



# InteropEHRate

**D5.14**

## **HCP Web App – V2**

### **ABSTRACT**

This deliverable presents the features and relevant technical aspects of the prototype of HCP Web app (designed in Task 5.1) – second version, corresponding to the second year of InteropEHRate project implementation. The HCP Web App prototype is a web app used by healthcare professionals for creating and accessing health data of patients. Healthcare professionals will use HCP Web App to securely exchange health data of their EMRs with any S-EHR (mobile or cloud) and to read health data stored in federated EHRs. This deliverable, drafted as demonstrator, is the second of the three iterations dedicated to development of HCP Web App prototype, corresponding to *Task 5.5 – Implementation and system testing of incremental EHRs integration*.

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DRAFT

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## LOGTABLE

Version	Date	Change	Author	Partner
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## ACRONYMS

Acronym	Term and definition
D2D	Device to Device protocol
EHR	Electronic Health Record
EMR	Electronic Medical Records
HCP	HealthCare Professional
S-EHR	Smart HER
Weasis	Weasis is a multipurpose standalone and web-based DICOM viewer

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# 1. INTRODUCTION

## 1.1. Scope of the document

The deliverable is the second demonstrator of *WP5 – Incremental EHRs integration*, covering the most relevant features and technical aspects of the prototype of HCP Web app (designed in Task 5.1) – second version, corresponding to the second year of InteropEHRate project implementation. At this stage of project implementation, the deliverable aims to present the status of HCP Web App prototype development, addressing essentially the import/export data from/to the S-EHR App for medical visit scenario and download data from S-EHR Cloud for the emergency scenario.

This document is a SW related report, a pointer to the actual source code is available at <http://iehrgitlab.ds.unipi.gr/interopehrate/reference-hcp-app/hcp-app> and the executable files are available at <https://drive.google.com/drive/folders/1Dd61TLV9vLaqadFVNshwQ3AlZgDEH4ts>.

## 1.2. Intended audience

The document is intended to different categories of professionals, such as:

- Technical staff: developers, consultants, analysts, web designers, interested to have an overview about HCP Web App;
- Healthcare professionals interested in how to use HCP Web App from the perspective of end-users.

Both categories might be interested in participating in co-design sessions during each development cycle (3 iterations), in order to improve and enrich the solution capabilities.

## 1.3. Structure of the document

The deliverable is structured in three chapters, as follows:

**Section 1.** Introduction: Presents a summary concerning the purpose and objectives of the deliverable, its structure and relation to other tasks and deliverables.

**Section 2.** Software Description: Presents and describes the main information of the software developed by SIMAVI within the InteropEHRate project.

**Section 3.** Overview: Describes details of the content of the current release of the HCP application. Also, presents tips on how to build, install and use the Healthcare Professional application.

## 1.4. Updates with respect to previous version (if any)

The current deliverable aims to present more relevant features and functionalities of the HCP Web App used by healthcare professionals for accessing and creating health data of patients than the version of HCP application presented on D5.13 HCP Web App - V1 at the beginning of Year 2. Major modifications and improvements were done, during this period, on the Graphical User Interface and also on the backend side and functionalities.

The top main functionalities implemented and developed this second Year in the HCP app are:

- The connection with S-EHR Cloud (implemented by Byte) was added into the system;
- Translation services, developed by UNITN, were integrated in the app;
- A lot more changes and improvements were done in the GUI (Home page, Current Patient tab and Administration tab) with more entries and screens;
- Security implementation was added in HCP app with roles, authorities and restrictions for the current user/HCP;
- The HCP app now has capabilities of uploading data back into the S-EHR mobile app;
- Weasys was integrated for visualizing DICOM content images;
- PDF documents and images can be transferred from S-EHR app to HCP app via D2D library;
- A backend microservice is developed for sending the current patient data from one HCP to another without a D2D connection;
- Other small functions like pagination and filtration were developed as well.



## 2. SW DESCRIPTION

SW TITLE	HCP Web App
SW VERSION	V2
LICENCES AND PATENTS	Apache License
PROGRAMMING LANGUAGES	Java (JDK15)
SUPPORTED PLATFORM(s)	Platform independent (there is a limitation for Windows OS introduced by the current D2D implementation)
SOURCE CODE	<ul style="list-style-type: none"><li>- <a href="#">HCP app</a></li><li>- <a href="#">HCP hospital services</a></li></ul>
EXECUTABLE	<ul style="list-style-type: none"><li>- <a href="#">GDrive location</a></li></ul>

Table 1 – SW DESCRIPTION

## 3. OVERVIEW

In this chapter of this deliverable, an overview of the most relevant aspects of the solution implemented is going to be presented. Every decision and implementation structure regarding the solution has been done according to the defined user requirements (scenarios and user requirements presented in deliverable **[D2.2]** User Requirements for cross-border HR integration - V2) and from the deliverable **[D4.5]** Design of libraries for remote and D2D HR exchange - V2 which is concerned about the designing methods of the most important library used for data exchange.

### 3.1. Building guide

In order to build the HCP App project, the basic process of packaging any Java Maven project is the simplest method which produces the executable Jar file. This Jar file is necessary for running the HCP App outside the developing environment.

- 1) Before the building process of the Jar file, the developers need to decide the coordinates necessary for the project model. Bellow is the current model of the HCP App:

```
<groupId>eu.interopehrate.hcpapp</groupId>
<artifactId>hcp-web-app</artifactId>
<version>1.0.0-SNAPSHOT</version>
<name>hcp-web-app</name>
<description>Reference HCP application</description>
```

- 2) The next process is to configure Maven to specify the main class and to create the jar executable:

```
<packaging>jar</packaging>
```

- 3) After the necessary configuration, the developers can run the package goal:

```
mvn package
```

One important information is that the steps 1 and 2 should not be repeated by anyone as they were necessary only the first time the developers package the project. Anyone that will download the source code of the project will already have this configuration inside the pom.xml file that comes when the cloning process of the project takes place.

### 3.2. Installation guide

To run the application, the user needs to make sure that he/she has Java installed (JDK version 15) on the machine and an internet browser (Ex. Google chrome).

How to use HCP Web App:

First, the HCP application is composed by 2 apps now:

- HCP web application;
- HCP Hospital services.

The second one is a backend REST service which communicates with a database. This one provides services that process the HCPs and patients data (saving data in database, returning data from database). This

application is used by the normal HCP web app to make possible the transfer of the patient's data from one HCP app instance to another HCP app instance.

To install the HCP app on a machine, next steps are to be followed:

- download the zip file from [HCP app an unzip it](#);
- In the extracted directory, there is a "readme" file. The steps from it should be followed.

To start the application, double click on the "Run-HCP-app.bat" file. After the application starts, it can be accessed from a web browser using <http://localhost:8080/hcp-web-ui>.

### 3.3. User guide

The main intent of the HCP App is to use it in conjunction with its mobile counterpart, the S-EHR App. Being a web based application, the HCP app can easily be run on any device that has Java VM installed. There is a strong relation in the functionalities of the HCP app regarding the S-EHR App. The exchange of data can now be possible in both ways. The HCP app can receive data from S-EHR but also it can upload data back to the S-EHR app. Other main functionality on the HCP app is the connection with the S-EHR Cloud services. The application can now make the connection with the Cloud in emergency situations. A third most important function that is developed now, in HCP application environment, is the transfer of the current patient from one HCP app instance to another (the transfer of the patient from one HCP to another HCP from the same hospital).

Below, every scenario will be presented in detail:

#### 3.3.1. Medical visit scenario. HCP app connection with S-EHR app via D2D library

This section contains the added / modified elements compared to the previous version of the document.

- HOME (connection):

The user (HCP) is using the Home screen to establish the connection with the mobile devices (phone with S-EHR application) of the patient via Bluetooth connection.

From the Home page, the user has to select "Outpatient visit" to be able to receive data from S-EHR App.

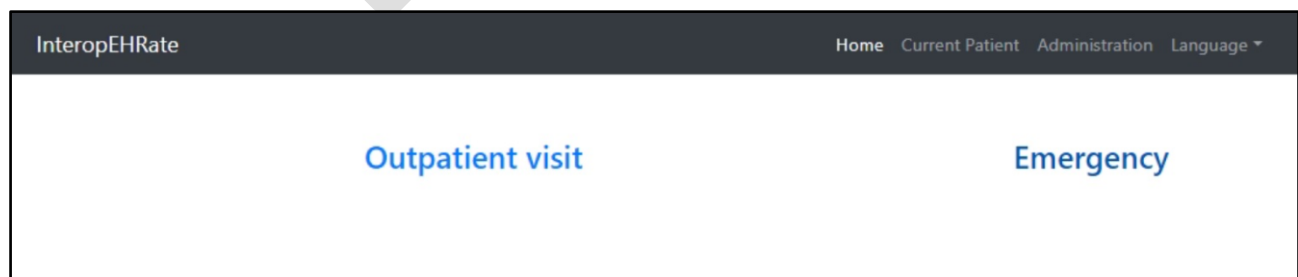
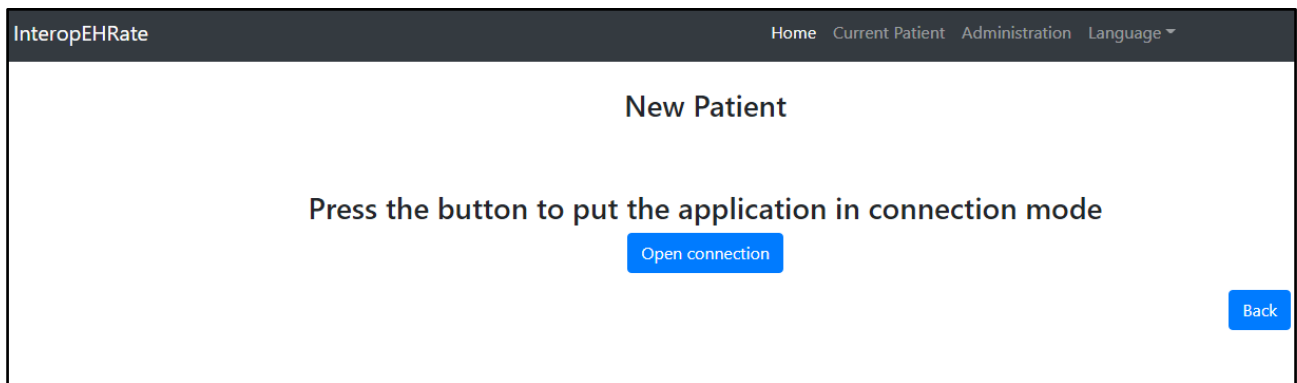
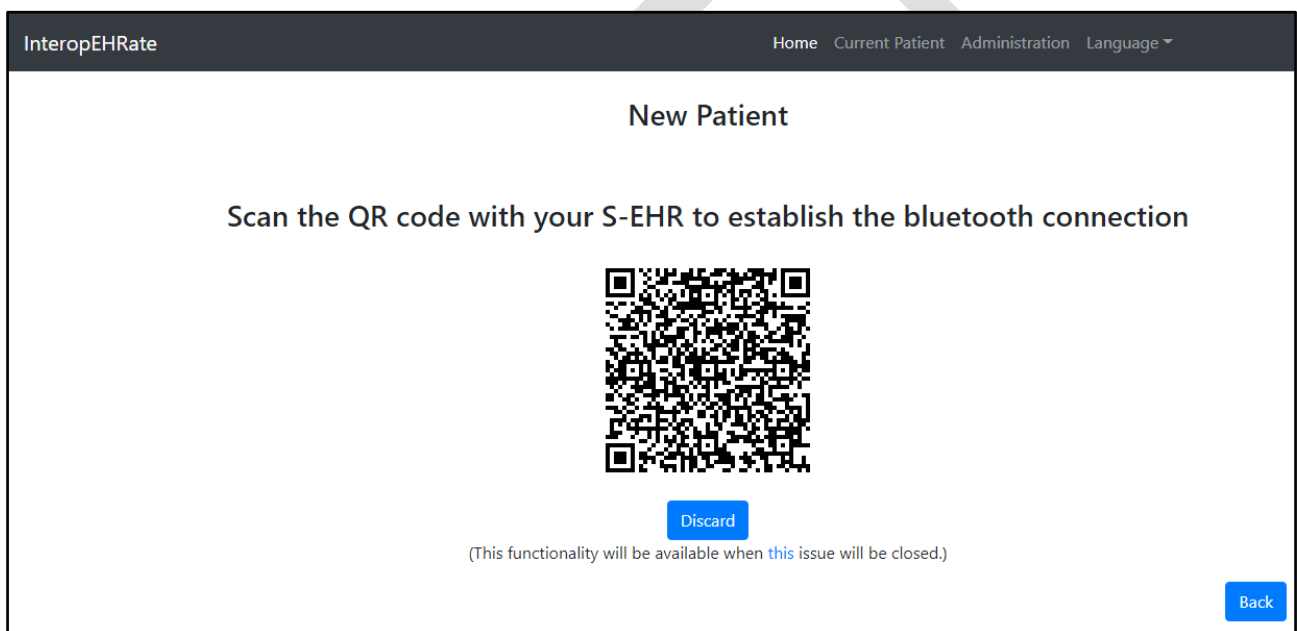


Figure 1 - Home screen with 2 options



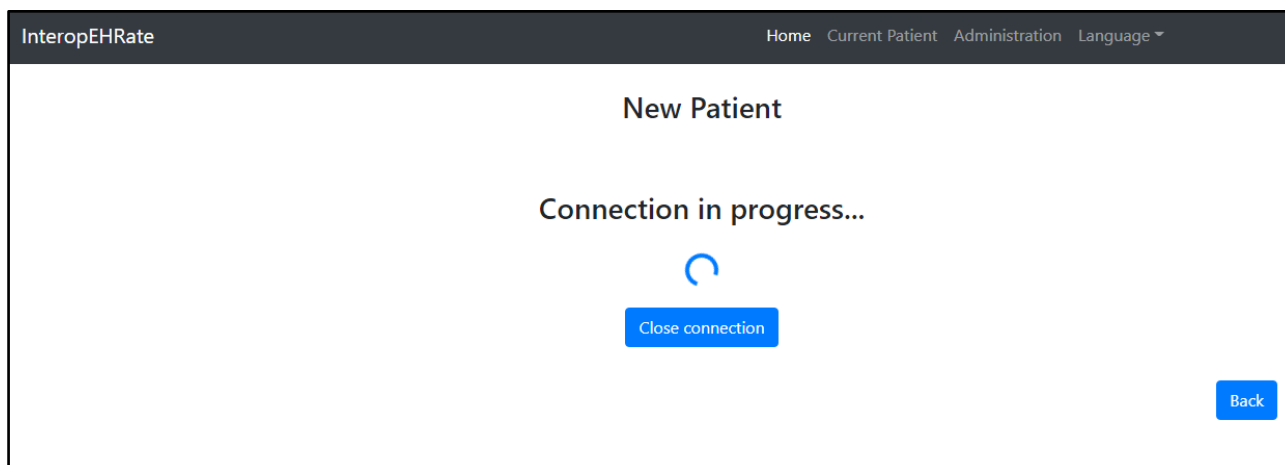
*Figure 2 - Start page of the HCP-App*

After clicking on the “Open connection” button, the user should present the following screen to the patient who shall scan the qr code with the mobile phone application.



*Figure 3 - Page displaying the QR code to be scanned by the S-EHR*

This screen shows that the data receiving process is in progress. The process ends when the message “Transmission completed” appears.



*Figure 4 - Page displaying the process of receiving data is in progress*

### 3.3.2. CURRENT PATIENT

Pathology History is the patient's health category which contains the tests that are done before the admission. The doctor may add notes (e.g. Patient History, Social History, Family History).

InteropEHRate Home Current Patient Administration Language ▾

Demographic Information

Current Diseases

**Pathology History**

Allergies

Current Medications

Document History Consultation

Laboratory tests

Diagnostic Imaging

Visit Data ▾

Outpatient report

Send to other HCP

### Pathology History

Language of the Section Original Translated

Diagnosis	Year of Diagnosis	Comments
Acute kidney failure	2003	Specified as due to procedure
Malignant (primary) neoplasm, unspecified	2014	Patient did 6 cycles of Chemotherapy
Bacterial infection, unspecified	2017	Patient had headaches, fever, stiff neck, seizures
No information about problems	0	

Risk Factor	Yes / No
Family history of ischemic heart disease and other diseases of the circulatory system	Yes
Essential (primary) hypertension	Yes
Other disorders of lipoprotein metabolism	No
Tobacco smoking status	No
Other specified diabetes mellitus	Yes

Patient History Social History Family History

Save

Figure 5 - Pathology History

In the Document History Consultation category, the HCP can see different documents that are related to the patient's health. A filtering option is available as well. This option allows to filter data by the speciality (i.e. Cardiology or Psychiatry).

InteropEHRate

[Home](#)
[Current Patient](#)
[Administration](#)
[Language ▾](#)

Demographic Information

Current Diseases

Pathology History

Allergies

Current Medications

Document History Consultation

Laboratory tests

Diagnostic Imaging

Visit Data ▾

Outpatient report

Send to other HCP

Document History Consultation

Speciality

☐ Cardiology
 ☐ Psychiatry
 ☒ All

Date

☐ Last Year
 ☐ Last 5 Years

Start

dd/mm/yyyy

End

dd/mm/yyyy

☒ All

Filter ▾

Please, set a filter to view data

Date	Location	Exam	View
------	----------	------	------

Figure 6 - Document History Consultation before filtration

InteropEHRate

[Home](#)
[Current Patient](#)
[Administration](#)
[Language ▾](#)

Outpatient visit

Name: Mario Rossi Age: 61 Country: -

Demographic Information

Current Diseases

Pathology History

Allergies

Current Medications

Document History Consultation

Laboratory tests

Diagnostic Imaging

Visit Data ▾

Outpatient report

Send to other HCP

Document History Consultation

Speciality

☐ Cardiology
 ☐ Psychiatry
 ☒ All

Date

☐ Last Year
 ☐ Last 5 Years

Start

dd/mm/yyyy

End

dd/mm/yyyy

☒ All

Filter ▾

Filter parameters:  
Speciality: psychiatry  
Date: last5Years

Date	Location	Exam	View
12/12/16	Pisa, Italy	exampleHomeEducationNote	Open ▾
8/10/20	Pisa, Italy	examplePsychiatryConsultNote	Open ▾

Figure 7 - Document History Consultation after filtration

In the Laboratory Tests category has been added the pagination option.

InteropEHRate
Home
Current Patient
Administration
Language

Outpatient visit
Name: Mario Rossi
Age: 61
Country: -

Demographic Information

Current Diseases
Pathology History
Allergies
Current Medications
Document History Consultation
Laboratory tests
Diagnostic Imaging
Visit Data
Outpatient report
Send to other HCP

### Laboratory tests

Language of the Section
Original
Translated

Laboratory results
Pathology results
Radiology results
Other results

Observation (Results: laboratory)

Filter

Analysis	6/18/19, 9:00 AM	6/25/19, 8:30 AM
Albumina	4.7 g/dL	4.0 g/dL
Ampiezza curva distribuzione eritrociti (RDW SD)	39.3 fL	39.1 fL
Ampiezza distribuzione piastrine (PDW)	13.3 fL	12.9 fL
Ampiezza distribuzione volume eritrocitario (RDW CV)	13.5 %	13.3 %
Azotemia	41.0 mg/dL	33.0 mg/dL
BNP	36.0 ng/L	-
Basofili	0.02 x10 <sup>3</sup> /μL	0.04 x10 <sup>3</sup> /μL
Basofili %	0.2 %	0.6 %
Bilirubina Totale Reflex	0.7 mg/dL	0.2 mg/dL
Calcemia	9.8 mg/dL	9.5 mg/dL

Total Rows: 41
1
2
3
4
5
Next
Last

Figure 8 - Laboratory Results



In this new category, Diagnostic Imaging was added the option to view images of the patient. There are 2 categories of images, first being the Image Report represents the image received from the S-EHR App. The second option was described in the D5.5 Design of an integrated EHR web app for HCP -V2.

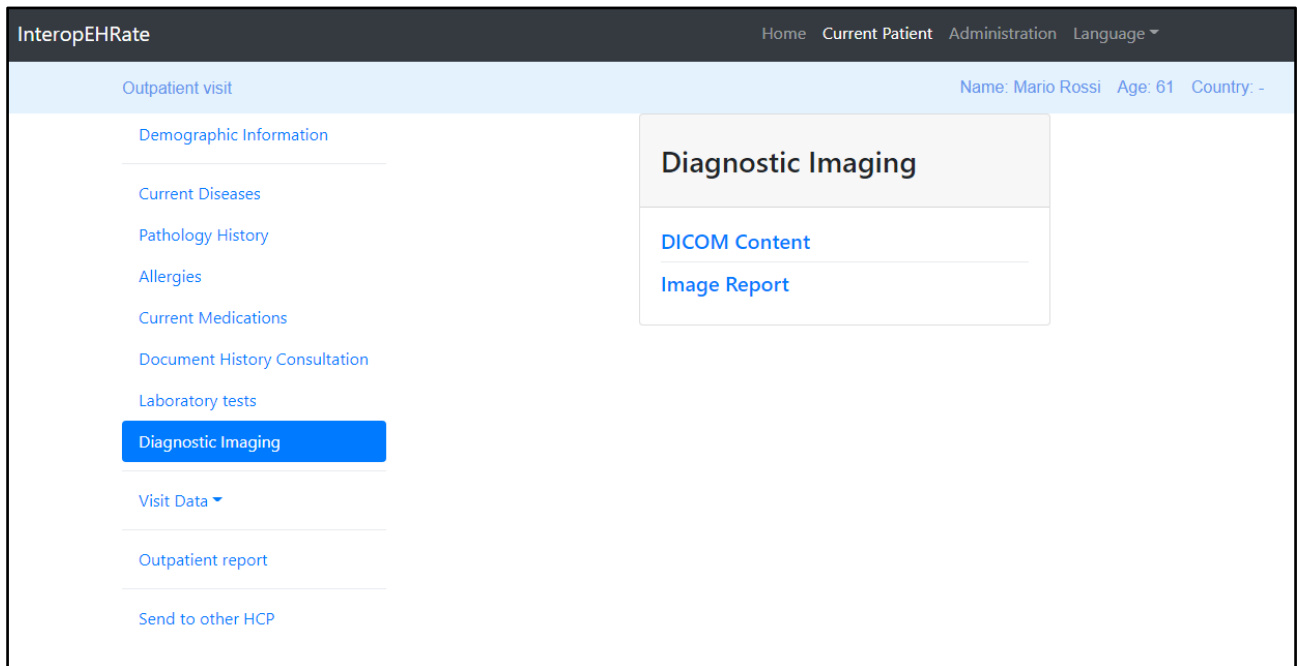


Figure 9 - Diagnostic Imaging with the 2 categories

The Dicom test was discussed in the D5.5 deliverable and in that section was described Weasis to allow the practitioner to access DICOM images.

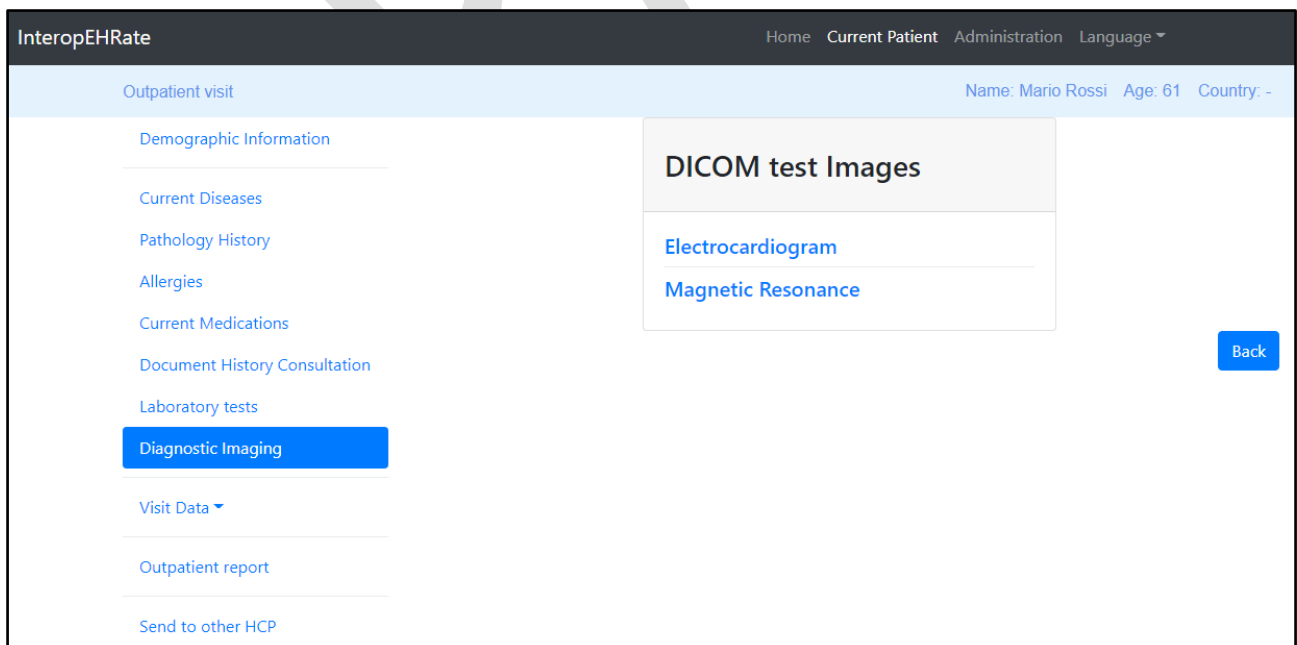


Figure 10 - Diagnostic Imaging

When clicking on the Image Report, 2 images will be displayed, these images are the same but the last image has attached a pdf with details.

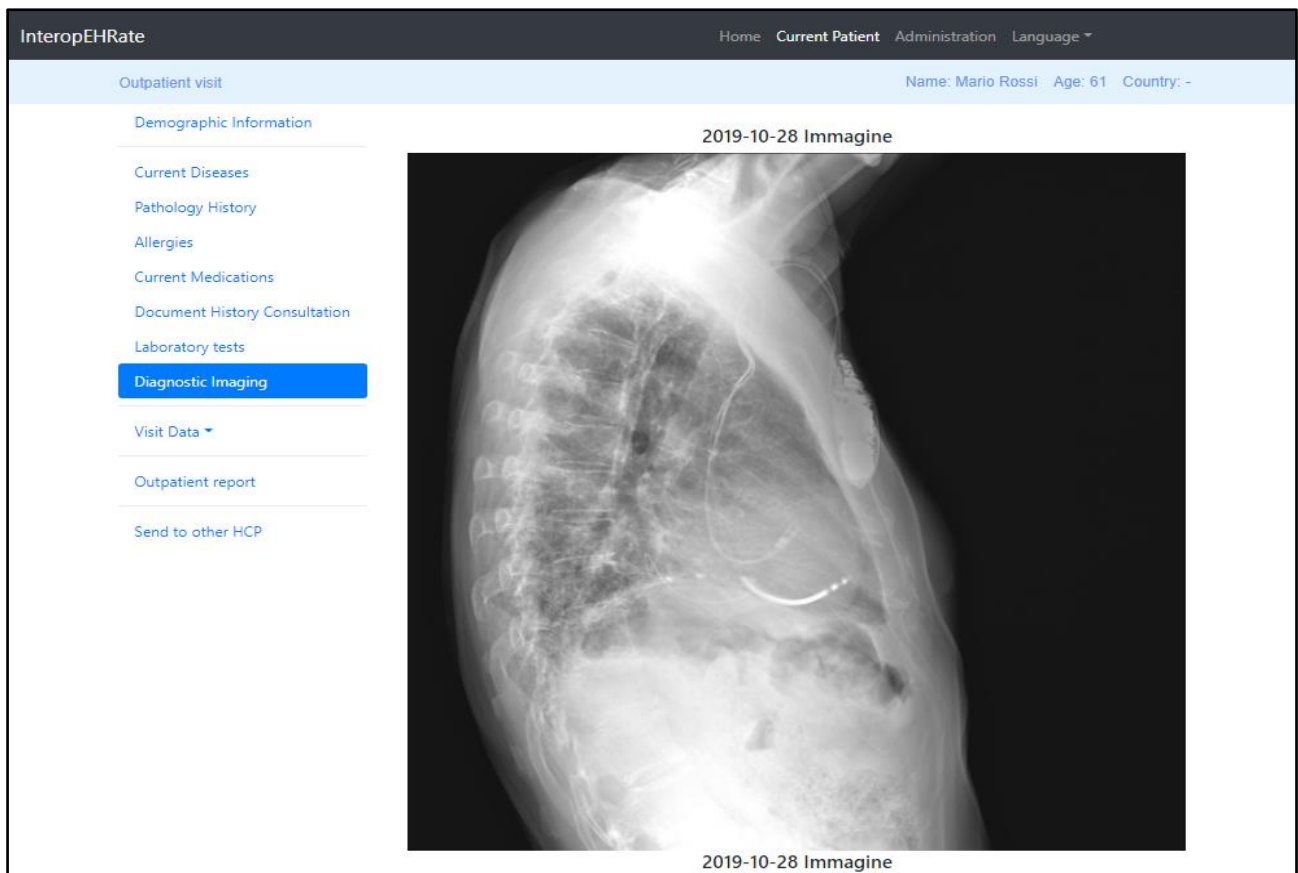


Figure 11 - DICOM image view



Related Documents

Name	Date	View
XR Chest Single view	10/28/19	<a href="#">Open</a>

[Back](#)

Figure 12 - Image Report with the pdf text

### 3.3.3. Emergency scenario. HCP app connection with S-EHR Cloud services

From the Home page, the user has to select “Emergency” to be able to extract data from Cloud.

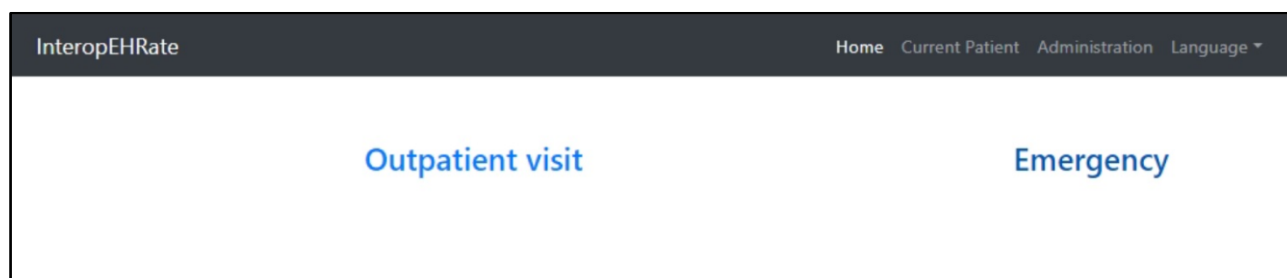


Figure 13 - Home screen with 2 options

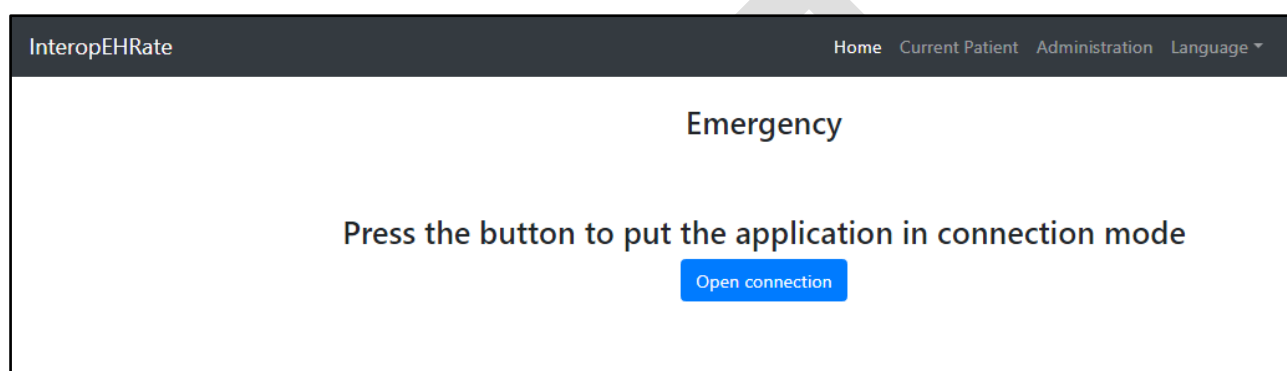


Figure 14 - Emergency screen

From the Emergency page, the user clicks on “Open connection” and a text area will appear where the user enters as text the QR code decrypted info into a text box which allows the user to proceed with the aforementioned scenario. Normally, on this step, the HCP should scan the QR code with a dedicated scanner but for the moment when this deliverable is written, this is the available option.

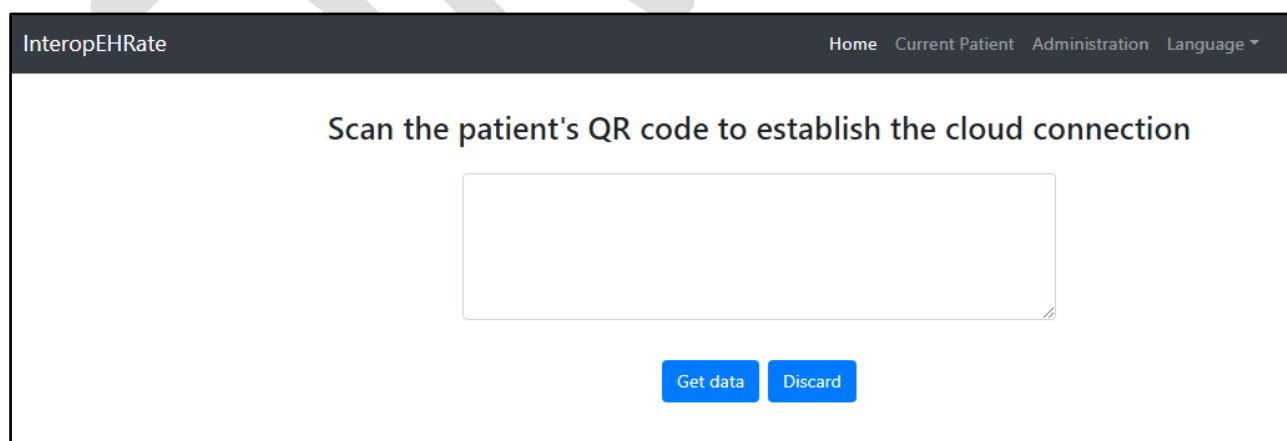


Figure 15 - Text area where the QR code content should be filled

After clicking on “Get data”, the connection is happening and the patient data is extracted from the Cloud.

InteropEHRate

HomeCurrent PatientAdministrationLanguage ▾

EmergencyName: Mario RossiAge: 60Country: -

Connected

Close connection

General info about patient

First Name

Mario

Last Name

Rossi

Gender

MALE

Birth date

1960-01-01

ID Patient

http://213.249.46.205:8080/NCP/fhir/Patient/31/\_history/1

*Figure 16 - Active Emergency scenario and general info about the patient*

Now, the patient data is extracted from S-EHR Cloud services.

### 3.3.4. Transfer of patients from one healthcare professional to another healthcare professional

This functionality provides an important asset when the patient has to be sent by the current HCP that is taking care of him/her to another HCP to treat him further. For example, let's say that at first, the current patient is treated by a generalist doctor and the doctor finds out that the patient requires a cardiology analysis. The current HCP should be able to send the patient data to a cardiologist. So the data is transferred between HCPs via a dedicated hospital service without the need to use the D2D connection again between the patient and the second doctor. The D2D connection is required only when new data is requested from the patient or when the HCP should upload new data on the patient Smart EHR mobile application.

So the flow for doing this is the following:

- First, the patient (Mario Rossi) is going to Ion Popescu (medical general doctor);
- The D2D connection is made between the patient's S-EHR app and doctor's HCP app;
- The data is transferred from S-EHR to HCP app;
- The consultation is happening;
- The HCP decides that the patient should also visit Enzo Anselmo Ferrari (cardiologist) for further investigations;
- At this moment, the user (HCP) needs to use a special screen in the HCP application called "Send to other HCP":

InteropEHRate

Home Current Patient Administration Language ▼ Ion Popescu

Outpatient visit Name: Mario Rossi Age: 61 Country: -

Demographic Information

Current Diseases

Pathology History

Allergies

Current Medications

Document History Consultation

Laboratory tests

Diagnostic Imaging

Visit Data ▼

Outpatient report

Send to other HCP

### Send to other HCP

Name	Occupation	Action
Enzo Anselmo Ferrari	doctor	<button>Send and close</button>

Figure 17 - Send to other HCP screen

- This screen shows to the user the list of potentially HCPs from the Hospital (only one option for now). Keep attention to the right corner of the screen where it is displayed the HCP that uses the HCP app (Ion Popescu);
- From here, the current HCP (Ion Popescu) can deliver the patient's data to the second HCP (Enzo Anselmo Ferrari) by using a specially developed backend service that stores the patients and HCPs data in a database;

- After clicking on “Send and close”, a message is displayed on the Home page and the D2D connection is automatically closed:

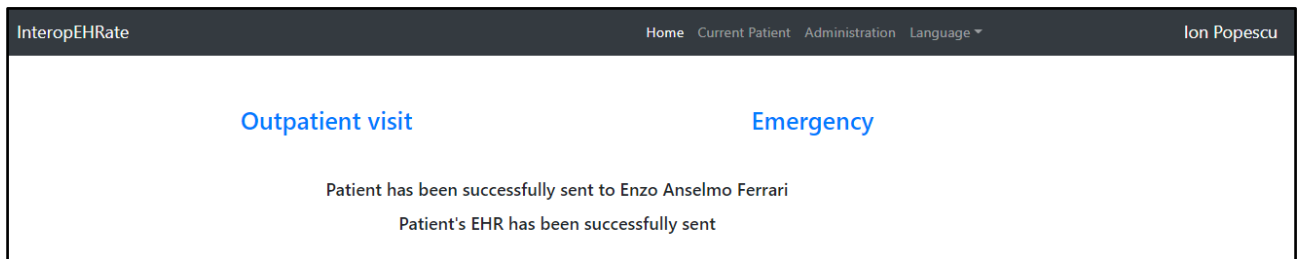


Figure 18 - Successful message

- Now, the second HCP, can retrieve the Mario Rossi's data from the backend service by using “Continue an existing visit” screen from the HCP app Home page:

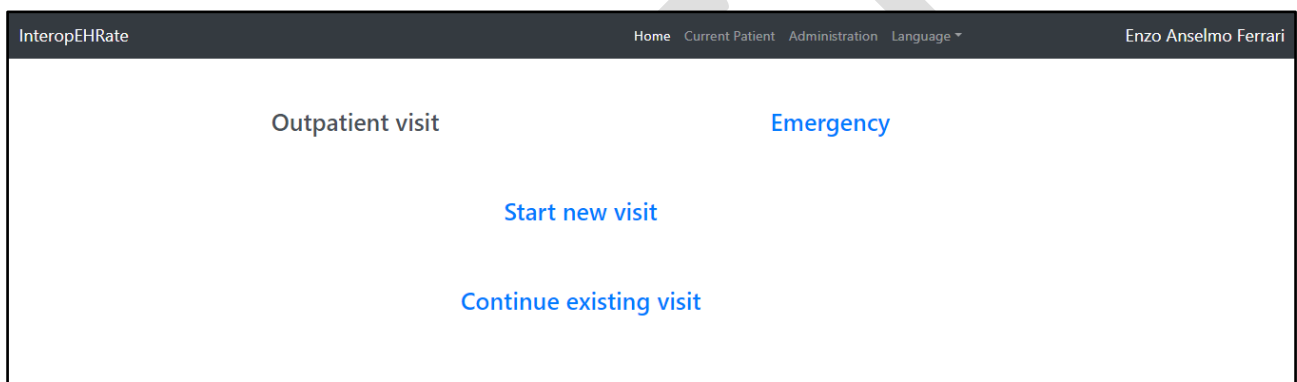


Figure 19 - Second HCP (Enzo Anselmo Ferrari) Outpatient visit (selected) -> 2 new options appear

- The second doctor, Enzo, can now select “Continue existing visit”. Keep attention that now in the right corner of the screen is displayed the name of the second HCP that uses the HCP app;

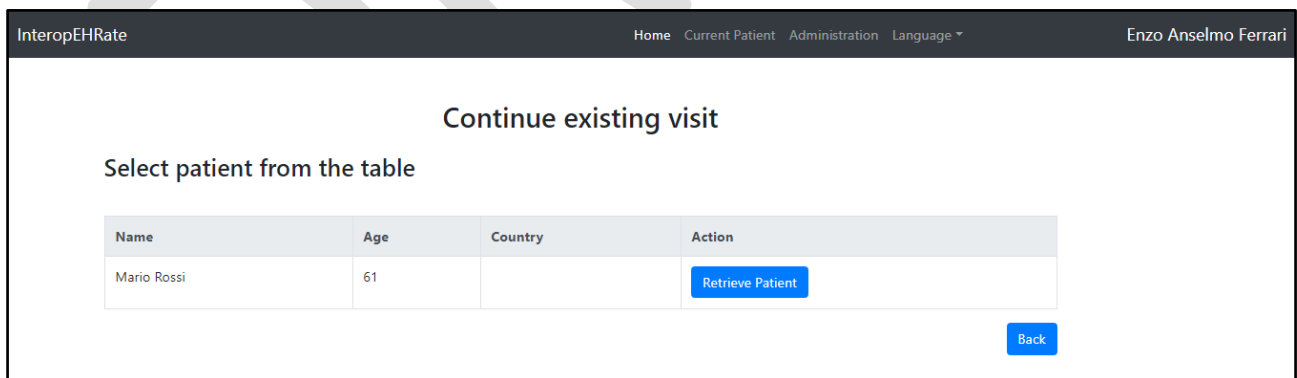


Figure 20 - Second HCP (Enzo Anselmo Ferrari) Continue existing visit screen

- Here, a table with all the patients sent to Enzo is present;
- The user can now click on “Retrieve Patient” and patient's data is recovered from the hospital microservice:

InteropEHRate

HomeCurrent PatientAdministrationLanguage

Enzo Anselmo Ferrari

Extracted Patient from Hospital

Name: Mario RossiAge: 61Country: -

General info about patient

First Name

Mario

Last Name

Rossi

Gender

UNKNOWN

Birth date

1960-01-01

ID Patient

Patient/842f0742-ed48-4a89-a746-88d719b3f38e

Clear Data

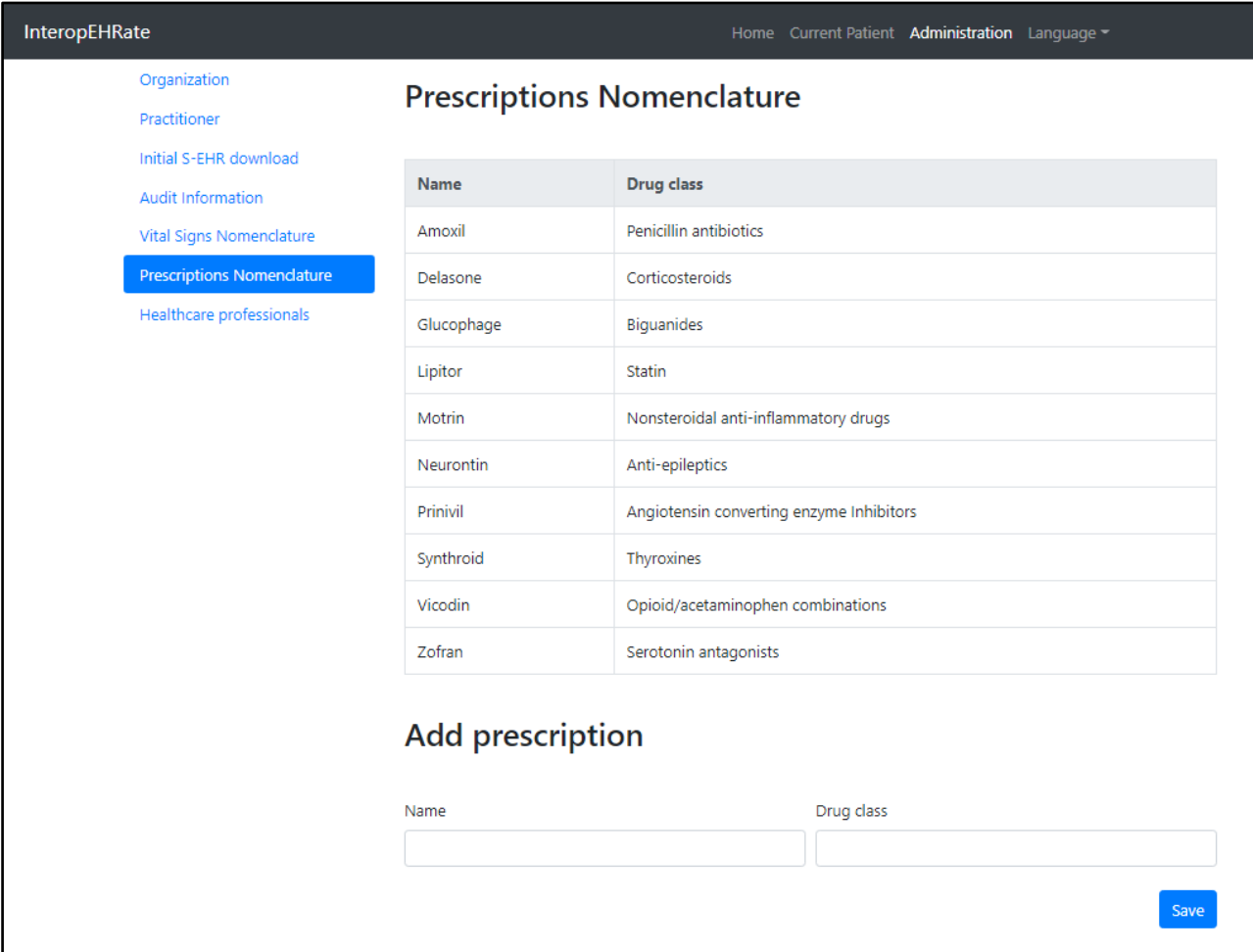
*Figure 21 - Extracted patient from hospital*

Mario Rossi's data with all his/hers EHRs are now available for the second HCP (cardiologist) without the necessity of using the D2D library again.



### 3.3.5. Administration tab

New entries have been added to the administration area:



The screenshot shows the InteropEHRate web application interface. The top navigation bar includes 'Home', 'Current Patient', 'Administration' (which is highlighted), and a 'Language' dropdown. On the left sidebar, there are several menu items: 'Organization', 'Practitioner', 'Initial S-EHR download', 'Audit Information', 'Vital Signs Nomenclature', 'Prescriptions Nomenclature' (which is highlighted with a blue button), and 'Healthcare professionals'. The main content area is titled 'Prescriptions Nomenclature' and contains a table with two columns: 'Name' and 'Drug class'. The table lists ten drugs and their corresponding classes. Below the table, there is a section titled 'Add prescription' with two input fields labeled 'Name' and 'Drug class', and a 'Save' button.

Name	Drug class
Amoxil	Penicillin antibiotics
Delasone	Corticosteroids
Glucophage	Biguanides
Lipitor	Statin
Motrin	Nonsteroidal anti-inflammatory drugs
Neurontin	Anti-epileptics
Prinivil	Angiotensin converting enzyme Inhibitors
Synthroid	Thyroxines
Vicodin	Opioid/acetaminophen combinations
Zofran	Serotonin antagonists

**Add prescription**

Name  Drug class

Figure 22 - Prescription Nomenclature

An entry for prescriptions has been created from which the HCP can see the types of drugs that are present in the database. Please, note that for adding prescriptions, the user can select a list of drugs and it is not needed for the user to write their names manually.

InteropEHRate

HomeCurrent PatientAdministrationLanguage

Organization

Practitioner

Initial S-EHR download

Audit Information

Vital Signs Nomenclature

Prescriptions Nomenclature

Healthcare professionals

Healthcare professionals

Name	Occupation
Enzo Anselmo Ferrari	doctor

Figure 23 - Healthcare professionals screen

This screen shows the list of all the HCPs present in the Hospital REST microservice database. Only one HCP is present for now in the database.

## REFERENCES

- [1] **[D5.13]** InteropEHRate Consortium, D5.13- HCP Web App - V1, 2020.  
<https://www.interopehrate.eu/resources/#dels>
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