

The logo for InteropEHRate features a stylized 'e' composed of several overlapping, semi-transparent circles in various colors (blue, orange, yellow, green, pink, light blue) arranged in a grid-like pattern. To the right of this graphic, the text 'InteropEHRate' is written in a large, black, sans-serif font.

InteropEHRate

D5.2

Software requirements specification of an integrated EHR web app for HCP - V2

ABSTRACT

This deliverable which is the updated version of deliverable [6] [D5.1] aims to present the new functionalities and features of the integrated web app - Healthcare Professional Application (HCP App). The updated version of software requirements specification of HCP App is the result of both technical improvements and software development and the continuous collaboration with the end-users (co-design / co-creation sessions).

For a suggestive overview on the updated version of HCP App and further development, the document includes a section for the version 1 and a section for the version 2 of the application.

Delivery Date	11 th December, 2020
Work Package	WP5
Task	T5.1
Dissemination Level	Public
Type of Deliverable	Report
Lead partner	SIMAVI



This document has been produced in the context of the InteropEHRate Project which has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 826106. All information provided in this document is provided "as is" and no guarantee or warranty is given that the information is fit for any particular purpose.



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DRAFT

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LOG TABLE

Version	Date	Change	Author	Partner
0.1	2020-02-13	Main sections of the document	Nicu Jalba, Andrei Oanca	SIMAVI
0.2	2020-02-20	Contribution to Abstract, Introduction and all introductive sections of deliverable Contribution to Conclusions and next steps Review of GUI representations	Simona Bica	SIMAVI
0.3	2020-02-27	Contribution to Section 2. Overall description - Health Care Professionals needs Contribution to Section 2. Overall description - HCP App Software perspective, Updated user interface	Mihai Seceleanu	SIMAVI
0.4	2020-03-03	Contribution to Section 3. HCP App features - Features implemented in version 1	Simona Alexandru	SIMAVI
0.5	2020-03-09	Contribution to Section 2. Overall description - Assumptions and Dependencies	Simona Alexandru	SIMAVI
0.6	2020-03-11	Contribution to Section 2. Overall description - HCP App Software perspective, System	Andrei Oanca	SIMAVI

		interface Contribution to Section 3. HCP App features - Exchanging healthcare data with S-EHR Mobile App Contribution to Section 3. HCP App features - Features that will be implemented in version 2		
0.7	2020-03-16	Contribution to Section 3. HCP App features - Exchanging healthcare data with InteropEHRate Health Services	Simone Bocca	UNITN
0.8	2020-03-18	Internal review for all sections.	Adrian Bradu	SIMAVI
0.9	2020-03-19	Partner internal review	Francois Sevrin	Andaman7
1.0	2020-03-24	Partner internal review	Christina Kotsiopoulou	HYGEIA
1.1	2020-03-25	Updates and resolving comments from internal reviewers	Andrei Oanca Simona Bica	SIMAVI
1.2	2020-03-25	Internal quality check	Adrian Bradu	SIMAVI
1.3	2020-03-25	Quality review	Argyro Mavrogiorgou	UPRC
1.4	2020-04-10	Updates and resolving comments from quality reviewer	Simona Bica	SIMAVI
1.5	2020-04-15	Internal review of updated section 3.4	Lucie Keunen	A7
1.6	2020-04-28	Internal quality check - ready to be submitted for quality review	Adrian Bradu	SIMAVI
1.7	2020-04-28	Quality review	Argyro Mavrogiorgou	UPRC
1.8	2020-04-28	Final version of deliverable ready to be submitted	Adrian Bradu	SIMAVI
1.9	2020-05-04	Final check	Laura Pucci Francesco Torelli	ENG
2.0	2020-07-06	Completed mock- ups for	Simona Alexandru	SIMAVI

		version 2		
2.1	2020-07-09	Check and review	Adrian Bradu	SIMAVI
2.2	2020-07-13	Review of GUI representations	Simona Bica	SIMAVI
2.3	2020-07-14	Contribution to Conclusions and next steps	Simona Bica	SIMAVI
2.4	2020-07-16	Review and transmission for submission	Adrian Bradu	SIMAVI
2.5	2020-09-16	Updates and resolving final comments from ENG reviewers Deliverable ready to be submitted	Simona Bica Adrian Bradu	SIMAVI
2.7	2020-11-30	Technical and overall review	Francesco Torelli, Laura Pucci	ENG
2.8	2020-12-04	Review and transmission for submission	Adrian Bradu	SIMAVI
Vfinal	2020-12-10	Final check and version for submission	Laura Pucci	ENG

ACRONYMS

Acronym	Term and definition
D2D	Device to Device
GUI	Graphical User Interface
HCP	Healthcare Professional
IPS	International Patient Summary
S-HER	Smart Electronic Health Record
HER	Electronic Health Record
EMR	Electronic Medical Record
IT	Information and Technology
IEHR	InteropEHRate

HR	Health Record
CA	Certification Authority

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1. INTRODUCTION

1.1 Scope of the document

The current deliverable addresses specific aspects and findings concerning the actual software requirements specification of HCP App, as they look like after the first year of InteropEHRate project implementation.

At this stage of project implementation, the deliverable aims to present the most significant features of the current version of HCP App which exploits an updated form of D2D protocol and covers the import/export data directly from/to the S-EHR on the smart-phone. Focus groups of end-users were organized in this particular stage of HCP App development, in November 2019, December 2019 and in 2020 from February to July, and their preliminary results were considered in designing the updated version of GUI of HCP App.

Moreover, the deliverable includes a specific section dedicated to the HCP App features that will be implemented in the version 2 of the application. This section addresses the features characteristic of both key user scenarios of InteropEHRate project: Medical visit abroad and Emergency access, as they are described in deliverable [2] [D2.2] User Requirements for cross-border HR integration - V2.

1.2 Intended audience

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

- Technical staff: developers, IT health consultants, analysts, web designers, interested to have an overview about the design and specific implementation of HCP App.
- Healthcare providers interested in how to use an application like HCP App from the perspective of end-users.

Both categories are interested and contributing by participating in focus groups / co-design sessions during each development cycle, in order to improve and enrich the HCP App capabilities.

1.3 Structure of the document

The report is structured in four chapters, as following:

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. Overall description: Presents relevant aspects concerning the healthcare professionals needs related to use of HCP App and the significant aspects about the HCP App software. Also the relevant aspects concerning the assumptions and dependencies in implementing HCP App are presented.

Section 3. HCP App features: Presents the major aspects concerning the features and characteristics of HCP App, such as: exchanging healthcare data with S-EHR Mobile App, exchanging healthcare data with InteropEHRate Health Services, features implemented in version 1 and features that will be implemented in version 2 specific to both scenarios of InteropEHRate project - Medical visit abroad and Emergency access.

Section 4. Conclusions and next steps: presents the conclusions and next steps concerning this particular stage of elaborating HCP App functionalities.

1.4 Updates with respect to previous version

The current deliverable is the second of the three deliverables of Task 5.1, the set of project activities dedicated to software requirements specification and design of HCP App, and is the updated version of the previous deliverable [6] [D5.1] Software Requirements specification of an integrated EHR web app for HCP - V1.

On the technical and technological side, this deliverable presents a number of updates and improvements from the ones presented in the deliverable [6] [D5.1]. Some of the most important updates that are brought to this level are the ones regarding the changes in the used technologies (most of them are connected to the updates of these technologies), changes regarding the used external libraries and changes regarding the system interface. All these updates are presented particularly in the sections 2 Overall Descriptions and 3 HCP App features.

Moreover, the deliverable presents a summary of GUI updates of HCP App compared to the situation presented at the time the deliverable [6] [D5.1] was made. One of the significant updates presented in the present deliverable compared to the deliverable [6] [D5.1] refers to the fact that the current deliverable depicts actual GUIs taken from the HCP software application.

Taking into consideration the specificity of our target group, the design of the user interface was improved from the perspective of healthcare providers, based on valuable feedback gathered from the end users within iterative co-design / co-creation sessions in November 2019, December 2019 and in 2020 from February to July.

Significant work was put on developing the main sections of HCP App compliant with IPS requirements such as: “Medication Summary”, “Allergies and Intolerances”, “Problem List”, “History of Procedures”, “Medical devices”, “Diagnostic Results” (with all its subsections), “Pregnancy” and “Social History”. Furthermore, an important feature developed in the period between drafting the two deliverables is the Translate function that is available to the end-user (healthcare professional) via a group of buttons located on every section implemented till now from the IPS profile.

2. OVERALL DESCRIPTION

This section addresses the main aspects regarding the needs and requirements of the healthcare professionals which pertain to the use of HCP App and to the relevant characteristics of HCP App solution. Two perspectives were explored in drafting this chapter: the technical perspective, as presented in section System interface and the end-users' perspective. Representative aspects about the assumptions and dependencies related to HCP App implementation are also depicted.

2.1 Healthcare Professionals needs

This section presents relevant aspects concerning the needs required of the healthcare professionals from the HCP application.

The Healthcare Professionals (HCP) will be able to observe the patient's general identification information on the HOME page of the app (first name, family name and ID). The full IPS profile should be visible in the application with all its categories required by the HCP.

The HCP must have access to the patient's health history to be able to provide a special treatment for the medical condition the patient has. Also the practitioner has to be able to see, in the app, the organization's information of which he/she is the part of (name of the hospital, phone numbers, address etc.) and personal details of the health care professional. The HCP app should have a function available for the practitioner to select what sections from IPS profile are required to be downloaded from the S-EHR mobile application.

The HCP app development adds the possibility to modify the retrieved international patient summary from an S-EHR application, as needed by the health care professional. By modifying the data, it means that the specific record of a specific category from the IPS should be addable, updatable or even removable from the HCP app. After the modifications are made, the HCP app shell uploads the new data into the S-EHR app.

Technically speaking, the communication between HCP App and S-EHR Mobile app is done through the D2D protocol having Bluetooth as backbone communication protocol. From a business point of view, FHIR is used for exchanging health information using an interoperability profile. The purpose of using a D2D library is to allow the connection independently of the usage of an internet connection in view of the exchange of the messages and healthcare related data between a healthcare practitioner and a citizen.

2.2 HCP App Software perspective

HCP App is a software solution designed such as to provide healthcare professionals with the ability to access and operate patients' data from S-EHR, S-EHR Cloud and EMR. In this stage of implementation, the major capabilities of HCP App concerning the access patients' data from S-EHR are presented.

2.2.1 System Interface

A clear image of the HCP App software perspective is not complete without the presentation of the updates regarding the technical part, which includes a description of the different tools, principles, modelling methods and other components, and the technological approach, which describes the changes that have emerged during the first year of development for the used technologies. During the following paragraphs, a description of the aforementioned aspects is presented and explained in detail with their actual use and reasons for the changes made.

One of the most important changes that have been made to the HCP App was the integration of the second version of the D2D library, which is the library that sits at the core of the functionality of the application. As it is presented in the [4] [D4.2] InteropEHRate Consortium, Specification of remote and D2D protocol and APIs for HR exchange - V2, the library has evolved, thus providing the HCP App to implement more functionality that brings the application closer to the final form of presentation. Functionalities like certification generator and Public Key loading have been implemented in the second version of the library and thus integrated in the latest releases of the HCP App. The latest change regarding the D2D library was the conversion of the process of inclusion of the library from a local one to a remote one, deploying it to a Nexus server. This brought a change into the HCP App by providing to the developers an easier and simple way of importing the library directly into the dependency list file.

From the development point of view, HCP App uses the latest available version of Java; that is Java 13. By using the latest Java technologies, the application conforms to the latest trends and improvements that every new Java update brings. As a second consequence of using the newest java version, it ensures the best compatibility with newer Operating Systems.

Other improvements were brought by updating different tools used in the development of the HCP App. Tools like Thymeleaf, Bootstrap, Zxing bring improvements with each update they provide, providing both performance and functionality changes. The HCP App updates each tool to the latest version and brings the code to the recommended states that are recommended by the changes of each upgrade from each tool.

In order to use the latest version of the aforementioned tools, the main developer tool, IntelliJ IDEA was updated to the latest version each time an update has been provided. The current version that is used for the development of the HCP App is the 2019.3.3 which is fully compatible with Java 13 and the rest of the tools used.

2.2.2 Updated user interface

This section contains a summary of the modifications of the HCP application compared to the situation presented at the time the deliverable [8] [D5.13] - HCP Web app - V1 was made. All the modifications done were implemented with respect to the requirements of HCP App.

The major transformation done in HCP App version 2 is the translation from the experimental test of the D2D library to the actual operational phase implemented. What it means, is that the connection and the consent to be sent to the S-EHR app are now done automatically after the QR code scan without the need to manually send the request to S-EHR. After the patient's consent is given in S-EHR app, the health care professional will have full access to the patient's details and health history. The HOME page now, displays also the consent given by the user of S-EHR app (patient with S-EHR mobile app).

Another important feature developed is the Translate function that is available to the end-user (health care professional) via a group of buttons located on every section from the IPS profile developed by now. The main sections developed are “Medication Summary”, “Allergies and Intolerances”, “Problem List”, “History of Procedures”, “Medical devices”, “Diagnostic Results” (with all its subsections), “Pregnancy” and “Social History”.

For more information, the complete presentation of the new features of the HCP application is available in Chapter 3 HCP APP FEATURES.

2.3 Assumptions and Dependencies

Dependencies represent the interconnection between HCP app and other elements instances of D2D library which are at the base of the exchange of data.

One version of consent was implemented into both S-EHR and the HCP app by displaying the identification details of the involved actors. The identification data stored at the level of each application has a personal character and must be protected. The consent was implemented with an RSA (used for the electronic signature or for the encryption of information) algorithm with SHA1 (used for the integrity of the data) for the signature of the certificate.

. The consent defines the details of what information is stored and the type of information is stored: personal number identification, country and other similar information contained in the identity card. Discussions for clarifying the final form of the consent were held by the partners.

The data formats are describing elements of each IPS category from HL7 FHIR standard. They communicate these descriptions of the elements of the IPS section in order to insure all the InteropEHRate use the same labelling of the data that is exchanged. The D2D library is containing the methods for the realisation of the connection between the HCP app and S-EHR and through which data is transmitted. Two versions of D2D library were implemented in the HCP app. The second version of the D2D library has improvements over the first D2D library by including the call-back system.

3. HCP APP FEATURES

This chapter aims to present the main aspects concerning the relevant features and characteristics of HCP App, such as: exchanging healthcare data with S-EHR Mobile App, exchanging healthcare data with InteropEHRate Health Services, features implemented in version 1 and features that will be implemented in version 2 specific to both scenarios of InteropEHRate project - Medical visit abroad and Emergency access, as they are described in deliverable [2] [D2.2] Requirements for cross-border HR integration - V2.

HCP App illustrates graphically through user interfaces how the healthcare data, which is reflecting the patient condition, is exchanged with S-EHR, thus being a valued tool for analyzing the perception of end users about the InteropEHRate solution.

For this purpose, significant work have been put on designing compliant GUIs to accomplish the end user needs and requirements, based on the results of focus groups and co-design sessions presented in the deliverable [2] [D2.2], as presented hereinafter in *Section 3.4 Features that will be implemented in the version 2 of the HCP App*.

3.1 Exchanging healthcare data with S-EHR Mobile App

During the first year of the InteropEHRate project, a relevant component that helped the development of the HCP App was the D2D library that uses the Bluetooth protocol in order to exchange the healthcare data from the S-EHR mobile app.

In this paragraph, a highlight of the updates that has been brought to the D2D library will be described, as the in depth information about the principles and the description of the implementation method of the transmission protocol is available inside the deliverable [5] [D4.4] Design of libraries for remote and D2D HR exchange - V1. The in depth description of the updates regarding the library itself will become the subject of a future deliverable.

One of the changes that have been done for the second version of the D2D library is the implementation of the call-back system for the implemented methods. This computer programming approach brings certain advantages like avoiding dependency between the implementation of the library and the calls of the functions inside the HCP App and helps with latency problems that might appear during the usage of the transmission protocol.

Other upgrades regarding the D2D library have been done to the functionalities that the library was providing to the HCP. In the second variant, the library provides to the developers a prime version of the certification generator for the authentication of the patient.

3.2 Exchanging healthcare data with InteropEHRate Health Services

The HCP App includes the possibility to display the health data in their original version and also translated in the language of the healthcare professional. For this functionality the application uses a set of tools for data interoperability, recognized as IHS (InteropEHRate Health Services).

These components, offered to the HCP App as external services, works with the multilingual knowledge of the health data standards, in order to be able to recognize several codes defined in those standards and so provide a correct translation of them.

The translation of the information in EHR could be done on two different kinds of data:

- Natural text: all the attributes in the EHR structure which contains natural text.
- Concepts: all the attributes in the EHR structure which contains concepts recognized by the imported knowledge.

For this reason there are two different services offered to the HCP App, one for the translation of natural text, using automatic machine translation, and another one for the translation of the concepts found in the EHR. The concept translation is useful also, if the related knowledge is available, to recognize health codes of different health standards, maybe not in use in the HCP App usage country, and due to this provide the correct interpretation of those codes.

It is important to specify that the HCP App can always display the original version of health data, in order to not fall in incorrect or ambiguous translations. Note that this situation could happen if the knowledge to be used is not imported correctly into the underlying system, but also because the automatic natural text translation is not one hundred percent reliable.

The data exchanged between the HCP App and IHS is using FHIR format, this being the standard for data exchange within the different project's components.

3.3 Features implemented in the version 1 of the HCP App

The first objective of the project was to create a web application with pages for instance Home page, Administration and Current Patient with the related sections. The Current Patient page contains an IPS section with information about the patient.

The main complex function implemented was data exchange between the S-EHR and HCP App which was completed by the request for consent from the HCP app of data from S-EHR.

3.3.1 Home section

Home page describes the first step for connecting into the HCP App.

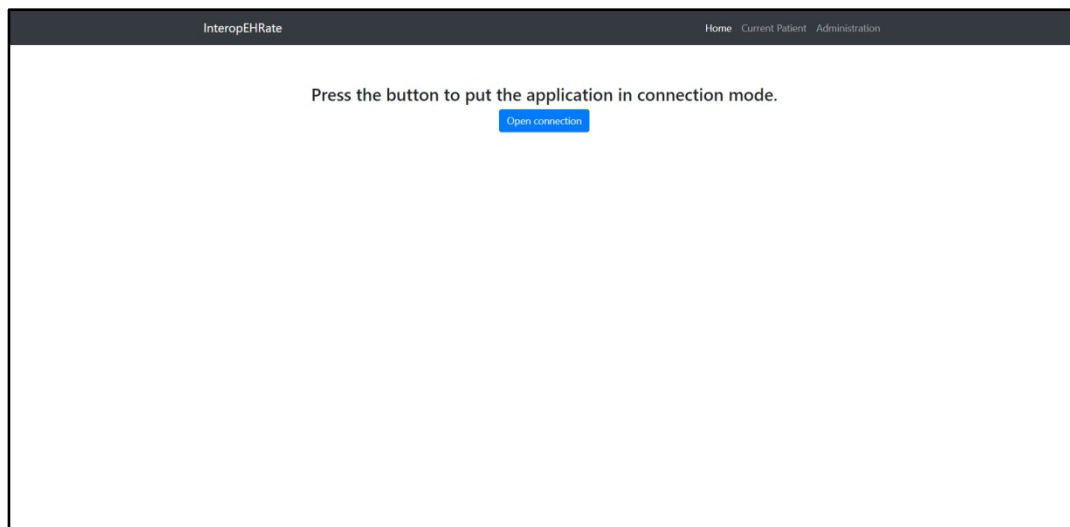


Figure 1: Home Page

Patients scan the QR code to establish connection between HCP App and S-EHR app.

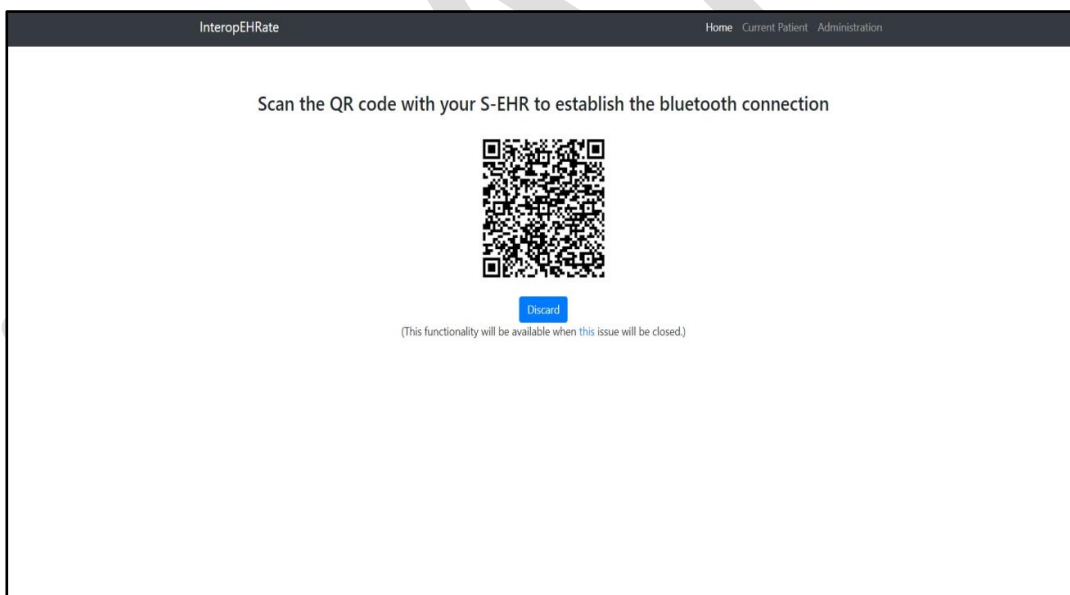


Figure 2: QR code for establishing the connection with S-EHR

After the connection and the acceptance of the consent, the information about the patient is displayed.

InteropEHRate Home Current Patient Administration

Connected
Close connection

General info about patient

First Name
Mario

Family Name
Rossi

ID Patient
Patient/4e048e3b-6efb-428b-858d-d4850d8486e4

Consent
I have read and understood InteropEHRate's Privacy Policy. I hereby give permission to the recipient health care provider to process (view, store, edit etc.) the personal data stored in my Personal Health Record on this application for the purpose of medical diagnosis and/or treatment. I understand that my consent will remain valid for these purposes unless I affirmatively withdraw it. I have the right to withdraw this consent at any time.

Figure 3: General information about patient

3.3.2 Current Patient section

Medication Summary information about patient:

InteropEHRate Home Current Patient Administration

Medication Summary

Allergies and Intolerances
Problem List
Immunizations
History of Procedures
Medical devices
Diagnostic Results
Vital Signs
Past History of Illnesses
Pregnancy
Social History
Plan of Care
Functional Status
Advance Directives

Medication Summary

Medication Statement Medication

Language of the Section Original Translated

Medication	Status	Effective	Dosage - Patient instructions
Medication/9	Active	01-03-2015	1 cps 10mg die (22:00)
Medication/7	Active	01-03-2015	1 cps 250mg die lun, mer, ven (14:00)
Medication/6	Active	01-03-2015	1/2 cps, 20mg x 2 die (8:00 - 20:00)
Medication/8	Active	01-03-2015	1 cps, 25mg x 2 die (8:00 - 20:00)
Medication/5	Active	01-03-2015	1 cps 20mg die (14:00)
Medication/10	Active	01-03-2015	1 cps, 200mg x 2 die (8:00 - 20:00)

Add

Figure 4: Medication Summary

Allergies and Intolerances category with information about the patient – original version:

InteropEHRate Home Current Patient Administration

Medication Summary

Allergies and Intolerances

Language of the Section Original Translated

Code	Name	Clinical Status	Type	Category	Critically
373270004	Penicillina -classe di antibiotico-	active	Allergy	Medication	High Risk

Add

Problem List

Immunizations

History of Procedures

Medical Devices

Diagnostic Results

Vital Signs

Past history of Illnesses

Pregnancy

Social History

Plan of Care

Functional Status

Advance Directives

Figure 5: Allergies and Intolerances original version

Allergies and Intolerances category with information about the patient – translated version:

InteropEHRate Home Current Patient Administration

Medication Summary

Allergies and Intolerances

Language of the Section Original Translated

Code	Name	Clinical Status	Type	Category	Critically
373270004	Penicillin -class of antibiotic- (substance)	active	Allergy	Medication	High Risk

Add

Problem List

Immunizations

History of Procedures

Medical Devices

Diagnostic Results

Vital Signs

Past history of Illnesses

Pregnancy

Social History

Plan of Care

Functional Status

Advance Directives

Figure 6: Allergies and Intolerances translated version

Problem List category about the patient:

InteropEHRate Home Current Patient Administration

Medication Summary
Allergies and Intolerances
Problem List
Immunizations
History of Procedures
Medical Devices
Diagnostic Results
Vital Signs
Past history of Illnesses
Pregnancy
Social History
Plan of Care
Functional Status
Advance Directives

Language of the Section Original Translated

Code	Name	Set on	Category Code	Category Name	Clinical Status	Verification Status
428.1	Insufficienza del cuore sinistro (scompenso cardiaco Sinistro)	30-03-2017	75326-9	Problema	active	confirmed
425.4	Altre Cardiomiopatie Primitive	30-03-2017	75326-9	Problema	active	confirmed

Add

Figure 7: Problem List

Diagnostic Results category with Dropdown lists for all the subsections:

InteropEHRate Home Current Patient Administration

Medication Summary
Allergies and Intolerances
Problem List
Immunizations
History of Procedures
Medical devices
Diagnostic Results
Vital Signs
Past History of Illnesses
Pregnancy
Social History
Plan of Care
Functional Status
Advance Directives

Diagnostic Results

Laboratory results Pathology results Radiology results Other results

Observation (Results: laboratory)
Specimen
Organization (laboratory)
Observation (Results: laboratory, media)

Figure 8: Diagnostic Results

3.3.3 Administration section of the HCP App

Presentation of the organization that contains details of the name, phone and address about the hospital:

The screenshot shows the 'Administration' section of the InteropEHRate app. On the left, a sidebar contains links: 'Organization' (highlighted in blue), 'Practitioner', 'Initial S-EHR download', and 'Audit Information'. The main content area is titled 'Health care organization'. It displays the following information: 'Code' (SCUBA), 'Name' (Spitalul Clinic de Urgenta Bagdasar-Arseni), 'Phone' (+4021 334 30 27 / +4021 334 30 25 / +4021 334 30 26), and 'Address' (Romania, Bucharest, Soseaua Berceni, 12, Sector 4, 041915). A blue 'Upload Certificate' button is located at the bottom right.


Health care organization
Code SCUBA
Name Spitalul Clinic de Urgenta Bagdasar-Arseni
Phone +4021 334 30 27 / +4021 334 30 25 / +4021 334 30 26
Address Romania, Bucharest, Soseaua Berceni, 12, Sector 4, 041915

Upload Certificate

Figure 9: Information about the organization of the HCP

Section practitioner contains details about the healthcare professional:

The screenshot shows the 'Practitioner' section of the InteropEHRate app. The sidebar is the same as in Figure 9, but 'Practitioner' is highlighted in blue. The main content area is titled 'Practitioner' and features a doctor icon. It displays the following information: 'First Name' (Ion), 'Last Name' (Popescu), 'Occupation Group' (Generalist medical practitioners), 'Occupation Name' (Medical doctor (general)), and 'Address' (Romania, Bucharest, Soseaua Bucuresti-Ploiesti, 73-81, Sector 1, Victoria Park, Cladirea 4, 013685). A blue 'Upload Certificate' button is located at the bottom right.

Practitioner

First Name Ion
Last Name Popescu
Occupation Group Generalist medical practitioners
Occupation Name Medical doctor (general)
Address Romania, Bucharest, Soseaua Bucuresti-Ploiesti, 73-81, Sector 1, Victoria Park, Cladirea 4, 013685

Upload Certificate

Figure 10: Information about the practitioner

Initial S-EHR represents the data to be downloaded. Practitioner selects the IPS category that he/she needs and the data is populated.

Figure 11: Choosing the initial information from S-EHR

The audit (e.g.: auditing for admission, auditing of healthcare organization) and consultation mechanism (e.g.: consultation of admission, consultation of auditing for healthcare organization) were implemented in the version 1 of the HCP App.

The Audit section that saves the time, type and category from the IPS was selected:

Time	Type	Details
25-06-2020 12:35:53	SAVE_INITIAL_SHER_DOWNLOAD	SEHRInitialDownloadCommand(currentDiseases=true, patHistory=true, allergies=false, currentMedication=false, documentHistoryConsultation=false, laboratoryTests=false)

Figure 12: Displaying the output of the audit mechanism

3.4 Features that will be implemented in version 2 of the HCP App

This chapter aims to present the most relevant features planned to be implemented in the version 2 of the HCP App.

The requirements for HCP App are based on the Scenarios and User Requirements presented in deliverable [1] [D2.2], as they are presented in *Chapter 5. User Requirements*, as well as on the findings resulted from the assessment made by the Focus Groups. The list of features that will be implemented

in version 2 represents a refined version of HCP App requirements depicted in deliverable [1] [D2.2] Section 5, referring to the HCP App, and identified with “Target” = v2.

This refined version of features is fully compliant with both Scenario 1 – Medical visit abroad and Scenario 2 – Emergency access as they are described in deliverable [2] [D2.2].

Following the introduction, an extensive and detailed description of the actual requirements is depicted in the following paragraphs. The requirement list that is proposed for the second year can be divided into four types of requirements, as most of them are focused on the manipulation of the data received or sent to or from the HCP App. The four categories have been chosen as a direct consequence of the same type of manipulation of certain healthcare data. The four main categories are the following ones:

- consultation = Includes the viewing process of the healthcare data;
- authoring = Includes the authorization process of the healthcare data. That includes the addition, editing and deletion of healthcare data;
- upload = Includes the uploading process of the healthcare data to S-EHR;
- download = Includes the downloading process of the healthcare data from S-EHR.

Before starting the actual presentation of the requirements, a thorough description of the concept of how the requirements were created needs to be explained further. The concept used in the creation of the requirements of the HCP App agreed in the InteropEHRate project is the macro and micro requirements model. The macro requirements, also called epics, are complex functionalities used by a final user of a software application and it takes at most one year to implement. An epic is split into several user stories. A user story, also called a micro requirement, is a more simple functionality which takes only one month to implement. Both epics and user stories describe functionalities used by the final user and defined from his/her point of view (describing what the user does or sees or obtains).

Most of the requirements for this year focus only on the perspective of the health information and the other are developed for the support which provides operating capabilities to the aforementioned healthcare data.

3.4.1 Features to be implemented in version 2 corresponding to Scenario 1 – Medical visit abroad

Requirements related to the consultation action:

- #42 Prescription consultation on HCP App:
 - User story: The HCP sees FHIR Prescription received from Mock Services;

The screens are developed based on the HL7 FHIR profile created by InteropEHRate project and by respecting the requests of the end-users.

For the prescription section, in the HCP App is developed and validated by the end-users. This version of screens uses hardcoded data in order to have a better representation of the result:

InteropEHRate
Home Current Patient Administration

Demographic Information
Current Diseases
Pat History
Allergies
Current Medications
Document History Consultation
Laboratory tests
Visit Data

Current Medications

Prescription
Medication Statement

Prescription
Language of the Section Original Translated

Drug Name	Drug Dosage	Timings	Status	Action
Theophylline 200mg	1 tablet	Frequency: 2 Period: 1 Period unit: D	Active	Medication Details

Add

Figure 13: Prescription screen

InteropEHRate
Home Current Patient Administration

Demographic Information
Current Diseases
Pat History
Allergies
Current Medications
Document History Consultation
Laboratory tests
Visit Data

Add Prescription information

Drug Name
Drug Dosage

Status
Notes

Active

Timings

Frequency

Period

Period unit

Date of Prescription
Choose...

Save

Figure 14: Medication screen

By pressing the “Medication details” button, a form is created to display extra data of the medication. This screen represents medication of Prescription from section Medication Summary.

- User story: The HCP sees an IEHR conformant Prescription received from S-EHR;

- #43 Laboratory result consultation on HCP App:
 - User story: The HCP sees a FHIR Laboratory result received from Mock Services:

Information about the patient: Patient Summary category – Laboratory tests

InteropEHRate Home Current Patient Administration

Demographic Information Name: Mario Rossi Age: Country:

Current Diseases Pat history Allergies Current Medications Document History Consultation Laboratory tests Visit Data Vital Signs Reason Ph Exam Conclusion Prescriptions

Laboratory Results Pathology Results Radiology Results Others Results

Observation Laboratory Language of the Section Original Translated

Analysis	5/17/20, 1:46 PM	5/17/20, 1:46 PM	5/17/20, 1:46 PM
SARS-Cov	-	-	-
Eritrociti	-	-	-

Figure 15: Laboratory tests mock-up

For the laboratory result section, in the HCP App is developed and validated by end-users this version of screen with hardcoded data:

InteropEHRate Home Current Patient Administration

Demographic Information Laboratory tests

Language of the Section Original Translated

Laboratory results Pathology results Radiology results Other results

Observation (Results: laboratory)

Analysis

Figure 16: Laboratory results screen in HCP App

A table is created by respecting the request of the end-users of the HCP App.

- User story: The HCP sees an IEHR conformant Laboratory result received from S-EHR.
- The user stories are also present in the issue tracker (Gitlab).

- #46 Vital signs and other measures consultation on HCP App:

Analysis	5/17/20, 1:46 PM	5/17/20, 1:46 PM
Heart rate [bpm]	-	-
Breathing rate [b\min]	-	-
Weight [kg]	-	-
Temperature [C]	-	-
Height [cm]	-	-
Blood pressure [mmHg]	-	-
SPO2 [%]	-	-
AVPU and alertness	-	-

Figure 17: Vital Signs of the patient

- #60 Display on HCP App of a portion of Patient Summary codes:

To determine the most suggestive way of designing and displaying data specific to this requirement a lot of iterative co-creation sessions with the end-users were organized from April 2020 to June 2020.

In the following are presented the mock-ups resulted from gathering the feed-back of end-users regarding the Patient Summary. The design will be implemented in HCP App version 2.

Information about the patient: Patient Summary category - Current Diseases

Disease	Date of diagnosis	Comment
Chronic Heart Failure	22.03.2020	EF= 25% ACD device implanted in 2006
Psoriasis	19.05.1998	Head, neck

Figure 18: Current Diseases of the patient

Information about the patient: Patient Summary category – Patient History

InteropEHRate		Home		Current Patient		Administration	
Demographic Information		Name: Mario Rossi		Age:		Country:	
Current Diseases							
Pat history							
Allergies							
Current Medications							
Document History Consultation							
Laboratory tests							
Visit Data							
Vital Signs							
Reason							
Ph Exam							
Conclusion							
Prescriptions							

Diagnosis	Year of diagnosis	Comments

Risk factor	
Hypertension	Yes/No
Diabetes	No
Dyslipidemia	Yes/No
Current/Past smoker	Yes/No
Family History of CVD	Yes/No

Patient History	Social History	Family History

Figure 19: Patient History

Information about the patient: Patient Summary category – Allergies

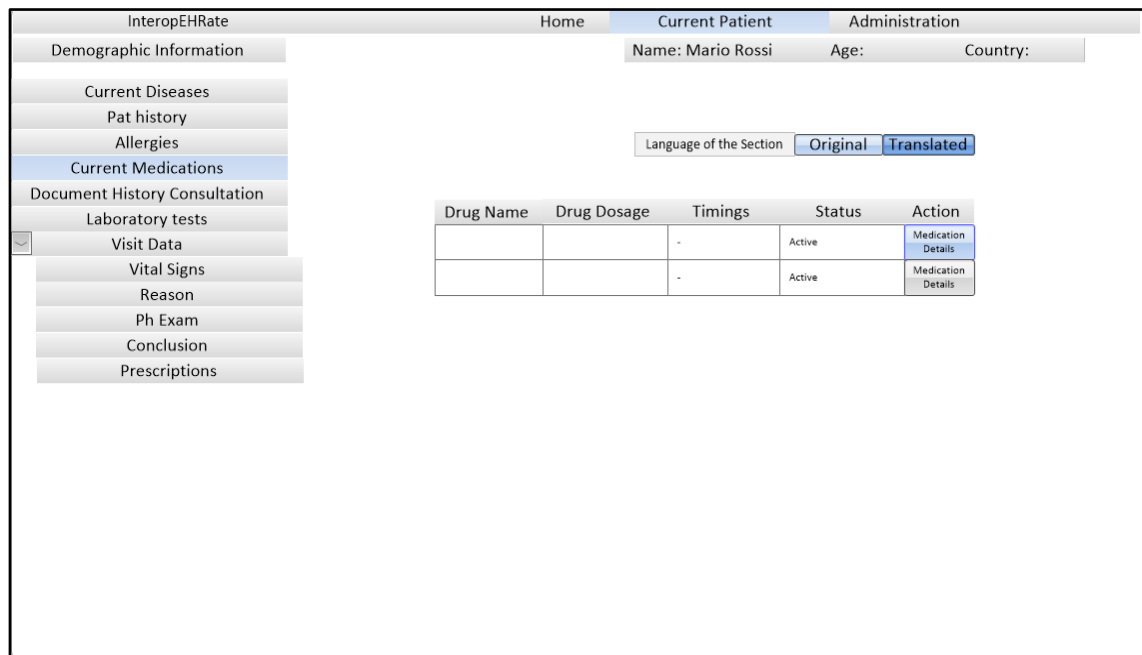
InteropEHRate		Home		Current Patient		Administration	
Demographic Information		Name: Mario Rossi		Age:		Country:	
Consents							
Current Diseases							
Pat history							
Allergies							
Current Medications							
Document History Consultation							
Laboratory tests							
Visit Data							
Vital Signs							
Reason							
Ph Exam							
Conclusion							
Prescriptions							

Category	Name	Type	Symptoms

Comments

Figure 20: Allergies of the patient

Information about the patient: Patient Summary category – Current Medications



InteropEHRate Home **Current Patient** Administration

Demographic Information Name: Mario Rossi Age: Country:

Current Diseases

Pat history

Allergies

Current Medications

Document History Consultation

Laboratory tests

Visit Data

Vital Signs

Reason

Ph Exam

Conclusion

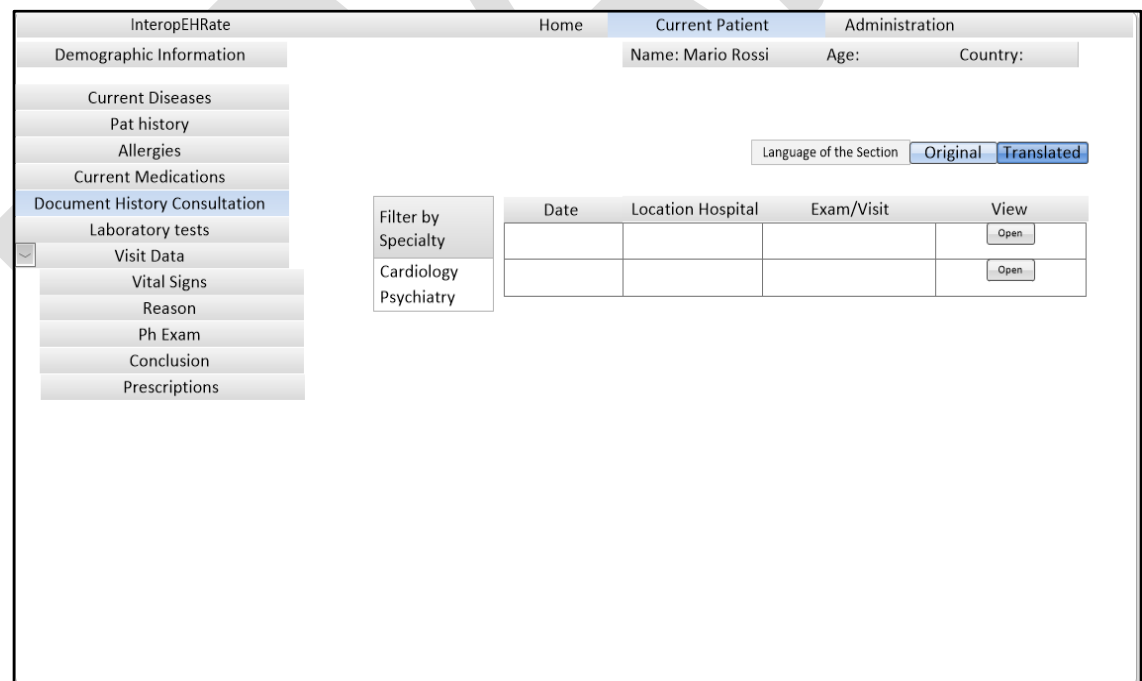
Prescriptions

Language of the Section Original Translated

Drug Name	Drug Dosage	Timings	Status	Action
		-	Active	Medication Details
		-	Active	Medication Details

Figure 21: Current Medications of the patient

Information about the patient: Patient Summary category – Document History Consultation



InteropEHRate Home **Current Patient** Administration

Demographic Information Name: Mario Rossi Age: Country:

Current Diseases

Pat history

Allergies

Current Medications

Document History Consultation

Laboratory tests

Visit Data

Vital Signs

Reason

Ph Exam

Conclusion

Prescriptions

Language of the Section Original Translated

Filter by Specialty

Date	Location Hospital	Exam/Visit	View
			Open
			Open

Figure 22: Document History Consultation for the patient

Information about the patient: Patient Summary category – Reason

The screenshot displays the InteropEHRRate application interface. At the top, there are three tabs: 'Home', 'Current Patient' (which is active), and 'Administration'. Below the 'Current Patient' tab, there are three fields: 'Name: Mario Rossi', 'Age:', and 'Country:'. On the left side, there is a vertical menu with the following items: 'Demographic Information', 'Current Diseases', 'Pat history', 'Allergies', 'Current Medications', 'Document History Consultation', 'Laboratory tests', 'Visit Data', 'Vital Signs', 'Reason' (highlighted in blue), 'Ph Exam', 'Conclusion', and 'Prescriptions'. In the center of the screen, there is a large rectangular box with the title 'Reason of patient who came to the doctor'.

Figure 23: Reason of the visit

Information about the patient: Patient Summary category – Conclusion

The screenshot displays the InteropEHRRate application interface. At the top, there are three tabs: 'Home', 'Current Patient' (which is active), and 'Administration'. Below the 'Current Patient' tab, there are three fields: 'Name: Mario Rossi', 'Age:', and 'Country:'. On the left side, there is a vertical menu with the following items: 'Demographic Information', 'Current Diseases', 'Pat history', 'Allergies', 'Current Medications', 'Document History Consultation', 'Laboratory Tests', 'Visit Data', 'Vital Signs', 'Reason', 'Ph Exam', 'Conclusion' (highlighted in blue), and 'Prescriptions'. In the center of the screen, there is a large rectangular box with the title 'Visit conclusion'.

Figure 24: Conclusion of the visit

- #61 Display on HCP App of a portion of Prescription codes;
- #62 Automated translation on HCP App of information extracted from natural language in Patient Summary;
- #63 Automated translation on HCP App of information extracted from natural language in Prescription.

Requirements related to authoring:

- #54 Prescription authoring on HCP App:
 - User story: The HCP visualizes the prescriptions inside the HCP App at every moment during the consultation;
 - User story: The HCP adds prescriptions inside the HCP App internal database;
 - User story: The HCP edits prescriptions inside the HCP App internal database;
 - User story: The HCP deletes prescriptions from the HCP App internal database.
- #78 Enabling of Citizen identification from S-EHR (with CA);
- #79 Enabling of HCP identification from HCP app (with CA);
- #80 Enabling of healthcare organization identification from HCP app (with CA);

Requirements related to upload:

- #50 D2D upload by HCP App of initial assessment of S-EHR;
- #52 D2D upload by HCP of Prescription.

Requirements related to download:

- #56 D2D download on HCP App from S-EHR of a portion of Patient Summary;
- #57 D2D download on HCP App from S-EHR of a portion of Prescriptions;
- #58 D2D download on HCP App from S-EHR of a portion of Laboratory results;
- #96 Download from the HCP of health information provided from the patient.

Requirements related to software support:

- #17 D2D Identification and Authentication of the citizen from HCP:
 - User story: The HCP visualizes the identification data received from the Patient on the HCP App;

Information about the patient – Current Patient / Demographic data:

InteropEHRate		Home	Current Patient	Administration
Demographic Information		Name: Mario Rossi Age: Country:		
Current Diseases	Name:	GP/Referral physician name:		
Pat history	Surname:	GP/Referral physician phone:		
Allergies	Birth date:	Country of residence:		
Current Medications	Place of birth:	E-mail physician:		
Document History Consultation	Gender:	Referral nurse name:		
Laboratory tests	Spoken language:	Referral nurse phone:		
Visit Data	Country of residence:	Country of residence:		
Vital Signs	Social security number/PID:	E-mail nurse:		
Reason	Next of kin:			
Ph Exam	Emergency contact:			
Conclusion	Patient phone:			
Prescriptions	E-mail patient:			

Figure 25: Demographic data of the patient

- User story: The HCP confirms the digital identity shown inside the HCP App;
- User story: The HCP stores the citizen's identity inside the HCP App internal database.
- #47 Selection of language on the HCP App;
- #75 D2D Visualization of citizen's identity to HCP (using certificate).

3.4.2 Features to be implemented in version 2 of the HCP App corresponding to Scenario 2 – Emergency access

Requirements related to emergency consultation:

- #99 HCP's access to health data of an identified citizen for emergency reasons;
- #143 HCP' access to Citizen identity by means of Citizen's token;
- #145 High transfer rate of IPS transmission in emergency.

4. CONCLUSIONS AND NEXT STEPS

The current deliverable aims to present the new functionalities and features of the integrated web app - Healthcare Professional Application (HCP App) solution used by healthcare professionals for accessing and creating health data of foreign patients within the InteropEHRate project. The updated version of software requirements specification of HCP App is the result of both technical improvements and software development and the continuous collaboration with the end-users (co-design / co-creation sessions).

Taking into consideration the particular requirements of the project Task “HCP web app and EHR functionalities”, the deliverable encompasses the updated UI design of the HCP App solution.

Moreover, compared to version 1 of the HCP App, the second version brings a change of perspective in terms of GUI design. The organization of the patient's healthcare data in version 2 of HCP App satisfies an EHR / EMR structure that is closer to the vision of the medical staff than the one previously proposed (IPS) in version 1, it's easier to use and more intuitive. Within the deliverable, the HCP App is depicted from two major perspectives:

- Design / Technical perspective
- End User perspective.

This deliverable is the second of the three deliverables of the project Task dedicated to software requirements specification and design of HCP app, and is the updated version of the previous deliverable [6] [D5.1]. The details and iterative completions of the technical solution will be described in the next version of this deliverable.

REFERENCES

- [1] **[D2.1]** - InteropEHRate Consortium, User Requirements for cross-border HR integration - V1, 2019. <https://www.interopehrate.eu/resources/>
- [2] **[D2.2]** - InteropEHRate Consortium, User Requirements for cross-border HR integration - V2, 2020. <https://www.interopehrate.eu/resources/>
- [3] **[D4.1]** - InteropEHRate Consortium, Specification of remote and D2D protocol and APIs for HR exchange - V1, 2019. <https://www.interopehrate.eu/resources/>
- [4] **[D4.2]** - InteropEHRate Consortium, Specification of remote and D2D protocol and APIs for HR exchange - V2, 2019. <https://www.interopehrate.eu/resources/>
- [5] **[D4.4]** - InteropEHRate Consortium, Design of libraries for remote and D2D HR exchange - V1
- [6] **[D5.1]** - InteropEHRate Consortium, Software Requirements specification of an integrated EHR web app for HCP - V1, 2019. <https://www.interopehrate.eu/resources/>
- [7] **[FHIR standard for health care data exchange]** published by HL7®. <https://www.hl7.org/fhir/index.html>
- [8] **[D5.13]** - HCP Web app - V1, InteropEHRate Consortium, 2019. <https://www.interopehrate.eu/resources/#dels>