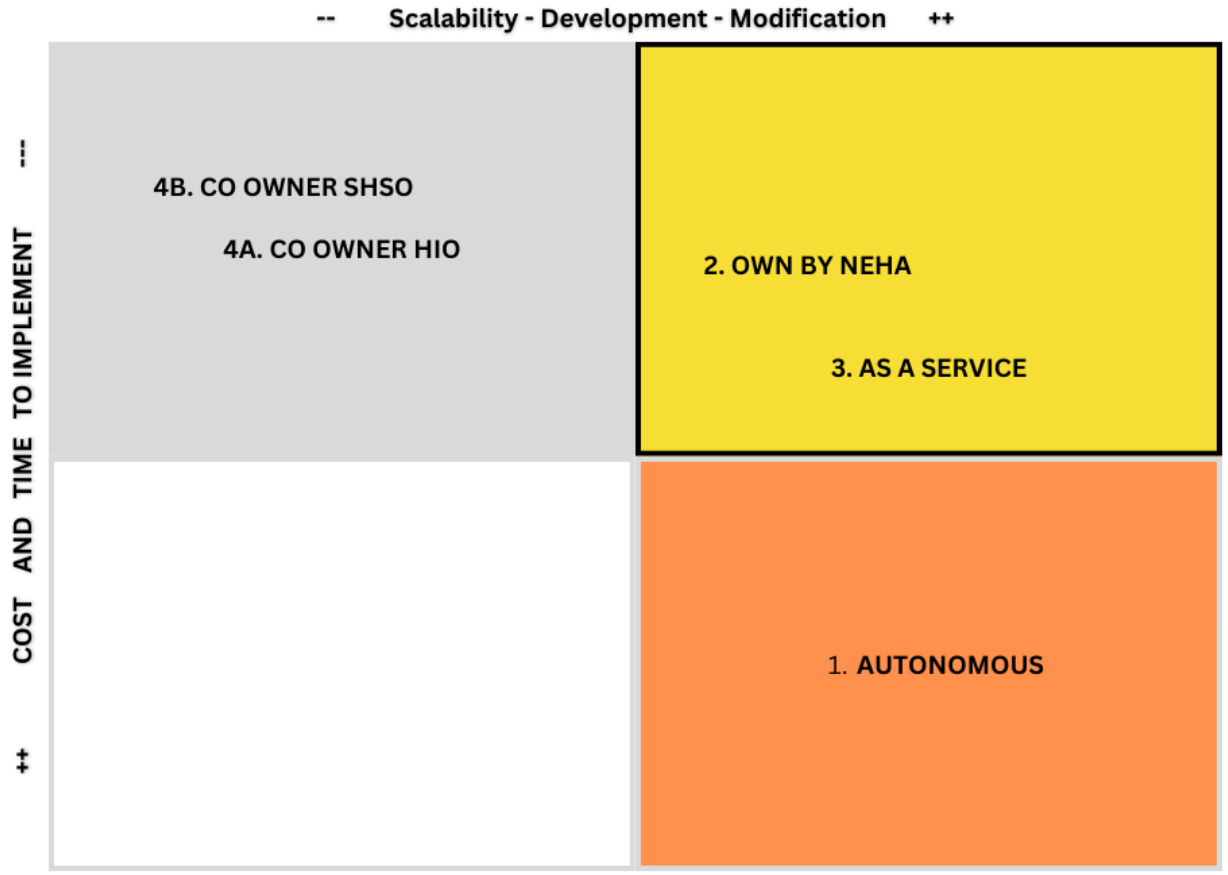



6 months
1 - 2 years
3 years +
Communications & Engagement
Establish Programme Governance
Programme Management
Define National requirements
Define EHR Requirements
Procure / develop solution
Implement Phase 1
Implement Phase 2
Develop NCP (audit underway)
Implement Phase 1 (NCP)
Enhance NCP
Implement Phase 2 (NCP)
Conduct readiness assessment
Onboard providers
Establish Privacy & Data Sharing
Define onboarding strategy
Project Scope
Decision / milestone
Define additional Requirements
Procure enhancements
Implementation

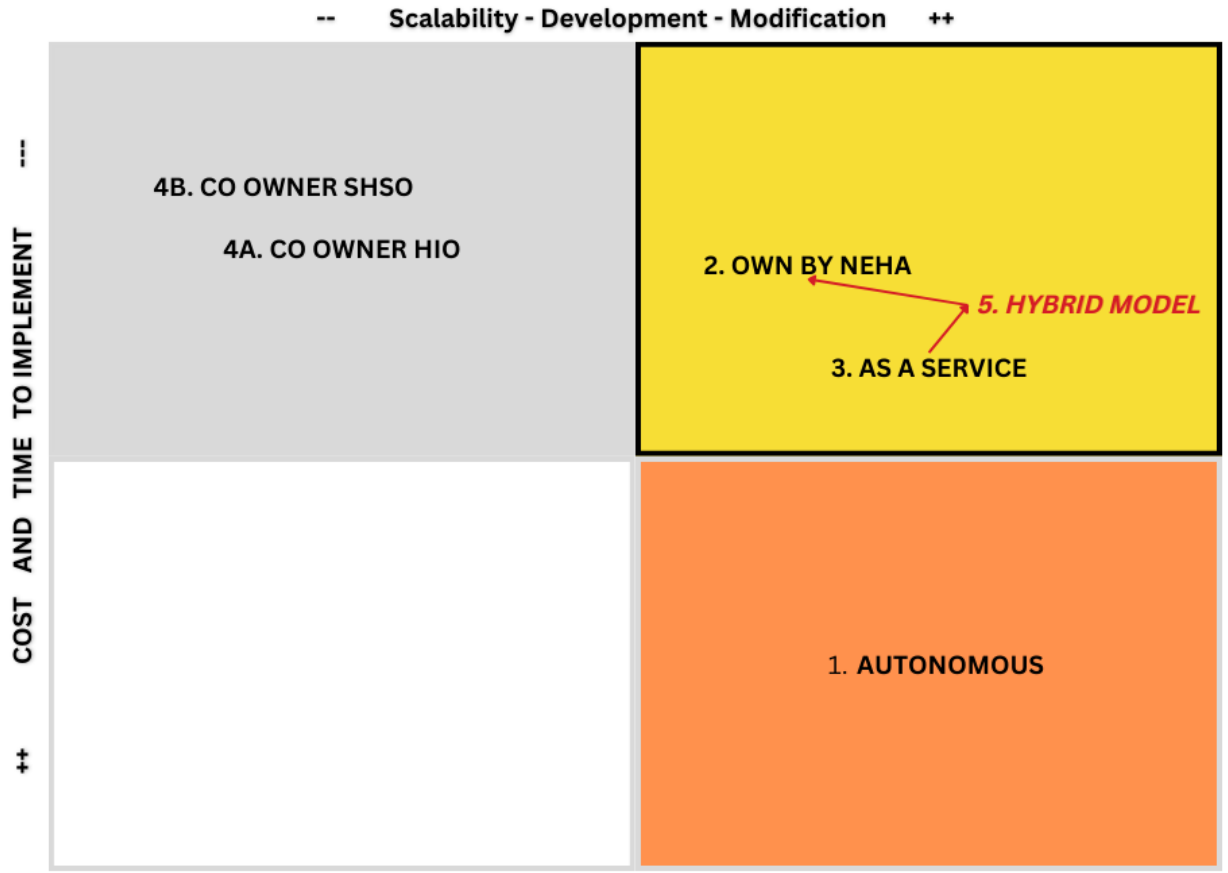
STUDY OF OPTIONS



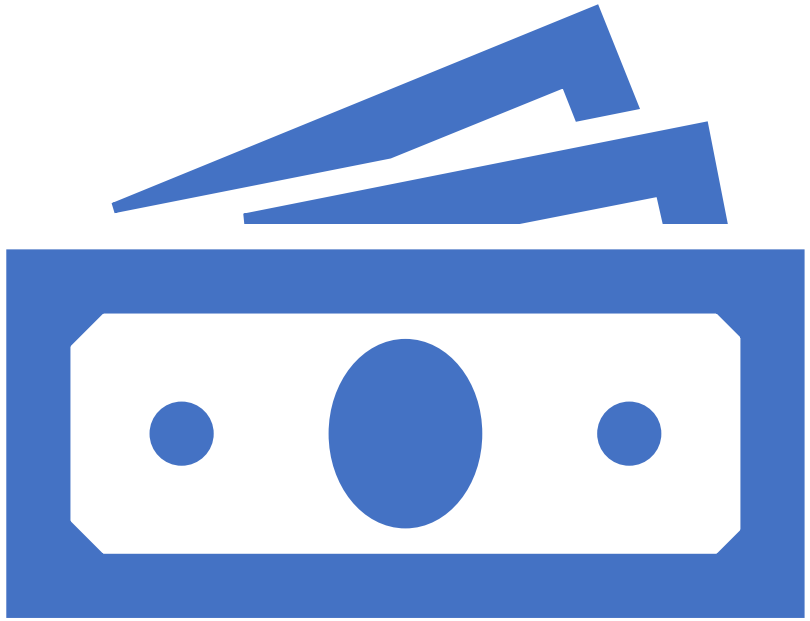
STUDY OF OPTIONS



STUDY OF OPTIONS



STUDY OF OPTIONS



COST AND BENEFIT

COST ANALYSIS

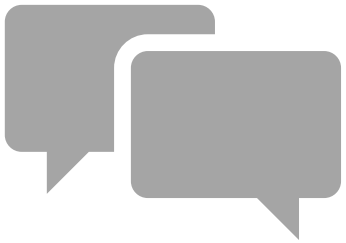
- **Program expenses** - reflect the *initial costs associated with the development of the project.*
- **Operating expenses** - are defined as *the costs of support and management of the system during its operation*.
- **Costs of providing services** - relate only to alternative 2 (As a Service) and are the costs that NEHA will have to pay to the service provider for the project.

COST

Περιγραφή Κόστους	Είδος Κόστους	Στρατηγική 1		Στρατηγική 2	
		1ος Χρόνος (€)	2-7 Χρόνια (€)	1ος Χρόνος (€)	2-7 Χρόνια (€)
Προσωπικό υποστήριξης	Έξοδα προγράμματος	1.050.000	5.215.000	850.000	5.215.000
Προσωπικό υποστήριξης	Λειτουργικά Έξοδα	372.000	4.480.000	-	-
Υλοποίηση	Έξοδα προγράμματος	2.000.000	-	-	-
Μηχανήματα και εξοπλισμός	Έξοδα προγράμματος	565.000	35.000	-	-
Ανάπτυξη λογισμικού και δικτύου	Έξοδα προγράμματος	750.000	-	-	-
Συντήρηση και αναβάθμιση λογισμικού	Λειτουργικά Έξοδα	-	2.800.000	-	-
Παροχή υπηρεσιών	Έξοδα παροχής υπηρεσιών	-	-	2.000.000	11.670.400
Λοιπά έξοδα εκπαίδευσης και διαχείρισης αλλαγών	Λειτουργικά Έξοδα	60.000	590.000	60.000	400.000
Προσαρμογή κόστους κατά 5%		67.350	656.000	145.500	864.270
Σύνολο		**4.864.350**	**13.776.000**	**3.055.500**	**18.149.670**
		18.640.350		**21.205.170**	

Benefit analysis

Quantitative benefits



Qualitative benefits

Quantitative benefits

- Reducing the cost of care per patient
- Reduction of double medical examinations
- Reduction of the average Hospital length of stay
- Increased productivity of the workforce
- Reduction of primary care visits
- Reduction of avoidable hospitalizations

Reducing the cost of care per patient

- A study by PwC Australia, estimated that hospitalizations from ***medical errors can be reduced by up to 4%.***

- The results of a study of 5 million people in the U.S. showed that ***patients treated in hospitals with advanced electronic health records cost an average of 9.66% less*** than patients admitted to hospitals without an electronic patient record (Swanson Kazley et al. 2014).

Reduction of double medical examinations

- A study by PwC Australia predicts that around ***13% of medical examinations*** performed in clinical laboratories and radiology centers ***can be avoided through the exchange of information between medical providers.***

Reduction of the average Hospital length of stay

- Lee et al., 2015, identified that ***the duration of hospitalization in hospitals with complete electronic patient record was 0.59 days less***

Increased productivity of the workforce

- The scientific journal Health Economics, Policy and Law, shows that ***the implementation of electronic record increased the productivity of medical staff by 6%.***

Reduction of primary care visits

- Two years after the full implementation of electronic health records, ***primary care visits decreased in two U.S. regions by 11%*** (Garrido et al., 2005)

Reduction of avoidable hospitalizations

- Supporting clinical decisions ***can reduce preventable hospitalizations by up to 37%*** (Wong, 2008).

- The capabilities of the electronic health record ***can reduce the readmission rate by 26% through better data analysis***, access to clinical notes and support decisions (Amarasingham et al., 2012)

Qualitative benefits

The qualitative benefits are understood and valued primarily by patients, healthcare professionals and healthcare managers.

At the same time, while their social benefit is clear, these benefits, are not easy to quantify.

Qualitative benefits

- Preventive management of care
- Improved provider collaboration
- Improved patient management
- Integrated management of health services
- Better research on population health and clinical interventions

Preventive management of care

Through a comprehensive long-term management of medical conditions based on the correct communication, thorough description and availability of the patient's full medical history ***Decisions are not made using incomplete medical information***.

As a result, ***fewer patients fall victim to wrong medical decisions or Errors***, which leads to **more satisfactory medical experience**

Improved provider collaboration

With electronic patient medical records constantly available and in a standardized format, ***the overall decision-making support and the ability of providers to collaborate is significantly increased***.

Medical care providers can form teams from the wide range of information ***leading to multidisciplinary approach on treatment plans***.

Improved patient management

Currently, ***early and effective intervention are being missed due to the lack of available clinical data***, which ultimately leads to delays in clinical involvement of specialists.

The continuous upgrading of the content of electronic health records ***will lead to improved decision support*** by reducing the time required before making medical decisions.

Integrated management of health services

- Through the management of hospitals and health services that can be supported ***through the monitoring of patient flow, service costs and clinical outcomes***.

Better research on population health and clinical interventions

The data in electronic health record systems contain a ***rich source of retrospective data that can be used to analyze health trends***.

The results of the various investigations can also ***support the development of guidelines based on medical evidence*** implemented as best clinical practices

$$NPV = \sum_{t=0}^{t-1} \frac{Bt}{(1+r)^{t-1}} - \sum_{t=0}^{t-1} \frac{C_t}{(1+r)^{t-1}}$$

COST AND BENEFIT

COST AND BENEFIT

- NPV – NET PRESENT VALUE
- T – Years
- R – Interest
- B – Benefits
- C – Costs

BENEFIT OVER TIME (7 YEARS) – 2%

1. **Καθαρή Παρούσα Αξία (NPV)**

Τα αποτελέσματα που προκύπτουν από τον υπολογισμό του NPV είναι ως ακολούθως:

Στρατηγικές Επιλογές (ΣΕ)	NPV (€)
Στρατηγική Επιλογή 1 - Ιδιόκτητο	137.999.355
Στρατηγική Επιλογή 2 - Σαν υπηρεσία	146.245.347

Πίνακας 4: NPV στρατηγικών επιλογών

BENEFIT OVER TIME (7 YEARS) 1% - 6%

Ανάλυση ευαισθησίας:

	Υφιστάμενο	Χαμηλότερο	Ψηλότερο
	2%	1%	6%
NPV - Στρατηγική Επιλογή 1 - Ιδιόκτητο	137.999.355	60.285.286	448.855.635
NPV - Στρατηγική Επιλογή 2 - Σαν υπηρεσία	146.245.347	63.325.012	477.926.688

Πίνακας 6: Ανάλυση ευαισθησίας για το ποσοστό όφελους κόστους

Hypotheses, assumptions and sensitivity analysis

- During the calculation of the NPV, we identified 7 areas that require a higher degree of judgment or are more complex, or areas where the assumptions and calculations are likely to have a significant effect on the outcome of the model. As a result, we described below the 7 areas together with the sensitivity analysis, presenting the results of the NPV in case we had a lower or higher source of information.

- i. Cost benefit rate
- ii. Cost adjustment
- iii. Growth rate
- iv. Discount rate
- v. Total costs of system implementation
- vi. Period cost benefits
- vii. Profit rate from a supplier (CC2)

Cost benefit rate

- **The percentage range used in other cases is between 2 – 7% for the calculation of the NPV**, *the lowest percentage (2%) of the spectrum was used, for the following reasons*:
- The size of the country is always directly relevant along with the rate of benefit from such projects. Considering the size of Cyprus compared to other national EHR projects, then the cost-benefit rate will be significantly lower, due to lower economies of scale.
- GHS was first implemented on 1 March 2019, which means that the system is still new.
- The HIO already has an existing system which allows for a central but basic visibility of patient information.