A Demonstration of 4D Digital Avatar Infrastructure for Access of Complete Patient Information

Project acronym: MyHealthAvatar

Deliverable No. 7.1
Description of scenarios and use cases for MyHealthAvatar

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PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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ABSTRACT:
This document describes the final Scenarios / Use Cases that are relevant for MyHealthAvatar (MHA). As scenarios are based on the results of WP2, the work on this document has started at month 10, after the finalization of WP2. According to the different stakeholders (citizens, patients clinicians, and researchers) the final set Scenarios / Use Cases have been updated, ranked, clustered and presented.

KEYWORD LIST:
Scenario, use case, stakeholder, end user needs, requirements.

[1] **R**=Report, **P**=Prototype, **D**=Demonstrator, **O**=Other

[2] **PU**=Public, **PP**=Restricted to other programme participants (including the Commission Services), **RE**=Restricted to a group specified by the consortium (including the Commission Services), **CO**=Confidential, only for members of the consortium (including the Commission Services)

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Contents

1 Executive Summary

This document describes the final Scenarios / Use Cases that are relevant for MyHealthAvatar (MHA). As scenarios are based on the results of WP2, the work on this document has started at month 10, after the finalization of WP2. According to the different stakeholders (citizens, clinicians, researchers and IT people) the final set Scenarios / Use Cases have been updated, ranked, clustered and provided.

In addition, the Scenarios / Use Cases updated from WP2 are described in linkage to external sources such as social networks and research infrastructures. All Scenarios / Use Cases have been developed in an interactive process between all beneficiaries of the project and described in a standardized way by using the updated template from WP2. Interoperability issues are taken into account to allow a seamless interaction between different scenarios and to guarantee data sharing. Tools that need to be developed in those scenarios are prioritized according to the user needs and requirements under a clinical perspective. Criteria for prioritization are given via Scenarios / Use Cases clustering approach and it could serve as a background for the required timeframes for realization of selected scenarios within MHA.

MHA high-end Scenarios / Use Cases have been defined and predictably divided in two major groups:

- Scenarios / Use Cases for Clinical Researchers
- Scenarios / Use Cases for Patients empowerment for long term disease treatment
- Scenarios for emergency contact

The final set of the agreed MHA High-End Scenarios / Use Cases, marked with 'High' ranking and top development priority is presented below.

ID	Scenario / Use Case Name
CHF	Personalized CHF Related Risk Profiles and "Real-Time Monitoring" Services
OST	Osteoarthritis
DIAB	Diabetes
NEPH	Nephroblastoma (Wilms Tumour) Simulation Model and Clinical Trial
EME	Emergency contact

The linkage and references to other WPs have been mentioned, a special attention has been paid to data collection utilities and data repository to store health related data of individual citizens. Furthermore the user requirements and specifications for the linkage to external sources such as social networks and for the collaboration with other existing research projects are described.

2 Scenario / Use Case Based Design

2.1 Scenario / Use Case Approach

According to the D 2.2 [1] our approach is to integrate as much as possible the described Scenarios in the frames of the related Use Cases. We designed a complex template which has a section dedicated to Scenario description, named 'Basic Flow'. As consequence, we are using the term

'Scenario / Use Case', it allows us to describe the MHA Scenarios with minimum technical information in linkage to more complex and rich in technical requirements Use Cases. Despite the complexity of this approach it has been accepted by all project partners and it serves as a powerful guideline for further MHA platform development activities. Additionally, this approach allows us, close to the precise identification of the end-user's needs and requirements, to underline the MHA platform architecture and the related ICT requirements.

2.2 Scenario / Use Case Template

The template for Scenarios / Use Cases , presented and described in the frames of D 2.2, has been first updated in the frames of the MHA project 1st Progress Meeting in Budapest, Hungary (September 12, 2013). The last updated version has been discussed and agreed in the frames of the MHA project meeting in Homburg, Germany (September 2014). The final, updated version of Scenario / Use Case template is presented below.

Use Case ID:	*UC-1*		
Use Case Name:	*Use case name*		
Technical Collaborators:		**Clinical Collaborator:**	
Description:	*Use case description. Ensure that you use an active voice.*		
Actors:	*Who will be taking part in this process? If you want to write descriptions, it makes the use case even more valuable.*		
Trigger:	*What is making the use case begin? For instance, User presses a button.*		
Preconditions:	*What needs to be true before the use case can begin (i.e. execution of other use cases prior to this use-case).*		
Successful End condition:			
Fail End condition:			
Basic Flow:	*What are the basic steps*		
Alternate Flows:	*Are there any deviations to the basic steps?*		
Postconditions:	*What is the next step? Consider this use case as the precondition for the next.*		
Dependencies:	*This use case extends to the following use cases:* *Is this part of a bigger use case?* *This use case includes the following use cases:* *Does this include other use cases?*		
Required External Resources:	*[ ] Data, please specify:*	*What type of data do we need to collect? Please be as specific as possible at this point of time.* *Who owns those data/where they will come from?* *What type of analysis we need to support?*	
	[ ] Tools, please specify:	*What type of tools?* *Who owns those tools?* *How they can be used in the MHA?*	
	[ ] Services, please specify:	*What type of Services?* *Who owns those Services?* *How they can be used in the MHA?*	
	[ ] Models, please specify:	*What type of Models?* *Who owns those Models?* *How they can be used in the MHA?*	

	[ ] Other, please specify:	
How this use-case is going to be validated?	*Include how the aforementioned use-case will be integrated possibly with clinicians workflow*	
Frequency of Use:	*How often will this be executed?*	
Who are the users?	*The main end-user categories are: Clinicians and Patients but feel free to add other end-use categories If necessary.*	
Special Requirements:	*Please detail any specific requirements demanded by the use case (e.g. performance, usability, interaction, storage requirements)*	
Assumptions:	*Any other detail that you feel relevant.*	
Questions:	*Please detail all issues and questions that need to be answered prior to the completion of the use-case description.*	

2.3 Architecture and Integration

The D 3.2 [2] defined and described the architecture of the MHA platform. Additionally it presents the rationale and the process for designing the architecture based on the requirements and the user scenarios of the project. This effort was focused on the identification of the major stakeholders, their concerns, and viewpoints following well-known best practices for documenting software architecture. Additionally an Architectural Description (AD) document has been presented; it defined the high level architecture of the platform. The architecture definition process is nevertheless a continuous task as the system evolves and new requirements arise or other issues emerge.

3 MHA Scenarios / Use Cases Summary

This chapter presents the summary of all final Scenarios / Use Cases that relevant for MHA platform. All Scenarios / Use Cases are ranked and aligned to different stakeholders (citizens, clinicians, basic researchers and IT people).

3.1The final set of MHA Scenarios / Use Cases

The final set of MHA Scenarios / Use Cases is presented in **Table 1** are in details described in **Chapters 4, 5** and **6** of this document.

ID	Scenario / Use Case Name
UAC	MHA User Accounts
3DS	3D Avatar Visualization
DB	MHA Data Browse
VC	MHA Virtual Community
DCU	Self Data Collection
TOOL	MHA Toolbox and MHA Simulation Models
HIS	Link MHA to HIS and CTMS
CHF	Personalized CHF Related Risk Profiles and "Real-Time Monitoring" Services
OST	Osteoarthritis
DIAB	Pre-Diabetes
NEPH	Nephroblastoma (Wilms Tumour) Simulation Model and Clinical Trial
EME	Emergency contact
TBI	Brain Trauma
APLA	Anti-Platelet & Anticoagulation Therapy in the Pre-Operative Patients

Table 1. The final set of MHA Scenarios / Use Cases

3.2Stakeholders MHA Scenarios / Use Cases

According to the different stakeholders (citizens, patients, clinicians and researchers) Scenarios / Use Cases are provided for each of them (**Table 2**) by taking into account the clustering approach described in **Chapter 5** of this document.

ID	Scenario / Use Case Name	Stakeholders
UAC	MHA User Accounts	Granular Scenario / Use Case for Data Access and Collection: • Citizens and Patients • Clinicians and Researchers
3DS	3D Avatar Visualization	Granular Scenario / Use Case for Data Access and Collection: • Citizens and Patients • Clinicians and Researchers
DB	MHA Data Browse	Granular Scenario / Use Case for Data Access and Collection: • Citizens and Patients • Clinicians and Researchers
VC	MHA Virtual Community	Granular Scenario / Use Case for Data Access and Collection: • Citizens and Patients

		Clinicians and Researchers
DCU	Self Data Collection	Granular Scenario / Use Case for Data Access and Collection: • Citizens and Patients • Clinicians and Researchers
TOOL	MHA Toolbox and MHA Simulation Models	Granular Scenario / Use Case for Data Access and Collection: • Citizens and Patients • Clinicians and Researchers
HIS	Link MHA to HIS and CTMS	Granular Scenario / Use Case for Data Access and Collection: • Citizens and Patients • Clinicians and Researchers
CHF	Personalized CHF Related Risk Profiles and "Real-Time Monitoring" Services	High-End Scenario / Use Case for patient empowerment and clinicians
OST	Osteoarthritis	High-End Scenario / Use Case for patient empowerment and clinicians
DIAB	Diabetes	High-End Scenario / Use Case for patient empowerment and clinicians
NEPH	Nephroblastoma (Wilms Tumour) Simulation Model and Clinical Trial	High-End Scenario / Use Case for Clinical Researchers, Patients
EME	Emergency contact	High-End Scenario / Use Case for clinicians and patients
TBI	Brain Trauma	High-End Scenario / Use Case for patient empowerment and clinicians
APLA	Anti-Platelet & Anticoagulation Therapy in the Pre-Operative Patients	High-End Scenario / Use Case for patient empowerment and clinicians

Table 2. Stakeholders' MHA Scenarios / Use Cases

3.3MHA Scenarios / Use Cases Ranking

According to the need of different use cases in high-end scenarios a ranking of granular use cases is required. This ranking (low, medium, high) is used to prioritize the MHA platform development activities (**Table 3**).

'High' priority Scenarios / Use Cases aims to provide the end users with the basic MHA platform functionalities. The main prioritisation criteria was to have in place the core functionalities able to integrate more complex Scenarios / Use Cases ranked with 'Medium' state.

The ranking of MHA Scenarios / Use Cases is used mainly for internal platform development process with direct impact on next project's tasks and in special the **T9.1: Definition of demos**.

MHA Scenarios / Use Cases ranking has been defined and agreed with all project partners in the frames of the last consortium meeting on September 2014 (Homburg, Germany).

ID	Scenario / Use Case Name	Ranking
UAC	MHA User Accounts	High
3DS	3D Avatar Visualization	High

DB	MHA Data Browse	High
VC	MHA Virtual Community	High
DCU	Self Data Collection	High
TOOL	MHA Toolbox and MHA Simulation Models	High
HIS	Link MHA to HIS and CTMS	High
CHF	Personalized CHF Related Risk Profiles and "Real-Time Monitoring" Services	High
OST	Osteoarthritis	High
DIAB	Diabetes	High
NEPH	Nephroblastoma (Wilms Tumour) Simulation Model and Clinical Trial	High
EME	Emergency contact	High
TBI	Brain Trauma	Medium
APLA	Anti-Platelet & Anticoagulation Therapy in the Pre-Operative Patients	Medium

Table 3. Ranking of MHA Scenarios / Use Cases

3.4 Requirement Analysis

Top user requirements have been successfully defined in the frames of D 2.2 [1], these are:

1. The Usage, management and sharing of a wide spectrum of heterogeneous data from multiple platforms to provide a comprehensive and longitudinal collection of data regarding the citizen's and patient's health status
2. The need for smart and easily accessible data collection methods
3. Entire data ownership and control by citizens
4. Secure, legal and regulatory compliant deployment of services
5. Integrated ICT for data navigation, search, visualization and analysis to support user understanding and education
6. Coordinated personal healthcare services with medical professionals and healthcare systems to allow knowledge discovery and assessment and prediction of the health status of patients by statistical analysis and simulation
7. Interfaces for the usage of external tools, models and services
8. Links to external data warehouse sources
9. Links to external hospital records
10. Links to social media networks and services and to support building of patient communities among patients with similar conditions
11. MHA API development for services interaction

All these requirements have been addressed in the updated versions of MHA's Scenarios / Use Cases (**Chapters 4, 5, 6**).

The D 2.3 [5] presented the user requirements and specifications for the linkage to external sources such as social networks and for the collaboration with other existing research projects. All presented resources have been analysed in the terms of the identified end user needs and requirements. As result, the concluding D 2.3 **Table 6** has been refreshed with new data and insights. Additionally, new, potential collaboration opportunities are described in **Chapter 7** (MyLifeHub and CARRE projects).

End User(s)	Needs	Requirements	Priority
Researchers, healthcare professionals	Integrate the results and achievements of the VPH Network of Excellence *(VPH-NoE project)*	Access, integration and usage of the VPH ToolKit elements	Medium
Researchers, healthcare professionals, patients, citizens	ObTiMA integration *(p-medicine Project)*	Implementation of the **UC-HIS**	High
All end-users	Data protection and data security framework *(p-medicine Project)*	Usage and integration of the p-medicine project deliverable D5.1 Setting up of the data protection and data security framework	High
Researchers, healthcare professionals	3D visualised cancer models *(p-medicine Project)*	Integration of the p-medicine's re-usable clinical trial driven multi-scale cancer models	High
Researchers, healthcare professionals, patients	3D visualised cancer models *(CHIC project)*	Implementation of the **UC-NEPH**	High
Researchers, IT professionals	Digital Patient Roadmap (DISCIPULUS project)	Usage and integration of the DISCIPULUS project's Digital Patient Roadmap	High
Researchers, IT professionals	Computer-based predictive models (MD-Paedigree project)	Usage and integration of the MD-Paedigree project's computer-based predictive models of various paediatric diseases	Low
Researchers, IT professionals, patients	Virtual reality based rehabilitation platform (REWIRE project)	Linkage and/or integration of the REWIRE project's virtual reality based rehabilitation platform	Low
Researchers, healthcare professionals, general public	Experience and linkage with Facebook Profile Access Timeline activity Post/Get/Share	Facebook platform components integration: • Social Plugins • Login • OpenGraph	Medium
Researchers, healthcare professionals, general public	Experience and linkage with LinkedIn Profile Access Timeline activity Post/Get/Share	LinkedIn services integration: Share Plugin Sign in with LinkedIn	Low
Researchers, healthcare professionals, general public	Experience and linkage with Google+ Profile Access Timeline activity	Google+ services integration: Interactive posts Integrated Hangouts Google+ plugins	Low

	Post/Get/Share		
Researchers, healthcare professionals, general public	Experience and linkage with Twitter Profile Access Timeline activity Post/Get/Share	Twitter services integration: Twitter Cards Embedded Timelines Embedded Tweets Tweet Button Follow Button	Medium
General public, patients	PatientsLikeMe health data import, export	To identify the tools and services able to import/export health data	Low
General public, patients	PHR systems (e.g. Indivo, Microsoft HealthVault) health data import/export	Implementation of the **UC-HIS**	High

Table 6: The refreshed, concluding table on End-User Needs and Requirements from D 2.3.

4 MHA Scenarios / Use Cases Description

This chapter presents the detailed description of the final set of the MHA Scenarios / Use Cases. These cases evolved from the original case description on D2.2, which is attached in Appendix 2 as a reference.

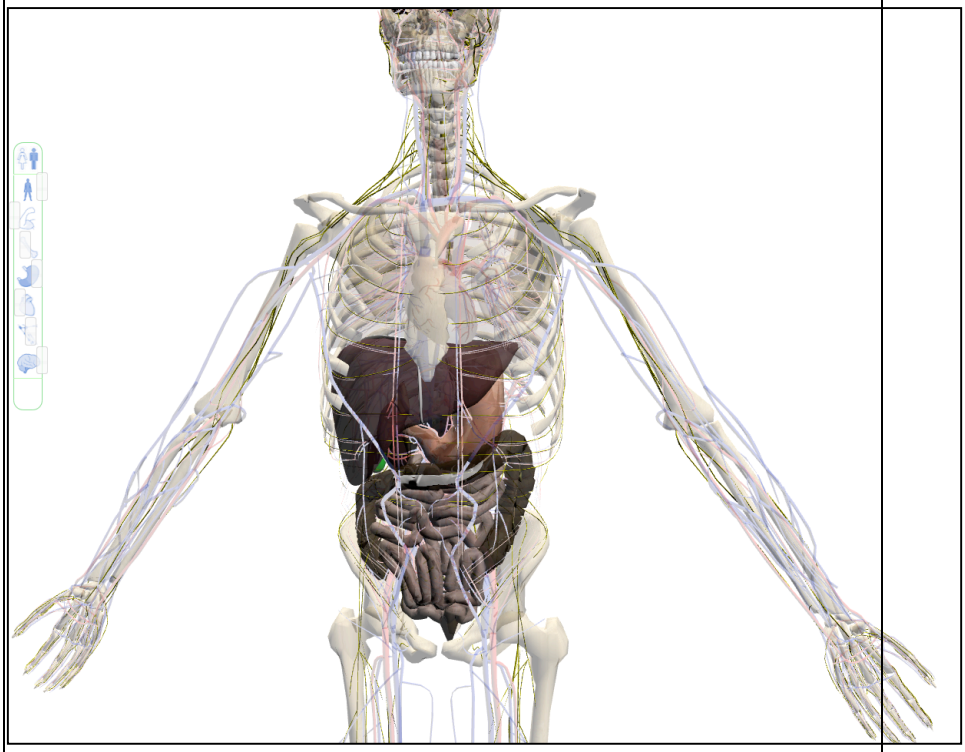
4.1 MHA User Accounts (UC-UAC)

Use Case ID:	UC-UAC		
Use Case Name:	MHA User Accounts		
Technical Collaborators:	BED, FORTH, ICCS	**Clinical Collaborator:**	USAAR
Description:	Users (citizens) will be able to log onto the system using their username and password. New users will be able to sign up to the system by creating basic personal information including security questions. Informed consent and privacy: Users will need to accept the privacy policy and the "terms and conditions" of using the MyHealthAvatar platform. Upon log into the system, users will be able to enter, browse their data, explore medical information, communicate with other fellow patients. Users will be able to view and interact with an avatar - a 3D representation of the human body. It will allow the End User to click with the computer mouse on a particular part of the avatar "body" to trigger a search of medical records to retrieve relevant information MyHealthAvatar is a platform for End-Users who want to share their health information to create collective knowledge about disease, health, and treatments. In order to achieve this goal advanced Informed Consent and Privacy Policy Scenario / Use Case should be implemented. End User has the GUIs, functionalities and tools in the frames of MyHealthAvatar platform to accept, reject, print or revise at any time the Privacy and Informed Consent settings. There will be two types of users, the first type includes patients and citizens for their life time data collection, the second type includes doctors who will be linked to the avatars from citizens/patients for clinical practices and medical research purpose		
Actors:	*Two types of users: Type 1: Patients/citizens* *Type 2: doctors/medical researchers*		
Trigger:	*n/a*		
Preconditions:	*n/a*		
Successful End condition	*n/a*		
Fail End condition	*n/a*		
Basic Flow:	Sign up and log in 1. After press a sign up button, new users will provide basic information (user name, age, gender etc.) and some security questions. They will also have to accept the privacy policy and the "terms and conditions" of using the MyHealthAvatar platform. 2. Upon log in, users will be able to access the system 3. Users will be able to perform the system operations (e.g. data browsing, sharing etc.) Privacy policy setting		

	1. Successful Log-In (or New account creation) by using Username or Email and Password 2. Click Accept/Revise link named "Privacy and Informed Consent" of your Avatar 3. The Privacy and Informed Consent description with checkboxes is shown. 4. End User has the option to select any checkbox according his/her preferences 5. End User has the option to "Edit", "Save" and "Print" the Accepted "Privacy and Informed Consent" preferences. Note: the sign up interface for patients and doctors will be slightly different.	
Alternate Flows:	*n/a*	
Postconditions:	*N/a*	
Dependencies:	*n/a*	
Required External Resources:	[ ] Data, please specify:	n/a
	[ ] Tools, please specify:	n/a
	[ ] Services, please specify:	n/a
	[ ] Models, please specify:	n/a
	[ ] Other, please specify:	n/a
How this use-case is going to be validated?		
Frequency of Use:		
Who are the users?	*Two types of users: Type 1: Patients/citizens* *Type 2: doctors/medical researchers*	
Special Requirements:		
Assumptions:		
Questions:		

4.2 Avatar Visualization (UC-3DS)

Use Case ID:	UC-3DS		
Use Case Name:	3D Avatar Visualization		
Technical Collaborators:	BED	**Clinical Collaborator:**	USAAR
Description:	MyHealthAvatar platform would propose an avatar - a 3D representation of the human body - to allow End Users (e.g. patients, doctors) to visualize patient medical records in a new way. The avatar will be used as a means for presenting general medical knowledge to the citizen users. Users will be able to select individual parts and see related medical information such as anatomy. The information may also include medicine and food. Some individualization of the 3D model is desirable.		

	 **3D Avatar View** *Centre for Computer Graphics & Visualisation University of Bedfordshire, UK* *(18-19 February 2014, Luton Meeting)*
Actors:	*This will be mainly for citizens/patients to view their own data* *The doctors can also load the avatars from their patients to see patient data*
Trigger:	*n/a*
Preconditions:	*n/a*
Successful End condition	*n/a*
Fail End condition	*n/a*
Basic Flow:	The basic steps are: 1. Successful Log-In (or New account creation) by using Username or Email and Password 2. Select your Avatar 3. Click on different parts of the 3-D Avatar of the human body (e.g. kidney) 4. See all the available medical history and information related to that patient's parts of the human body (e.g. text entries, EHR, lab results and/or medical images). 5. Browse the available information with ability to Add, Edit, Save, Change the Privacy Settings, or Delete the existing entries. 6. End messages (e.g. "Success", "Error") in case of any of the above performed actions. 7. Log-Out option with related message
Alternate Flows:	*n/a*
Postconditions:	*N/a*
Dependencies:	*n/a*
Required External	[ ] Data, please specify: n/a

Resources:		
	[ ] Tools, please specify:	n/a
	[ ] Services, please specify:	n/a
	[ ] Models, please specify:	n/a
	[ ] Other, please specify:	n/a
How this use-case is going to be validated?		
Frequency of Use:		
Who are the users?	*This will be mainly for citizens/patients to view their own data* *The doctors can also load the avatars from their patients to see patient data*	
Special Requirements:		
Assumptions:		
Questions:		

4.3 MHA Data Browse (UC-DB)

Use Case ID:	UC-DB		
Use Case Name:	MHA Data Browse		
Technical Collaborators:	BED, LIN, FORTH, ICCS	**Clinical Collaborator:**	USAAR
Description:	Upon log in to their own account, users will be able to browse their own data, including all the personal health status data collected through the avatar system, plus medical records and clinical data from the hospitals The avatar system will need to offer tools that support effective data query and search, such as filtering. The 4D avatar will play an important role in presenting the data. Users will be able to select individual parts of the avatar body to view the data associated to the selected parts. Different colours or textures will be assigned to individual parts of the 4D avatar to represent their health status. For example, if the heart has a serious problem it will be highlighted using a unique colour or texture Patients/citizens will use the data browser to view their own data; Doctors will be able to view data from all his/her patients connected to the avatar. The avatar system will also need tools which will help users to analyze medical images		
Actors:	*Patients/citizens will use the data browser to view their own data* *Doctors will be able to view data from all his/her patients connected to the avatar.*		
Trigger:	*n/a*		
Preconditions:	*n/a*		
Successful End condition	*n/a*		
Fail End condition	*n/a*		
Basic Flow:	The basic steps are: 1. Successful Log-In (or New account creation) by using Username and Password 2. Use user interface (menus, dialog boxes etc) to view data		

	3. Allow to use filters for data selection 4. Allow data presentation at different level of details (e.g. use small text box, large textbox, or even open a new page) 5. View health status through the colours/textures of the 4D avatar 6. Click on individual parts of the avatar to view relevant data 7. For image data browsing: • Select a set of medical images within the avatar • Load and Browse the selected images • Allow zoom in/out at particular areas of the images • Indicate the images at corresponding part of the avatar body • Perform basic image processing, such as Image filtering, and enhancement, etc. • Perform segmentation of region of interests (lesions or anatomies) on selected images	
Alternate Flows:	*n/a*	
Postconditions:	*N/a*	
Dependencies:	*n/a*	
Required External Resources:	[ ] Data, please specify:	n/a
	[ ] Tools, please specify:	n/a
	[ ] Services, please specify:	n/a
	[ ] Models, please specify:	n/a
	[ ] Other, please specify:	n/a
How this use-case is going to be validated?		
Frequency of Use:		
Who are the users?	*Patients/citizens will use the data browser to view their own data* *Doctors will be able to view data from all his/her patients connected to the avatar.*	
Special Requirements:		
Assumptions:		
Questions:		

4.4 MHA Virtual Community (UC-VC)

Use Case ID:	UC-VC		
Use Case Name:	MHA Virtual Community		
Technical Collaborators:	BED, FORTH	**Clinical Collaborator:**	USAAR
Description:	This case describes the search framework from end-users' perspective and it is focused on listing all MHA registered end-users with ability to apply advanced search filters: • Age • Gender • Votes (Likes) • Treatment • Symptom • Interests		

	• Country • City • etc. It is important to mention that every end-user should confirm the possibility to visualize his/her profile publically or privately. Only public profiles should be visible in search results. Additionally, the search function is suggested to be accessible only for end-users with public profiles. This case also provides a social media that allows patients to build up a virtual community by sharing their daily activities (e.g. how many exercises they have done), exchanging their experiences. It should also provide a link to Facebook/Twitter. The social media service will be used to allow the interconnection of end users. This social media service, accessible by smart phones, will be used in a dual mode allowing the users to insert information about themselves (like they do in common social media technologies) but also will be a mean of supporting personalized services to them from the system in the form of alerts and guidance (i.e. post therapy monitoring of user's behaviours after orthopaedics operation, cancer patients reaction to treatment, etc.). More specifically, patients will be able to 1) Find patients with similar condition, symptom and treatments 2) Find out symptoms and treatment for their conditions by looking at other fellow patients 3) Find out possible conditions for their symptoms by looking at other fellow patients *4)* Find out possible treatments for their conditions by looking at other fellow patients *5)* Find out "friends" and allow "followers" as in Facebook/Twitter *6*) Share activities, exercise experiences etc with friends and followers. End User has the related tools in the frames of MyHealthAvatar platform to collect, save and share data from third party social networks (Facebook, Twitter, etc.). The interface allows the End Users to attach to his/her own Avatar his/her own Facebook and/or Twitter account. The End-User's Avatar will have the frames to show the last updates, status messages or short texts from the related Facebook and/or Twitter accounts. The Avatar (End-User) has the option to share data to the added (only own!) Twitter and/or Facebook channels
Actors:	*Patients/citizens will use this to build patient communities* *Doctors can also have the option to join in the patient communities*
Trigger:	*n/a*
Preconditions:	*n/a*
Successful End condition	*n/a*
Fail End condition	*n/a*
Basic Flow:	*Upon* successful Log-In (or New account creation) by using Username and Password, users will be able to carry out search among all the users of the avatar system for the following purposes: 8. Search for patients with specific conditions, symptoms and treatments 9. Find out symptoms and treatments for specific conditions

	10. Find out conditions from specific symptoms. 11. Search for treatments for specific conditions 12. Find out "friends" and allow "followers" as in Facebook/Twitter 13. Share activities, exercise experiences etc with friends and followers.	
Alternate Flows:	*n/a*	
Postconditions:	*n/a*	
Dependencies:	*n/a*	
Required External Resources:	[ ] Data, please specify:	n/a
	[ ] Tools, please specify:	n/a
	[ ] Services, please specify:	n/a
	[ ] Models, please specify:	n/a
	[ ] Other, please specify:	n/a
How this use-case is going to be validated?		
Frequency of Use:		
Who are the users?	*Patients/citizens will use this to build patient communities* *Doctors can also have the option to join in the patient communities*	
Special Requirements:		
Assumptions:		
Questions:		

4.5 Self Data Collection (UC-DCU)

Use Case ID:	UC-DCU		
Use Case Name:	Self Data Collection		
Technical Collaborators:	BED, FORTH	**Clinical Collaborator:**	USAAR
Description:	This case seeks new solutions for increasing the quality and sustainability of future healthcare systems by actively engaging citizens in monitoring their own health through self collection of lifelogging data. The development and treatment of many diseases are affected by our life styles and environment. A long term monitoring of these factors, especially through the self-involvement of patients, is extremely valuable in supporting individualised health prediction and treatment. Many studies have shown compelling needs in self-lifelogging and self monitoring of patients, which has great potential in leading to preventive medicine, cost saving and enhanced quality in future healthcare. We aim to create a symbiotic relationship of available technology today and MyHealthAvatar platform. The goal is to respond to the fast growing demand for developing new technologies and services for self monitoring for supporting wellness, fitness and prevention of the most common chronic diseases (i.e. cardio-vascular and stroke, diabetes, rheumatic problems, respiratory problems and COPD, etc.). Mobile applications will monitor user's "health-status", "lifestyle" and "wellness" and upload data to the MyHealthAvatar system for close monitoring of health conditions and		

	prevention of many diseases. The system then will be able to analyse user's lifestyle and medical data. Special "alerts" will be applied to support end users with feedback supporting and assisting their daily activities and well-being. An interface for patients writing a diary is very helpful to collect patient specific data related to their disease. This can be partly structured: e.g. body weight, heart rate, blood pressure, temperature, medicine taken, etc. It can also include structured data of scoring systems, e.g. physical and/or psychological and/or emotional status. In addition free text entry needs to be allowed. More specifically, we explores various ways for the data collection in the avatar to monitor users' health-status, lifestyle and wellness. These include: • Web interface for data entry • Sensors (e.g. blood glucose, blood pressure, heart rate, locations, steps, sleep) • Mobile apps For example, users uses a glucose meter and MyHealthAvatar platform to monitor his/her blood sugar levels. The data is saved that maintains the Avatar's long-term history and looks for possible abnormal events. If the saved data is unusual, or the End-User skips a test, the MyHealthAvatar platform automatically generates an alert message Mobile apps will be used to monitor the health status of the users (e.g. mood, food). We will also explore the possibility to extract health related information from electronic cards (e.g. purchase of food and drink, daily exercises in gyms), as well as from social network. We will also look into the possibility of implementing an advanced Patient Devices Software Development Kit (SDK or "devkit"). A SDK will represent a set of software development tools that will allow healthcare it professionals the creation of applications for MHA able to access and strore data from any patient monitoring device. Patient Devices SDK may be something as simple as an application programming interface (API) in the form of some files to interface to a particular programming language or include sophisticated hardware to communicate with MHA platform. SDK may also include sample code and supporting technical notes or other supporting documentation to help clarify points from the primary reference material.
Actors:	*Patients/citizens*
Trigger:	*n/a*
Preconditions:	*n/a*
Successful End condition	*n/a*
Fail End condition	*n/a*
Basic Flow:	The basic steps are: For manual data entry: • Successful Log-In (or New account creation) by using Username and Password • Click relevant section from your Avatar • The interface is shown with ability to enter and or visualize data by date, week, month, year. • End User has the option to select any date or any diary entry with possibility to update it (in case of updates the update date is shown) • Some diary entries could be in linkage with avatar appearance.

	• End User has the option to “Edit”, “Save”, “Print” or “Share” the Diary info. For automatic data collection 1. Login in and select “remote monitoring devices” 2. End-User has the option to “Add” the monitoring device, at the initial stage only a glucose meter could be added 3. The monitoring devices parameters (Bluetooth or USB) are settled. 4. Users should be able to switch on/off the automatic data collection 5. User has the option to visualize the collected data 6. Collected data could change the appearance of the Avatar and/or alert messages are sent if the End-User skipped a test	
Alternate Flows:	*n/a*	
Postconditions:	*N/a*	
Dependencies:	*n/a*	
Required External Resources:	[ ] Data, please specify:	n/a
	[ ] Tools, please specify:	n/a
	[ ] Services, please specify:	n/a
	[ ] Models, please specify:	n/a
	[ ] Other, please specify:	n/a
How this use-case is going to be validated?		
Frequency of Use:		
Who are the users?	*Citizens/patients*	
Special Requirements:		
Assumptions:		
Questions:		

4.6 MHA Toolbox (UC-TOOL)

Use Case ID:	UC-TOOL		
Use Case Name:	MyHealthAvatar Toolbox		
Technical Collaborators:	ICCS, FORTH	**Clinical Collaborator:**	USSAR
Description:	**<u>Remote Monitoring</u>** The Remote Monitoring tool/frame collects and processes patient care information from supported healthcare devices that conform to standards (preferably selected by the Continua Health Alliance). End User uses a glucose meter and MyHealthAvatar platform to monitor his/her blood sugar levels. The MyHealthAvatar platform reminds to check the blood sugar regularly during the day, and the glucose meter should be able seamlessly to transmit the measurements to the Avatar after each use. The data is saved that maintains the Avatar's long-term history and looks for possible abnormal events. If the saved data is unusual, or the End-User skips a test, the MyHealthAvatar platform automatically generates an alert message.		

	The monitoring data will be made available through the citizen self-monitoring case (which is another use case). To allow for remote monitoring from the doctors using the avatar system, we need to link the avatar system to the hospital information system (which is again another use case). This will subsequently allow the transfer of the avatar data into the hospital records. **Simulation** End-User has the GUIs, functionalities and tools in the frames of MyHealthAvatar platform to create and execute a biological simulation scenario. End-User selects one of the biological simulation models available in the Model Repository and one of the sets of clinical data available in the Clinical Data Repository (or uploads a set from his computer). Afterwards he/she executes a biological simulation. Finally he/she retrieves the results of the simulation and proceeds to their evaluation. **Knowledge discovery** Patients are interested in the most recent and personalized information about their disease, treatment and prognosis. MHA platform could contain a ontology-based Knowledge Discovery (KD) module able to connects highly heterogeneous data and textual information. The semantic framework could be based on gene, tissue, disease and compound ontologies (important for drugs and clinical research frames). This framework could contain information from different organisms, platforms, data types and research areas that is integrated into and correlated within a single searchable environment using search algorithms. It could provide a unified interface for all MHA users to formulate, explore and identify new information (according to specific preferences and needs) across vast collections of available experimental and research data. KD module could combine classical keyword-based search with text-mining and ontologies to navigate large results sets (internal & external) and facilitate information and/or knowledge discovery. End users could be provided with an advanced ontology based (Gene Ontology (GO) and Medical Subject Headings (MeSH)) 'Table of Contents' in order to access, explore, structure (quickly) the millions of available resources (PubMed abstracts, news, clinical trials info) according to the predefined topics of interest (Allergy, Cancer, etc.).
Actors:	*Remote consultation: doctors (GPs) and patients* *Simulation: researchers, clinicians, patients* *Knowledge discovery: medical researchers, doctors*
Trigger:	**Simulation:** • User accesses the section "Simulation Interface". • User "clicks" on a specific area of the 3-D avatar of the human body, for example the kidney, is directly or indirectly (by a menu) redirected to the "Simulation Interface" and is guided to the proper biological simulation model/-s (for example the kidney simulation model/-s
Preconditions:	**Simulation:** • The User has to Log-in or to create a New Account (New Avatar). • The option to "perform simulations using biological models" must be enabled in the user's profile.

	• The user must have the proper access rights in order to use a biological simulation model from the Model Repository. • The biological simulation model must be already imported to the Model Repository. • The user must have the proper access rights in order to use a set of clinical data from the Clinical Data Repository. • The clinical data that the biological simulation model needs in order to run must be already imported into the Clinical Data Repository or it must be provided (uploaded) by the user just before the start of the simulation. • The clinical data must be compatible, in terms of format and content, with the selected biological simulation model. • The user must have the proper access rights to a computational platform. • The computational platform must have enough available resources in order for the simulation to be performed successfully
Successful End condition	*n/a*
Fail End condition	*n/a*
Basic Flow:	The basic steps in case of **simulation** are: 1. Successful Log-In (or New account creation) by using Username or Email and Password. 2. Select the Avatar. 3. The flow ends here if the End-User doesn't have the option "Perform simulations using biological models" enabled. 4. The flow continues if the End-User has the option "Perform simulations using biological models" enabled. 5. End-User creates a biological simulation scenario, by selecting a simulation model from the Model Repository and a set of data from the Clinical Data Repository. 6. End-User starts the simulation process. 7. When the simulation is completed, the proper ending code is displayed, either a success message or an erroneous message. 8. End-User user has the possibility to download the results of the simulation to his computer, either the simulation ended successful or with errors".
Alternate Flows:	The alternative flows in case of **simulation** are: 1. In step 5 of the basic flow, the selection of the simulation model can be guided by narrowing the available simulation models to only the ones related to a specific part of the human body, by clicking on the 3-D representation of human body. *2.* In step 6 of basic flow, End-User can upload a set of data from his computer instead of using a set of data provided by the Clinical Data Repository
Postconditions:	*N/a*
Dependencies:	**Simulation:** • The option to perform simulations using biological models must be enabled in the user's profile. • The user must have the proper access rights to the Model Repository. • The user must have the proper access rights to the Clinical data repository. • The user must have the proper access rights to a Computational Platform.

Required External Resources:	[ ] Data, please specify:	Clinical data (already preprocessed), ready to be used by the simulation models
	[ ] Tools, please specify:	• Model Repository • Clinical Data Repository (related to simulation models)
	[ ] Services, please specify:	• Query the Model Repository for available models. • Query the Clinical Data Repository (related to biological simulation models). • Copy a selected model to the computational platform. • Copy a set of selected preprocessed data to the computational platform. • Execute the simulation scenario (by sending a computational job to the computational platform). • Retrieve the result of the execution of a simulation model.
	[ ] Models, please specify:	Simulation Models
	[ ] Other, please specify:	Computational Platform: Can be either a personal computer, a cloud virtual machine, a High Performance Computer (HPC) or any other system able to perform computational simulations.
How this use-case is going to be validated?		
Frequency of Use:	*Medium*	
Who are the users?	*Remote consultation: doctors (GPs) and patients* *Simulation: researchers, clinicians, patients* *Knowledge discovery: medical researchers, doctors*	
Special Requirements:		
Assumptions:	**Simulation:** • The biological simulation model is already imported in the model repository. • A set of clinical data compatible with the aforementioned biological simulation model is already imported in the clinical data repository. • Appropriate computational resources are available for running the simulation. • The security framework is responsible for controlling the access to the model repository, the clinical data repository and the computational platform.	
Questions:	Although the biological simulation model (nephroblastoma) planned to be	

	used in the MyHealthAvatar demonstrator doesn't use proprietary software, what if a model uses proprietary software, like a model developed in Matlab (licensing issues)?

4.7 Link MHA to HIS and CTMS (UC-HIS)

Use Case ID:	UC-HIS		
Use Case Name:	Link MHA to HIS (Hospital Management System) and CTMS (Clinical Trials Management System)		
Technical Collaborators:	FORTH, ICCS	**Clinical Collaborator:**	USAAR
Description:	End User has the GUIs, functionalities and tools in the frames of MyHealthAvatar platform to enter, import, store and export personal medical data with hospital information systems. One option is to use ObTiMA as a dummy system to mimic external hospital system. ObTiMA, an ontology-based clinical trial management system, has been developed as a proof-of-concept application to highlight the possibilities of ontology based creation and managing of clinical trials within the ACGT (Advancing Clinico-Genomic Trials on Cancer) project. ObTiMA has a modular architecture with a core basic module for data management of clinical trials. Different other modules are under development in the frames of p-medicine project. The data stored in ObTiMA are relevant for the Health Avatar to enhance the system with relevant clinical trial data. On the other hand the info stored in MHA might be of relevance for a clinical trial. As result, the bidirectional data upload from MHA to ObTiMA is needed. This Scenario / Use Case describes the bilateral linkage between ObTiMA and MHA by being focused on the Operational Data Model (ODM). There are also a few other dummy systems available at FORTH, which can be used to mimic the external hospital system.		
Actors:	*Patients/citizens will see their own health records from the hospitals* *Doctors will be able to see patient data in their avatars*		
Trigger:	*n/a*		
Preconditions:	*n/a*		
Successful End condition	*n/a*		
Fail End condition	*n/a*		
Basic Flow:	The basic steps are: • Access the data export/import interface • Specify data export/import from ObTiMA (or other dummy systems) • Specify data export/import from MHA • Confirmation message of data/export		
Alternate Flows:	*n/a*		
Postconditions:	*N/a*		
Dependencies:	*n/a*		
Required External Resources:	[ ] Data, please specify:		eCRF with filed in data from ObTiMA Health Avatar with clinical trial

		related data (i.e. laboratory results, pre-operative state, etc.)
	[ ] Tools, please specify:	ObTiMA platform
	[ ] Services, please specify:	n/a
	[ ] Models, please specify:	The Operational Data Model (ODM) is designed to facilitate the archive and interchange of the metadata and data for clinical research, its power being fully unleashed when data are collected from multiple sources.
	[ ] Other, please specify:	n/a
How this use-case is going to be validated?		
Frequency of Use:		
Who are the users?	*Patients/citizens will see their own health records from the hospitals* *Doctors will be able to see patient data in their avatars*	
Special Requirements:		
Assumptions:		
Questions:		

4.8 Personalized CHF Related Risk Profiles and "Real-Time Monitoring" Services (UC-CHF)

Use Case ID:	UC-CHF		
Use Case Name:	Personalized CHF Related Risk Profiles and "Real-Time Monitoring" Services		
Technical Collaborators:	FORTH	**Clinical Collaborator:**	University of Crete, Faculty of Medicine
Description:	A major challenge related to caring for patients with chronic conditions is the early detection of exacerbations of the disease that may be of great significance. In this scenario we focus on methodologies that would facilitate the prevention, monitoring, and treatment of heart disease on a daily basis. Generally, cardiovascular disorders as chronic diseases require a continuous everyday record for patient's status. The proposed scenario is built on the following pillars: *1) Real-time patient monitoring* In addition to the above the dedicated clinical personnel should be contacted immediately and possibly intervene in time before an acute state is reached, by changing medication, or any other interventions, in order to ensure patient safety. There is a need to support real-time remote monitoring of patients diagnosed with congestive heart failure and MHA, enhanced with semantic technologies, may host personalized, accurate and up-to-date clinical information. To this end we built a real-time patient/ doctor alarming will be built according to rule-based alarms enabling intelligent alerting of the dedicated physician in case of an emergency. The alarming process will be based on vital signs monitoring and specifically Heart Rate (HR), Pulse		

	Oximetry, and Blood Pressure acquisition, adapted according each specific patient's medical history and age, and even risk predictor's outcome (described below). *2) CHF Risk Assessment* In order to tailor the proposed system to the patient's profile and assist physicians in selecting people who are predisposed by coronary disease, hypertension, or valvular heart disease; we build a CHF related risk profile based on a risk appraisal function that is based on the diagnostic criteria [i.e. the Framingham Heart Study (486 heart failure cases during 38 years of follow-up)]. The predictors used are based on Age, Coronary heart disease and Valve disease status provided by the patient Electronic Health Record (EHR), as well as on HR, on blood pressure and on Body Mass Index (BMI) provided by the pulse oximeter, the blood pressure monitor and the weight scale, respectively. The calculated risk probability may be used to alter the default threshold values (higher risk probability adds more constraint on the physiological patterns). Furthermore, we present what else data regarding patients' health status could be embed into the platform towards the creation of a profile with necessary information for both patient and treating physicians. To this respect an approach of presenting data regarding demographic, physiology, diagnostic test results and disease management (i.e. prescribed drugs) is provided. *3) Comorbidities and Drug Interaction* There are many cases where more than one medications are prescribed due to disease progression or due to the wide appearance of both cardiac and non-cardiac co-morbidities (respiratory comorbidities, renal dysfunction, cognitive dysfunction, depression and in some cases arthritis). To this respect, there is an urgent need for providing information in both the treating physicians, but also the patient him/ herself regarding negative drug interactions.
Actors:	Avatar1 (Doctor), Avatar2 (Patient)
Trigger:	Patient is diagnosed with CHF according to: • Patient's physiological, imaging, blood test results data and past diagnoses, uploaded in patient's electronic health record or during creation of patient's Avatar in MHA platform. • Patient physical examination and confirmation with differentiating diagnostic tests (i.e. echocardiography)
Preconditions:	The major precursor of all cardiovascular diseases is attributed in congenital or acquired factors that lead to atherosclerosis disorders and in some cases to complications from diabetes, kidney disease and hypercholasterolaemia. Heart failure is caused by any condition, which reduces the efficiency of the myocardium, or heart muscle, through damage or overloading. As such, it can be caused by a diverse array of conditions, including myocardial infarction (in which the heart muscle is starved of oxygen and dies), hypertension (which increases the force of contraction needed to pump blood) and amyloidosis (in which protein is deposited in the heart muscle, causing it to stiffen).
Basic Flow:	Basic steps 1. Generation of patient's avatar ○ Register life style factors (i.e. diet habit, alcohol, smoking) ○ Register of physiology, pathology, genetic information (i.e. pharmacogenomics) regarding patient's health ▪ Age ▪ Height ▪ Weight

	▪ Body Mass Index(BMI)/Body Surface Area (BSA) ▪ Blood pressure ▪ Pulse (possible need for creating time graphs) o Register life style factors (i.e. diet habit, alcohol, smoking physical activity) 2. Embed in Avatar platform of patient's examination results o Update of patient's basic examination outputs regarding cardiovascular system (blood test results, blood pressure, EEG results, imaging and physical exam) 3. Diagnosis of the heart failure and classification of patient according to one (or if possible more) categories (i.e. Framingham and or NYHA) o Matching of possible co-morbidities or setting alarms for possible complications due to disease progression (i.e. kidney function) 4. Record of patient's drug prescription (dose regiments) provided by the treating physician 5. Record of patient's compliance regarding provided treatment o Update avatar during last drug prescription for other diseases and alarm for possible interactions between medications (i.e. antibiotic medicines that could interact with cardiovascular treatments) 6. Real-time patient vital signs and data updates (if available) and processing to detect possible deviations from normal values
Alternate Flows:	Alternative flows will be followed if patient data are not provided in full.
Postconditions:	• Remote monitoring of patient health status after diagnosis. • Risk assessment and update data in MHA platform. o Creation of graphs with data values in time (i.e. BP, pulse, time of drug administration etc.) • Basic information for patient regarding health status during treatment. • Information regarding administration of other medications prescribed regarding drug-drug interactions and also in cases of over-the-counter medication that can be taken from the patient etc.
Dependencies:	This case tries to integrate information from the potential architecture of the platform including data from ontologies (linking of information regarding disease progression, side effects, drug interactions, genomic data, environmental factors, regulatory organizations guidance etc.) This use case includes or is part of the following use cases: • Utilization of personal genomic information for the individualization of MHA platform • Decision making tools regarding emergency situations in clinical practice. The example of anti-platelet & anticoagulation therapy in the pre-operative patients To achieve a good functionality as proposed in this set the following device and technologies should also be available: • Wireless or wearable medical devices and sensors acquiring patient's vital signs. In our reference implementation the supported measurements are: o Heart Rate (HR), SpO2, body weight and real time ECG monitoring. • Monitoring application recording the aforementioned bio signals and hosting risk assessment algorithms to enable the alerting process. • Ontology-driven application intelligence capable of reasoning on the

	patient's and drug data.	

Required External Resources:	[ ] Data, please specify:	• Patient's data
		  ○ Demographic
		  ▪ Gender
		  ▪ Age
		  ▪ Height
		  ▪ Weight
		  ▪ BMI/BSA
		  ○ Genetic
		  ▪ CHF related genome data
		  ▪ Pharmacogenomic data
		  ○ Physiology- Pathology
		  ▪ Blood pressure
		  ▪ Cardiac flow (BP and pulse)
		  ▪ Kidney function
		  ▪ Blood test results
		  ▪ Coagulation factors
		  ▪ Atherosclerosis level
		• Differentiating tests
		• Associated diseases
		• Physical examination
		• Imaging
		• Electrocardiography
		• Echocardiogram
		• Protocols/References regarding disease diagnosis/treatment
		  ○ Available regimens for prescription and potential alternatives
		  ○ Medline references
		  ○ Patients hand out from regulatory organizations for disease management

	[ ] Tools, please specify:	For Physician • PC hosting MHA platform with access to EHR • Links of Avatar's internal organs with diagnostic tools (i.e. linking of heart with ultra-sound image of the patient or ECG) • Medline references ○ i.e. drug interactions • Availability to store part of the data as case study For Patient • PC hosting MHA platform with access to EHR • Smartphone with MHA interface capable of updating necessary data (i.e. daily diet) • Wireless vital signs monitoring devices Information on disease progression

		with/without compliance (i.e. visualization of heart function)
	[ ] Services, please specify:	Links with EHR and PACS Links with external databases (i.e. DrugBank)
	[ ] Models, please specify:	1. Risk Assessment model 2. Real Time Alarming model 3. Visualization models 4. Disease progression models
	[ ] Other, please specify:	
Frequency of Use:	The proposed application can be used even in real time or selected time intervals, depending on the patient's initial diagnosis. Frequency of use can be categorized in two parts: 1) Patient's information regarding health status, disease progression, improvement etc. 2) Any treating physician which is going to prescribe a specific treatment for the patient and has access to MHA platform	
Special Requirements:	Familiarity of doctors and generally of the medical staff with MHA technologies Linking of MHA data between research and medical organizations and personnel applying MHA technological tools and services.	
Assumptions:	Some basic assumptions are: • Necessary physiological and clinical data to run the model. • Detailed patient's health history record • Linking of MHA platform with hospitals as well as research institutions that contribute in the health care system • Linking of the platform with external resources for providing information regarding CHF diagnosis and treatment • Monitoring Devices/ Sensors, if available • Patient's compliance in keeping update information in MHA platform • Doctor's compliance in updating patient's examination info in MHA platform • Full and detailed patient's health history record.	
Questions:		

4.9 Osteoarthritis (UC-OST)

Use Case ID:	*UC-OST*		
Use Case Name:	Osteoarthritis		
Technical Collaborators:	FORTH	**Clinical Collaborator:**	University of Crete, Faculty of Medicine
Description:	Osteoarthritis (OA) is a disabling degenerative joint disease leading to joint pain, stiffness and loss of function predominantly in the knees, hips, hands, and spine. The major histological finding in OA is degeneration and loss of the articular cartilage that acts as a protective cushion between bones within a joint. Imaging methods including weight bearing radiographs and in selected cases Magnetic Resonance Imaging (MRI,) may be used to study morphological and inflammatory changes occurring in the articular cartilage, menisci, extra-articular soft tissues and the subchondral bone marrow. Health care professionals support assessment and management of patients with OA in order to modify their nutrition and exercise lifestyle		

	behaviour. Hereditary factors (genetic) increase the risk for developing OA. It is worth pointing out that an estimated 75% of adults over the age of 65 years have OA resulting to impaired quality of life, and considerable healthcare costs. Moreover, about 100% of adults over the age of 80 years old have OA. The avatar system will monitor patient's daily diary and ambulatory activity and warn the patient, if she/he does not meet the special medical guidelines. The monitoring will rely on techniques of self-life logging, enhancing the patient engagement. Also, the platform will function as a supportive system to the patients by means of offering advice and assistance. Moreover, the avatar system will offer a useful input to doctors, as the related heterogeneous data (i.e. imaging and semi-quantitative data) will be properly visualized and presented using interactive, multi-scale visualization techniques. This will help doctors for data reasoning and for carrying out personalized healthcare. Advanced personalized healthcare will also be enhanced by existing genomic predisposition evaluation and health risk estimation. Thus, this use case is strongly related with the UC-09 (MHA Personal Genomic Information).
Actors:	*Doctors and citizens/patients*
Trigger:	1. *A citizen is diagnosed with Osteoarthritis* 2. *Avatar platform reveals for a citizen an increased risk of developing OA*
Preconditions:	*n/a*
Successful End condition	*n/a*
Fail End condition	*n/a*
Basic Flow:	1. The patient visits the doctor complaining for knee joint pain, stiffness, particularly after rest, crepitus, and swelling (soft from joint effusion or hard from osteophyte formation). The diagnosis of OA is based on the: a. History including pre-existing disorders such as previous serious injury, b. Clinical examination, c. Imaging studies, primarily radiographs and in some cases MRI, d. Additional semi-quantitative metrics are collected for diagnosis and follow up: • A number recorded with regard to a certain pain-scale • Range of motion of the knee joint (in degrees), e. Genetic predisposition evaluation for examining if an increased risk of developing OA exists (according to available genomic data). The above data, imaging and evaluation metrics, are collected and

	stored through the avatar system, which has novel ways for representing this multi-scale and heterogeneous information to medical professionals. **Self-care:** The treatment includes drugs and in more severe cases local injections, use of knee braces and knee replacement surgery. In addition, the doctor advices patient to modify or change the lifestyle. This includes weight reduction, exercise (quadriceps muscle strengthening, resistance training, aerobic exercise-walking, and flexibility exercise) and aquatic exercise. Too little movement can lead to stiffness and weak joints, whereas strong muscles protect joints. An OA management plan also involves following a healthy diet, managing stress and depression, and getting a good balance of rest and activity each day. **Monitoring:** The avatar system will monitor patient's daily dietary and ambulatory activity (using activity trackers) and warn the patient, if he does not meet the special medical guidelines (e.g. losing weight, exercise etc.). The monitoring will rely on techniques of self-life logging, which will monitor a wide range of daily activities and behaviours of the patients, including their locations, movements, diet, quality of life, environment, and other symptoms, etc. Visual analytics will be used to display individual/aggregated data items to allow easy interpretation of the data from the patients. With the search bar of the system, the users can easily send queries about their activities, movements, diet, etc. **Patient education:** The avatar system will also allow patient education on the knowledge of the diseases. It will also test the knowledge of the patients. It is expected that a good knowledge of the disease will lead to enhanced patient behaviours. 2. The patient visits the doctor again complaining for recurrence and deterioration of symptoms. a. The semi-quantitative metrics are collected again and compared with the previous ones stored through the avatar system. b. A new weight baring radiograph is taken. c. The doctor examines if the patient was compliant with the treatment guidelines. If the radiograph reveals severe structural changes, the doctor will discuss the surgical replacement of the joint. If the radiographic findings do not explain the clinical symptoms, a new MRI is required to explore other than internal derangement causes, such as insufficiency fracture of the subchondral bone. Due to the temporal nature of the data the representation is obtained by “animating” the visualization over time. Each frame will display the value of each parameter at a given time point.
Alternate Flows:	*1. Avatar system reveals for a citizen an increased risk of developing*

	OA through comparison to existing genomic predisposition data and warns the patient. 2. *Avatar system advices citizen to modify or change his lifestyle. This includes weight reduction, exercise (quadriceps muscle strengthening, resistance training, aerobic exercise-walking, and flexibility exercise) and aquatic exercise.*	
Postconditions:	-	
Dependencies:		
Required External Resources:	[ ] Data, please specify:	• Patients' data from MyHealthAvatar, including patient's history, imaging data, genomic data, semi-quantitative metrics, daily activities, exercises, diet over the time
	[ ] Tools, please specify:	• Multi-scale visualization & visual analytics tools for the visual representation of the multi-scale, heterogeneous data related to OA • Genomic analysis tools for evaluating the genomic predisposition and health risk
	[ ] Services, please specify:	• Links to data repository for retrieving the patients' clinical data
	[ ] Models, please specify:	•
	[ ] Other, please specify:	• Visualization server for performing the multi-scale data representation: can be either a personal computer or a high performance computer
How this use-case is going to be validated?	*By citizens with OA and medical experts*	
Frequency of Use:	*When a citizen is diagnosed with OA or has an increased risk of developing OA*	
Who are the users?	*Doctors and citizens/patients*	
Special Requirements:	-	
Assumptions:	-	
Questions:	-	

4.10 Pre-Diabetes (UC-DIAB)

Use Case ID:	UC-DIAB		
Use Case Name:	Pre-Diabetes		
Technical Collaborators:	BED	**Clinical Collaborator:**	
Description:	Diabetes is the world's fastest growing disease with substantial costs at individual and social economic level. It is estimated diabetes affect more than 32 million EU citizens (nearly 10% of the total EU population), and an additional 32 million citizens have not yet been diagnosed, or with pre-diabetes. Globally, the main risk factors for chronic disease, such as diabetes, are hypertension, tobacco use, high cholesterol, low fruit and		

	vegetable intake, overweight and obesity, sedentary lifestyle and alcohol abuse. Strategies for tracking chronic disease include prevention and early detection; people with high risk of developing diabetes are suggested to carry out many self-care behaviours. These include dietary change, exercise, regular self-medication , and regular attendance at clinic and for screening programmes. If diagnosed with diabetes, additional care, such as insulin injection, self-manage of blood glucose, and insulin dose adjustment are needed. Self-management means that people can take a more active role in decisions about their own treatment and about healthy lifestyle. It is a shared responsibility between individuals and service provider. Service providers recognise the individual's role in managing their health and well-being. MyHealthAvatar provides a unique citizen/patient empowered system that can be used, in particular for pre-diabetes care where the citizens with high risk of diabetes but not yet been diagnosed, and therefore not yet been known to the health care system. The functionalities of MyHealthAvatar provides a one-stop service for citizens in terms of data collection, and self-management services, such as monitor, record, and education. The avatar system will support the storage the behaviours and daily activities of citizen. The platform will function as a supportive environment from healthcare providers to the individual by means of offering advice, assistance and assessments; and by means of allowing for health promotion.
Actors:	Doctors and citizen/patient
Trigger:	Citizen takes risk analysis, and has been predicted with high risk
Preconditions:	
Successful End condition	
Fail End condition	-
Basic Flow:	The avatar system will include: • **Personal Diary:** Storage and management of the health status of the individual and their behaviours. This will rely on techniques of self-lifelogging, which will monitor a wide range of daily activities and behaviours of the citizen/patient, including their locations, movements, diet, quality of life, environment, mood, blood pressure, glucose, alcohol, smoking, and other symptoms, etc. Visual analytics will be used to display individual/aggregated data items to allow easy interpretation of the data from the patients. With the search bar of the system, the users can easily send queries about their activities, movements, diet, etc. • **Intervention:** allowing for multi-modal intervention of lifestyle in a shared decision manner between the doctor and citizens/patients. In the case of pre-diabetes, MyHealthAvatar will be able to demonstrate to the citizens/patients the relations between the outcomes of the self-management/treatment using prediction models. . "Behaviour prescription" will be issued based on clinical guidelines and trusted sources (such as NICE), which is expected to include a set of targets in terms of daily activities, calorie intake and energy consumption, etc. • **Monitoring:** allowing for the progress review of the individual by comparing the personal diary with the behaviour prescription as mentioned above. • **Warning:** The avatar system will send reminder messages at various priorities in one of the following occasions: medication

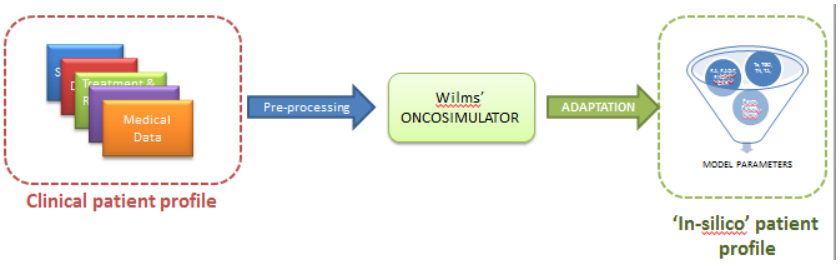
	reminder, due hospital visit (for screening etc.), sign of change of conditions, early sign of one of developing diabetes with constant scored as high risk. • **Complication:** The avatar system will have patients' clinical records and history, which will facilitate the management of complications from other possible conditions. The long term records will also help define personalised care plan.	
Alternate Flows:	-	
Postconditions:	-	
Dependencies:	-	
Required External Resources:	[x] Data, please specify:	Citizen/Patients' data from MyHealthAvatar, including daily activities, exercises, diet, mood, etc.
	[x] Tools, please specify:	Visual analytics tools for data visualization & analysis Statistical tools for computing standard indexes & charts (e.g. BMI, SAD) Prediction tolls for 'good' or 'bad' behaviours.
	[ ] Services, please specify:	
	[x] Models, please specify:	Statistical tools for computing standard indexes & charts(e.g. BMI, SAD)
	[ ] Other, please specify:	
How this use-case is going to be validated?		
Frequency of Use:		
Who are the users?	Citizen/patients	
Special Requirements:		
Assumptions:		
Questions:		

4.11 Nephroblastoma (Wilms Tumour) Simulation Model and Clinical Trial (UC-NEPH)

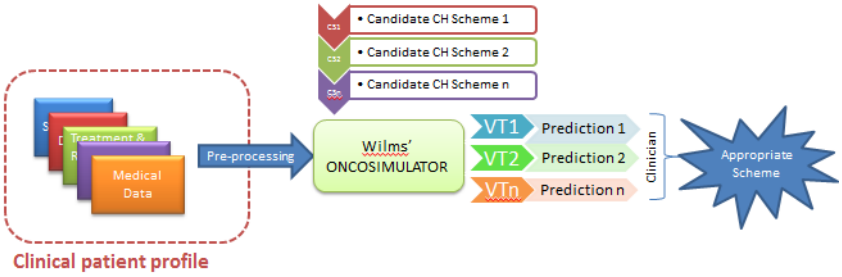
Use Case ID:	UC-NEPH		
Use Case Name:	Nephroblastoma (Wilms tumour) Simulation Model and Clinical Trial: In-silico profiling of patients and prediction simulations		
Technical Collaborators:	ICCS	**Clinical Collaborator:**	USAAR
Description:	Nephroblastoma diagnosis is based on a variety of multiscale data. These data can be used in the creation of a clinical multiscale profile of the tumour. After the necessary pre-processing of the available data, the data are fed into a nephroblastoma simulation model. The nephroblastoma simulation model is a predominantly discrete, clinically-oriented multiscale model of solid tumour response to treatment. Preoperative chemotherapy is the simulated form of treatment. A ''top-down'' simulation approach is adopted. The simulation method starts from the macroscopic imaging data, representing a high biocomplexity level, and proceeds towards		

lower biocomplexity levels.
Clinical orientation of the model has been a fundamental guiding principle throughout its development. Available medical data (imaging, histopathological, molecular) can be exploited, in order to strengthen patient individualized modeling.

Stage 1 (in-silico profile of patients):
Semi-automatic adaptation of the model parameters could be conducted in case of efficient availability of clinical data (many data sets at different time points). The determined model parameters serve as a patient record for in silico tumor characteristics and form the 'in-silico profile' of the patient.



Stage 2 (prediction simulatations):
The paediatric oncologist using the 'in-silico profile' of the patient runs a number of experiments in silico (= on the computer), to simulate the most likely response of the tumour to the most relevant candidate chemotherapeutic schemas. The outcomes of the simulations (predictions) help the oncologist decide the appropriate treatment plan.
The 'in-silico profile' could be further used from clinicians as a tool to provide insight into individualized biological characteristics of the tumor, an input for future model use and an input for the use of other models. It could also serve as a statistical tool to categorize the patients (by associating their clinical and in silico profiles) and define a range for model parameters to lead adaptations of new patients.



References:

- G.S.Stamatakos, E.Ch.Georgiadi, N.Graf, E.A.Kolokotroni, and D.D.Dionysiou., Exploiting Clinical Trial Data Drastically Narrows the Window of Possible Solutions to the Problem of Clinical Adaptation of a Multiscale Cancer Model. 2011, PLOS ONE

- Georgiadi EC, Stamatakos GS, Graf NM, Kolokotroni EA, Dionysiou DD et al., Multilevel Cancer Modeling in the Clinical Environment:

	Simulating the Behaviour of Wilms Tumour in the Context of the SIOP 2001/GPOH Clinical Trial and the ACGT Project. in. : Proceedings of the 8th IEEE International Conference on Bioinformatics and Bioengineering. 8-10 Oct 2008. Athens, Greece. CFP08266, ISBN: 978-1-4244-2845-8, Library of Congress: 2008907441, Paper No. BE-2.1.2. • Graf N, Hoppe A, Georgiadi E, Belleman R, Desmedt C et al., In Silico Oncology for Clinical Decision Making in the Context of Nephroblastoma. Klinische Paediatrie , Vol. 221, pp. 141-149.
Actors:	End User & MyHealthAvatar platform
Trigger:	Stage1: Enrich the patient record with an "in silico" profile Stage2: Prognosis is needed for nephroblastoma response to treatment.
Preconditions:	• The availability of clinical data that is compatible, in terms of format and content, with the nephroblastoma simulation model. • The availability of sufficient computational resources in order for the simulation to be performed.
Successful End condition	-
Fail End condition	-
	The basic steps for stage 1 are: 1. The End-User places the already preprocessed data to the location where the model expects to find them. 2. The Technical partner adapts the model parameters according to the available clinical data 3. The End-User starts the simulation process. 4. When the simulation is completed, the End-Users use the appropriate tools in order to read or/and visualize the outcome of the simulation. 5. The End-Users evaluate the adaptation by comparing simulation results with clinical reality. 6. In case of a succesful adaptation, the defined model parameters are recorded by the End Users and form the "in-silico patient profile" 7. In case of not satisfying adaptation, steps 2-5 are repeated. The basic steps for stage 2 are: 1. The End-User places the already preprocessed data to the location where the model expects to find them. 2. The End-User starts the simulation process. 3. When the simulation is completed, the End-User uses the appropriate tools in order to read or/and visualize the outcome of the simulation.
Alternate Flows:	-
Postconditions:	Stage 1: The in-silico profile of the patient is recorded. Stage 2: A treatment plan is drawn.

Dependencies:	This use case will be used as test case for UC-TOOL (MHA Toolbox).	
Required External Resources:	[x] Data, please specify:	Clinical data (already preprocessed), ready to be used by the simulation model. The SIOP 2001/GPOH clinical trial, including microRNA data, if available, will be used.
	[x] Tools, please specify:	Open source tools (e.g. ImageJ) can be used for visualization purposes.
	[ ] Services, please specify:	
	[ ] Models, please specify:	
	[ ] Other, please specify:	
How this use-case is going to be validated?	Technical validation of the use case will be performed by the responsible technical partner.	
Frequency of Use:	When a prognosis in needed for nephroblastoma patients.	
Who are the users?	Clinicians, Researchers	
Special Requirements:	-	
Assumptions:	-	
Questions:	-	

4.12 Emergency Contact (UC-EME)

Use Case ID:	UC-EME		
Use Case Name:	MHA Emergency Contact		
Technical Collaborators:	BED, USAAR	**Clinical Collaborator:**	USAAR
Description:	This use case describes the situation where a patient is unconscious in Accident and Emergency Units in hospitals. The patient is not able to authorize the doctors to access his data in the avatar. However, some of the information within the avatar can be crucial for the clinical decisions by the doctors. For example, the doctor needs to know a health profile of the patient, including his previous medical history, etc. We envisage a Europe-wide MHA service centre is needed to offer a solution to this case. Each avatar user will have the option to sign an agreement to authorize the data access to doctors, who may treat him/her under a future emergency circumstance. For the signed users, doctors can contact the MHA service centre to obtain their data in the MHA for the treatment purpose under an emergency situation.		
Actors:	Doctors at emergency units in hospitals Patients Worker in the MHA service centre		
Trigger:	n/a		
Preconditions:	n/a		
Successful End condition:			
Fail End condition:			
Basic Flow:	Users		

	1. New users will grant access to the doctors for emergency data access during the sign up process. 2. The users can also log in the existing account first and then to grant the access 3. The users can change their decisions at anytime 4. The users will be informed about their legal rights and risks for giving or not giving the access In an emergency situation where 1. The doctors will contact the MHA service centre 2. The IDs of the doctors and the hospital will be checked 3. The service centre will search for the patient information in the MHA system according to the patient information provided by the doctors 4. The patient information will be provided to the doctors by either direct download, or granting access to the account	
Alternate Flows:	n/a	
Postconditions:	n/a.	
Dependencies:	n/a	
Required External Resources:	[ ] Data, please specify:	n/a
	[ ] Tools, please specify:	n/a
	[ ] Services, please specify:	n/a
	[ ] Models, please specify:	n/a
	[ ] Other, please specify:	
How this use-case is going to be validated?	We will create a virtual citizen who will provide the authorization during his MHA amount, and will simulate the case where a doctor contact the MHA service centre and will be checked and granted access to the patient data by the service centre.	
Frequency of Use:	Only in medical emergency	
Who are the users?	Patients who give authorization through their user account Doctors from emergency units The MHA service center staff	
Special Requirements:	no	
Assumptions:	The authorization from the users will be given	
Questions:	n/a	

4.13 Brain Trauma (UC-TBI)

Use Case ID:	*UC-TBI*		
Use Case Name:	*Brain Trauma*		
Technical Collaborators:	LIN	**Clinical Collaborator:**	*BED*
Description:	A pre-injury clinical profile of patient is a critical aide that can help the clinicians by providing a better insight and possibly improve the clinical outcomes by circumventing the barriers imposed by the heterogeneity of traumatic brain injuries. Individualized treatment and targeted therapies based on patients' data are imperative both from the patients' perspective and also from the clinicians point of view and can ensure more promising outcomes and better prediction and prevention. Such a profile can be used to establish models of pathphysiologic mechanisms significant to pathoanatomic presentations of brain injuries. A clinical phenotype of the patient has to be developed based on pre-injury characteristics. The patients' past medical history, drug history,		

	demographic information, family history, socioeconomic status and life style and habits contribute significantly towards accurate assessment and management in case of brain trauma or cerebrovascular accident. In cases requiring surgical intervention, pertinent medical history can provide information about any co-existing brain lesions or any medical condition that contra-indicates general anesthesia or surgery e.g., patients on anticoagulation therapy. Studies show that prognosis after TBI is strongly correlated to the medical history of the patient and characteristics like age, alcoholism, drugs, cardiac problems, hypertension, liver dysfunction, diabetes and renal impairment etc. can affect the treatment regimen and morbidity and mortality. For example, subdural haematomas (SDH)can be difficult to differentiate from extradural haematomas (EDH) if the size is small, however, the aetiology, management and outcomes can be significantly different. History of repeated brain injury, e.g., sports related, can exacerbate the symptoms. Small children and old people are prone to falls and history of head trauma may be difficult to identify, while road traffic accidents are more common in young and middle aged people with associated skull fractures. Family history of brain aneurysms is an important consideration for suspected subarachnoid haemorrhage (SAH). Junior doctors in A&E who do not have adequate experience in interpreting ct scans can sometime misdiagnose and this undertriage or overtriage can lead to a treatment which is different than what is required. An automated system providing second opinion to the radiologist can help improve the sensitivity and specificity of diagnoses and reduce inter-observer variability. The data repository available within MyHealthAvatar can allow researchers develop mathematical and computational models based on gender, race, ethnicity categories, age, lifestyle, education and medical data and this can significantly contribute to innovative healthcare practices. These data from MyHealthAvatar combined with presenting complaints at the time of admission, history of presenting illness, clinical and neurological findings such as the Glasgow Coma Scale, pupil reactivity, loss of consciousness, vomiting episodes, ENT bleeding, fits, headaches and vital signs can be combined with image features from CT scans and Marshall CT Classification to develop a prognostic model for traumatic brain injuries (TBI).
Actors:	Doctors and patients .
Trigger:	Prognosis is needed for patients with suspected brain injury.
Preconditions:	The availability of demographic data, past medical history, drug history, clinical phenotypes (from clinical and neurological examination) and image phenotypes (from neuroimaging modalities like CT scans)
Successful End condition	Differential diagnosis of the type of injury and prognosis for traumatic brain injuries are reported. The information is updated in MyHealthAvatar.
Fail End condition	-
Basic Flow:	The basic steps include: 1. The patients share their avatar data with the doctors. The pre-injury profile of the patient is developed including life style factors, medical history, drug history and clinical examination data like age, height, weight, vital signs and neurological assessment. 2. The doctor accesses the data of the patient to identify life style, habits, existing or suspected medical conditions, drug usage and/ or occupational hazards which can affect the prognosis and outcome in case of brain injury. The assessments by the doctors are updated in the MyHealthAvatar system. 3. The doctor accesses the clinical and image data of the patient from

	the hospital system (e.g. PACS) when a patient with suspected brain injury comes to A&E. The physical mechanism of injury, presenting complaints, clinical and neurological examination results and imaging interpretation are combined with the MyHealthAvater data to derive differential diagnosis e.g., ischaemia, EDH, SDH, SAH, contusion, IVH or DAI etc., and a management plan is drawn for targeted therapy and surgical intervention. 4. The doctor assesses the patients' condition using a prognosis model such as Rotterdam Scale or Glasgow Outcome Scale to ascertain possible outcomes. A second opinion is provided by the automated system in MyHealthAvatar.	
Alternate Flows:	-	
Postconditions:	• A management, surgical intervention and targeted treatment plan is developed • Future monitoring of the patient after injury and discharge from hospital • Risk assessment and prediction of long-term outcomes of TBI including pathoanatomic and pathophysiologic sequelae • Classification of patients in cohorts with common characteristics likely to benefit from a given targeted intervention	
Dependencies:	The patients are registered to the avatar system and their medical history and other characteristics data are available in their avatars.	
Required External Resources:	[ ] Data, please specify:	• Patients' data from MyHealthAvatar • Clinical and neurological examination data at the time of admission to hospital • Related studies on patient cohorts, such as IMPACT, CRASH
	[ ] Tools, please specify:	• Prognosis models, data mining tools and image segmentation tools for doctors • MyHealthAvatar access for the doctors and patients
	[ ] Services, please specify:	• Links with PACS and electronic health records • Links with TBI databases like TARN and FITBIR • Related studies on patient cohorts, such as IMPACT, CRASH, ADNI
	[ ] Models, please specify:	• Prognosis and outcome models such as Rotterdam Scale and Glasgow Outcome Scale • Risk assessment model for predisposition to and outcomes from TBI
	[ ] Other, please specify:	• Normal values and ranges of clinical and neurological assessments • Neurological atlas for image interpretation and segmentation tools

How this use-case is going to be validated?	*By experts with clinical background in BED*	
Frequency of Use:	*When a prognosis is needed for patients with suspected brain injury*	
Who are the users?	*Doctors and patients*	
Special Requirements:	*Creating awareness and familiarizing doctors and patients with the MyHealthAvatar services*	
Assumptions:	• *Patients' clinical and neurological data are available* • *Patients' imaging data and interpretations are available*	
Questions:		

4.14 Anti-Platelet & Anticoagulation Therapy in the Pre-Operative Patients (UC-APLA)

Use Case ID:	UC-APLA		
Use Case Name:	Decision making tools regarding emergency situations in clinical practice. The example of anti-platelet & anticoagulation therapy in the pre-operative patients		
Technical Collaborators:	FORTH	**Clinical Collaborator:**	FORTH
Description:	Hemostasis disorders can develop due to a deficiency or defect in an individual's platelets or clotting mechanisms. Dysfunctions can lead either in bleeding disorders (hemophilia) or in over-clotting disorders such as thrombosis. Dysfunctions that lead in thrombus formation can be related with morbidities such as cardiovascular disorders (coronary disease, heart attack, angina, congestive heart failure and valve disease), pulmonary embolism, stroke and transient ischemic attacks, deep vein thrombosis, peripheral vascular disease (PVD), phlebitis and in some cases obesity. Patients that are diagnosed with over-clotting deficiencies are treated with anticoagulant or anti-platelet therapies as a preventive care. Several single nucleotide polymorpshisms (SNPs) are known regarding drug-targets or metabolizing enzymes (mainly of Cytochrome P450 family) of anti-platelet and anticoagulant therapies. Some well-known examples are the Vitamin K epoxide reductase complex subunit 1 (VKORC1) where specific gene mutations have been related with deficiencies in Vitamin-K-depedent clotting factors and the response to anticoagulant therapies of warfarin and acenocoumarol. In addition, regarding the metabolizing enzymes of P450 family, CYP2C19 is the main metabolic enzyme for the activation of the anti-platelet agent clopidogrel. The latter, is a pro-drug activated in the liver by cytochrome P450 enzymes, mainly CYP2C19. Genetic polymorphism (CYP2C19*2, CYP2C19*3 and CYP2C19*17) exists for CYP2C19 expression, with approximately 5% of Caucasian and 20% of Asian populations being poor metabolizers with no CYP2C19 function. Due to the above, anti-platelet and anticoagulant agents that are administered in clinical practice, appear to have a wide inter-subject variability in their pharmacokinetics and thus in pharmacodynamics. Antiplatelet and anticoagulation therapies are typical examples where therapeutic drug monitoring is applied for every patient as well as pharmacogenomics information are taken into account and several algorithms have been created in order to integrate data and improve pharmacotherapy. Moreover, there are emergency cases such as pre-operative status, where an adjustment in dose should be applied for patients following anti-coagulation and anti-platelet therapies in order to avoid bleeding problems during surgery or during recovery.		

	Summarizing the above information there are cases where additional information are needed but not easily attainable due to lack of clinical data. To this respect in silico approaches (such as Physiologically-based pharmacokinetic/pharmacodynamic modeling) seem capable in providing evidence regarding possible treatment outcomes and organized in order treating physicians will be able to avoid as much as possible “guesswork” for a specific patient. The availability of creating “virtual cohorts” of patients and in silico approaches can assist in generating predictive approaches towards improved personalized medicine. A typical use-case scenario: "A male 55 years old that follows anti-platelet therapy, needs to go on surgery. The doctor has to re-adjust the administration of the anti-platelet therapy for the up-coming surgery and needs to schedule the operation as soon as possible. General guidelines are known for pre-operative care but how could the doctor avoid any guesswork and apply a personalized approach for this patient but also for future patients?"
Actors:	Avatar1(Doctor),Avatar2 (patient), (Avatar3) Research staff for in silico clinical trials platforms, genome information platform/tool, MyHealthAvatar platform
Trigger:	Upload of diagnosis in patient’s electronic health record or during creation of patient’s Avatar in MHA platform. Alternative the use case can be triggered after the medical examination and the decision that patient should go on surgery.
Preconditions:	The facts that are true in this case are: i) Anti-platelet therapy may lead in bleeding during the perioperative or the postoperative period ii) Anti-platelet and anti-thrombotic agents that are administered in clinical practice, appear to have a wide inter-subject variability in their pharmacokinetics and thus in pharmacodynamics due to genetic and epigenetic factors. iii) Anti-platelet therapy is a clinical case in which personalized medicine tools are essential. Therapeutic drug monitoring is usually followed for the proper adjustment of the applied treatment iv) There are not many data available regarding the time that the treatment will stop being active after the discontinuation v) Clinical trials regarding the above situation cannot be performed
Basic Flow:	Basic steps: 1. Gathering all the necessary data required from patients health records. This step can run during the therapeutic drug monitoring and dose adjustment prior to the emergency situation. Also this step can run during utilization of personal genomics (Use-case 12) 2. Creating of MyHealthAvatar profile for this patient 3. Embed results of pharmacogenomics information in MHA profile for patient 4. Clustering patients in appropriate cohorts and creation of “virtual population” based on demographic, physiology and genomic data 0. The creation of “virtual population” is based in the distribution of the several parameters and the relation with each other (i.e. weight modeled against height) according to specific algorithms followed by a platform for in silico clinical trials 1. Distribution of pharmacogenomics data in the population of patients 5. Export of “virtual population” in appropriate in silico clinical trials platform

	6. Development of a workspace in a platform for in silico clinical trials The basic required information are: I. Drug data regarding the pharmacokinetic and/or pharmacodynamic parameters including toxicity II. Population data including demographic, genetic, biochemical and physiological parameters – Patient's genetic data of drug-metabolizing enzymes which can influence drug concentrations in the body should be considered. – Data for (I) and (II) could be available from literature and can be in the default parameters of the platform or can be enriched from patient's data – Data for (II) can be created from clustering of MyHealthAvatar profiles of patients with same or similar disease profile III. Clinical trial protocol and design. In this case the clinical trial will need to estimate the drug concentrations in the body for a period of time following the last administration (i.e. 48 hours) 7. Simulation of virtual clinical trials in the specific "virtual population" 8. Embed results in an appropriate worksheet or in a different platform 9. Matching and identification of the Avatar from MHA with the "virtual patient" from the "virtual population" of the simulated clinical trial 10. Identification of the time that anti-platelet's drug concentration is below the minimum effective concentration 11. Evaluation for the time needed after the sub-therapeutic concentrations of the drug in order the clotting activity to start returning to the default values. 12. Evaluation of the obtained results and decision of the time that the patient will be ready for surgery 13. Surgery performing and re-introduction of the anti-thrombotic treatment Note: This basic flow can be created during therapeutic drug monitoring of patient's status after the diagnosis of clotting-deficiency
Alternate Flows:	Alternative flows will be followed if the patient is receiving treatments for other co-existing diseases in order to assess any interactions and/or any modulations regarding the basic flow. Alternative flows can be considered, taking into account the adding therapies applied after or during surgery for this patient (e.g. antibiotics, analgesics, sedatives, antacids, anticoagulants administered subcutaneous or intravenous such as heparin etc.)
Postconditions:	Monitoring of patients status after surgery. Evaluating results and update data in MHA and in clinical trial simulator platform. Re-adjust the therapy on the recovery stage Embed results in MHA platform so both patient and physicians could have access in necessary information. • Example dose adjustment was based in the pharmacogenomics data regarding metabolizing enzyme CYP2C19. In case of modulation of dose the concentration-time profile for this Avatar (patient) is expected to follow this trend (show graph).
Dependencies:	This case refers to the administration of drugs in emerging situations in the

	clinical setting of the preoperative and ICU patients. However it represents a typical example of how data can be created and organized through in silico clinical trials approaches particularly in clinical cases where clinical trials cannot be performed. It also attempts to represent how personalized information regarding drugs, diseases and health status information can be introduced and exploited through MHA in order to create decision making tools and approaches. Dependencies of this case can be related with use cases 1, 2, 3 and 5. This case follows and it is related with the use case-12 and utilization of personal genomic information for the individualization of MHA platform	

Required External Resources:	[ ] Data, please specify:	• Drug data
		  ○ Pharmacokinetic properties
		  ○ Pharmacodynamic properties
		• Population data
		  ○ Demographic
		  ○ Genetic
		  ○ Physiology
		  ○ Pathology
		• Clinical trials protocols and parameters (as they described in regulatory organizations FDA and EMA)

	[ ] Tools, please specify:	• MHA platform • Genomic platforms/tools • Bio-informatics tools • PCs with related software installed regarding in silico clinical trials ○ PB/PK/PD platforms with license of use
	[ ] Services, please specify:	Links with databases: Genomic databases (see use-case 12) Drug databases (PharmKGB, Pubmed, DrugBank) Links with internal/external research laboratories providing data regarding PB/PK/PD and TDM
	[ ] Models, please specify:	• Physiologically-Based Pharmacokinetic/Pharmacodynamic models • Therapeutic drug monitoring models
	[ ] Other, please specify:	Normal values of hemostatic factors in general and/or specific population
Frequency of Use:	The in silico application of virtual clinical trials can be used in every emergency case where a following treatment may influence the post-operating recovery of a patient after surgery. The development of databases and generation of data prior to the emergency situation could be more helpful regarding the faster fitting of the patient with Avatar. End-users of this approach are physicians and research personnel focusing to in silico clinical trials approaches. Especially for physicians it could provide them with results through in silico approaches of treatment outcomes in patient group that fit with the patients that are monitoring and not with a general	

	"virtual population". This approach and the data provided could be benefit for the treating physicians giving them tools of decision making options towards an improved personalized medicine approach. End-users will also be the patients with MHA profile since they can have access to information regarding the provided treatment and the modulations that could be occurred. It could be possible also to provide them with explanations and answers regarding different treatment outcomes in patient groups that would be able to participate through MHA platform. Moreover, under their approval, they could be able in providing their MHA profile in research facilities towards creating of in silico research approaches in drug development processes and therapeutic drug monitoring as they would do if they would choose to participate in a clinical trial process.
Special Requirements:	Familiarity of doctors and generally of the medical staff with MHA technologies Linking of MHA data between research and medical organizations and personnel applying MHA technologies
Assumptions:	Some basic assumptions are: • Necessary drug data for the generation of the in silico clinical trials are available in the literature and easily accessed • Full and detailed patient's health history record • Platforms used for in silico clinical trials have been evaluated with clinical results from other studies (Validity of the platform) • Continuous development and simulation of clinical trials from in silico platforms in order to create databases for patient's avatar fitting
Questions:	The new era in health care towards the "stratified medicine" and personalization of treatment demands the development of approaches and tools such as MHA platform. The question that rises is how an education program could be introduced for medical society (especially staff that work in the point of service such as hospitals etc) in order to get familiar with user-friendly platforms and tools and also stay up to date with these approaches?

5 MHA Granular Scenarios / Use Cases Clustering

5.1Introduction

In this deliverable different MHA Scenarios / Use Cases are described. All are clustered under 2 different topics:

1. Granular Scenarios / Use Cases
    a. Legal and Ethical Scenarios / Use Cases
    b. Scenarios / Use Cases for Data Access and Collection (including user accounts, data browsing, 3D visualization, self-data collection. Link to HIS)
    c. Virtual community
    d. Toolbox
2. High-End Scenarios / Use Cases
    a. Scenarios / Use Cases for Clinicians and Researchers
    b. Scenarios / Use Cases for Citizens and Patients

This chapter presents the narrative description of the granular use cases according to the decisions taken by the consortium in response to the reviewer's comments after the first review.. High-end Scenarios / Use Cases are described in this chapter with aim to demonstrate the MHA platform as a whole.

The clustering is important, as demos will be presented in each of these areas at the end of the project. Deliverable 9.1 'Definition of Demos' will be based on this allocation.

5.2Legal and Ethical Scenarios / Use Cases

MHA proposes a solution for access, collection and sharing of long-term and consistent personal health status data through an integrated environment, which will allow more sophisticated clinical data analysis, prediction, prevention and treatment simulations tailored to you as an individual citizen.

It is intended that the information provided by the avatar will be both valuable for clinical decisions concerning your own care, as well as offer a promising approach to acquiring population data to support clinical research, leading to strengthened multidisciplinary research excellence in supporting innovative medical care.

5.2.1 User Information Sheet and Privacy Policy

Both documents, the user information sheet as well as the Privacy Policy are in the progress of drafting. These shall firstly explain the purpose of the MHA platform, including the explanation of what data the user can upload to the platform and how the data will be used. Here it will be desirable to develop and present the user with different sharing and/or usage options from which they may select.

After this, it should be explained to the user how his or her data will be protected and, following that, the rights of the user, as a "data subject" under data protection law should be explained and described.

Moreover, the roles such as controller and processor should be explained in the information sheet/Privacy Policy and the applicable national law should be pointed out.

Lastly, the user should be referred to the need for registration and the agreement of the General Terms and Conditions. The latter should pop up after the user has confirmed that he or she has read the User Information Sheet/Privacy Policy.

It should be made technically impossible for persons to enter the site unless they have first agreed to the terms and conditions.

The rights of the data subject are, in particular:

- the right to information;
- the right of access;
- the right of rectification, erasure or blocking; and
- the right to object.

5.2.2 Information Sheet / Privacy Policy Draft

At this early point in the project's development, prior to concrete decisions or conclusions that fix the platform and avatar functionalities and/or use modalities, it is difficult to draft a specified information sheet or a Privacy Policy. But in broad outline a user information sheet/Privacy Policy could contain terms of the kind presented in the following preliminary draft:

I. General information

This information sheet describes the functionalities of MHA, what kind of data you can store at the platform and how your rights are protected. By this, we hope that you can better decide if you want to contribute data to the proto-platform as a volunteer and/or later become a user of the MHA platform. Please take your time when you make your decision.

Please read the information provided carefully and discuss it with others if you wish. Feel free to ask us if there is anything that is unclear or if you wish more information.

If you decide to contribute your data to the proto-platform as a volunteer/become a user of MHA, you have to give consent in the processing of the data that you will upload. You can withdraw your consent at any time without any disadvantages. In this case, your uploaded data will be permanently deleted from the MHA platform.

By registering as a user, after confirming that you have read the Information Sheet/ Privacy Policy and the General Terms and Conditions, you will confirm that you were properly informed about this platform.

A copy of the Information Sheet/Privacy Policy and the General Terms and Conditions will be sent to your e-mail-address or postal address (as specified by you) for you to keep.

II. Purpose of MHA

MHA proposes a solution for access, collection and sharing of long-term and consistent personal health status data through an integrated environment, which will allow more sophisticated clinical data analysis, prediction, prevention and treatment simulations tailored to you as an individual citizen.

It is intended that the information provided by the avatar will be both valuable for clinical decisions concerning your own care, as well as offer a promising approach to acquiring population data to support clinical research, leading to strengthened multidisciplinary research excellence in supporting innovative medical care.

III. Functionalities of MHA

Your data is collected for the purposes of allowing more sophisticated clinical data analysis, prediction, prevention and treatment simulations tailored to you as an individual citizen.

This can be achieved by using the functions offered by the avatar as:

- a lifetime collection of your health status data,
- a tool to allow you to be active in promoting your own healthcare,
- allowing you to access a rich set of relevant health and other data from various sources,
- an interface to access hospital data and healthcare resources,
- a toolbox for data analysis, fusion and visualization for both you and the clinicians responsible for your care,
- the option to register for predictive risk assessment, and
- the opportunity to share your data on a variety of platforms, either for promoting your own health interests, to help particular other persons, or for general altruistic reasons (such as contributing to current and future medical research).

In order to use MHA to its full extent, you should ideally be prepared to upload data concerning personal information as gender, age, ethnic, symptoms, diagnosis, treatment and response to drugs, health indicators as blood pressure, pulses and body temperature, medical data as images, biological data, multi-scale data. It could be also helpful to upload data concerning your life style, e.g. drinking and smoking habits and to organise all uploaded data in a timeline.

But nevertheless you should only upload data that you are sure you want to have included in your personalised avatar.

IV. Security measures to protect your data

We are aware of the fact that the uploaded data are highly sensitive.

All necessary state-of-the-art security measures are incorporated in the platform to protect your data against accidental or unlawful destruction or accidental loss, alteration, unauthorized disclosure

or access or any other misuse. Other users of the MHA platform will only be able to access your data after connecting with them as “friends”.

V. Your rights

Firstly, we would like to inform you that your data will not be further processed without your consent or in any way incompatible with the purposes you specify. If you would like to allow us to use your data for a further purpose that you did not initially agree to, such as other health-related projects, you can later give a separate consent for this.

It is your decision whether to disclose the information to physicians or added "friends". Only the persons you want to will have the opportunity to access this data, like added "friends" or physicians you allow to have access to your data.

Secondly, we would like to point out to you that the Data Protection Directive establishes the following special rights through which you as the data subject can protect your privacy:

- right to be informed;
- right of access;
- right of rectification, erasure or blocking; and
- right to object

Right to information

You have the right to inform yourself about the identity of the controller who hosts this platform and of his representative, if any. The controller is the University of Bedfordshire (to be decided).

When storing data at the platform, this data will be processed. In this context, we point out that you have the right to inform yourself about the purposes of the processing for which the data are intended.

As already mentioned, the purpose of MHA is to access, collect and share long-term and consistent personal health status data in order to analyse, predict, prevent and simulate treatment tailored to you as an individual citizen.

Finally, we would point out to you that you may inform yourself about any further information, e.g. about the recipients of the data and if you have the right of access to and the right to rectify the data concerning you.

Right of access, rectification, erasure or blocking

At any time, you can receive information about the personal data stored and request that corrections be made if the data are incorrect or outdated. Furthermore, you can demand to block or delete your data.

Whenever you wish to make use of the above mentioned rights, please feel free to contact the University of Bedfordshire. It will be happy to inform you.

Exceptions and restrictions

Right to object

You have the right to object to the processing of your data at any time.

In this case we will delete your data as soon as reasonably practicable from the MHA platform and/or your avatar. An exception may occasionally have to be made when the data is collected in order to comply with a legal obligation, or when it is necessary for the performance of a contract to which you are a party, or is already being used for a purpose for which you gave your consent, where significant investment has occurred, and the deletion would prejudice the fulfilment of that purpose.

VI. Roles as controller and processor

The host of this platform is the University of Bedfordshire and complies with the duties it has as a controller in terms of Article 2d of the Data Protection Directive. The processors are… (who will process personal data on behalf of the controller will be decided)

VII. Applicable national law

The data controller is on the territory of the United Kingdom (if the University of BED will be the data controller). Therefore, our Privacy Policy meets the requirements stipulated in the Data Protection Act of 16th July 1998[3] which implements the requirements of the Data Protection Directive into national law.

VIII. Need for registration

If you decide to become a volunteer/user of the MHA platform, you may register at the platform.

Therefore, you have to tick the box by which you confirm that you have read and understood this information sheet/Privacy Policy.

Afterwards, you will still need to complete the consent form. Before doing so, you should also read and familiarise yourself with the MHA General Terms and Conditions.

Thank you for reading this Information Sheet/Privacy Policy.

5.3Scenarios / Use Cases for Data Access and Collection

5.3.1 MHA User Accounts (UAC)

End-users will be able to log onto the system using their username and password. New users will be able to sign up to the system by creating basic personal information including security questions (**Figure 1**).

Informed consent and privacy: Users will need to read and accept the Information Sheet and Privacy Policy. (Please see **Chapter 5.2.2: Information Sheet / Privacy Policy Draft**)

Upon log into the system, users will be able to enter, browse their data, explore medical information, and communicate with other end-users.

[3] http://www.legislation.gov.uk/ukpga/1998/29/contents (March, 2014)

Users will be able to view and interact with an avatar - a 3D representation of the human body. It will allow the End User to click with the computer mouse on a particular part of the avatar "body" to trigger a search of medical records to retrieve relevant information

MHA is a platform for End-Users who want to share their health information to create collective knowledge about disease, health, and treatments. In order to achieve this goal advanced Informed Consent and Privacy Policy Scenario / Use Case should be implemented.

End-user has the GUIs, functionalities and tools in the frames of MHA platform to accept, reject, print or revise at any time the Information Sheet and Privacy Policy settings.

There will be two types of end-users; the first type includes patients and citizens for their life time data collection, the second type includes clinicians and researchers who will be linked to the avatars from citizens/patients for clinical practices and medical research purpose.

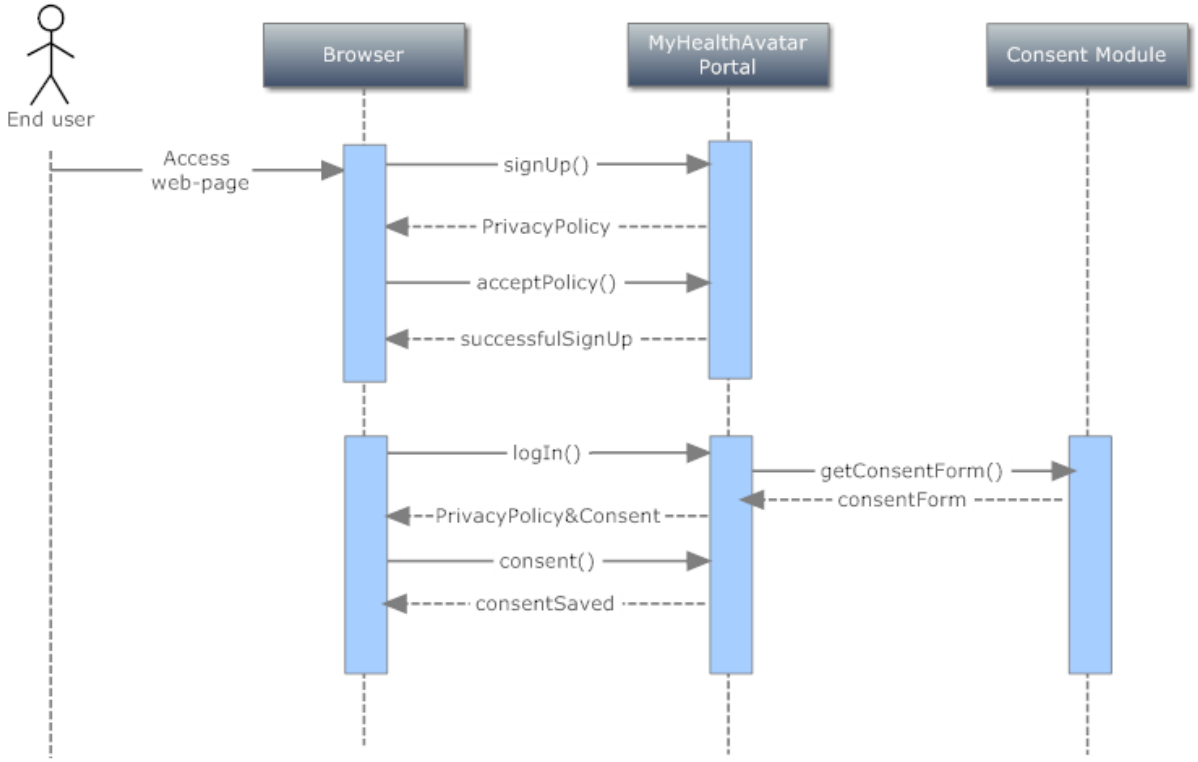


Figure 1. The sequence diagram for 'MHA User Accounts' Scenario / Use Case (Source: D 3.2)

5.3.2 MHA Data Browse (DB)

Upon successful log in to their own account, users will be able to browse their own data, including all the personal health status data collected through the avatar system, plus medical records and clinical data from the hospitals (**Figure 2**).

The avatar system will need to offer tools that support effective data query and search, such as filtering.

The 4D avatar will play an important role in presenting the data. Users will be able to select individual parts of the avatar body to view the data associated to the selected parts.

Different colours or textures will be assigned to individual parts of the 4D avatar to represent their health status. For example, if the heart has a serious problem it will be highlighted using a unique colour or texture

Patients/citizens will use the data browser to view their own data; Doctors will be able to view data from all his/her patients connected to the avatar.

The avatar system will also need tools which will help users to analyse medical images

Patients/citizens will use the data browser to view their own data. Clinicians will be able to view data from all their patients connected to the avatar.

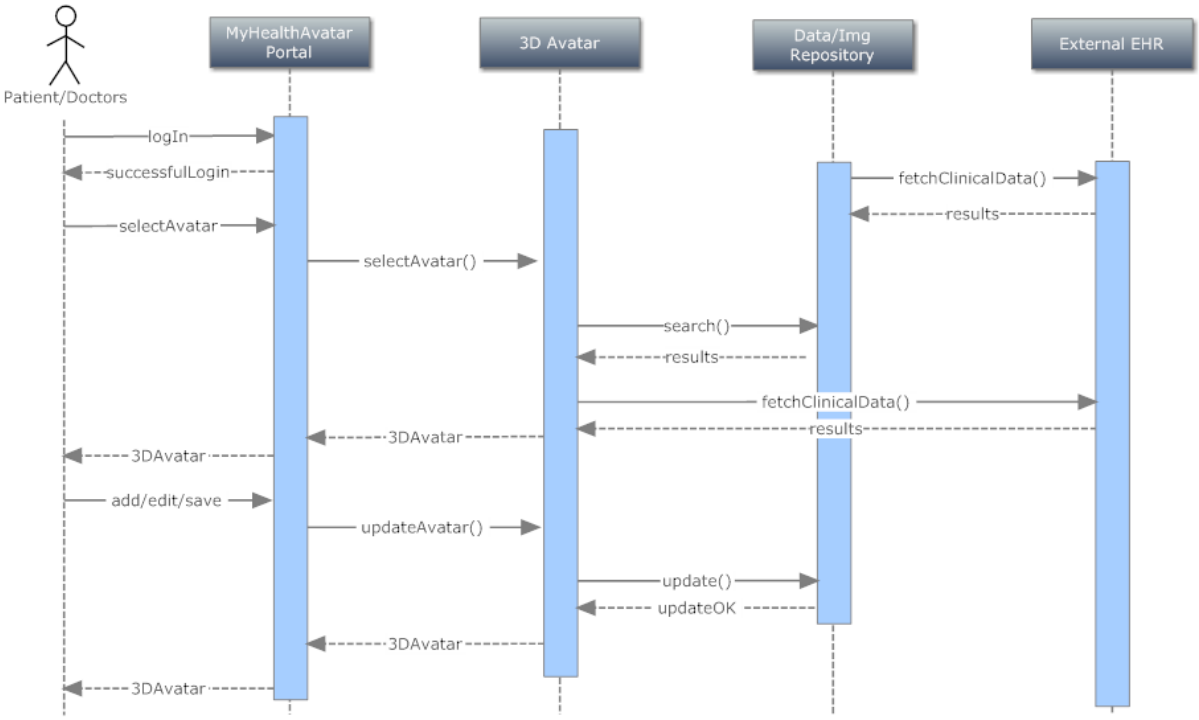


Figure 2. The sequence diagram for 'MHA Data Browse' Scenario / Use Case (Source: D 3.2)

5.3.3 Self-Data Collection (DCU)

This case seeks new solutions for increasing the quality and sustainability of future healthcare systems by actively engaging citizens in monitoring their own health through self-collection of life logging data (**Figure 3**).

The development and treatment of many diseases are affected by our life styles and environment. A long term monitoring of these factors, especially through the self-involvement of patients, is extremely valuable in supporting individualised health prediction and treatment. Many studies have shown compelling needs in self-life logging and self-monitoring of patients, which has great potential in leading to preventive medicine, cost saving and enhanced quality in future healthcare.

We aim to create a symbiotic relationship of available technology today and MyHealthAvatar platform. The goal is to respond to the fast growing demand for developing new technologies and services for self monitoring for supporting wellness, fitness and prevention of the most common chronic diseases (i.e. cardio-vascular and stroke, diabetes, rheumatic problems, respiratory problems and COPD, etc.). Mobile applications will monitor user's "health-status", "lifestyle" and "wellness" and upload data to the MyHealthAvatar system for close monitoring of health conditions and prevention of many diseases. The system then will be able to analyse user's lifestyle and medical data. Special "alerts" will be applied to support end users with feedback supporting and assisting their daily activities and well-being.

An interface for patients writing a diary is very helpful to collect patient specific data related to their disease. This can be partly structured: e.g. body weight, heart rate, blood pressure, temperature, medicine taken, etc. It can also include structured data of scoring systems, e.g. physical and/or psychological and/or emotional status. In addition free text entry needs to be allowed.

More specifically, we explores various ways for the data collection in the avatar to monitor users' health-status, lifestyle and wellness. These include:

- Web interface for data entry
- Sensors (e.g. blood glucose, blood pressure, heart rate, locations, steps, sleep)
- Mobile apps

For example, users uses a glucose meter and MyHealthAvatar platform to monitor his/her blood sugar levels. The data is saved that maintains the Avatar's long-term history and looks for possible abnormal events. If the saved data is unusual, or the End-User skips a test, the MyHealthAvatar platform automatically generates an alert message

Mobile apps will be used to monitor the health status of the users (e.g. mood, food).

We will also explore the possibility to extract health related information from electronic cards (e.g. purchase of food and drink, daily exercises in gyms), as well as from social network.

We will also look into the possibility of implementing an advanced Patient Devices Software Development Kit (SDK or "devkit"). A SDK will represent a set of software development tools that will allow healthcare it professionals the creation of applications for MHA able to access and strore data from any patient monitoring device. Patient Devices SDK may be something as simple as an application programming interface (API) in the form of some files to interface to a particular programming language or include sophisticated hardware to communicate with MHA platform. SDK may also include sample code and supporting technical notes or other supporting documentation to help clarify points from the primary reference material.

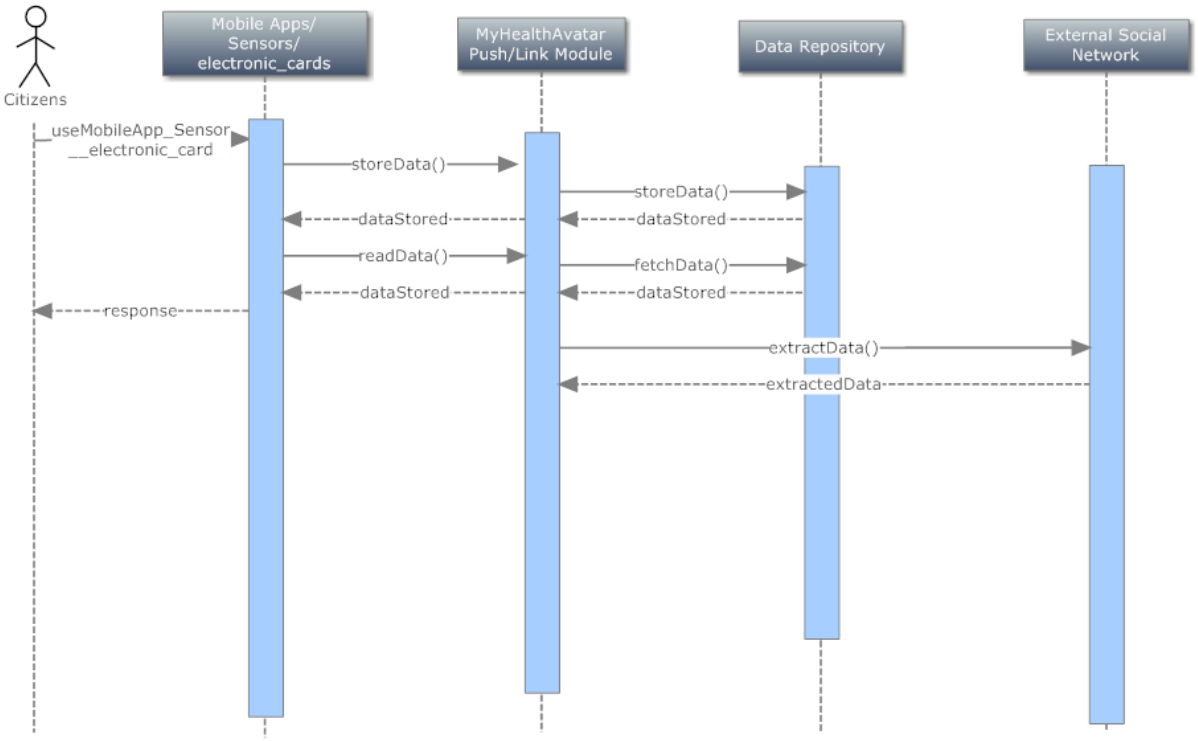


Figure 3. The sequence diagram for 'Self-Data Collection' Scenario / Use Case (Source: D 3.2)

5.3.4 Link MHA to HIS and CTMS (HIS)

End User has the GUIs, functionalities and tools in the frames of MHA platform to enter, import, store and export personal medical data with hospital information systems (**Figure 4**).

One option is to use ObTiMA as a dummy system to mimic external hospital system.

ObTiMA, an ontology-based clinical trial management system, has been developed as a proof-of-concept application to highlight the possibilities of ontology based creation and managing of clinical trials within the ACGT (Advancing Clinico-Genomic Trials on Cancer) project. ObTiMA has a modular architecture with a core basic module for data management of clinical trials. Different other modules are under development in the frames of p-medicine project.

The data stored in ObTiMA are relevant for the Health Avatar to enhance the system with relevant clinical trial data. On the other hand the info stored in MHA might be of relevance for a clinical trial. As result, the bidirectional data upload from MHA to ObTiMA is needed. This Scenario / Use Case describes the bilateral linkage between ObTiMA and MHA by being focused on the Operational Data Model (ODM).

There are also a few other dummy systems available at FORTH, which can be used to mimic the external hospital system.

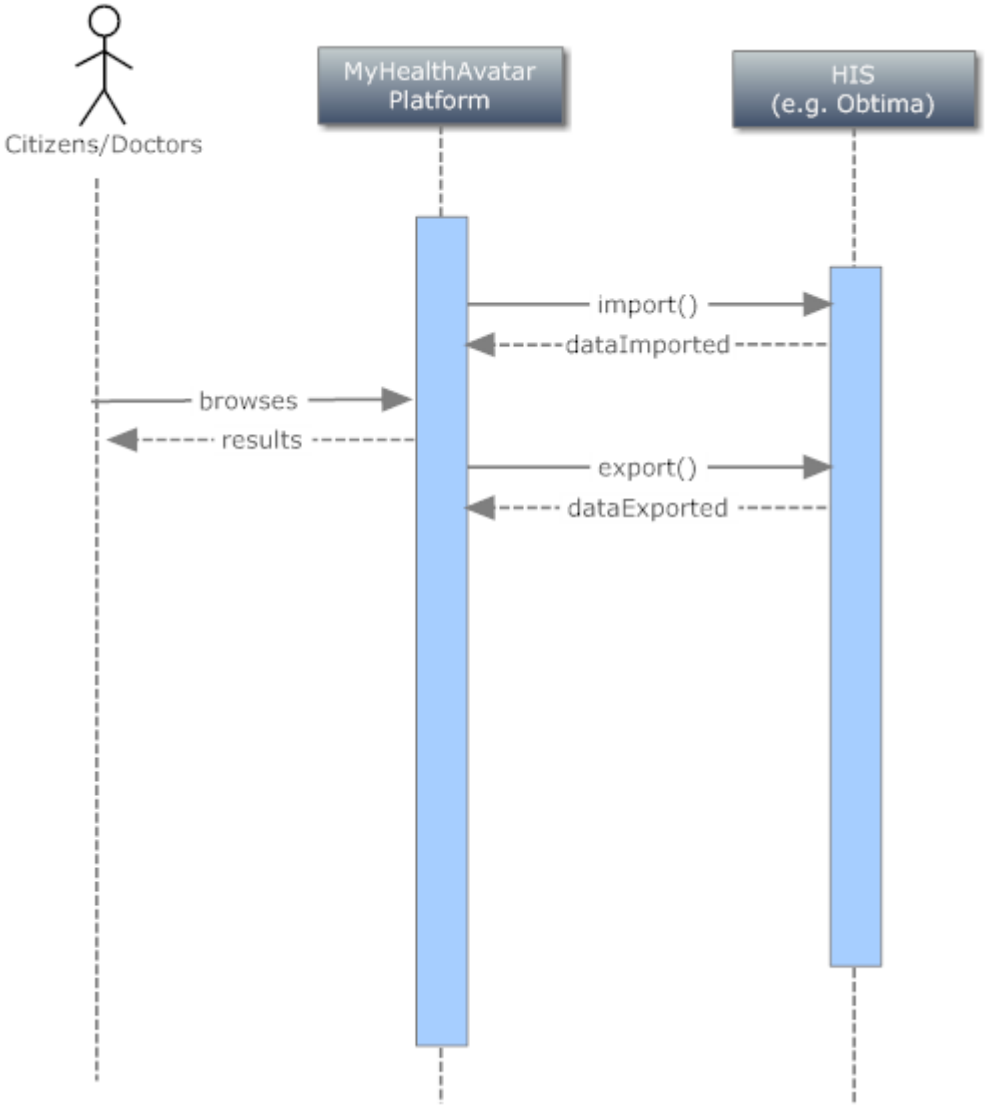


Figure 4. The sequence diagram for 'Link MHA to HIS and CTMS' Scenario / Use Case (Source: D 3.2)

5.3.5 3D Avatar Visualization (3DS)

MyHealthAvatar platform would propose an avatar - a 3D representation of the human body - to allow End Users (e.g. patients, doctors) to visualize patient medical records in a new way. The avatar will be used as a means for presenting general medical knowledge to the citizen users.

Users will be able to select individual parts and see related medical information such as anatomy. The information may also include medicine and food.

5.4 MHA Virtual Community (VC)

This case describes the search framework from end-users' perspective and it is focused on listing all MHA registered end-users with ability to apply advanced search filters:

- Age

- Gender
- Votes (Likes)
- Treatment
- Symptom
- Interests
- Country
- City
- etc.

It is important to mention that every end-user should confirm the possibility to visualize his/her profile publically or privately. Only public profiles should be visible in search results. Additionally, the search function is suggested to be accessible only for end-users with public profiles.

This case also provides a social media that allows patients to build up a virtual community by sharing their daily activities (e.g. how many exercises they have done), exchanging their experiences. It should also provide a link to Facebook/Twitter.

The social media service will be used to allow the interconnection of end users. This social media service, accessible by smart phones, will be used in a dual mode allowing the users to insert information about themselves (like they do in common social media technologies) but also will be a mean of supporting personalized services to them from the system in the form of alerts and guidance (i.e. post therapy monitoring of user's behaviours after orthopaedics operation, cancer patients reaction to treatment, etc.).

More specifically, patients will be able to

1. Find patients with similar condition, symptom and treatments
2. Find out symptoms and treatment for their conditions by looking at other fellow patients
3. Find out possible conditions for their symptoms by looking at other fellow patients
4. Find out possible treatments for their conditions by looking at other fellow patients
5. Find out "friends" and allow "followers" as in Facebook/Twitter
6. Share activities, exercise experiences etc with friends and followers.

5.5 MHA Toolbox (TOOL)

5.5.1 Remote Monitoring

The Remote Monitoring tool/frame collects and processes patient care information from supported healthcare devices that conform to standards (preferably selected by the Continua Health Alliance).

End User uses a glucose meter and MyHealthAvatar platform to monitor his/her blood sugar levels. The MyHealthAvatar platform reminds to check the blood sugar regularly during the day, and the glucose meter should be able seamlessly to transmit the measurements to the Avatar after each use. The data is saved that maintains the Avatar's long-term history and looks for possible abnormal events. If the saved data is unusual, or the End-User skips a test, the MyHealthAvatar platform automatically generates an alert message.

The monitoring data will be made available through the citizen self-monitoring case (which is another use case). To allow for remote monitoring from the doctors using the avatar system, we need to link the avatar system to the hospital information system (which is again another use case). This will subsequently allow the transfer of the avatar data into the hospital records.

5.5.2 MHA Simulation Models

End-User has the GUIs, functionalities and tools in the frames of MHA platform to create and execute a biological simulation scenario. End-User selects one of the biological simulation models available in the Model Repository and one of the sets of clinical data available in the Clinical Data Repository (or uploads a set from his computer). Afterwards he/she executes a biological simulation. Finally he/she retrieves the results of the simulation and proceeds to their evaluation.

5.5.3 Knowledge Discovery

Patients are interested in the most recent and personalized information about their disease, treatment and prognosis. MHA platform could contain a ontology-based Knowledge Discovery (KD) module able to connects highly heterogeneous data and textual information. The semantic framework could be based on gene, tissue, disease and compound ontologies (important for drugs and clinical research frames). This framework could contain information from different organisms, platforms, data types and research areas that is integrated into and correlated within a single searchable environment using search algorithms. It could provide a unified interface for all MHA users to formulate, explore and identify new information (according to specific preferences and needs) across vast collections of available experimental and research data.

6 High-End Scenarios / Use Cases

6.1 Introduction

High-end Scenarios / Use Cases are predictably divided in two major groups:

- Scenarios / Use Cases for Patient empowerment for long-term diseases.
- Scenarios / Use Cases for Clinical Researchers
- Scenarios for emergency contact

6.2 Scenarios / Use Cases for Patient Empowerment

6.2.1 Pre-Diabetes (UC-DIAB)

MyHealthAvatar platform aims to provide an unique citizen/patient empowered system that can be used, in particular for pre-diabetes care in addition to the health care system.

The avatar system will support the storage the behaviours and daily activities of citizen. The platform will function as a supportive environment from healthcare providers to the individual by means of offering advice, assistance and assessments; and by means of allowing for health promotion.

6.2.2 Personalized CHF Related Risk Profiles and "Real-Time Monitoring" Services (UC-CHF)

In order to tailor the proposed system to the patient's profile and assist physicians in selecting people who are predisposed by coronary disease, hypertension, or valvular heart disease; we build a CHF related risk profile based on a risk appraisal function that is based on the diagnostic criteria. The predictors used are based on Age, Coronary heart disease and Valve disease status provided by the patient Electronic Health Record (EHR), as well as on HR, on blood pressure and on Body Mass Index (BMI) provided by the pulse oximeter, the blood pressure monitor and the weight scale respectively. The calculated risk probability may be used to alter the default threshold values (higher risk probability adds more constraint on the physiological patterns). Furthermore we present what else data regarding patient's health status could be embed into the platform towards the creation of a profile with necessary information for both patient and treating physicians. To this respect an approach of presenting data regarding demographic, physiology, diagnostic test results and disease management (i.e. prescribed drugs) is provided.

6.2.3 Osteoarthritis (UC-OST)

This Scenario / Use Case aims at the development of MHA technology as an individualized medicine platform by the utilization, interpretation and integration of personal genomic information into health medical history record. This technically high-level and complex Scenario / Use Case involves a number of health and lifestyle related processes, tools and services which translate genomic data to genetic predisposition evaluation and health risk estimation, pharmacogenomic predictions, histology and pathway visualizations etc. in order to support and facilitate advanced individualized

medical decision making (i.e. integrative individual patient case view, specification of simulation models, therapy selection etc.) and provide with guidelines for preventive medicine.

6.2.4 Brain Trauma (UC-TBI)

A pre-injury clinical profile of patient is a critical aide that can help the clinicians by providing a better insight and possibly improve the clinical outcomes by circumventing the barriers imposed by the heterogeniety of traumatic brain injuries. Individualized treatment and targeted therapies based on patients' data are imperative both from the patients' perspective and also from the clinicians point of view and can ensure more promising outcomes and better prediction and prevention. Such a profile can be used to establish models of pathphysiologic mechanisms significant to pathoanatomic presentations of brain injuries.

6.2.5 Anti-Platelet & Anticoagulation Therapy in the Pre-Operative Patients (UC-APLA)

Anti-platelet and anticoagulant agents that are administered in clinical practice, appear to have a wide inter-subject variability in their pharmacokinetics and thus in pharmacodynamics. Antiplatelet and anticoagulation therapies are typical examples where therapeutic drug monitoring is applied for every patient as well as pharmacogenomics information are taken into account and several algorithms have been created in order to integrate data and improve pharmacotherapy. Moreover, there are emergency cases such as pre-operative status, where an adjustment in dose should be applied for patients following anti-coagulation and anti-platelet therapies in order to avoid bleeding problems during surgery or during recovery.

6.3 Scenarios / Use Cases for Clinical Researchers

6.3.1 Nephroblastoma (Wilms Tumour) Simulation Model and Clinical Trial (UC-NEPH): In-silico Profiling of Patients and Predictions

Nephroblastoma is the most common malignant renal tumor in children. Treatments are based on prospective multicentre trials and studies conducted by the International Society of Pediatric Oncology (SIOP) in Europe and the Children's Oncology Group, North America (COG) in North America. Information from these nephroblastoma studies have allowed the identification of prognostic indicators independent of whether patients are treated by immediate surgery (COG) or surgery after preoperative chemotherapy (SIOP).

The Wilms' Oncosimulator is an integrated software system simulating the growth of nephroblastoma tumors and their in vivo response to chemotherapeutic modalities within the clinical trials environment aiming to support clinical decision making in individual patients.

The nephroblastoma simulation model is a predominantly discrete, clinically oriented multiscale model of solid tumour response to treatment. Preoperative chemotherapy is the simulated form of treatment. A ''top-down'' simulation approach is adopted. The simulation method starts from the macroscopic imaging data, representing a high biocomplexity level, and proceeds towards lower biocomplexity levels. Clinical orientation of the model has been a fundamental guiding principle throughout its development. A finite number of states of the model is defined by several different

types of biological cells. The transition rules of the cells from one state to another form the "decision calculators" and define the evolution and interaction rules between the predefined number of finite states of the model. In this way, several cellular-level biological phenomena that are reported in literature are incorporated in the model such as cell proliferation, quiescence, differentiation and death (normal and chemotherapy-induced).

Stage 1:

Nephroblastoma diagnosis is based on a variety of multiscale data. These data constitute the multiscale clinical profile of the tumour. After the necessary pre-processing of the available data of nephroblastoma patients, the data are fed into the nephroblastoma simulation model. By integrating insights from the personalized multiscale clinical profile of the patient, numerical parameter studies and any information that can be gleaned from the experimental and theoretical biology literature, semi-automatic adaptation of the model parameters is conducted. The determined model parameter values serve as a patient record for in silico tumor characteristics and form the 'in-silico profile' of the patient (fig. 5). Training the model with a patient's data gives a more accurate description of the specific kinetics of disease progression.

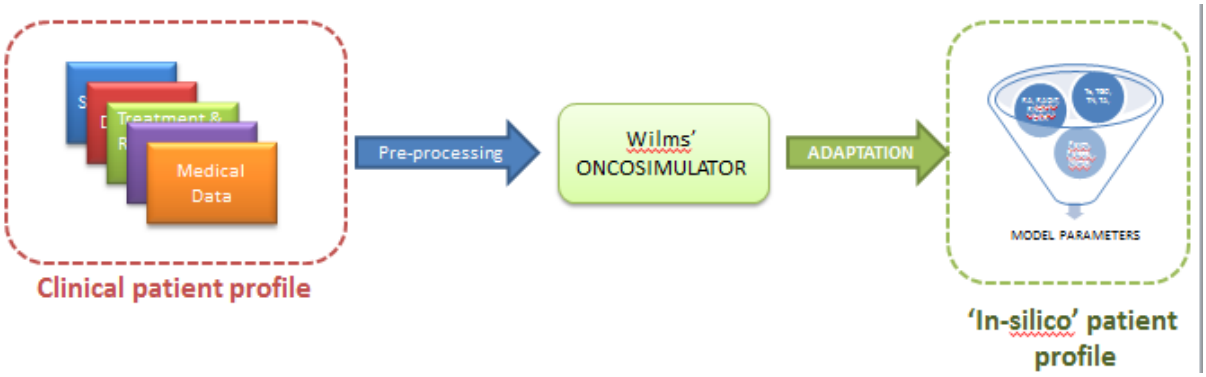


Figure 5: Schematic representation of stage 1 of the nephroblastoma use case (UC-NEPH, stage 1): 'In-siico profilng' of patients with Wilms' tumor

Stage 2:

The paediatric oncologist runs a number of experiments in silico (= on the computer) simulating the most likely response of the tumour to the most relevant candidate chemotherapeutic schemas. The outcomes of the simulations (predictions) help the oncologist decide the appropriate treatment plan (fig. 6).

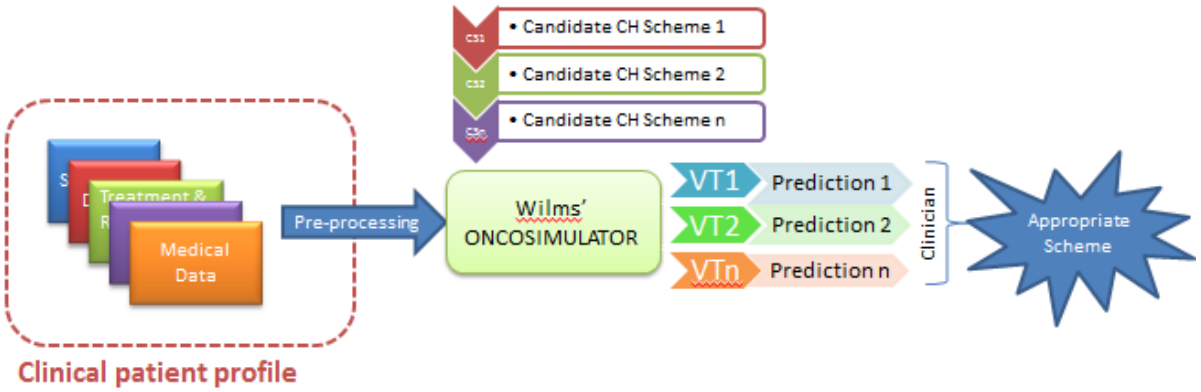


Figure 6: Schematic representation of stage 2 of the nephroblastoma use case (UC-NEPH): Prediction simulations.

The identification of histological subtypes of Wilms' tumor in addition to stage classification and response to treatment is of prognostic value. In this way, the SIOP trials and studies largely focus on the issue of preoperative therapy. Response to treatment can be measured individually by tumour volume reduction and percentage of therapy-induced necrosis or remaining vital blastema at the time of surgery in the histological specimen. In nephroblastoma, the blastemal subtype after preoperative chemotherapy is recognized as an unfavourable entity. This gives an early individual prognostic parameter and is used for further stratification and more individualization of the postoperative treatment.

The nephroblastoma case is ideal for the development and validation of in silico models since the highly successful treatment rate in SIOP provides an excellent, reliable reference for both developing and validating such models. The main goal in this context is to quantitatively predict the response to preoperative chemotherapy in every case. The model aims at avoiding unnecessary treatment in non-responding tumors and applying chemotherapy only to those patients that would benefit most. At the same time, the provision of a clinical decision support tool for the less experienced clinicians treating this disease is of particular importance.

The spatiotemporal simulation module embedded in the Oncosimulator is based on the multiscale, predominantly top-down, discrete entity-discrete event cancer simulation technique developed by the In Silico Oncology Group, National Technical University of Athens. [3]

The 'in-silico profile' created in stage 1 of the use-case could be further used from clinicians as a tool to provide insight into individualized biological characteristics of the tumour, an input for future model use and an input for the use of other models (e.g. within CHIC platform). It could also serve as a statistical tool to categorize the patients (by associating their clinical and in silico profiles) and define a range for model parameters to guide model adaptation for new patients. It is widely accepted that the more quantitative clinical data are available to build and constrain the parameter values, the more likely models are to accurately describe observed behaviors.

6.3.2 Emergency Contact (UC-EME)

This use case describes the situation where a patient is unconscious in Accident and Emergency Units in hospitals, and where some of the information within the avatar could be crucial for the clinical decisions to be taken by the doctors. Though some data access (in the patient's vital interests) is permitted without consent, the bounds of this exception are uncertain, and there may be issues in authenticating the doctor's legitimate access interest.

We envisage a Europe-wide MHA service center as a solution to this case. Each avatar user will have the option to sign an agreement to authorize the data access to the doctors, who may treat him/her under a future emergency situation. For the signed users, the doctors can contact the MHA service center to obtain their data in the MHA for the treatment purpose under an emergency situation.

6.4 Granularity of the High-End Scenarios / Use Cases

All high-end use cases include different granular use cases. **Table 5** shows the composition of all high-end use cases as described above.

ID	Scenario / Use Case	Legal and Ethical	Data Access and Collection
TOOL	MHA Toolbox and MHA Simulation Models	Information Sheet Privacy Policy	UAC, DB, DCU. HIS, 3DS
CHF	Personalized CHF Related Risk Profiles and "Real-Time Monitoring" Services	Information Sheet Privacy Policy	UAC, DB, DCU. HIS, 3DS
OST	Osteoarthritis	Information Sheet Privacy Policy	UAC, DB, DCU. HIS, 3DS
DIAB	Pre-Diabetes	Information Sheet Privacy Policy	UAC, DB, DCU. HIS, 3DS
NEPH	Nephroblastoma (Wilms Tumour) Simulation Model and clinical trial	Information Sheet Privacy Policy	UAC, DB, DCU. HIS, 3DS
EME	Emergency Contact	Information Sheet Privacy Policy	UAC, DB, DCU. HIS, 3DS
TBI	Brain Trauma	Information Sheet Privacy Policy	UAC, DB, DCU. HIS, 3DS
APLA	Anti-Platelet & Anticoagulation Therapy in the Pre-Operative Patients	Information Sheet Privacy Policy	UAC, DB, DCU. HIS, 3DS

Table 5. Granularity of the High-End Scenarios / Use Cases

7 Further links with external projects

7.1 MyLifeHub

Visual impairment is one of the most feared forms of medical disability, which imposes a great social and economic burden on our society. In the UK, the number of visually impaired people is almost 2 million, with total annual costs estimated over £13,000 million. Notably, age-related increase of visual impairment has been well-documented and is set to be on constant rise owing to the growing ageing population nowadays. Visual impairment has significant impact on quality of life (QoL), as reduced visual acuity seriously affect patients' daily and social activities, with substantial increase of risk of mortality, fracture and falls, depression and other emotional distress.

A variety of responsive instruments for quantifying functional impairment related to vision have been developed. Also, there are well-recognised generic instruments for the assessment of QoL in general health terms. These instruments contain questionnaires referring to a broad range of physical, social and psychological aspects, offering the basis for establishing the QoL profiles of the individuals under concern.

Any changes in the QoL profile, for instance, the increase or drop of the level of physical and social activities before and after an eye surgery, can be used as important indicators for the outcome of the treatment.

However, QoL assessment through written questionnaires has several significant drawbacks. Many answers often rely on participants' memory over a long period of time; people may read differently into the questions with their own interpretations; often there is no way of validating the truthfulness of many responses. These limitations raise serious questions on the reliability and validity of the measurements.

Remarkably, the rapid advance of the Internet of Things (IoT) technology grants us opportunities to build QoL profiles of individuals with increased reliability and validity by monitoring their life logging data captured by a variety of IoT assets (namely objects, sensors, mobile apps, web-objects, etc.) with constant connectivity and interaction in a pervasive network. MyLifeHub is an UK EPSRC project and it is such an attempt with focus on the interoperability of the IoT assets, aiming at a common, interoperable and internet-based environment for long-term lifestyle information for individuals. The system will keep users well informed about their daily activities, diet, sleep, mood, blood pressure, pulse, etc., enhancing self-awareness in health and encouraging positive attitudes towards lifestyles. Data sharing among different users will also be enabled to allow for experience exchange and to build healthcare social-networks among users.

Especially, MyLifeHub will feature new techniques enabling simultaneously and long-term quantifying the functional impairment related to vision underpinned with smart glasses (e.g. Google-Glass), which provide wearable sensors to connect with the environment through RFID, infrared, Bluetooth or QR code, allowing for a constant monitoring of the behaviours of people's vision.

MyLifeHub will be utilized as a platform to assess the impact of visual impairment on the QoL of ophthalmic patients both in general health terms and in vision specific terms. The research will be conducted "in the wild" through direct exposure to potential beneficiaries. Our clinical collaborator, Moorfields Eye Hospital (MEH), is the largest eye hospital in the UK and earns a reputation worldwide. The outcome of MyLifeHub will be evaluated by the end users (namely MEH and its patients).

The technical development of MyLifeHub can utilise the existing work of MyHealthAvatar (which are delivered as open sources), including NoSQL data repository, system security, semantics, visualization and social network. While MyHealthAvatar is a feasibility study to build up the entire concept of "digital patient" for demonstration purpose, MyLifeHub could make significant effort to,

- Extend the data collection capacity by introducing a wider variety of IoT assets for lifelogging, featuring techniques tailored for capturing and assessing vision related behaviours.
- Enhance the technical scalability for handling the large-scale lifelogging data.
- Add features that are friendly to ophthalmic patients, such as big fonts and voice messages.

7.2 CARRE

CARRE is a EC FP7 project that addresses comorbidity management via an approach that first fosters understanding of the complex interdependent nature of comorbidities in general and as specialized for the specific patient, then calculates informed estimations for disease progression and comorbidity trajectories, and finally compiles a variety of personalized alerting, planning and educational services so that patients (and professionals) are empowered and can make shared informed decisions. CARRE research aims at a technological infrastructure for visual understanding of disease progression pathways and comorbidity trajectories, enriched with medical evidence and personalized for the individual patient. Based on this, CARRE will develop personalized shared decision support services for the patient & the professional. CARRE innovation lies in semantic interlinking of 3 types of data (a) medical ground knowledge; (b) up-to-date medical evidence; and (c) personal patient data, in order to create a personalized model of the disease and comorbidities progression pathways. Visual presentations of this personalized model (against ground knowledge and against statistical views of 'similar' patient groups) will form the basis for patient empowerment services. Finally, the personalized model of comorbidities will be used for shared decision support services targeting personalized education, complex risk calculation for disease & comorbidities progression, alerts for adverse events of multiple treatments and personalized planning. The ultimate goal is to provide the means for patients with comorbidities to take an active role in care processes, including self-care and shared decision making, and also to support medical professionals in understanding and treating comorbidities via an integrative approach. CARRE will address the specific medical domain of cardio-renal disease comorbidities and will provide proof-of-concept via deployment and validation in two different healthcare settings.

BED is currently exploring the possibility of linking CARRE with MyHealthAvatar by allowing the participants in CARRE to use MyHealthAvatar as an empowerment platform.

8 Conclusions

The main goal of this document has been successfully accomplished by presenting the summary (**Chapter 3**) and the detailed description of the final set of MHA's Scenarios / Use Cases (**Chapter 4**). All Scenarios / Use Cases, based on the results of WP2, have been updated with insights and contributions received from all projects partners. The final Scenarios / Use Cases have are ranked (**Chapter 3.3**) with option to define (in case of availability) the updated version in the frames of the next project's tasks, and, close to the ranking approach, an additional clustering and granulatity option (**Chapter 5**) has been applied. Criteria for prioritization were given via Scenarios / Use Cases clustering model and it would serve as a background for the required timeframes for realization of selected scenarios within MHA.

MHA Scenarios / Use Cases are clustered (**Chapter 5**) under 2 different topics:

1. Granular Scenarios / Use Cases
    a. Legal and Ethical Scenarios / Use Cases (**Chapter 5.2**)
    b. Scenarios / Use Cases for Data Access and Collection (**Chapter 5.3**)
2. High-End Scenarios / Use Cases (**Chapter 6**)
    a. Scenarios / Use Cases for Patient Empowerment
    b. Scenarios / Use Cases for Clinical Research

The linkage and references to other WPs have been mentioned, a special attention has been paid to data collection utilities and data repository to store health related data of individual citizens.

An overview about the conducted requirement analysis for the final set of MHA Scenarios / Use Cases has been presented in **Chapter 3.4**. All presented data resources have been (re)analysed in the terms of the identified end user needs and requirements. As result, the concluding table from D 2.3 has been refreshed with new data and insights.

Close to the clustering option this document presented as well the first outline of the end-user Information Sheet / Privacy Policy (**Chapter 5.2**) with a preliminary draft and terms linked to the legal and ethical aspects.

Criteria for prioritization have been elaborated at the beginning of this task and presented according to the need in high-end and granular Scenarios / Use Cases. The ranking (low, medium, high) has been applied to prioritize the MHA platform development activities.

The ranking of MHA Scenarios / Use Cases is accepting updates and will be used in special for internal platform development process with direct impact on next project's tasks and the final ranking set will be presented in **D 9.1**: Definition of demos.

This document concludes that the timeframe required for realization of the final set of MHA Scenarios / Use Cases is in line with MHA project DoW (Description of Work) document. The **Task 9.1** will develop a flow diagram for every tool that is developed along a timeline.

8.1MyHealthAvatar Global Meeting

The final set and the description of MHA Project Scenarios / Use Cases have been discussed and agreed by all project partners in the frames of the last MHA Global Meeting from Homburg Germany, 18 - 19th September, 2014 (**Appendix 3** – MyHealthAvatar Global Meeting Agenda). We are proud to acknowledge the attention, support and contribution received from all project

partners. Meeting's presentations and discussions allowed us to refresh, update or mention new insights in the final set of MHA Project Scenarios / Use Cases, all contributions served as a solid background for this document. Additionally, the final Scenarios / Use Cases have been ranked, clustered and the granularity option has been successfully applied and described in this document (**Chapters 3, 4, 5, 6**).






8.2 MyHealthAvatar Scenarios / Use Cases with 'High' Development Priority

MHA Global Meeting in Homburg was a successful and very productive event, very useful and with important insights / contributions for the final version of this document. Special attention has been paid to the conclusion of the projected for implementation MHA Scenarios / Use Cases. The final set of the agreed MHA High-End Scenarios / Use Cases, marked with 'High' ranking (**Chapter 3.3**) and top development priority is presented below.

ID	Scenario / Use Case Name
CHF	Personalized CHF Related Risk Profiles and "Real-Time Monitoring" Services
OST	Osteoarthritis
DIAB	Diabetes
NEPH	Nephroblastoma (Wilms Tumour) Simulation Model and Clinical Trial
EME	Emergency contact

It is important to mention that due to granularity and clustering approach the MHA Scenarios / Use Cases with 'High' priority are in linkage with granular Scenarios / Use Cases and in special with Scenarios / Use Cases for Data Access and Collection (**Chapter 5.3**).

MHA Global Meeting agenda allowed all project partners to present in details their Scenarios / Use Cases (**Appendix 3**) and after active concluding discussions and by taking into account previous reviewers' comments and the available resources were decided to focus our efforts in a small set of MHA Scenarios / Use Cases with highest impact and added value for patients / citizens empowerment.

References

[1] Scenario Based User Needs and Requirements (MHA D 2.2)

[2] Architecture Design (MHA D 3.2)

[3] Stamatakos G, Dionysiou D, Lunzer A, Belleman R, Kolokotroni E, Georgiadi E, Erdt M, Pukacki J, Rüeping S, Giatili S, d'Onofrio A, Sfakianakis S, Marias K, Desmedt C, Tsiknakis M, Graf N. The technologically integrated oncosimulator: combining multiscale cancer modeling with information technology in the in silico oncology context. IEEE J Biomed Health Inform. 2014 May;18(3):840-54. doi: 10.1109/JBHI.2013.2284276.

[4] Initial report on data collection methods and plans (MHA D 6.5)

[5] User requirements and specifications for the linkage to external sources such as social networks and for the collaboration with other existing research projects (MHA D 2.3)

Appendix 1 – Abbreviations and Acronyms

CHF	Congestive Heart Failure
DoW	Description of Work
EHR	Electronic Health Record
ICT	Information and Communications Technology
MHA	MyHealthAvatar
PHR	Personal Health Record

Appendix 2 – The Initial Set of MHA Scenarios / Use Cases

Enter, import, store and export personal medical data

Use Case ID:	UC-1		
Use Case Name:	Enter, import, store and export personal medical data (e.g. Electronic Health Records)		
Use Case Owner:	USAAR	**Last Updated By:**	Haridimos Kondylakis
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	02.05.2013	**Last Revision Date:**	01.07.2013
Description:	End User has the GUIs, functionalities and tools in the frames of MyHealthAvatar platform to enter, import, store and export personal medical data.		
Actors:	End User & MyHealthAvatar platform		
Trigger:	User accesses the section "Personal Medical Data"		
Preconditions:	User has to Log-in or to create a New Account (New Avatar)		
Successful End condition:			
Fail End condition:			
Basic Flow:	The basic steps are: 1. Successful Log-In (or New account creation) by using Username or Email and Password 2. Select your Avatar 3. Click Enter/Import personal medical data for your Avatar 4. The list of available HIS (by location) is presented, if not applicable, skip to the next step 5. Import personal medical data from PHR system (Microsoft HealthVault, IndivoX, etc.), if not applicable, skip to the next step 6. Enter Personal medical data (Conditions, Treatment, Symptoms)		
Alternate Flows:	Two alternative flows are in place: • Import personal medical data (HIS and/or PHR) • Enter personal medical data		
Postconditions:	The next step is to store the entered/imported medical data on your Avatar ("Save" button). After successful data save, the option "Export data" is activated and/or available.		
Dependencies:	This use case extends to the following use cases: 1. Successful Log In (TBD) 2. Creation of New (account) Avatar, plus the acceptance of MyHealthAvatar platform's Privacy, Terms and conditions (TBD) 3. New Avatar creation functionality (TBD) 4. Other Use Cases (TBD)		
Required External Resources:	[x] Data, please specify:	Access to HIS and/or PHR	
	[x] Tools, please specify:	Access to ObTiMA	
	[x] Services, please specify:	PHR export/import functionality	
	[ ] Models, please specify:		
	[ ] Other, please specify:		
Frequency of Use:	Frequent use is expected due to the general and basic character of this Use Case		
Who are the users?			
Special Requirements:	The interface and tools to assure the access to HIS should be described and implemented. Access to ObTiMA tool should be described as a separate use case.		

	The minimum medical dataset should be defined and described (compatible and/or similar to Continuity of Care Record (CCR) and the Continuity of Care Document (CCD) formats/standards)
Assumptions:	UC-1 would play the central role in MyHealthAvatar platform. MyHealthAvatar should support the Continuity of Care Record (CCR) and the Continuity of Care Document (CCD) formats/standards.
Questions:	Who will be responsible for this Use Case development/implementation?

Informed Consent and Privacy

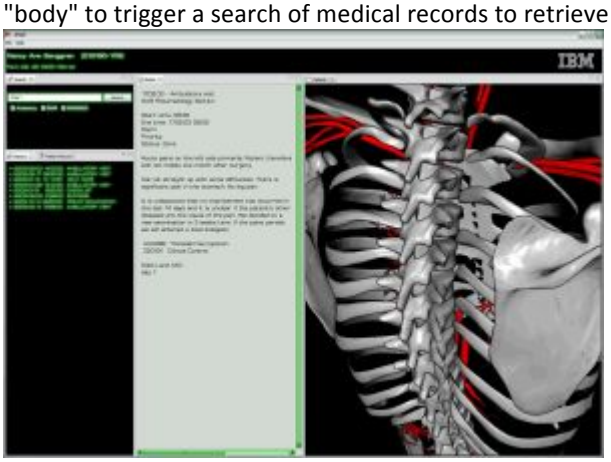
Use Case ID:	UC-2		
Use Case Name:	Informed Consent and Privacy		
Use Case Owner:	USAAR	**Last Updated By:**	
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	03.05.2013	**Last Revision Date:**	
Description:	MyHealthAvatar could be treated as a platform for End-Users who want to share their health information to create collective knowledge about disease, health, and treatments. In order to achieve this goal advanced Informed Consent and Privacy Policy Scenario / Use Case should be implemented. End User has the GUIs, functionalities and tools in the frames of MyHealthAvatar platform to accept, reject, print or revise at any time the Privacy and Informed Consent settings.		
Actors:	End User & MyHealthAvatar platform		
Trigger:	User accesses the section "Privacy and Informed Consent"		
Preconditions:	User has to Log-in or to create a New Account (New Avatar)		
Successful End condition:			
Fail End condition:			
Basic Flow:	The basic steps are: 1. Successful Log-In (or New account creation) by using Username or Email and Password 2. Select your Avatar 3. Click Accept/Revise link named "Privacy and Informed Consent" of your Avatar 4. The Privacy and Informed Consent description with checkboxes is shown. 5. End User has the option to select any checkbox according his/her preferences 6. End User has the option to "Edit", "Save" and "Print" the Accepted "Privacy and Informed Consent" preferences.		
Alternate Flows:	The alternative flows are possible by allowing the End Users to access the "Privacy and Informed Consent" section from any location of the MyHealthAvatar platform.		
Postconditions:	The important post condition is the ability to "Print" the accepted "Privacy and Informed Consent" preferences. It would be great to have in place the "Track Changes" frames, the kind of history of changes with dates.		
Dependencies:	Guidance messages should be in place (i.e. if the End User selects to not share any anonymous Avatar data he/she will not have access to any other anonymous Avatar data)		
Required External Resources:	[ ] Data, please specify:		
	[ ] Tools, please specify:		
	[ ] Services, please specify:		
	[ ] Models, please specify:		
	[x] Other, please specify:	Linkage to the results of CONTRACT Project[4]	
Frequency of Use:	Frequent use is expected due to linkage with existing functionalities. The access to some functionalities of MyHealthAvatar will be restricted as soon as the End User didn't accept the related "Privacy and Informed Consent"		

[4] CONTRACT Project, http://www.contract-fp7.eu (May 2013)

	conditions.
Who are the users?	
Special Requirements:	Privacy and Informed Consent should be in details explained. Examples of shared data that End Users may submit at the MyHealthAvatar platform, including through their Avatar, may include[5]: • Biographical information, e.g. photograph, biography, gender, age, location (city, state and country), general notes; • Condition/disease information, e.g. diagnosis date, first symptom, family history; • Treatment information, e.g. type of treatment/ medication, treatment start dates, stop dates, dosages, side effects, treatment evaluations; • Symptom information, e.g. severity, duration; • Primary and secondary outcome scores over time, e.g. ALSFRS-R, MSRS, PDRS, FVC, PFRS, Mood Map, Quality of Life, weight, InstantMe; • Laboratory results, e.g. CD-4 count, viral load, creatinine; • Genetic information, e.g. information on individual genes and/or entire genetic scans; • Individual and aggregated survey responses; • Information shared via free text fields, e.g. the forum, treatment evaluations, surveys, annotations, journals, feeds, adverse event reports; and • Connections to other Avatars. In the course of using the MyHealthAvatar platform, End Users should be aware that other End Users may share information that could be used to reasonably identify them ("Personal Information"), including name, medical images, and email address. When a Member chooses to share Personal Information via a free text field (e.g. forum, treatment evaluations, annotations, journals, feeds and adverse event reports) and photos or images, the information shall be treated as Shared Data.
Assumptions:	UC-2 would require continuous revisions in close collaboration with MyHealthAvatar project partners.
Questions:	Could we implement the Privacy, Informed Consent related frames in line with the bellow guidelines? Final Guidelines for Informed Consent and Data Security, Deliverable 4.2, CONTRACT Project, http://www.contract-fp7.eu/site/images/Documents/D4.2._Final%20guidelines.pdf

[5] http://www.patientslikeme.com/about/privacy (June 2013)

Interactive 3D Model of the Human Body (Patient Education & Serious Game)

Use Case ID:	UC-3		
Use Case Name:	Interactive 3D Model of the Human Body (Patient Education & Serious Game)		
Use Case Owner:	USAAR	**Last Updated By:**	
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	03.05.2013	**Last Revision Date:**	
Description:	MyHealthAvatar platform would propose an avatar - a 3D representation of the human body - to allow End Users (e.g. patients, doctors) to visualize patient medical records in a new way. Similar to IBM's Anatomic and Symbolic Mapper Engine (ASME), this visualization method would allow the End User to click with the computer mouse on a particular part of the avatar "body" to trigger a search of medical records to retrieve relevant information.  "The ASME system will allow doctors to "click" on different parts of the 3-D avatar of the human body - for example, the spine - and instantly see all the available medical history and information related to that patient's spine, including text entries, lab results and medical images such as radiographs or MRIs. Or the doctor might be interested only in information related to a particular part of the spine; in this case, the practitioner can zoom in, narrowing the search parameters by time or other factors."[6]		
Actors:	End User & MyHealthAvatar platform		
Trigger:	User accesses the Avatar		
Preconditions:	User has to Log-in or to create a New Account (New Avatar)		
Successful End condition:			
Fail End condition:			
Basic Flow:	The basic steps are: 1. Successful Log-In (or New account creation) by using Username or Email and Password 2. Select your Avatar 3. Click on different parts of the 3-D Avatar of the human body (e.g. kidney) 4. See all the available medical history and information related to that patient's parts of the human body (e.g. text entries, EHR, lab results and/or medical images). 5. Browse the available information with ability to Add, Edit, Save, Change the Privacy Settings, or Delete the existing entries. 6. End messages (e.g. "Success", "Error") in case of any of the above performed actions.		

[6] http://www-03.ibm.com/press/us/en/pressrelease/22375.wss (June 2013)

	7. Log-Out option with related message.	
Alternate Flows:	The alternative flows are possible by allowing the End Users to access his/her Avatar from any location of the MyHealthAvatar platform.	
Postconditions:	The important post conditions are the end messages in case of any performed actions (e.g. Add, Edit, Save, Change the Privacy Settings, Delete, etc.)	
Dependencies:	Dependencies are related to UC 1 and UC 2	
Required External Resources:	[x] Data, please specify:	EHR, PHR
	[x] Tools, please specify:	Semantic Core Ontology
	[ ] Services, please specify:	
	[x] Models, please specify:	3-D models of the human body
	[ ] Other, please specify:	
Frequency of Use:	Frequent use!	
Who are the users?		
Special Requirements:	The key technologic challenge is the integration of heterogeneous data sources and complex text-based information (unstructured data) and linking that data to the anatomical model in a meaningful and easy-to-navigate way. Strong linkage to: • WP 3 (Architecture and integration) • WP 4 (Semantic interoperability) • WP 8 (Avatar centred visual analytics)	
Assumptions:	UC-3 would require a close collaboration and contribution from all MyHealthAvatar project partners.	
Questions:	Who is elaborating the mockups?	

Collecting, saving and sharing data from third party social networks

Use Case ID:	UC-4		
Use Case Name:	Collecting, saving and sharing data from third party social networks (Facebook, Twitter)		
Use Case Owner:	USAAR	**Last Updated By:**	
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	13.05.2013	**Last Revision Date:**	
Description:	This Use Case is in strong relationship with project's tasks bellow: • T3.4 Methodologies to support link with external data sources: PM2=>PM33(Task Leader: FORTH) • T6.1 Data collection utilities PM2=>PM12 (Task Leader: BED) • Task 11. 3. Understanding the Legal and IPR regime in MyHealthAvatars PM25=>PM30 (Task Leader: LUH) End User has the related tools in the frames of MyHealthAvatar platform to collect, save and share data from third party social networks (Facebook, Twitter, etc.). The interface allows the End Users to attach to his/her own Avatar his/her own Facebook and/or Twitter account. The End-User's Avatar will have the frames to show the last updates, status messages or short texts from the related Facebook and/or Twitter accounts. The Avatar (End-User) has as well the possibility to subscribe to Twitter and/or Facebook channels of interest. The Avatar (End-User) has the option to share data to the added (only own!) Twitter and/or Facebook channels.		
Actors:	End-User, MyHealthAvatar platform		
Trigger:	End-User accesses the section "My Social Networks" with options: • Add "Social Network Account" • Edit "Social Network Account" • Delete "Social Network Account" • Follow "Social Network Account" • Share your data (data has to be defined) to "Social Network Account"		
Preconditions:	User has to Log-in or to create a New Account (New Avatar). Is important to mention that End-Users could have the option to create a New Account (New Avatar) with or without the linkage to the third party social networks.		
Successful End condition:			
Fail End condition:			
Basic Flow:	The basic flow is: 1. Create a New Avatar (select the option with or without the third party social networks) 2. The flow ends here if the End-User selects the option "without the third party social networks" 3. The flow continues if the End-User selects the option "with the third party social networks" 4. End-User has the option to add his social network account (Facebook and/or Twitter) 5. The account information (User Name and Password) is requested and provided 6. The last status messages from the added social network account are shown in a separate Avatar's frame/section		

Alternate Flows:	Alternative flows are related to the available options like: • Edit “Social Network Account” • Delete “Social Network Account” • Follow “Social Network Account” • Share your data (data has to be defined) to “Social Network Account”	
Postconditions:	The postcondition is to make visible (or hide) the status messages from the added social network account to other Avatars.	
Dependencies:	The only dependence is the option presented above, and in special, to create a New Avatar with or without the third party social networks.	
Required External Resources:	[ ] Data, please specify:	
	[ ] Tools, please specify:	
	[x] Services, please specify:	Twitter and Facebook APIs
	[ ] Models, please specify:	
	[ ] Other, please specify:	
Frequency of Use:	Frequency of use could be high	
Who are the users?		
Special Requirements:	The special requirement is an advanced integration of Twitter and Facebook APIs into MyHealthAvatar platform	
Assumptions:	This Use Case could serve as an advanced dissemination tool in special by End Users active in third party social networks.	
Questions:	We have to identify who has the experience and skills to integrating/use Twitter and Facebook APIs.	

Remote Monitoring

Use Case ID:	UC-5		
Use Case Name:	Remote Monitoring (Diabetes, blood sugar level)		
Use Case Owner:	USAAR	**Last Updated By:**	
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	13.05.2013	**Last Revision Date:**	
Description:	 Image source: Continua Health Alliance, http://www.continuaalliance.org The Remote Monitoring tool/frame collects and processes patient care information from supported healthcare devices that conform to standards (preferably selected by the Continua Health Alliance). End User uses a glucose meter and MyHealthAvatar platform to monitor his/her blood sugar levels. The MyHealthAvatar platform reminds to check the blood sugar regularly during the day, and the glucose meter should be able seamlessly to transmit the measurements to the Avatar after each use. The data is saved that maintains the Avatar's long-term history and looks for possible abnormal events. If the saved data is unusual, or the End-User skips a test, the MyHealthAvatar platform automatically generates an alert message.		
Actors:	End-User, MyHealthAvatar platform, Glucose Meter (Bluetooth or USB enabled)		
Trigger:	End-User accesses the section “My Remote Monitoring Devices” and allow the access of the Glucose Meter by using Bluetooth or USB connection (computer or other mobile device should be equipped with a Bluetooth wireless adapter or USB)		
Preconditions:	User has to Log-in or to create a New Account (New Avatar). End-Users could have the option to create a New Account (New Avatar) with or without the linkage to the remote monitoring devices.		

Successful End condition:		
Fail End condition:		
Basic Flow:	The basic flow is: 1. Create a New Avatar (select the option with or without the remote monitoring devices) 2. The flow ends here if the End-User selects the option “without the remote monitoring devices” 3. The flow continues if the End-User selects the option “with the remote monitoring devices” 4. End-User has the option to “Add” the monitoring device, at the initial stage only a glucose meter could be added 5. The monitoring devices parameters (Bluetooth or USB) are settled. 6. The glucose meter starts sending data. 7. End user has the option to visualize the collected data 8. (to be discussed) Collected data could change the appearance of the Avatar and/or alert messages are sent if the End-User skipped a test	
Alternate Flows:	Alternative flows are related to the available options like: • Visualize collected data (blood sugar levels) • Share collected data (blood sugar levels) • Archive collected data (blood sugar levels) • Send/Remove Reminders and/or Alerts messages	
Postconditions:	The postcondition is to make visible (or hide) the collected data (blood sugar levels)	
Dependencies:	The only dependence is the option presented above, and in special, to create a New Avatar with or without the linkage to the remote monitoring devices.	
Required External Resources:	[ ] Data, please specify:	
	[x] Tools, please specify:	Glucose Meter with Bluetooth or USB connection
	[ ] Services, please specify:	
	[ ] Models, please specify:	
	[x] Other, please specify:	Continua Health Alliance standards
Frequency of Use:	Frequency of use could be high	
Who are the users?		
Special Requirements:	The special requirement is an advanced integration and interoperability of Glucose Meter (Bluetooth or USB connection) with MyHealthAvatar platform	
Assumptions:	This Use Case would serve as an example of the advanced integration of the remote monitoring devices. The open access to MyHealthAvatar API would allow the developers to add more devices and solutions.	
Questions:	Who has the experience and the skills to implement Continua Health Alliance standards?	

Mobile Driven 3D Virtual Lung

Use Case ID:	UC-6		
Use Case Name:	Mobile Driven 3D Virtual Lung		
Use Case Owner:	FORTH	**Last Updated By:**	
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	20.06.2013	**Last Revision Date:**	
Description:	**This use case has strong relationship with the following project's tasks:** T5.1 Development of the models repository T5.2 A data repository for models T4.5: Semantic Reasoning for Decision Support T6.1 Data collection utilities T6.2 Data collection from online patient diary T6.3 Data repository for health information T7.1: Scenarios and use cases for MyHealthAvatar Task 8.2 Key techniques of visual analysis Task 8.3 A visual data analysis suite **Moreover it is related to the following project objectives:** • ICT utilities that support data collection, including web information extraction and mobile apps • Visual representation of the avatars in multi-layer geometries and colors to support a body (anatomy) centered visualization of health status data • Visual analytics within the ICT toolbox that offers valuable information blending and analysis from heterogeneous data sources **Details:** In this use case we will capture breathing movements from lung from patients through the acoustic signal of respiration using a mobile smart phone. Using personalized information, additional to the acoustic breathing signal, like the age, gender, height, and possible diseases (i.e. cancer) we will use the MyHealthAvatar model to represent a 3D visualization avatar of the lungs' function. This will be used in order to allow for the visual comparison of the normal function or the goals of the patient. The envisaged application's aim is to create a 3D virtual therapy environment, using MyHealthAvatar platform, customized for the patients which will encourage them to regulate their breath.		
Actors:	End User & MyHealthAvatar platform		
Trigger:	End User		
Preconditions:	This use case will use a smart-phone application that will interface a breathing classification component, a lung capacity estimation component and a 3D visualization component. All the components will be integrated in order to produce appropriate output including the 3-D animations component of the human lung moving according to the corresponding breathing movements of a specific person. Data from MHA and external data source should be mapped to this component.		
Successful End condition:			
Fail End condition:			
Basic Flow:	1. Acoustic signal recording (using mobile phone) 2. Analysis (segmentation) of the acquired signal 3. Lang capacity computation (FVC) 4. Classification to identify breathing movements 5. Visualization		

Alternate Flows:		
Postconditions:		
Dependencies:		
Required External Resources:	[x] Data, please specify:	If MHA wants to retrieve external information, the relevant data sources should be available and accessible
	[x] Tools, please specify:	Android/iOS development tools Mobile phone 3d visualization
	[ ] Services, please specify:	
	[ ] Models, please specify:	
	[ ] Other, please specify:	
Frequency of Use:	Frequently	
Who are the users?		
Special Requirements:	A proper interface should be available for searching and visualizing results.	
Assumptions:		
Questions:		

Mobile Lifestyle and Social media

Use Case ID:	UC-7		
Use Case Name:	Mobile Lifestyle and Social media		
Use Case Owner:	FORTH	**Last Updated By:**	
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	20.06.2013	**Last Revision Date:**	
Description:	**This use case has strong relationship with the following project's tasks:** T6.1 Data collection utilities T6.2 Data collection from online patient diary T6.3 Data repository for health information Task 8.2 Key techniques of visual analysis Task 8.3 A visual data analysis suite **Moreover it is related to the following project objectives:** • ICT utilities that support data collection, including web information extraction and mobile apps • Visual representation of the avatars in multi-layer geometries and colors to support a body (anatomy) centered visualization of health status data **Details:** In this use case we aim to create a symbiotic relationship of available technology today for mobile applications and MyHealthAvatar platform. The goal is to respond to the fast growing demand for developing new technologies and services for mobile/health applications supporting wellness, fitness and prevention of the most common chronic diseases (i.e. cardio-vascular and stroke, diabetes, rheumatic problems, respiratory problems and COPD, etc.). Mobile applications will monitor user's "health-status", "lifestyle" and "wellness" and upload data to the MyHealthAvatar system for close monitoring of health conditions and prevention of many diseases. The system then will be able to analyse user's lifestyle and medical data. Special "alerts" will be applied to support end users with feedback supporting and assisting their daily activities and well-being. A social media service will be used to allow the interconnection of end users. This social media service, accessible by smart phones, will be used in a dual mode allowing the users to insert information about themselves (like they do in common social media technologies) but also will be a mean of supporting personalized services to them from the system in the form of alerts and guidance (i.e. post therapy monitoring of user's behaviours after orthopaedics operation, cancer patients reaction to treatment, etc.). The user will be able to take advantage of mobile digital technology using 3D visualization models the project will deploy.		
Actors:	End User & MyHealthAvatar platform		
Trigger:	End User		
Preconditions:	This use case will use a smart-phone application that will interface with the social media service that will be deployed but also other MyHealthAvatar enabled social media services available today.		
Successful End condition:			
Fail End condition:			
Basic Flow:			
Alternate Flows:			
Postconditions:			
Dependencies:			

Required External Resources:	[x] Data, please specify:	If MHA wants to retrieve external information, the relevant data sources should be available and accessible
	[x] Tools, please specify:	Android/iOS development tools Mobile phone 3d visualization
	[ ] Services, please specify:	
	[ ] Models, please specify:	
	[ ] Other, please specify:	
Frequency of Use:	Frequently	
Who are the users?		
Special Requirements:	A proper interface should be available for searching and visualizing results.	
Assumptions:		
Questions:		

Compile and perform a simulation using a biological model

Use Case ID:	UC-8		
Use Case Name:	Compile and perform a simulation using a biological model		
Use Case Owner:	ICCS	**Last Updated By:**	
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	19.06.2013	**Last Revision Date:**	
Description:	End-User has the GUIs, functionalities and tools in the frames of MyHealthAvatar platform to create and execute a biological simulation scenario. End-User selects one of the biological simulation models available in the Model Repository and one of the sets of clinical data available in the Clinical Data Repository (or uploads a set from his computer). Afterwards he/she executes a biological simulation. Finally he/she retrieves the results of the simulation and proceeds to their evaluation. This use case has strong relationship with the following project task: T.3.5 Investigation of local cloud T.3.7 Platform integration T.5.1 Development of the model repository T.5.2 Development of the data repository for models T5.3 Integration with the security framework		
Actors:	End User & MyHealthAvatar platform		
Trigger:	• User accesses the section “Simulation Interface”. • User “clicks” on a specific area of the 3-D avatar of the human body, for example the kidney, is directly or indirectly (by a menu) redirected to the “Simulation Interface” and is guided to the proper biological simulation model/-s (for example the kidney simulation model/-s).		
Preconditions:	• The User has to Log-in or to create a New Account (New Avatar). • The option to “perform simulations using biological models” must be enabled in the user’s profile. • The user must have the proper access rights in order to use a biological simulation model from the Model Repository. • The biological simulation model must be already imported to the Model Repository. • The user must have the proper access rights in order to use a set of clinical data from the Clinical Data Repository. • The clinical data that the biological simulation model needs in order to run must be already imported into the Clinical Data Repository or it must be provided (uploaded) by the user just before the start of the simulation. • The clinical data must be compatible, in terms of format and content, with the selected biological simulation model. • The user must have the proper access rights to a computational platform. • The computational platform must have enough available resources in order for the simulation to be performed successfully.		
Successful End condition:			
Fail End condition:			
Basic Flow:	The basic steps are: 1. Successful Log-In (or New account creation) by using Username or Email and Password.		

	2. Select the Avatar. 3. The flow ends here if the End-User doesn't have the option "Perform simulations using biological models" enabled. 4. The flow continues if the End-User has the option "Perform simulations using biological models" enabled. 5. End-User creates a biological simulation scenario, by selecting a simulation model from the Model Repository and a set of data from the Clinical Data Repository. 6. End-User starts the simulation process. 7. When the simulation is completed, the proper ending code is displayed, either a success message or an erroneous message. 8. End-User user has the possibility to download the results of the simulation to his computer, either the simulation ended successful or with errors.	
Alternate Flows:	The alternative flows are: 1. In step 5 of the basic flow, the selection of the simulation model can be guided by narrowing the available simulation models to only the ones related to a specific part of the human body, by clicking on the 3-D representation of human body. 2. In step 6 of basic flow, End-User can upload a set of data from his computer instead of using a set of data provided by the Clinical Data Repository.	
Postconditions:		
Dependencies:	• The option to perform simulations using biological models must be enabled in the user's profile. • The user must have the proper access rights to the Model Repository. • The user must have the proper access rights to the Clinical data repository. • The user must have the proper access rights to a Computational Platform.	
Required External Resources:	[x] Data, please specify:	Clinical data (already preprocessed), ready to be used by the simulation models
	[x] Tools, please specify:	• Model Repository • Clinical Data Repository (related to simulation models)
	[x] Services, please specify:	• Query the Model Repository for available models. • Query the Clinical Data Repository (related to biological simulation models). • Copy a selected model to the computational platform. • Copy a set of selected preprocessed data to the computational platform. • Execute the simulation scenario (by sending a computational job to the computational platform). • Retrieve the result of the

		execution of a simulation model.
	[x] Models, please specify:	Simulation Models
	[x] Other, please specify:	Computational Platform: Can be either a personal computer, a cloud virtual machine, a High Performance Computer (HPC) or any other system able to perform computational simulations.
Frequency of Use:	Medium frequency.	
Who are the users?		
Special Requirements:		
Assumptions:	• The biological simulation model is already imported in the model repository. • A set of clinical data compatible with the aforementioned biological simulation model is already imported in the clinical data repository. • Appropriate computational resources are available for running the simulation. • The security framework is responsible for controlling the access to the model repository, the clinical data repository and the computational platform.	
Questions:	Although the biological simulation model (nephroblastoma) planned to be used in the MyHealthAvatar demonstrator doesn't use proprietary software, what if a model uses proprietary software, like a model developed in Matlab (licensing issues)?	

Manage the content of the Model Repository and the Clinical Data Repository

Use Case ID:	UC-9		
Use Case Name:	Manage the content of the Model Repository and the Clinical Data Repository (related to simulation models)		
Use Case Owner:	ICCS	**Last Updated By:**	
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	29.06.2013	**Last Revision Date:**	
Description:	End-User has the GUIs, functionalities to manage the content of the Model Repository and the Clinical Data Repository (related to simulation models). This use case has strong relationship with the following project task: T.3.7 Platform integration T.5.1 Development of the model repository T.5.2 Development of the data repository for models T5.3 Integration with the security framework Due to the commonness of this use case, a detailed description is redundant.		
Actors:	End User & MyHealthAvatar platform		
Trigger:	• User "clicks" on links available in the main MyHealthAvatar web interface. • User accesses the Model Repository URL or the Clinical Data Repository URL.		
Preconditions:	The following precondition applies to both Model Repository and the Clinical Data Repository: • The User has to Log-in to the interface of the Repository		
Successful End condition:			
Fail End condition:			
Basic Flow:	The following basic flow applies to both Model Repositories and Clinical Data Repository. The basic steps are: 1. Successful Log-In (or New account creation) by using Username or Email and Password. 2. Manage (add, edit, upload, delete) the content of the Repository.		
Alternate Flows:	The alternative flow is: 1. In case the user has administrative rights he/she can have access to the user management interface and perform the corresponding actions.		
Postconditions:			
Dependencies:			
Required External Resources:	[ ] Data, please specify:		
	[ ] Tools, please specify:		
	[ ] Services, please specify:		
	[ ] Models, please specify:		
	[ ] Other, please specify:		
Frequency of Use:	Medium frequency.		
Who are the users?			
Special Requirements:			
Assumptions:			
Questions:			

Tools for browsing medical images in avatar

Use Case ID:	UC-10		
Use Case Name:	Tools for browsing medical images in avatar		
Use Case Owner:	LIN	**Last Updated By:**	
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	04.07.2013	**Last Revision Date:**	
Description:	Tools which will help the user to analyze medical image		
Actors:	End User & MyHealthAvatar platform		
Trigger:	User accesses the section "Tools"		
Preconditions:	User has to Log-in or to create a New Account (New Avatar)		
Successful End condition:			
Fail End condition:			
Basic Flow:	The basic steps are: 1. Successful Log-In (or New account creation) by using Username or Email and Password 2. Select your Avatar 3. Click Enter on the 'Tools' section and manipulate the 3D Body		
Alternate Flows:	The 'Tools' section must be accessible from any location of the MyHealthAvatar platform.		
Postconditions:			
Dependencies:	The platform must provide library consisted by information regarding several anatomy objects with 3D navigation		
Required External Resources:	[ ] Data, please specify:		
	[ ] Tools, please specify:		
	[ ] Services, please specify:		
	[ ] Models, please specify:		
	[ ] Other, please specify:		
Frequency of Use:	Frequent use is expected		
Who are the users?			
Special Requirements:	Tools • Select a set of medical images within the avatar • Load and Browse the selected images • Allow zoom in/out at particular areas of the images • Indicate the images at corresponding part of the avatar body		
Assumptions:	To be accessible in all browsers.		
Questions:			

Tools for the analysis of medical images in avatar

Use Case ID:	UC-11		
Use Case Name:	Tools for the analysis of medical images in avatar		
Use Case Owner:	LIN	**Last Updated By:**	
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	04.07.2013	**Last Revision Date:**	
Description:	Tools which will help the user to analyze medical images		
Actors:	End User & MyHealthAvatar platform		
Trigger:	User accesses the section "Tools"		
Preconditions:	User has to Log-in or to create a New Account (New Avatar)		
Successful End condition:			
Fail End condition:			
Basic Flow:	The basic steps are: 1. Successful Log-In (or New account creation) by using Username or Email and Password 2. Select your Avatar 3. Click Enter on the 'Tools' section and manipulate the 3D Body		
Alternate Flows:	The 'Tools' section must be accessible from any location of the MyHealthAvatar platform.		
Postconditions:			
Dependencies:	The platform must provide library consisted by information regarding several anatomy objects with 3D navigation		
Required External Resources:	[ ] Data, please specify:		
	[ ] Tools, please specify:		
	[ ] Services, please specify:		
	[ ] Models, please specify:		
	[ ] Other, please specify:		
Frequency of Use:	Frequent use is expected		
Who are the users?			
Special Requirements:	Tools • Perform basic image processing, such as Image filtering, and enhancement, etc. • Perform segmentation of region of interests (lesions or anatomies) on selected images		
Assumptions:	To be accessible in all browsers.		
Questions:			

Utilization of personal genomic information for the individualization of MHA platform

Use Case ID:	UC-12		
Use Case Name:	Utilization of personal genomic information for the individualization of MHA platform		
Use Case Owner:	FORTH	**Last Updated By:**	
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	21.07.2013	**Last Revision Date:**	
Description:	Our health status and all our personal traits are the outcome of the continuous interaction between our genomic background and the various environmental parameters. The present use case aims at the **development of MHA technology as an individualized medicine platform by the utilization, interpretation and integration of personal genomic information into health medical history record**. This technically high-level and complex use case involves a number of health and lifestyle related processes, tools and services which translate genomic data to genetic predisposition evaluation and health risk estimation, pharmacogenomic predictions, histology and pathway visualizations etc. in order to support and facilitate advanced individualized medical decision making (integrative individual patient case view, specification of simulation models, therapy selection etc.) and provide with guidelines for preventive medicine. This use case relates to the following tasks of the project: T.3.7 Platform integration T4.5: Semantic Reasoning for Decision Support T.5.2 Development of the data repository for models T6.1 Data collection utilities T6.3 Data repository for health information Task 8.2 Key techniques of visual analysis Task 8.3 A visual data analysis suite		
Actors:	User, MyHealthAvatar platform, eHR, Genome Information		
Trigger:	User uploads file with genome information to MHA platform.		
Preconditions:	Inform consent should have been obtained for comprehensive genome analysis and genetic counseling should be available. Further evaluation of the volunteer(s) could be considered (according to **Personal Genome Project** criteria). Personal Genome (or Exome) information at high coverage (>75%) should have been obtained by Next Generation Sequencing Platforms (available to MHA consortium) and at an adequate depth. Personal genome data, but with limited health related information, can be downloaded from public data sources (**1000 genomes**) and or Personal Genomics initiatives (**genomes unzipped**).		
Successful End condition:			
Fail End condition:			
Basic Flow:	The basic (high-level) steps from the Genome information upload to the creation of an individualized HealthAvatar platform are: 1. **Sequence comparison and alignment** algorithms using the input genome data and the **Human Genome Reference** identify gene alleles, haplotypes, mutations and polymorphisms on the individual's genome. Other special algorithms and quantitative measurements identify chromosomal aberrations. Genome browser tools can also be included as an option for the expert user. 2. Identified genome variations are compared to reported Disease related and Pharmacogenomic databases. Extensive **lists of**		

	annotated variations are generated. 3. Health related genotype evaluations are performed: a) Burden or risk from mutations related to **monogenic disorders** is identified (more than 10,000 diseases are known to be monogenic ie. Thalassaemia, Cystic Fibrosis, Huntington's). b) Sets of gene alleles or SNPs are co-evaluated for **genetic predisposition to multigenic diseases** (T2 diabetes, Obesity, Dyslipidemia, Hypertension etc.) or protective alleles (in PCSK9 and Coronary disease). c) **Pharmacogenomic variations** are identified in Phase I, II, transporters and other drug metabolism related genes. 4. Personalized **Risk Graphs** are generated presenting the current risks, according to individual's epidemiological data and genotype. Re-evaluation by comparison of the genetic predisposition and the actual health status. 5. Individual is classified according to pharmacogenomics background to Poor/Intermediate/Extensive/Ultra-rapid metabolizer for **various drugs** and active compounds. 6. Evaluating the risks and possibly considering the pharmacogenomics background, specific, individualized, **preventive medicine and lifestyle counseling** can be provided by experts (i.e. prescription of Prasugrel instead of Plavix for CVD in poor CYP2C19 metabolizer, changes in fat diet and nutraceuticals i.e. plant sterols) according to general guidelines. 7. **Visualization** of this information into the MHA platform in disease and/or tissue specific manner. Note: Certain steps (ie. 1 & 2) can also be implemented "off-line" using a specialized genome analysis platform (Partek genomics suite, Ingenuity Systems, CLC genomics workbench etc.) and then introduced into the MHA platform.
Alternate Flows:	Alternatively and targeting the interested individual or "patient", the MHA platform could provide special tools and services such as: 1. Mobile expert information, guidelines and suggestions about lifestyle habits (exercise, diet, food supplements) on an individualized basis. 2. Genetic counseling services and awareness reports about certain "actionable" genetic characteristics and possible risks. Participation to social networks and involvement in patient groups (as in UC-9: Mobile Lifestyle and Social media). 3. Capture everyday lifestyle information such as diet (fats, calorie content, sweeteners etc.), health related habits (smoking etc.), work environment (hazard agents etc.), exercise (distance walked etc.), mood and physical condition, vital signals (blood pressure, sugar levels etc.) and record all this information together with the medical Health Record and the Personal Genomic Information in order to create the most comprehensive health related information collection for further evaluation of genomic and environmental determinants in health and disease. 4. Deviating from health applications, ethnic heritage information based on mitochondrial DNA (matrilineal) and Y chromosome (patrilineal) haplogroup information could be provided.
Postconditions:	Further directions for the utilization of personal genomic information can be the use of MHA platform as an advanced visualization and/or simulation tool for pharmacodynamics and pharmacokinetics. In this case use co-

	visualization and/or *in silico* models can be developed for: i) drug distribution to various tissues (according to pharmacokinetic measurements), ii) drug target expression and iii) individual's mutant and variant protein expression maps for those related to drug response (according to available data sources i.e. Human Protein Atlas), and iv) molecular pathways related to the particular tissues, drug target and therapy related proteins. Tissue, organ visualization tools (UC-3: Interactive 3D Model of the Human Body and UC-7: 3D Avatar Visualization and manipulation) and simulation tools (UC-10: Compile and perform a simulation using a biological model) described in other Use Cases could be utilized and further specialized in support of these further advancements of the MHA platform.	
Dependencies:	The present use case is presented as a high technical level scenario assuming that various procedures and tools are in place and operational (i.e. genome annotation). Specific technical developments (i.e. generation of predisposition gene lists) can be further elaborated as lower level use cases. Other existing dependencies, such as the availability of medical data, are covered in related use cases. (UC-1: Enter, import, store and export personal medical data e.g. Electronic Health Records). It should also be noted that targeted genomic information could also be utilized in order to individualize specific use cases such as UC-5: Remote monitoring (Diabetes, blood sugar level).	
Required External Resources:	[x] Data, please specify:	Pharmacogenomics profile (DMET chip) and/or comprehensive genome or exome information (from Ion Proton HTP Sequencing platforms available at IMBB-FORTH) and health records of 2-4 volunteers. Personal genome information with limited health data annotation from public sources (1000genomes etc.)
	[x] Tools, please specify:	Genome browser and annotation: VEGA, Argo, Artemis, genome browsers Genomes unzipped, or Golden Helix Genome Browse, or Integrative Genomics Viewer Ingenuity (variant analysis) Genome Space tools (GeneOntology, KEGG etc.) DNAnexus Bioconductor (Variants)
	[x] Services, please specify:	Query databases: Annovar (biobase) The Human Gene Mutation Database Cosmic Database (human cancers) GWAS central The Cancer Genome Atlas MutaBase Human Protein Atlas
	[x] Models, please specify:	Pharmacodynamics and pharmacokinetics model for specific (demonstration) purposes. PharmGkb simCYP
	[x] Other, please specify:	Disease-Tissue MHA Visualization tools
Frequency of Use:	In principle personal genomic information should be the basis of every "patient" case and its MHA instantiation. In that sense, all platform tools	

	should eventually become “individualized” utilizing and presenting genomic and genetic information
Who are the users?	
Special Requirements:	Specialized Databases for providing specific disease and/or risk and/or lifestyle guidelines (step 6 and alternative step 2) Pharmacodynamics and pharmacokinetics data (step 5) A user friendly interface for introducing/recording everyday health and lifestyle information and for monitoring “biosignals” via a number of portable, mobile, wearable devices (alternative step 3)
Assumptions:	The present use case utilizes most of the available knowledge but for accurate risk calculations, health evaluations and therapy predictions detailed patho-physiological data and correlation information are needed. Although these are intensively gathered in a wide variety of studies, extensive detailed information is not yet available.
Questions:	The technical development of such a complex and high-level use case scenario into an individualized MHA platform is obviously demanding more than the available time and resources. Can the consortium identify a specific application (ie. blood sugar monitoring, specific drug and therapy modeling or monitoring etc.) in which there is available interest and expertise?

Anti-platelet therapy in pre-operating period

Use Case ID:	UC-13		
Use Case Name:	Anti-platelet therapy in pre-operating period (The example of decision making tool regarding emergency situations in clinical practice)		
Use Case Owner:	FORTH	**Last Updated By:**	
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	28/06/2013	**Last Revision Date:**	23/07/2013
Description:	Hemostasis disorders can develop due to a deficiency or defect in an individual's platelets or clotting factors. Dysfunctions can lead either in bleeding disorders (hemophilia) or in over-clotting disorders such as thrombosis. Dysfunctions that lead in thrombus formation can be related with morbidities such as cardiovascular disorders (coronary disease, heart attack, angina, congestive heart failure and valve disease), pulmonary embolism, stroke and transient ischemic attacks, deep vein thrombosis, peripheral vascular disease (PVD), phlebitis and in some cases obesity. Patients that are diagnosed with over-clotting deficiencies are treated with anticoagulant or anti-platelet therapies as a preventive care. Several single nucleotide polymorpshisms (SNPs) are known regarding drug-targets or metabolizing enzymes (mainly of Cytochrome P450 family) of anti-platelet and anticoagulant therapies. Some well-known examples are the Vitamin K epoxide reductase complex subunit 1 (VKORC1) where specific gene mutations have been related with deficiencies in Vitamin-K-depedent clotting factors and the response to anticoagulant therapies of warfarin and acenocoumarol. Also regarding metabolizing enzymes of P450 family, CYP2C19 is the main metabolic enzyme for the activation of the anti-platelet agent clopidogrel. Clopidogrel is a pro-drug activated in the liver by cytochrome P450 enzymes, mainly CYP2C19. Genetic polymorphism (CYP2C19*2, CYP2C19*3 and CYP2C19*17) exists for CYP2C19 expression, with approximately 5% of Caucasian and 20% of Asian populations being poor metabolizers with no CYP2C19 function. Due to the above, Anti-platelet and anticoagulant agents that are administered in clinical practice appear to have a large inter-subject variability in their pharmacokinetics and thus in pharmacodynamics. Antiplatelet and anticoagulation therapies are typical examples where therapeutic drug monitoring is applied for every patient as well as pharmacogenomics information are taken into account and several algorithms have been created in order to integrate data and improve pharmacotherapy. Moreover, there are emergency cases such as pre-operative periods where an adjustment in dose should be applied for patients following anti-coagulation and anti-platelet therapies in order to avoid bleeding problems during surgery or in the stage of recovery. A typical use-case scenario: "A male 55 years old that follows anti-platelet therapy, needs to go on surgery. The doctor has to re-adjust the administration of the anti-platelet therapy for the up-coming surgery and wants to perform the operation as soon as possible. General information are known for pre-operative care but how can the doctor avoid any guesswork and apply a personalized approach for this case and possible for future patients?"		
Actors:	Avatar1(Doctor),Avatar2 (patient), (Avatar3) Research staff for in silico clinical trials platforms, genome information platform/tool, MyHealthAvatar platform		
Trigger:	Upload of diagnosis in patient's electronic health record or during creation of patient's Avatar in MHA platform.		

	Alternative the use case can be triggered after the medical examination and the decision that patient should go on surgery.
Preconditions:	The facts that are true in this case are: 1. Anti-platelet therapy may lead in the appearance of bleeding in the postoperative period. 2. Anti-platelet and anti-thrombotic agents that are administered in clinical practice appear to have a large inter-subject variability in their pharmacokinetics and thus in pharmacodynamics due to genetic and epigenetic factors. 3. Anti-platelet therapy is a clinical case that personalized medicine tools are essential. Therapeutic drug monitoring is usually followed for the proper adjustment of the treatment administered. 4. There are not many data available regarding the time that the treatment will stop be active after the discontinuation. 5. Clinical trials regarding the above situation cannot be performed.
Successful End condition:	
Fail End condition:	
Basic Flow:	Basic steps: 1. Gathering all the necessary data required from patients health record. This step can be during the therapeutic drug monitoring and dose adjustment prior to the emergency situation. Also this step can be during utilization of personal genomics (Use-case 14) 2. Creating of MyHealthAvatar profile for this patient 3. Development of a workspace in a platform for in silico clinical trials The basic things that are needed: IV. Drug data regarding the pharmacokinetic and/or pharmacodynamic parameters as well as for toxicity V. Population data regarding demographic, genetic, biochemical and physiological parameters – Patient's genetic data of drug-metabolizing enzymes which can influence drug concentrations in the body should be considered. – Data for (I) and (II) could be available from literature and can be in the default parameters of the platform or can be enriched from patient's data – Data for (II) can be created from clustering of MyHealthAvatar profiles of patients with same or similar disease profile VI. Clinical trial protocol and design. In this case the clinical trial will need to estimate the drug concentrations in the body for a period of time after the last administration (i.e. 48 hours after the last administration) 4. Simulation of virtual clinical trials in the specific "virtual population" 5. Embed results in an appropriate worksheet or in a different platform 6. Matching and identification of the Avatar from MHA with the "virtual patient" from the "virtual population" of the simulated clinical trial 7. Identification of the time that anti-platelet's drug concentration is below the minimum effective concentration 8. Evaluation for the time needed after the sub-therapeutic concentrations of the drug in order the clotting activity to start returning to the default values.

	9. Evaluation of the obtained results and decision of the time that the patient will be ready for surgery 10. Surgery performing and re-introduction of the anti-thrombotic treatment Note: This basic flow can be created during therapeutic drug monitoring of patient's status after the diagnosis of clotting-deficiency	
Alternate Flows:	Alternative flows will be followed if the patient is receiving treatments for other co-existing diseases for the possible evaluation of any interactions and/or any modulations regarding the basic flow. Alternative flows can be considered taking into account the adding therapies applied after or during surgery for this patient (e.g. antibiotics, analgesics, sedatives, antacids, anticoagulants administered subcutaneous or intravenous such as heparin etc.)	
Postconditions:	Monitoring of patients status after surgery. Evaluating results and update data in MHA and in clinical trial simulator platform. Re-adjust the therapy on the recovery stage	
Dependencies:	This case refers in the administration of drugs in emerging situations in clinical level such as pre-operative period and for patients in intensive care units. It represents a typical example of how data can be created through in silico clinical trials approaches especially in clinical cases where clinical trials cannot be performed. It also tries to represent how personalized information regarding drugs, diseases and health status information can be introduced and exploited through MHA in order to create decision making tools and approaches. Dependencies of this case can be related with Use Cases 1, 2, 3 and 5. This case follows and it is related with the Use Case 14 and utilization of personal genomic information for the individualization of MHA platform	
Required External Resources:	[x] Data, please specify:	• Drug data ○ Pharmacokinetic properties ○ Pharmacodynamic properties • Population data ○ Demographic ○ Genetic ○ Physiology ○ Pathology • Clinical trials protocols and parameters (as they are described in regulatory organizations FDA and EMA)
	[x] Tools, please specify:	PCs with related software installed regarding in silico clinical trials MHA platform Genomic platforms/tools Bioinformatic tools
	[x] Services, please specify:	Links with databases: Genomic databases (see use-case 14) Drug databases (PharmKGB, Pubmed, DrugBank)
	[x] Models, please specify:	Physiologically-Based Pharmacokinetic/Pharmacodynamic models
	[x] Other, please specify:	Normal values of hemostatic factors in general and/or specific population

Frequency of Use:	The in silico application of virtual clinical trials can be used in every emergency case where a following treatment may influence the post-operating recovery of a patient after surgery. The development of databases and generation of data prior to the emergency situation could be more helpful regarding the faster fitting of the patient with Avatar.
Who are the users?	
Special Requirements:	Familiarity of doctors and generally of the medical staff with MHA technologies Linking of MHA data between research and medical organizations and personnel applying MHA technologies
Assumptions:	Some basic assumptions are: • Necessary drug data for the generation of the in silico clinical trials are available in the literature and easily accessed • Full and detailed patient's health history record • Platforms used for in silico clinical trials have been evaluated with clinical results from other studies (Validity of the platform) • Continuous development and simulation of clinical trials from in silico platforms in order to create databases for patient's avatar fitting
Questions:	The new era in health care towards the "stratified medicine" and personalization of treatment demands the development of approaches and tools such as MHA platform. The question that rises is how an education program could be introduced for medical society (especially staff that work in the point of service such as hospitals etc.) in order to get familiar with user-friendly platforms and tools and also stay up to date with these approaches?

Multi-scale visualization of biomedical data

Use Case ID:	UC-14		
Use Case Name:	Multi-scale visualization of biomedical data		
Use Case Owner:	FORTH	**Last Updated By:**	
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	25.07.2013	**Last Revision Date:**	
Description:	One of the key challenges for MyHealthAvatar is the interactive visualization of multi-scale biomedical data. The typical data will be a 3D+time dataset of which multiple instances at different scales will have to be displayed together. Information will be on very different spatial and temporal scales going from the molecule up to body level, in different forms (medical images, computer models, signals etc.) and of heterogeneous dimensionality (2D, 3D, 3D+t). This use case relates to the following tasks of the project: T8.1 Avatar modeling and rendering suite T8.2 Key techniques of visual analysis T8.3 A visual data analysis suite Moreover it is related to the following project objectives: “Visual representation of the avatars in multi-layer geometries and colours to support a body (anatomy) centred visualization of health status data”. This use case will be presented in the context of the clinical case of Alzheimer disease. Alzheimer is a chronic, progressive neurodegenerative disease. The following tools are used for the diagnosis, monitoring and treatment: 1. **Patient history** helps the doctor assess an individual’s past and current health situation. It also helps the doctor evaluate any medical problems, develop a plan of treatment, and monitor the patient’s health over time. This may include information about age, sex, history of current illness, past medical history, memory loss events etc. 2. **Physical examination** enables the doctor to assess the overall physical condition of the patient. The physical exam includes an examination of vital signs (temperature, blood pressure, pulse), height and weight, skin, head, eyes, ears, nose, throat/neck, chest, including lungs and heart, breasts, abdomen, bones and muscles, nerves. 3. **Laboratory tests**, including blood tests and urinalysis. Blood tests are used to look for the presence of a specific gene that has been identified as a risk factor for Alzheimer’s disease. Urinalysis tests detect abnormalities, such as improper levels of sugar or protein. 4. **Lumbar puncture/spinal tap** is a procedure in which the fluid surrounding the spinal cord is withdrawn through a needle and examined in a laboratory. This test can help your doctor diagnose disorders of the central nervous system. 5. **Computed tomography (CT)** scan creates a series of cross-sectional "slices" of the body. CT scans often can reveal certain changes that are characteristic of Alzheimer’s disease in its later stages. 6. **Magnetic resonance imaging (MRI)** is very helpful for imaging "soft tissues," such as organs. MRI is beneficial in ruling out other causes of dementia, such as tumors or strokes. It also might help to show the physical and functional changes in the brain that are associated		

	with Alzheimer's disease. 7. **Electroencephalography (EEG)** measures brain function by analyzing the electrical activity generated by the brain. This activity is measured through special electrodes applied to the scalp. It is most helpful in identifying disorders that can mimic Alzheimer's disease. 8. **Electrocardiogram (ECG or EKG)** is a recording of the heart's electrical activity, showing the heart's rate and rhythm. In addition, the following tests also might be done to help diagnose and monitor the progression of Alzheimer's disease: Neuropsychological testing, Positron emission tomography (PET) scan, Single photon emission computed tomography (SPECT) scan and Magnetic resonance spectroscopy imaging (MRSI). Considering that Alzheimer is a chronic disease, the above multi-level medical data will exhibit a strong dynamic and temporal nature. Interactive multi-scale visualization is necessary for supporting data reasoning and search. This will offer a useful input to doctors and will help them to carry out personalized healthcare. A first step target multi-scale visualization is the use of different markers on the avatar, presenting the existence and the location of available datasets on different levels, from molecule to body level.	
Actors:	End User & MyHealthAvatar platform	
Trigger:	User accesses the Avatar	
Preconditions:	1. User has to Log-in 2. Biomedical data have been imported to the platform for the specific avatar.	
Successful End condition:		
Fail End condition:		
Basic Flow:	1. Select the avatar. 2. The visual markers are presented on the avatar, indicating the available datasets on different locations of the body. 3. Mouse over a marker, a popup window with basic information for the specific dataset is presented. 4. Click on a desired marker and a navigation window is opened. The navigation window presents the complete description of the dataset and a list of all available children datasets. 5. Navigate on different levels (from body to molecule level and reverse) by clicking on the corresponding datasets icons on the navigation window.	
Alternate Flows:	1. For temporal multi-scale data, the representation is obtained by "animating" the visualization over the time. Each frame displays the value of each parameter at a given time point (e.g. predictive models). 2. For spatial multi-scale data, user can configure multiple views of the same dataset. The user can move from one scale to other by clicking on the visual markers, which show the presence of lower scale data.	
Postconditions:	-	
Dependencies:	Dependencies are related to UC 1, UC 3, UC 5, UC 7	
Required External Resources:	[x] Data, please specify:	Medical Data
	[ ] Tools, please specify:	
	[ ] Services, please specify:	

	[x] Models, please specify:	3D Models of the human body
	[ ] Other, please specify:	
Frequency of Use:	Frequently	
Who are the users?		
Special Requirements:		
Assumptions:	User friendly interface, accessible by all browsers	
Questions:		

Bidirectional linkage to ObTiMA

Use Case ID:	UC-15		
Use Case Name:	Bidirectional linkage to ObTiMA		
Use Case Owner:	USAAR	**Last Updated By:**	
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	02.08.2013	**Last Revision Date:**	
Description:	ObTiMA, an ontology-based clinical trial management system, has been developed as a proof-of-concept application to highlight the possibilities of ontology based creation and managing of clinical trials within the ACGT (Advancing Clinico-Genomic Trials on Cancer) project. ObTiMA has a modular architecture with a core basic module for data management of clinical trials. Different other modules are under development in the frames of p-medicine project. The data stored in ObTiMA are relevant for the Health Avatar to enhance the system with relevant clinical trial data. On the other hand the info stored in MHA might be of relevance for a clinical trial. As result, the bidirectional data upload from MHA to ObTiMA is needed. This Scenario / Use Case describes the bilateral linkage between ObTiMA and MHA by being focused on the Operational Data Model (ODM).		
Actors:	Patients and healthcare professionals enrolled in clinical trials		
Trigger:	Two trigger interfaces are required, one for patients with an account in ObTiMa and MHA. The second trigger interface is required for healthcare professionals with accounts in MHA and ObTiMA platforms.		
Preconditions:	The major precondition is the presence of the confirmed accounts in two platforms (MHA and ObTiMA)		
Successful End condition:	Successful data exchange		
Fail End condition:	Failed data exchange		
Basic Flow:	The basic steps are: • Access the data export/import interface • Specify data export/import from ObTiMA • Specify data export/import from MHA • Confirmation message of data/export		
Alternate Flows:			
Postconditions:	Data export/import confirmation		
Dependencies:	Presence of data export/import frameworks in two platforms (MHA and ObtiMA)		
Required External Resources:	[x] Data, please specify:	eCRF with filed in data from ObTiMA Health Avatar with clinical trial related data (i.e. laboratory results, pre-operative state, etc.)	
	[x] Tools, please specify:	ObTiMA platform	
	[ ] Services, please specify:		
	[x] Models, please specify:	The Operational Data Model (ODM) is designed to facilitate the archive and interchange of the metadata and data for clinical research, its power being fully unleashed when data are collected from multiple sources.	
	[ ] Other, please specify:		
How this use-case is going	Successful implementation of data/export functionalities with the related end		

to be validated?	user frames.
Frequency of Use:	Frequent in case of enrolment in clinical trials
Who are the users?	Healthcare professionals and Patients enrolled in clinical trials.
Special Requirements:	Export/ import interfaces in both platform according to CDISC ODM standards
Assumptions:	
Questions:	

Consultation Scenario: Interaction between the patient and physician

Use Case ID:	UC-16		
Use Case Name:	Consultation Scenario: Interaction between the patient and physician		
Use Case Owner:	USAAR	**Last Updated By:**	
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	02.08.2013	**Last Revision Date:**	
Description:	The MyHealthAvatar system can be used for direct interaction between the patient and the physician. Such an interaction might provide the following functionalities: 1. Making appointments with the physician 2. Asking questions to the physician 3. Giving advice to the patient by the physician		
Actors:	Patients and healthcare professionals		
Trigger:	The patient is accessing the MHA consultation interface and selects his/her physician from the list of MHA platform registered healthcare professionals		
Preconditions:	The patient and healthcare professionals should be with confirmed registrations in the frames of MHA platform.		
Successful End condition:	The patient is able to find and to select his/her physician from the consultation interface		
Fail End condition:	The patient is not able to find and to select his/her physician from the consultation interface		
Basic Flow:	The basic flow is: • patient finds and selects his physician from consultation interface • the option to write a message and/or invite to view his/her Avatar is given • patient specify his request with possibility to attach (or provide the access) to his/her avatar • the notification message is sent to the selected physician • the selected physician is receiving a related notification with ability to access all additional provided information (patient avatar) or with possibility to request more information • a feedback message is sent back to the patient • all sent/received messages are stored with possibility to access or delete them		
Alternate Flows:	Alternative flows could be available in case if patient is requesting any information from his/her physician by visualizing the 3D avatar. Vice-versa flow as well should be possible (healthcare professional is asking questions to his patient or is requesting the access to his avatar)		
Postconditions:			
Dependencies:	Many dependences are in place, end users should be able to: • create accounts to visualize the avatar; • access the avatar with related healthcare data; • share their data and/or avatar.		
Required External Resources:	[x] Data, please specify:	Avatar with healthcare related data	
	[] Tools, please specify:		
	[ ] Services, please specify:		
	[ ] Models, please specify:		
	[ ] Other, please specify:		
How this use-case is going to be validated?			

Frequency of Use:	Frequent
Who are the users?	Healthcare professionals and patients
Special Requirements:	Advanced end-users usability frames should be implemented
Assumptions:	
Questions:	

Patient Diary

Use Case ID:	UC-17		
Use Case Name:	Patient Diary		
Use Case Owner:	USAAR	**Last Updated By:**	
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	02.08.2013	**Last Revision Date:**	
Description:	An interface for patients writing a diary is very helpful to collect patient specific data related to their disease. This can be partly structured: e.g. body weight, heart rate, blood pressure, temperature, medicine taken, etc. It can also include structured data of scoring systems, e.g. physical and/or psychological and/or emotional status. In addition free text entry needs to be allowed.		
Actors:	MHA platform end-users (patients)		
Trigger:	.		
Preconditions:	Confirmed registration and the access to the Diary interface		
Successful End condition:	Access Diary interface		
Fail End condition:	No access to Diary interface		
Basic Flow:	The basic steps are: 1. Successful Log-In (or New account creation) by using Username or Email and Password 2. Select your Avatar 3. Click Diary section from your Avatar 4. The Diary interface is shown with ability to enter and or visualize data by date, week, month, year. 5. End User has the option to select any date or any diary entry with possibility to update it (in case of updates the update date is shown) 6. Some diary entries could be in linkage with avatar appearance. 7. End User has the option to “Edit”, “Save”, “Print” or “Share” the Diary info.		
Alternate Flows:	Alternatively flows are possible, important is to have the Diary interface accessible from any page of MHA platform.		
Postconditions:			
Dependencies:	Diary structured data or minimum data set should be specified		
Required External Resources:	[x] Data, please specify:	Diary structured data or minimum data set	
	[x] Tools, please specify:	Import tools from other patients diary systems could be required	
	[ ] Services, please specify:		
	[ ] Models, please specify:		
	[ ] Other, please specify:		
How this use-case is going to be validated?	By project partners and end-users		
Frequency of Use:	Frequently in special case of patients with chronic conditions		
Who are the users?	Patients as end-users of MHA platform		
Special Requirements:			
Assumptions:			
Questions:			

Patient Devices SDK

Use Case ID:	UC-18		
Use Case Name:	Patient Devices SDKs		
Use Case Owner:	USAAR	**Last Updated By:**	
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	02.08.2013	**Last Revision Date:**	
Description:	Today many different devices are available that collect data, e.g. blood pressure, heart rate, blood glucose levels, etc. The approach for direct storage of these data in MHA is possible by implementing an advanced Patient Devices Software Development Kit (SDK or "devkit"). A SDK will represent a set of software development tools that will allow healthcare professionals the creation of applications for MHA able to access and store data from any patient monitoring device. Patient Devices SDK may be something as simple as an application programming interface (API) in the form of some files to interface to a particular programming language or include sophisticated hardware to communicate with MHA platform. SDK may also include sample code and supporting technical notes or other supporting documentation to help clarify points from the primary reference material.		
Actors:	IT professionals		
Trigger:	IT professionals may request the access to MHA API interface		
Preconditions:	IT professionals should register and provide some basic registration information.		
Successful End condition:	IT professionals have the access to MHA API		
Fail End condition:	IT professionals do not have the access to MHA API		
Basic Flow:	No flow is available, important is to develop from the very beginning the MHA platform with related API frames/functionalities		
Alternate Flows:			
Postconditions:	With access to MHA API software developers will be able to elaborate any services and software able to connect to avatars and store patient data from any device.		
Dependencies:	The MHA platform is proposed for implementation as a web-based API layer. It could include a web application that provides an explorer type UI for the MHA platform as well as being the key middleman web based authentication. This environment (API framework) will enable all interested software developers to create a comprehensive suite of functionalities that will leverage MHA core capabilities.		
Required External Resources:	[] Data, please specify:		
	[ ] Tools, please specify:		
	[ ] Services, please specify:		
	[ ] Models, please specify:		
	[x] Other, please specify:	Java Programming Language Application Programming Interfaces (APIs)	
How this use-case is going to be validated?	By project partners (IT professionals)		
Frequency of Use:	Frequently in case of API presence		
Who are the users?	IT professionals and (indirectly) all MHA end-users		
Special Requirements:			

Assumptions:	
Questions:	

Search for Similar Patients

Use Case ID:	UC-19		
Use Case Name:	Search for Similar Patients		
Use Case Owner:	USAAR	**Last Updated By:**	
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	02.08.2013	**Last Revision Date:**	
Description:	This Scenario / Use Case describes the search framework from end-users' perspective and it is focused on listing all MHA registered end-users with ability to apply advanced search filters: • Age • Gender • Votes (Likes) • Treatment • Symptom • Interests • Country • City • etc. It is important to mention that every end-user should confirm the possibility to visualize his/her profile publically or privately. Only public profiles should be visible in search results. Additionally, the search function is suggested to be accessible only for end-users with public profiles. For an example of advanced search filters, please visit http://www.patientslikeme.com/patients		
Actors:	Patients and other end-users of MHA platform		
Trigger:	User search for patients (other end users).		
Preconditions:	Confirmed MHA end-user profile should be in place (preferably) with confirmation to visualize his/her profile publically. The minimum suggested search filters are: • Age • Gender • Votes (Likes) • Treatment • Symptom • Interests • Country • City		
Successful End condition:	Similar patients are found		
Fail End condition:	No similar patients are found		
Basic Flow:	No flow is available, important is to develop from the very beginning the MHA platform with related API frames/functionalities		
Alternate Flows:			
Postconditions:	none		
Dependencies:	UC-2		
Required External Resources:	[x] Data, please specify:	End user generated data.	
	[x] Tools, please specify:	Advanced semantic search	

		interfaces.
	[ ] Services, please specify:	
	[ ] Models, please specify:	
	[ ] Other, please specify:	
How this use-case is going to be validated?		
Frequency of Use:	Frequently	
Who are the users?	All MHA platform end-users	
Special Requirements:	Presence of end-user generated data.	
Assumptions:		
Questions:		

Knowledge Discovery

Use Case ID:	UC-20		
Use Case Name:	Knowledge Discovery		
Use Case Owner:	USAAR	**Last Updated By:**	
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	02.08.2013	**Last Revision Date:**	
Description:	Patients are interested in the most recent and personalized information about their disease, treatment and prognosis. MHA platform could contain a ontology-based Knowledge Discovery (KD) module able to connects highly heterogeneous data and textual information. The semantic framework could be based on gene, tissue, disease and compound ontologies (important for drugs and clinical research frames). This framework could contain information from different organisms, platforms, data types and research areas that is integrated into and correlated within a single searchable environment using search algorithms. It could provide a unified interface for all MHA users to formulate, explore and identify new information (according to specific preferences and needs) across vast collections of available experimental and research data. KD module could combine classical keyword-based search with text-mining and ontologies to navigate large results sets (internal & external) and facilitate information and/or knowledge discovery. End users could be provided with an advanced ontology based (Gene Ontology (GO) and Medical Subject Headings (MeSH)) 'Table of Contents' in order to access, explore, structure (quickly) the millions of available resources (PubMed abstracts, news, clinical trials info) according to the predefined topics of interest (Allergy, Cancer, etc.). Some related examples are presented below: • GoPubMed, http://www.gopubmed.com • NextBio, http://www.nextbio.com • ResearchGate, http://www.researchgate.net		
Actors:	All MHA platform's end users		
Trigger:	Click on search button and/or ontology based (taxonomy) 'Table of Content'		
Preconditions:	End user has to have a confirmed MHA profile MHA platform has to have the access to external and/or local databases with publically available data (PubMed, Clinical Trials, News, etc.)		
Successful End condition:	Personalized search results are displayed with possibility to refine them according available taxonomies.		
Fail End condition:	No search results or no available information		
Basic Flow:	The basic steps are related to end user interactions with search button, search text fields and search results.		
Alternate Flows:	Alternative flows could be available in case of clicks to 3D Avatar body and the presentation of the available search results.		
Postconditions:	Search results could be saved		
Dependencies:	This use case extends all ontology related Scenarios / Use Cases		
Required External Resources:	[x] Data, please specify:	PubMed Repository, Clinical Trials information, news articles, etc.	
	[x] Tools, please specify:	Text mining tools; Apache Lucene(TM) is a high-performance, full-featured text search engine; GATE - a full-lifecycle open source	

		solution for text processing
	[x] Services, please specify:	OpenCalais Web Service will allow to automatically annotate the content with rich semantic metadata
	[x] Models, please specify:	Semantic data model
	[x] Other, please specify:	Advanced ontologies and taxonomies (i.e. Gene Ontology (GO), Medical Subject Headings (MeSH))
How this use-case is going to be validated?	Test of the Implemented search interfaces (KD module)	
Frequency of Use:	Frequent	
Who are the users?	All MHA platform's end users	
Special Requirements:	Needs for proprietary search algorithms and the contribution of high skilled and experienced semantic and/or data mining experts would be required.	
Assumptions:	Term extraction experience from external data (PubMed abstracts, Clinical Trial, News articles) and semantic benchmarking with GO and MeSH would be required.	
Questions:		

Building patient community among users

Use Case ID:	UC-21		
Use Case Name:	Building patient community among users		
Use Case Owner:	BED	**Last Updated By:**	
Technical Collaborators:	FORTH, ICCS, LIN, ANS	**Clinical Collaborator:**	USAAR
Date Created:	14.08.2013	**Last Revision Date:**	
Description:	The avatar system offers an ideal platform for interaction and communications among patients. They will be able to: • Find patients with similar condition, symptom and treatments • Find out symptoms and treatment for their conditions by looking at other fellow patients • Find out possible conditions for their symptoms by looking at other fellow patients • Find out possible treatments for their conditions by looking at other fellow patients		
Actors:	Patients		
Trigger:			
Preconditions:	Users need to have their avatar accounts		
Successful End condition			
Fail End condition			
Basic Flow:	Upon successful Log-In (or New account creation) by using Username and Password, users will be able to carry out search among all the users of the avatar system for the following purposes: • Search for patients with specific conditions, symptoms and treatments • Find out symptoms and treatments for specific conditions • Find out conditions from specific symptoms. • Search for treatments for specific conditions		
Alternate Flows:			
Postconditions:			
Dependencies:	Users need to have their user account in the avatar system		
Required External Resources:	[ ] Data, please specify:		
	[x] Tools, please specify:	Web service tools (in Java)	
	[x] Services, please specify:	Citizens who will use the avatar system for communication with other fellow patients.	
	[ ] Models, please specify:		
	[ ] Other, please specify:		
How this use-case is going to be validated?	Usability test from users		
Frequency of Use:	Frequently		
Who are the users?	Citizens		
Special Requirements:			
Assumptions:			
Questions:			

Avatar Data Browse

Use Case ID:	UC-22		
Use Case Name:	Avatar Data Browse		
Use Case Owner:	BED	**Last Updated By:**	
Technical Collaborators:	FORTH, ICCS, LIN, ANS	**Clinical Collaborator:**	USAAR
Date Created:	14.08.2013	**Last Revision Date:**	
Description:	Upon log in to their own account, users will be able to browse their own data, including all the personal health status data collected through the avatar system, plus medical records and clinical data from the hospitals The avatar system will need to offer tools that support effective data query and search, such as filtering. The 4D avatar will play an important role in presenting the data. Users will be able to select individual parts of the avatar body to view the data associated to the selected parts. Different colours or textures will be assigned to individual parts of the 4D avatar to represent their health status. For example, if the heart has a serious problem it will be highlighted using a unique colour or texture		
Actors:	Citizens		
Trigger:			
Preconditions:	Users will need to sign up to the system, accept all the legal terms, and log onto the system, personal data (health, lifestyle, lab, clinical trial data etc.) should already be available on the MHA platform or user should be able to extract it from PHR or EHR etc..		
Successful End condition	A smooth browse of all data		
Fail End condition	Users fail to retrieve data they need		
Basic Flow:	The basic steps are: 8. Successful Log-In (or New account creation) by using Username and Password 9. Use user interface (menus, dialog boxes etc). to see data 10. Allow to use filters for data filtering 11. View health status through the colours/textures of the 4D avatar 12. Click on individual parts of the avatar to view relevant data		
Alternate Flows:			
Postconditions:	Browsing data is a fundamental step that allows users to perform operations that require data information		
Dependencies:	Browsing data is a fundamental step that allows users to perform operations that require data information		
Required External Resources:	[x] Data, please specify:	Synthetic data and other publicly available data from the web	
	[x] Tools, please specify:	Web service tools (Java)	
	[ ] Services, please specify:		
	[ ] Models, please specify:		
	[ ] Other, please specify:		
How this use-case is going to be validated?	The feedback from the public (citizens)		
Frequency of Use:	Frequently		
Who are the users?	Citizens		
Special Requirements:			
Assumptions:			
Questions:			

Avatar Data Collection

Use Case ID:	UC-23		
Use Case Name:	Avatar Data Collection		
Use Case Owner:	BED	**Last Updated By:**	
Technical Collaborators:	FORTH, ICCS, LIN, ANS	**Clinical Collaborator:**	USAAR
Date Created:	14.08.2013	**Last Revision Date:**	
Description:	This case explores various ways for the data collection in the avatar to monitor users' health-status, lifestyle and wellness. These include: • Web interface for data entry • Sensors (e.g. blood pressure, heart rate, locations) • Mobile apps • Eletronic cards from daily life (e.g. shopping cards, gym cards, credit cards) • Computer social network (e.g. Twitter, facebook, Internet forums) For example, users uses a glucose meter and MyHealthAvatar platform to monitor his/her blood sugar levels. The data is saved that maintains the Avatar's long-term history and looks for possible abnormal events. If the saved data is unusual, or the End-User skips a test, the MyHealthAvatar platform automatically generates an alert message Mobile apps will be used to monitor the health status of the users (e.g. mood, feeling). We will also explore the possibility to extract health related information from electronic cards (e.g. purchase of food and drink, daily exercises in gyms), as well as from social network.		
Actors:	Citizens		
Trigger:			
Preconditions:	Users need to have their avatar accounts		
Successful End condition:	Data collection without much effort from users		
Fail End condition:	Data collection that needs a lot effort from users		
Basic Flow:	The basic steps are: For manual data entry: • Successful Log-In (or New account creation) by using Username and Password • Enter data from the text boxes For automatic data collection • The users will need to register their avatar accounts with their mobiles, social network account, electronic cards. • Users should be able to switch on/off the automatic data collection • The data will go into the avatar automatically		
Alternate Flows:			
Postconditions:	The data will be key to all the activities in the avatar system		
Dependencies:	Users need to have their user account in the avatar system		
Required External Resources:	[ ] Data, please specify:		
	[x] Tools, please specify:	Information extraction toolkits (Apache, Gate, etc.), mobile apps (Android), Twitter and Facebook APIs	
	[x] Services, please specify:	Citizens will use these data collection tools to automatically	

		collect data in their avatars.
	[ ] Models, please specify:	
	[ ] Other, please specify:	
How this use-case is going to be validated?	These will be validated from the users of the avatar system	
Frequency of Use:	Frequently	
Who are the users?	Citizens	
Special Requirements:		
Assumptions:		
Questions:		

Knowledge Avatar

Use Case ID:	UC-24		
Use Case Name:	Knowledge Avatar		
Use Case Owner:	BED	**Last Updated By:**	
Technical Collaborators:	FORTH, ICCS, LIN, ANS	**Clinical Collaborator:**	USAAR
Date Created:	14.08.2013	**Last Revision Date:**	
Description:	The avatar will be used as a means for presenting general medical knowledge to the citizen users. Users will be able to select individual parts and see related medical information such as anatomy. The information may also include medicine and food.		
Actors:	Citizens		
Trigger:			
Preconditions:	Users will need to sign up to the system, accept all the legal terms, and log onto the system		
Successful End condition	Users get information they need		
Fail End condition	Users fail to get information they need		
Basic Flow:	The basic steps are: 1. Successful Log-In (or New account creation) by using Username and Password 2. Click on individual parts of the avatar to view associated medical information, including anatomical functions, relevant medicine/food.		
Alternate Flows:			
Postconditions:			
Dependencies:	Users need to have their user account		
Required External Resources:	[x] Data, please specify:	Medical and health knowledge available from the Web.	
	[x] Tools, please specify:	Web service tools (in Java)	
	[x] Services, please specify:	For citizens to get general health and medical knowledge	
	[ ] Models, please specify:		
	[ ] Other, please specify:		
How this use-case is going to be validated?	The feedback from the public (citizens)		
Frequency of Use:	Frequently		
Who are the users?	Citizens		
Special Requirements:			
Assumptions:			
Questions:			

Web Login

Use Case ID:	UC-25		
Use Case Name:	Web Login		
Use Case Owner:	BED	**Last Updated By:**	
Technical Collaborators:	FORTH, ICCS, LIN, ANS	**Clinical Collaborator:**	USAAR
Date Created:	14.08.2013	**Last Revision Date:**	
Description:	Users (citizens) will be able to log onto the system using their username and password. New users will be able to sign up to the system by creating basic personal information including security questions. Informed consent and privacy: Users will need to accept the privacy policy and the "terms and conditions" of using the MyHealthAvatar platform. Upon log into the system, users will be able to enter, browse their data, explore medical information, communicate with other fellow patients. Users will be able to view and interact with an avatar - a 3D representation of the human body. It will allow the End User to click with the computer mouse on a particular part of the avatar "body" to trigger a search of medical records to retrieve relevant information.		
Actors:	Citizens and patients		
Trigger:			
Preconditions:			
Successful End condition	Successful log in		
Fail End condition	Fail to log in or register		
Basic Flow:	The basic steps are: 1. After press a sign up button, new users will provide basic information (user name, age, gender etc.) and some security questions. They will also have to accept the privacy policy and the "terms and conditions" of using the MyHealthAvatar platform. 2. Upon log in, users will be able to see the system menu, a visual avatar (presented in 4D form). 3. Users will be able to perform operations described in all the other use cases.		
Alternate Flows:			
Postconditions:	Users will be able to perform all the operations described in all the other use cases		
Dependencies:	This will be the basic step for all the operations described in all the other use cases		
Required External Resources:	[ ] Data, please specify:		
	[x] Tools, please specify:	Web service tools (in Java)	
	[ ] Services, please specify:		
	[ ] Models, please specify:		
	[ ] Other, please specify:		
How this use-case is going to be validated?	The feedback from the public (citizens)		
Frequency of Use:	Frequently		
Who are the users?	Citizens		
Special Requirements:			
Assumptions:			
Questions:			

Brain Trauma

Use Case ID:	UC-26		
Use Case Name:	Brain Trauma		
Use Case Owner:	BED	**Last Updated By:**	
Technical Collaborators:	LIN	**Clinical Collaborator:**	BED
Date Created:	20.08.2013	**Last Revision Date:**	
Description:	A pre-injury clinical profile of patient is a critical aide that can help the clinicians by providing a better insight and possibly improve the clinical outcomes. Individualized treatment and targeted therapies based on patients' data are imperative both from the patients' perspective and also from the clinicians point of view and can ensure more promising outcomes and better disease prediction and prevention. A clinical phenotype of the patient has to be developed based on pre-injury characteristics. The clinical and neurological findings can be combined with image features from CT scans to develop a prognostic model for traumatic brain injuries (TBI).Related studies show that prognosis after TBI is strongly correlated to the medical history of the patient and characteristics like age, alcoholism, drugs, cardiac problems, liver dysfunction, diabetes and renal impairment can affect the treatment regimen and morbidity and mortality. The data repository available within MyHealthAvatar can allow researchers develop mathematical and computational models based on gender, race, ethnicity categories, age, lifestyle, education and medical data and this can significantly contribute to innovative healthcare practices.		
Actors:	Doctors and patients .		
Trigger:	Prognosis is needed for head injury patients		
Preconditions:	The availability of demographic data, clinical phenotypes and image phenotypes		
Successful End condition:			
Fail End condition:			
Basic Flow:	The basic steps include: 5. The patient share their avatar data with the doctors 6. The doctor accesses the demographical data of the patient 7. The doctor accesses the clinical and image data of the patient from the hospital system (e.g. PACS) 8. The doctor assesses the patient using a prognosis model		
Alternate Flows:			
Postconditions:	A treatment plan is drawn		
Dependencies:	The patients are registered to the avatar system and their medical history and other characteristics data are available in their avatars.		
Required External Resources:	[x] Data, please specify:	Related studies on patient cohorts, such as CRASH	
	[x] Tools, please specify:	Prognosis models and data mining tools	
	[x] Services, please specify:	Provide prognosis for head injury patients	
	[ ] Models, please specify: Prognosis models		
	[ ] Other, please specify:		

How this use-case is going to be validated?	By experts with clinical background in BED
Frequency of Use:	When a prognosis is needed for head injury patients
Who are the users?	Doctors and patients
Special Requirements:	
Assumptions:	
Questions:	

Personalised CHF Risk Analysis

Use Case ID:	UC-27		
Use Case Name:	Building personalized CHF related risk profiles and "real-time monitoring" services		
Use Case Owner:	FORTH	**Last Updated By:**	Vangelis Sakkalis
Technical Collaborators:	TBD	**Clinical Collaborator:**	USAAR
Date Created:	28/06/2013	**Last Revision Date:**	31/07/2013
Description:	A major challenge related to caring for patients with chronic conditions is the early detection of exacerbations of the disease that may be of great significance. The dedicated clinical personnel should be contacted immediately and possibly intervene in time before an acute state is reached, by changing medication, or any other interventions, in order to ensure patient safety. There is a need to support real-time remote monitoring of patients diagnosed with congestive heart failure and MHA, enhanced with semantic technologies, may host personalized, accurate and up-to-date clinical information. In order to tailor the proposed system to the patient's profile and assist physicians in selecting people who are predisposed by coronary disease, hypertension, or valvular heart disease; we build a CHF related risk profile based on a risk appraisal function that is based on the Framingham Heart Study (486 heart failure cases during 38 years of follow-up). The predictors used are based on Age, Coronary heart disease and Valve disease status provided by the patient Electronic Health Record (EHR), as well as on HR, on blood pressure and on Body Mass Index (BMI) provided by the pulse - oximeter, the blood pressure monitor and the weight scale respectively. The calculated risk probability may be used to alter the default threshold values (higher risk probability adds more constraint on the physiological patterns).		
Actors:	Avatar1(Doctor),Avatar2 (patient)		
Trigger:	Upload of patient's physiological and imaging data and past diagnosis in patient's electronic health record or during creation of patient's Avatar in MHA platform. Alternative the use case can be triggered after the condition is diagnosed by patient physical examination and confirmed with echocardiography.		
Preconditions:	Heart failure is caused by any condition, which reduces the efficiency of the myocardium, or heart muscle, through damage or overloading. As such, it can be caused by a diverse array of conditions, including myocardial infarction (in which the heart muscle is starved of oxygen and dies), hypertension (which increases the force of contraction needed to pump blood) and amyloidosis (in which protein is deposited in the heart muscle, causing it to stiffen).		
Successful End condition:			
Fail End condition:			
Basic Flow:	Basic steps: 1. Gathering all the necessary patient data (as described in Dependencies). 2. Creating of MyHealthAvatar profile for this patient 3. Real-time patient data updates (if possible) and processing to detect possible deviations from normal values. 4. Alarm Doctor for possible intervention		
Alternate Flows:	Alternative flows will be followed if patient data are not provided in full.		
Postconditions:	Remote monitoring of patient health status after diagnosis. Risk assesment and update data in MHA.		
Dependencies:	To achieve such functionality the following device and technologies should be available:		

	• Wireless or wearable medical devices and sensors acquiring patient's vital signs. In our reference implementation the supported measurements are: Blood Pressure5 (BP), SpO2 , Heart Rate (HR), body weight and 12-lead ECG monitoring. • Monitoring application recording the aforementioned bio signals and hosting risk assessment algorithms to enable the alerting process. A full description of this application as applied in a clinical environment is described in. • Ontology-driven application intelligence capable of reasoning on the patient data.	
Required External Resources:	[x] Data, please specify:	Patient Electronic Health Record (EHR) • Age • Coronary heart disease • Valve disease status Pulse oximeter • HR Blood pressure monitor • Blood pressure Weight scale • Body Mass Index (BMI)
	[x] Tools, please specify:	Server PC hosting the risk assessment algorithm. Smartphone if remote monitoring is to be used. MHA platform
	[x] Services, please specify:	Links with EHR and PACS
	[x] Models, please specify:	Risk Assessment model
	[x] Other, please specify:	Normal values are provided in general and/or specific population
How this use-case is going to be validated?		
Frequency of Use:	The proposed application can be used even in real time or selected time intervals, depending on the patient's initial diagnosis.	
Who are the users?		
Special Requirements:	Familiarity of doctors and generally of the medical staff with MHA technologies Linking of MHA data between research and medical organizations and personnel applying MHA technologies	
Assumptions:	Some basic assumptions are: • Necessary physiological and clinical data to run the model. • Full and detailed patient's health history record. • Monitoring Devices/ Sensors, if available.	
Questions:		

Diabetes

Use Case ID:	UC-28		
Use Case Name:	Diabetes		
Use Case Owner:	BED	**Last Updated By:**	
Technical Collaborators:	BED	**Clinical Collaborator:**	BED (doctor), LIN (GP)
Date Created:		**Last Revision Date:**	
Description:	Diabetes is the world's fastest growing disease with substantial costs at individual and social economic level. Healthcare professionals ask patients with diabetes to carry out many self-care behaviours. These include dietary change, exercise, regular self-medication, insulin injection, self-monitoring of blood glucose, insulin dose adjustment, regular attendance at clinic and for screening programmes. Self-management means that people can take a more active role in decisions about their own treatment and about healthy lifestyle. It is a shared responsibility between individuals and service provider and the service providers recognise the individual's role in managing their health and well-being. Evidence suggests that assisting people in self-manage can result in significant gains in health status, increased symptom control, reduced use of general practitioners and reduced admissions to hospital. However, expected good behaviours of patients are often not achieved in practice, despite their value being well understood so far. The avatar system will support the storage the behaviours and daily activities of patients. The platform will function as a supportive environment from healthcare providers to the patients by means of offering advice, assistance and assessments; and by means of allowing for health promotion.		
Actors:	Doctors and patients		
Trigger:			
Preconditions:			
Successful End condition			
Fail End condition	-		
Basic Flow:	The disease management through the avatar system will include: • **Patient Diary:** Storage and management of the health status of the patients and their behaviours. This will rely on techniques of self-lifelogging, which will monitor a wide range of daily activities and behaviours of the patients, including their locations, movements, diet, quality of life, environment, mood, blood pressure, glucose, alcohol, smoking, and other symptoms, etc. Visual analytics will be used to display individual/aggregated data items to allow easy interpretation of the data from the patients. With the search bar of the system, the users can easily send queries about their activities, movements, diet, etc.. • **Intervention:** allowing for multi-modal intervention of lifestyle in a shared decision manner between the doctor and patients. The doctors will be able to demonstrate to the patients the relations between the outcome of the treatment and the behaviour. "Behaviour prescription" will be issued by the doctors, which is expected to include a set of targets in terms of daily activities, calorie intake and energy consumption, etc. • **Monitoring:** allowing for the progress review of the patients by comparing the patient diary with the behaviour prescription as		

	mentioned above. • **Warning:** The avatar system will send reminding messages at various priorities in one of the following occasions: medication reminder, due hospital visit (for screening etc.), sign of change of conditions, early sign of one of the diabetic complications. • **Education:** The avatar system will allow patient education on the knowledge of the diseases. It will also test the knowledge of the patients. It is expected that a good knowledge of the disease will lead to enhanced patient behaviours. • **Complication:** The avatar system will be connected to the hospital system to allow for a full access of patients' clinical records and history, which will facilitate the management of complications from other possible conditions. • **GPs:** The avatar system will be shared with GPs to allow coordinated care from the GPs of the patients.	
Alternate Flows:	-	
Postconditions:	-	
Dependencies:	-	
Required External Resources:	[x] Data, please specify:	Patients' data from MyHealthAvatar, including daily activities, exercises, diet, mood, etc.
	[x] Tools, please specify:	Visual analytics tools for data visualization & analysis Statistical tools for computing standard indexes & charts (e.g. BMI, SAD)
	[ ] Services, please specify:	
	[x] Models, please specify:	Statistical tools for computing standard indexes & charts(e.g. BMI, SAD)
	[ ] Other, please specify:	
How this use-case is going to be validated?		
Frequency of Use:		
Who are the users?		
Special Requirements:		
Assumptions:		
Questions:		

Appendix 3 – MyHealthAvatar Global Meeting Agenda

Wohlfühlhotel „Rabenhorst“, Am Rabenhorst 1, 66424, Homburg, Germany.

18-19th September, 2014

18th Sept 2014			
	Agenda	**Descriptions**	**Facilitator**
9:00 – 9:30	Welcome/Coffee		
9:30 – 10:00	Introduction	Update of the progress of the project development with the possibility of a demo	BED
10:00 – 10:45	CHF	The implementation details of the CHF case	FORTH
10:45 – 11:30	Osteoarthritis/Genome	The implementation details of the OA case	FORTH
11:30 – 12:15	Nephroblastoma/OBTIMA	The implementation details of the Nephroblastoma/OBTIMA case	USAAR/ICCS
12:15 – 13:00	Diabetes/Geonome	The implementation details of the diabetic case with a possible link with genome	BED/FORTH
13:00 – 14:00	Lunch		
14:00 – 14:30	Emergence access	This describes the scenario of emergence data access	BED
14:30 – 14:45	Anti-Platelet	The implementation details of the anti-platelet case	FORTH
14:45 – 15:00	Brain trauma	The implementation details of the brain trauma case	BED
15:00 – 15:30	Discussion & Summary of the use cases		
15:30 – 16:15	WP6: Data repository	The latest progress in WP6	BED
16:15 – 16:30	Coffee break		
16:30 – 17:15	WP5: Model repository	The latest progress in WP5	ICCS
17:15 – 18:00	WP4: Semantics	The latest progress in WP4	FORTH
18:00 – 19:00	WP3: Architecture	The latest progress in WP3	TEI/FORTH

19:00	**End of Day 1**
20:00 Joint Dinner	

19th Sept, 2014			
	Agenda	**Descriptions**	**Facilitator**
9:00 – 9:30	WP8: Visualization	The latest progress in WP8	BED
9:30 – 12:00	Discussions on the Architecture & Integration		
12:00 – 13:00	WP11: Legal	The latest progress in WP11	LUH
13:00 – 14:00	Lunch		
14:00 – 14:30	WP10: Dissemination	The latest progress in WP10 in dissemination	ICCS
14:30 – 15:30	WP10: Exploitation	The latest progress in exploitation and business	Larkbio
15:30 – 16:00	H2020 Opportunities		
16:00 – 16:30	Other business and conclusion		
16:30	**End of Day 2**		