727521 – EVOTION

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EVOTION Architecture and Detailed Design

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List of Abbreviations

ATC	ATHENS TECHNOLOGY CENTER SA
BDA	BIG DATA ANALYTICS
CITY	CITY, UNIVERSITY OF LONDON
DOA	DESCRIPTION OF ACTION
DSS	DECISION SUPPORT SYSTEM
EMP	EMPELOR GMBH
HA	HEARING AID
HL	HEARING LOSS
ICCS	INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS
IPH	CROATIAN NATIONAL INSTITUTE OF PUBLIC HEALTH
OTC	OTICON A/S
PHPDM	PUBLIC HEALTH POLICY DECISION MAKING
PRA	PAZARDZHIK DISTRICT ADMINISTRATION
TLS	TRANSPORT LAYER SECURITY
UNIMI	UNIVERSITA DEGLI STUDI DI MILANO

1. Introduction

1.1 Overview

The primary goal of EVOTION project is to develop an integrated platform (referred to as the "EVOTION platform" in the rest of this deliverable) supporting evidence based public health policy making related to the management of hearing loss (HL). The platform is to support the acquisition, management and processing of patient medical, physiological, behavioural, hearing aid usage and cognitive activity data to support decision making.

To acquire the data that it is meant to process, the EVOTION platform will interact with external devices and systems. These include hearing aids, biosensors, mobile phones, as well as medical system and devices which are used in current clinical practice to support patient testing for the purposes of hearing aid fitting and the process of hearing aid fitting itself.

The EVOTION platform will also incorporate capabilities for big data analytics (e.g., data mining algorithms and statistical analysis, parallel data processing), decision making and simulation to aid the analysis of the data that it will collect and produce evidence that can aid public health policy making. The processes underpinning data analytics and policy making will be model driven. To enable this vision, the EVOTION platform will also incorporate health policy decision making model specification and execution capabilities.

The EVOTION architecture is structured by five layers which are Visualization Layer, PHPD Modelling Layer, Data Ingestion and Execution Layer, Data Acquisition Layer and Security Layer. A detailed explanation is provided in the next section.

1.2 Purpose and scope of deliverable

The purpose of this deliverable is to define the architecture of the EVOTION platform. This is necessary in order to

- identify with more precision the functional capabilities and the quality and security constraints that will need to be realised by the EVOTION platform
- allocate responsibility for the realisation of these capabilities and constraints to specific components within the platform
- specify the exact services (aka interfaces) that each of these components will offer
- specify dependencies between components, which arise from the realisation and usage of component interfaces
- specify structural relations between components
- define how the components of the platform are expected to interact with each other
- establish major implementation decisions, e.g. control flow, access control, data storage
- eventually integrating and testing the components as part of the platform.

To fulfil these purposes, this deliverable specifies

- the key components of the EVOTION platform and the overall architecture that structures them into a coherent system
- the main functional capabilities that the components should realise and the programming interfaces through which these capabilities will be accessible to other components
- the functional, quality and security requirements that are addressed by the different components, and
- the envisaged interactions of the components in order to realise the use cases specified for the EVOTION platform (see deliverable D2.1 [1])

1.3 Methodological approach

The key inputs that were taken into account in producing this deliverable were: (a) the description of key components of the EVOTION platform in the Description of Action (DOA) of the EVOTION project and (b) the requirements and use cases (scenarios) for the EVOTION platform specified in the deliverable D2.1 [1].

The deliverable has been produced by adopting an iterative development approach. In this approach, the partners responsible for key components of the EVOTION platform took responsibility for the development of the specification of their interfaces and the identification of the requirements which the component should contribute to the realisation of. The overall architecture of the platform was specified in a series of weekly teleconferences and a physical meeting that considered in detail dependencies between components and the ways in which they could be addressed through the definition of proper component structures and interactions.

The architecture of the platform has been specified using the Unified Modelling Language [2]. Two types of UML models have been used for this purpose: (a) an architecture level component diagram and (b) component interaction diagrams.

Special attention was given to the design of the security and privacy mechanisms of the EVOTION platform. To ensure that security and privacy would be taken under consideration as part of the design process, we followed an established approach in the industry. This approach was based on the Common Criteria framework [3] for specifying security features, requirements and capabilities of systems in a manner than can enable a systematic assessment of their effectiveness and ultimately providing system security certification and security assurance.

It should be noted that although we have tried to provide a comprehensive specification of the EVOTION platform architecture, it is inevitable that the architecture presented in this deliverable will be subject to changes during the implementation of the EVOTION platform, when the full extent of constraints around the interaction of components and the use of the envisaged development mechanisms (e.g., third party components etc.) will emerge. Our expectation is that deviations from the architecture as specified in this document will be minimal. Should such deviations arise, however, we commit to document them as part of an updated specification of the architecture in forthcoming project deliverables, namely the deliverables D5.1 and D5.2 which will document the implementation of the integrated version of the EVOTION platform. Hence, eventually the prospective users of the EVOTION platform will get an architectural specification of the platform that is fully aligned with its implementation.

1.4 Structure of deliverable

This deliverable is organized as follows:

Section 1 (“Introduction”) provides an introduction to the overview of this documentation.

Section 2 (“Overall Architecture”) includes architecture overview and components descriptions of the project.

Section 3 (“EVOTION Platform Components specifications”) shows the detailed descriptions of the components and the interfaces of each component.

Section 4 (“Interaction Specifications”) shows the interaction diagrams of the entire system processes.

Section 5 (“Platform Security”) illustrates the security requirements, objectives and components. The interfaces of security components are provided as well to explain the relationship between each security component.

Section 6 (“Deployment Infrastructure”) illustrates the tools and equipment which are required in the development of the EVOTION project.

Section 7 (“Concluding Remarks”) provides concluding remarks.

Section 8 (“References”) lists all references that are used in this document.

2. Overall Architecture

2.1 Overview

The overall architecture of the EVOTION Platform is presented in a multi-tier view for the sake of simplicity and readability. The functional relation between components is presented as diagram where each component offers some API interfaces to be used by other components for realizing the interaction with it. In the following, we present the architecture component diagram and describe each interaction interfaces exposed.

2.2 Architecture diagram

Figure *1* shows the diagram of the EVOTION architecture. We note that these components are abstract entities grouping functionalities of interest for the architecture, while their implementation will be specified later on each component specific deliverable when released.

Conceptually, the architecture is structured in logical layers, four of them grouping components with homogeneous feature and one vertical layer - the *Security* layer - meant to be integrated and distributed over most actual components.

The logical layers grouping the components are: *Data Acquisition*, *Data Ingestion and Execution*, *PHPDM Modelling*, and *Visualization*. In Data Acquisition layer, all components in charge of gathering runtime data for the EVOTION platform are grouped. These ones represent data collected from the HA devices, the wearable sensors, the mobile app, and social campaigns. Data collected by these components feed the Data ingestion and Execution layer, where they are first stored, then used for logical operations. Operations on data could be either based on analytics (e.g., queries, statistical analyses, machine learning, etc.) or driven by documents supporting decisions, in both cases they are informed by an ontology-oriented representation of policy models. This last aspect lead us to the PHPDM Modelling layer, which groups components dealing with model instances representing how a user is allowed to interact with the EVOTION platform. Instances of policy models are defined with respect to semantic representations of pre-defined policy models and should command the execution of operations on data (e.g., analytics). In this respect, the PHPDM Modelling layer logically act as the middleware between EVOTION data, analytics, and decision procedures, and the users, which interact with the Visualization layer. The Visualization layer provides the frontend to the EVOTION platform, offer the results of operations, and drives social campaigns. Finally, the Security layer is showed as a vertical logical layer with no specific interfaces and a unique generic Security manager. This representation means that security properties are spread on several functional components, possibly coordinated through global policies. Specific security-oriented components will be adopted at network or physical levels, as well as component configurations, activity monitoring, and technology solutions will be adopted and described in following deliverables.

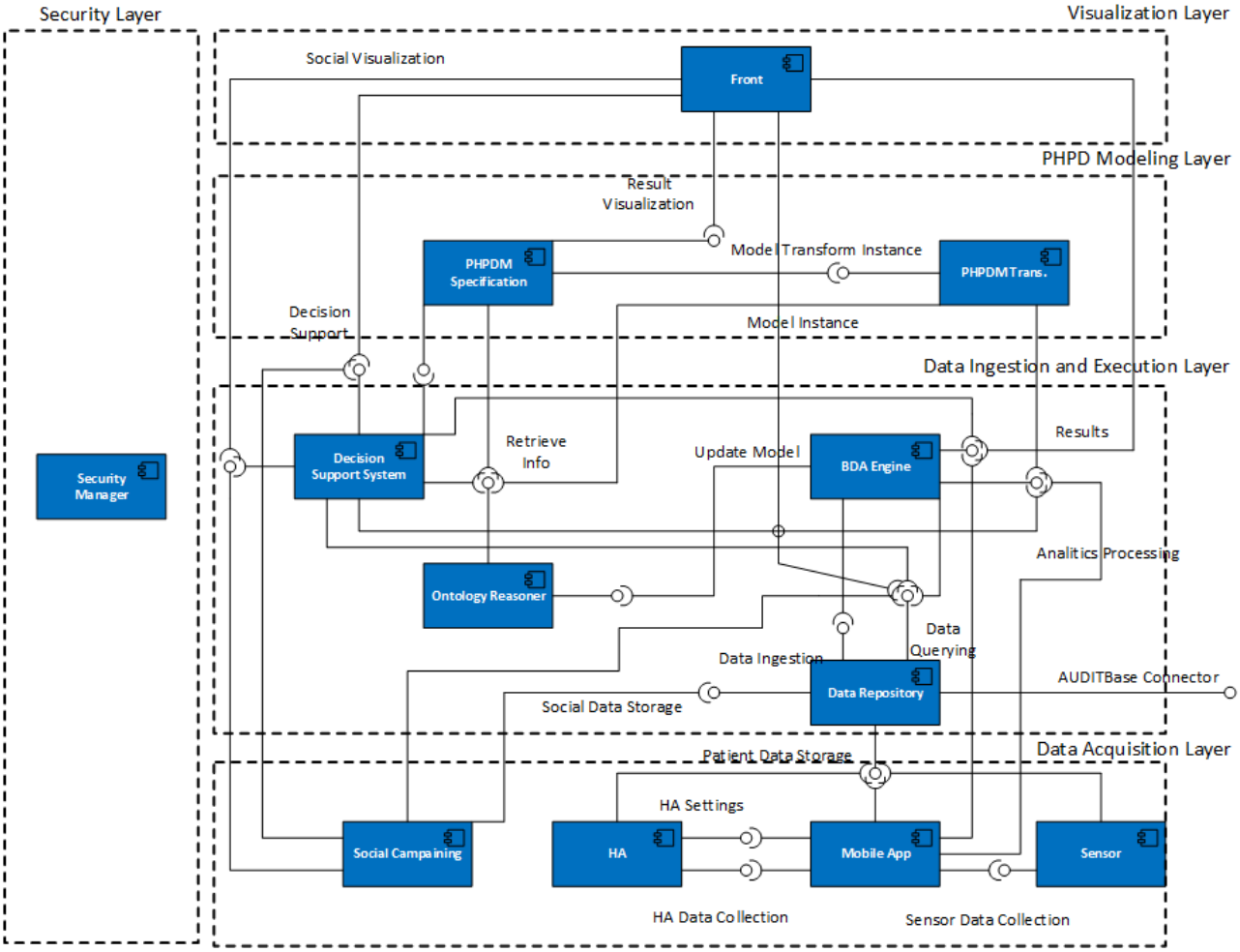

Figure 1 the architecture overview of the EVOTION platform

The architecture is structured in four layers:

- *Data Acquisition Layer*: It is responsible to collect data needed for the EVOTION platform. It includes the following components: i) HA that sends data runtime to Mobile App or offline to the EVOTION platform and receives configuration setting from the Mobile App; ii) Sensor that sends data runtime to Mobile App or offline to the EVOTION platform; iii) Mobile App that is responsible to feed data collected from the HAs and sensors to the EVOTION platform, as well as to send any other data retrieved from the usage of the Mobile App (e.g., auditory test results) and to ask for an analytic computation; and iv) Social Campaigning component, responsible to store feedbacks of social campaigning actions as well as providing source of information for visualization and for the Decision Support System.
- *Data Ingestion and Execution Layer:* it is responsible to i) ingest data from Data Acquisition Layer and from external repositories if needed, and ii) process data when required. The processing is mainly mediated by the EVOTION Modelling layer so that all the processing activities are expressed in terms of models and using EVOTION language. The two principal actors of the data processing are: (i) the Decision Support System aimed at document based processing; and (ii) the BigData Engine aimed at model based processing. This layer includes the following components: i) the Data Repository that is responsible to ingest data from the AUDITBase repository as well as from the *Data Acquisition Layer* and to allow querying and ingestion when required to compute query and analytics tasks; ii) BDA Engine that is responsible for the processing of data, offering

processing feedback to the Ontology Reasoner component for modelling improvements as well as to the Front component for visualization and to Mobile App for feedback; iii) Ontology Reasoner responsible to manage EVOTION models; and iv) Decision Support System that aims to support users in taking correct decisions like selecting the mostly suitable models for a given task.

- *Modelling Layer:* It is responsible to handle the process of PHPDM model definition and the relative analytic definition starting from the specification of *declarative analytics* produced by PHPDM Specification tool using EVOTION models and language, to the *procedural analytics* produced by the PHPDM Transformation tool. It interacts with the Data Ingestion and Execution Layer for i) providing procedural analytics to be executed by the BDA Engine, ii) retrieving suggestions from the Decision Support System and iii) retrieving models form the Ontology Reasoner. It includes the following components: i) PHPDM Specification tool that allows EVOTION user to specify analytics tasks using EVOTION language and models in a declarative way; ii) PHPDM Transformation tool component that mainly transforms the declarative analytics into procedural analytics to be executed by the BDA Engine.
- *Visualization Layer:* It is responsible to handle the interaction with the end user. It includes the EVOTION Front aimed at helping EVOTION users in interaction with the EVOTION Platform and providing visualization facilities mainly for showing the results of a given analytic task. It interacts with Data Acquisition Layer for showing the results of the Social Campaigning, with the Data Ingestion and Execution Layer for visualization of analytics and for suggestion obtained by the Decision Support System, and with Modelling layer for providing interface to the model specification.
- *Security Layer:* Security layer is a vertical layer responsible to cover security-related functionalities that need to be enforced by all the EVOTION components according to an agreed component-specific security policy. For instance, one of the key functionality provided by the security manager component is a centralized authentication and authorization service that provides authentication and authorization to all the components so that they can communicate in an authentication manner.

2.3 Overview of Components

In the following, we briefly describe the purpose of each component shown in Figure *1* and its interfaces. A full specification of these interfaces is provided in subsequent sections.

- **HA**: It is the hearing aids device component which allows to collect data of its usage (HADataCollection interface) and retrieve, set HA settings (HASetting interface)
    - *HADataCollection* interface is a collection of interfaces enables the transmission environment data, user behaviour, and device identifiers from the hearing aids to the mobile (environmentDataHAOP, userChangeHAOP, hearingTestModeHAOP, deviceIDHAOP)
    - *HASetting* interface contains two interfaces that enables the mobile app to change programs and volume on the fly and the mobile app to change the default settings (userChangeHAOP, changeDefaultSettingsHAOP)
- **Mobile App:** It will be used in the data gathering process of the EVOTION platform as it will be the main tool to collect information from the EVOTION HAs, the environment and the HA users. It will be the main way of interaction with the HA users by getting input by them as well as serving them with relevant information according to their needs.
- **Sensor:** It is the wearable/embedded sensors module component, which offers the physiological data measurements collection. It has one interface

- *PHDataCollection* interface

- **Social Campaigning:** This component will run campaigns on social media which will try to inform the public about policies generated by PHPDM models and subsequently collect and analyze feedback from different stakeholder groups for these policies.

- **BDA Engine**: It realizes executions of queries and analytics tasks (*AnalyticsProcessing* interface) and offers the interface to retrieve their results in different ways (*ProcessingResult* Interface).
  - *AnalyticsProcessing* interface for the execution of a specific analytics specified by the PHPDM transformation tool.
  - *ProcessingResult* Interface to offer the output of the processing task in different ways, structured data or visualization oriented data (e.g., Zepplelin notebook URI)

- **Data Repository**: It provides the storing facilities to all the EVOTION component requiring it and directly interact with BDA Engine to provide data for the execution of the analytic tasks
  - *PatientDataStorage* interface to receive data from Data Acquisition layer specifically related to EVOTION patients.
  - *SocialDataStorage* interface which is a specific interface for storing social campaigning data
  - *AUDITBaseConnector* interface to connect with AUDITBase databases for clinical data access.
  - *DataQuering* interface for the execution data query needed for the BDA Engine execution.
  - *DataIngestion* interface to directly ingest data if needed for specific BDA processing
  - *StreamCollection* interface to collect Streams from Mobile Apps,

- **Ontology Reasoner:** The component is responsible for finding a semantic structure in the ontology. It provides an interface to query the ontology and allows other components to update an ontology or create a new ontology.
  - *loadOntology* (load Ontology and create an Ontology instance in the system)
  - *createNewOntology* (create an ontology instance during execution of an analysis task)
  - *queryOntology* (query information from an Ontology instance)
  - *closeOntology* (close an Ontology and save the changes to it original location)
  - *addEntities* (add entities to an Ontology instance)
  - *deleteEntities* (delete entities from an Ontology instance)
  - *updateOntology* (apply any kind of changes to the Ontology instance)
  - *saveOntology* (save the changes of an ontology instance to its original location)

- **Decision Support System:** The purpose of the EVOTION Decision Support System (DSS) is to provide data retrieval and summarization functionalities for text-mining related tasks, aimed mainly at PHPD makers and clinicians, in order to define and produce decision-related scenarios, based on information produced by the EVOTION platform and external sources as well. For that reason, the following interfaces:

- *ExternalData/DocumentUpload Related Interfaces* (allow the user to upload documents in pre-defined formats to the DSS Document Repository)
- *EVOTIONDataImport Related Interfaces* (allow the user to query data reports produced by the EVOTION platform components)
- *InformationExtraction/QuestionScenarios Related Interfaces* (allow the user to select analysis type and definition of factors via pattern matching algorithms and to select questions (scenarios) to be run in order to produce decision-producing cases)
- *DSSScenariosReports Related Interfacse (allow the user to view DSS-produced reports)*

- **PHPDM Specification tool:** It provides interfaces to create a decision support model instances and manage the created model instances (list instance, delete instance, modify instances and re-launch instances).
  - *createModelInstance* (create an model instance for a task)
  - *listModelInstances* (list all existing instances that created by a particular user)
  - *modifyModelInstance* (modify an existing model instance)
  - *relaunchModelInstance* (relaunch an updated model instance)
  - *deleteModelInstance* (delete a particular model instance)
  - *selectDataTypes* (select data types that a user specified)
- **PHPDM Transformation tool:** It takes a declarative program written in the EVOTION language, expressing a model instance, and transforms it into a procedural set of commands that either the BDA Engine or the Decision Support System should execute. It provides the *Transform Model Instance* interface.
- **Front-End Visualization Dashboard:** The purpose of this module is to provide a user-friendly visualization interface for the PHPM and Clinician end-users so as to allow them interaction with the EVOTION platform in a meaningful way. It entails the following interfaces, connecting the most crucial components of the EVOTION platform:
  - *SocialComp_Visualization related Interface* (allows interaction with the Social Campaigning component)
  - *DSS_Visualization related Interface*(allows interaction with the DSS component)
  - *BDA_Visualization related Interface* (allows interaction with the BDA component)
  - *PHPDTrans_Visualization related Interface* (allows interaction with the PHPDTrans component)
  - *DataRep_Visualization related Interface* (allows interaction with the Data Repository component)

3. EVOTION Platform Components Specifications

3.1 PHPDM Specification tool

3.1.1 Purpose

The PHPDM Specification Tool is the component that allows users to create instances of decision models. This component is designed to assist the users of the EVOTION platform in defining suitable instances of public health policy decision making (PHPDM) models. The operation relies on the ontology to retrieve the information about decision support model. The Specification tool will then collect the template of a particular model.

This function is part of the Ontology Reasoner component, which provides the semantic structure of suitable decision models, and the repository of abstract decision models (templates) implementing EVOTION scenarios.

The tool will guide the user in defining PHPDM models by dynamically adapting the possible choices, for instance by setting thresholds or intervals for possible values or by limiting the choice of parameters to the ones available for scenarios and logically defined by the ontology.

Such PHPDM models are implemented by using the particular model definition language developed by the EVOTION project. Usability considerations are taken into account, and the PHPDM Specification Tool would also provide a graphical interface for assisting users in the model definition, rather than requiring them to use the language directly.

When a model instance is completed, a user can commit it through the PHPDM Specification Tool for execution. The PHPDM Specification Tool does this indirectly by passing all the information to the PHPDM Transformation Tool that is in charge of, first, transforming the model specification into an executable command for the BDA Engine, and then of invoking the BDA Engine.

Operations that a user could perform through the PHPDM Specification Tool, other than creating a new model instance, are: to list the model instances previously defined, to modify an existing model instance, to relaunch a model instance already created, and to delete model instances.

DEPENDENCIES

others --> PHPDM Spec Tool

- Web Frontend: an interface of the PHPDM Specification Tool is used to start a Decision Model related operation.

PHPDM Spec Tool --> others

- PHPDM Transformation Tool: the PHPDM Specification Tool uses an interface of the PHPDM Transformation Tool for invoking the transformation of a PHPDM model instance, defined with the specific language and through the frontend, into a BDA executable operation (query, analytics).

- Ontology Reasoner: uses an interface of the Ontology Reasoner to retrieve the ontology for a specific model.

- Decision Models Repository: the PHPDM Specification Tool uses an interface of DSS_RetrEVMod from the DSS component to retrieve the decision model template corresponding to the user selection.

3.1.2 Functional Capabilities and Interfaces

The functional capabilities of the PHPDM specification tool include:

- **createModelInstance --** The component will provide a functionality to users of the Web Frontend to create a model instance based on the repository of decision models to implement the EVOTION scenarios and the logical relationships defined by the EVOTION ontology. This capability will assist users in the definition of model instances by dynamically guiding the selection of values and parameters and by providing a simplified graphical interface to support the definition language syntax.
- **listModelInstances** -- The component will let users listing all previously defined model instances and possibly select one of the following operations.
- **modifyModelInstance** -- The component will let a user select a model instance previously defined and modify it to create variants of a certain instances to be executed. The modified instances will be saved as a new one.
- **relaunchModelInstance** -- The component will let a user select a model instance previously defined and re-execute it by calling the PHPDM Transformation Tool.
- **deleteModelInstance** -- The component will let a user select a model instance and delete it.
- **selectDataTypes** – The function allows users to select the types of data which they want to use for the analysis task.

The above capabilities are to be realised by operations of the component which are grouped into the following interfaces.

createModelInstance

Operation Description	A user creates a decision model instance	
Input parameters		
Name	**Type**	**Description**
modelName	string	The name/ID of the model template selected by the user
instanceConfiguration	OWLOntology	A dynamic structure representing all parameter choices for the specific model template chosen
Output parameters		
Name	**Type**	**Description**
modelInstance	PHPDMobject	The code in the definition language representing the model instance to be transformed into an executable command

listModelInstances

Operation Description	List all model instances created by a user	
Input parameters		
Name	**Type**	**Description**
userName	string	The name/ID of a user
Output parameters		

Name	Type	Description
modelObjects	arrayList<modleObject>	A list of model instances.

modifyModelInstance

Operation Description	Modify an existing model instance	
Input parameters		
Name	**Type**	**Description**
instanceName	string	The name/ID of the model instance to be modified as selected by the user
instanceConfiguration	OWLOntology	A dynamic structure representing all parameter choices for the specific model template chosen
Output parameters		
Name	**Type**	**Description**
modelInstance	PHPDMobject	The code in the definition language representing the modified model instance.

relaunchModelInstance

Operation Description	An existing model instance is re-executed	
Input parameters		
Name	**Type**	**Description**
instanceName	string	The name/ID of the model instance to re-execute
Output parameters		
Name	**Type**	**Description**
modelInstance	PHPDMobject	The code in the definition language representing the model instance to be transformed into an executable command

deleteModelInstance

Operation Description	Delete a model instance	
Input parameters		
Name	**Type**	**Description**
instanceName	string	The name/ID of the model instance to delete
Output parameters		
Name	**Type**	**Description**

status	boolean	A Boolean indicates status of the operation.

selectDataTypes

Operation Description	Select the data types which users want to use for the analysis task.	
Input parameters		
Name	**Type**	**Description**
dataTypes	Array<string>	An array of the name of data types
Output parameters		
Name	**Type**	**Description**
status	boolean	A Boolean indicates status of the operation.

3.1.3 Related Requirements

This section will identify the requirements addressed (partially or fully by this component)

Requirement	**Operation**	**Notes**
FR(PHAS)2: Discover factors of low HA usage	createModelInstance	
FR(CLIS)79 Creation of auditory training sessions	createModelInstance	

3.2 PHPDM Models Transformation tool

3.2.1 Purpose

The PHPDM Models Transformation tool is the component in charge of producing an executable artifact (list of commands, program, script, directives) for the BDA Engine from an instance of decision model produced by the PHPDM Specification tool.

This component has the goal of decoupling the specification of a model instance, driven by the Policy Maker preferences and expressed by the ad hoc model definition language developed by the EVOTION project, from the specific inputs required by the BDA Engine technology and interface specification. This way the specification language and the PHPDM Specification tool could be just concerned with supporting the Policy Maker definition of a model instances. It is the PHPDM Model Transformation tool that must take a model instance in declarative form and transform it into a procedural program that the BDA Engine could interpret and execute without further transformations.

The PHPDM Model Transformation tool does not work in isolation, it is not self-contained for the transformation task, but in general should acquire data and information from the Ontology Reasoner about the model (for example, it would need data types model specifications in order to define a mapping with data type parameters for the BDA Engine).

DEPENDENCIES

others --> PHPDM Model Transformation Tool

- PHPDM Specification Tool: The PHPDM Transformation tool implements an interface that the PHPDM Specification Tool will use to ask the transformation of a model instance.

PHPDM Model Transformation Tool --> others

- Ontology Reasoner: uses an interface of the Ontology Reasoner to retrieve data from a specific model.

- BDA Engine: uses the AnalyticProcessing interface of the BDA engine.

- DSS: uses the QuestionScenarios interface of the DSS.

3.2.2 Functional Capabilities and Interfaces

The operation available from the PHPDM Transformation tool is just one, i.e., to take a declarative model instance from the PHPDM Specification tool and transform it into a procedural set of executable commands for the PDA platform, the decision support tool, the simulation tool or the social media tool of the platform.

The above capabilities are to be realised by operations of the component which are grouped into the following interfaces.

Transform model instance

Operation Description	The PHPDM Specification tool requests the transformation of a model instance	
Input parameters		
Name	**Type**	**Description**
model_instance	OWLOntology	The code in the EVOTION specification language representing the model instance to be transformed into an executable command
Output parameters		
Name	**Type**	**Description**
processing_req	BDAExecutable	The list of commands to be executed by the BDA engine or the DSS

3.2.3 Related Requirements

The requirements addressed (partially or fully) by this component are as listed below.

Requirement	**Operation**	**Notes**
PPSR3: System capacity	Transform Model Instance	Performance of the PHPDM Transformation should not be a bottleneck for subsequent model instance transformation, either by multiple Policy Makers or multiple requests from the PHPDM Specification tool.

3.3 Ontology Reasoner

3.3.1 Purpose

The Ontology Reasoner is a component that generates the semantic structure of a particular decision model which is specified by the specification tool component. The semantic structure is used to support

decision support system for making a decision model object. The Ontology engine should be developed based on Hermit 1.3.8.4 [4], OWL API 3.5.3 [5] and SparqlDL API 2.0.0 [6].

The component is responsible for finding a semantic structure in the ontology. The PHPDM specification tool requires the semantic structure to generate the model instance. The decision support system also needs to communicate with the Ontology Reasoner to get more information about the semantic structure. The BDA engine requires looking for the semantic structure to execute the operations.

3.3.2 Functional Capabilities and Interfaces

This component offers the following functional capabilities:

- **loadOntology:** The operation provides an ability to load an ontology and creating an ontology object in the system. It requires a string which represents the address of the ontology. The operation will load the ontology, create an ontology reasoner and output an OWLOntology object which is called OntologyReasoner.
- **createNewOntology:** The purpose of this process is to create a new ontology reasoner with specified data. The operation creates a new OWLOntology object with some input parameters.
- **queryOntology:** The process provides an ability to query an ontology to retrieve parts of it. The Input parameter contains a list of strings which represent the questions which need to be addressed. The output of the function is a set of OWLEntities which represents the answers from the ontology.
- **closeOntology:** The purpose of this operation is to save ontology on local disk and close an ontology object (free the occupied memory). The operation takes an OWLOntology object which is required to be killed.
- **addEntities:** The purpose of this procedure is to insert entities into an existing ontology. The action takes a set of OWLEntities which is required to be added.
- **deleteEntities:** The purpose of this operation is to delete entities in the ontology. The operation takes a set of OWLEntities which is desired to be removed.
- **updateOntology:** The purpose of this operation is to update ontology with any possible operations. This is a generic operation which provides a general format of the input and applies the changes to the ontology.
- **saveOntology:** The purpose of this operation is to save an ontology (save on local storage, hard disk). The operation takes a string of ontology address, an integer of ontology version and an ontology object.

The above capabilities are to be realised by operations of the component which are grouped into the following interfaces.

loadOntology

Operation Description	The purpose of this operation is to load an ontology and create an ontology object	
Input parameters		
Name	**Type**	**Description**
ontologyAddress	string	A string describes the location of an ontology
Output parameters		
Name	**Type**	**Description**
ontologyReasoner	OWLOntology	An ontology reasoner object

createNewOntology

Operation Description	The purpose of this operation is to create a new ontology reasoner with specified data in the memory.	
Input parameters		
Name	**Type**	**Description**
Entities	Set<? extends OWLEntity>	The entities which is required to create a new Ontology
Output parameters		
Name	**Type**	**Description**
Ontology	OWLOntology	The created new ontology object.

queryOntology

Operation Description	The purpose of this operation is to query the ontology with specified details.	
Input parameters		
Name	**Type**	**Description**
ClassName	ArrayList<string>	A string describes an entity which is required to inference in the Ontology.
Output parameters		
Name	**Type**	**Description**
OWLEntity	Set<? extends OWLEntity>	A set which contains the result from the reasoner

closeOntology

Operation Description	The purpose of this operation is to close an ontology (free the occupied memory).	
Input parameters		
Name	**Type**	**Description**
Ontology	OWLOntology object	The ontology object
Output parameters		
Name	**Type**	**Description**
status	boolean	A Boolean shows the status of the operation. True(insert successful) False(insert fail)

addEntities

Operation Description	The purpose of this operation is to insert entities into an existing ontology.	
Input parameters		
Name	**Type**	**Description**

OWLEntity	Set<? extends OWLEntity>	A string describes the location of an ontology
Output parameters		
Name	**Type**	**Description**
status	boolean	A Boolean shows the status of the operation. True(insert successful) False(insert fail)

deleteEntities

Operation Description	The purpose of this operation is to delete entities in the ontology.	
Input parameters		
Name	**Type**	**Description**
OWLEntities	Set<OWLAxiom>	A set of OWL Axioms which is required to delete.
Output parameters		
Name	**Type**	**Description**
status	boolean	A Boolean shows the status of the operation. True(insert successful) False(insert fail)

updateOntology

Operation Description	The purpose of this operation is to update ontology with any possible operations.	
Input parameters		
Name	**Type**	**Description**
OWLEntities	Map<key, Set<values>	A map which contains operations and values. The Keys represent operation goal and the sets contains generic type of values.
Output parameters		
Name	**Type**	**Description**
status	boolean	A Boolean shows the status of the operation. True(insert successful) False(insert fail)

saveOntology

Operation Description	The purpose of this operation is to save an ontology (save on local storage, hard disk).	
Input parameters		
Name	**Type**	**Description**

ontologyAddress	string	A string address indicates where the ontology should be stored
OntologyVersion	integer	An integer indicates the type of the ontology
OntologyObject	OWLOntology object	An ontology object
Output parameters		
Name	**Type**	**Description**
status	boolean	A Boolean shows the status of the operation. True(insert successful) False(insert fail)

3.3.3 Related requirements

The requirements addressed (partially or fully) by this component are as listed below.

Requirement	Operation	Notes
FR(PHAS)10: Initiate data analysis session	loadOntology	
FR(PHAS)16: Data analysis, in a statistical way, between different data types	queryOntology createNewOntology closeOntology addEntities deleteEntities saveOntology closeOntology	
FR(PHAS)17: Support multiple types of analysis' criteria	queryOntology createNewOntology closeOntology addEntities deleteEntities saveOntology closeOntology	
FR(CLIS)58 Select from a list of data types	queryOntology	

3.4 Enhanced Hearing Aids

3.4.1 Purpose

The purpose of the enhanced EVOTION hearing aids is to enable the collection of sound environment parameters from the patient's everyday life, and the collection of how the patients operate their hearing aids, i.e. program shifts and volume shifts. Moreover, the hearing aids should also enable measuring the patients' audiogram, and change and suggest program shifts/volume changes in specific settings as well as adapt the default processing according to the collected usage patterns or suggestions from the BDA.

3.4.2 Functional Capabilities and Interfaces

This component offers the following functional capabilities:

- **Sound environment parameters (environmentDataHAOP).** This capability is important for contextualizing the audio environment which the patients experience as well as monitoring the sound/noise levels. It transmits the contextual estimates of the sound environment from the hearing aid to the mobile app over Bluetooth. This happens automatically as long as the hearing aid is turned on, while it requires that the mobile app is connected to the hearing aid for the data logging to take place. Implemented by **environmentDataHAOP**.
- **Hearing aid usage patterns (userChangeHAOP)**. This capability is important for monitoring the use of the hearing aids. When the program or volume is changed on the hearing aid, it transmits the new values over Bluetooth to the mobile app. Implemented with **userChangeHAOP.**
- **Change hearing aid program/volume (userChangeHAOP)**. This capability is important contextualizing the hearing aids beyond state of art, and enables the mobile app to change the program and volume by sending control messages over Bluetooth the hearing aid. Implemented as part of **userChangeHAOP.**
- **Hearing test mode (hearingTestModeHAOP).** This capability is important for monitoring the patients hearing thresholds. Together with the mobile app and the hearing aid can measure the aided thresholds, perform speech tests and auditory training. Implemented with **hearingTestModeHAOP.**
- **Updated default settings (changeDefaultSettingsHAOP)**. This capability is important for implementing learning hearing aids that adapt the default settings to the individual usage patterns or to matching profiles found in the data repository. Implemented with **changeDefaultSettingsHAOP.**
- **Device identification (deviceIDHAOP)**. This capability is linking across the different data sources for the EVOTION platform. Each hearing aid has a unique serial number/ID which can be stored in the clinic and read via the mobile app. Implemented with **deviceIDHAOP**.

General hearing aid functionality.

In order to serve the requirements of the hearing impaired patients participating in the clinical validation under WP7, the EVOTION hearing aid contains all hearing aid functionality from the CE marked Oticon OPN hearing aids commercially available world-wide from October 2016 plus the functional requirements **environmentDataHAOP** and **changeDefaultSettingsHAOP** specific to the EVOTION hearing aids. Clinicians fit the EVOTION hearing aids using a special EVOTION fitting software based on Oticon Genie 2. The EVOTION hearing aids and EVOTION fitting software is implemented as Deliverable D5.1 EVOTION hearing aids.

The above capabilities are to be realised by operations of the component which are grouped into the following interfaces.

environmentDataHAOP

Operation Description	**Transmitting sound environment parameters over BLE.** This operation takes place every minute initiated by the hearing aid. The APP can request the data as well, but the information is only updated once every minute in the Hearing aid so a read request does not update the information. Raw stream from HA is 42 byte value (16 bits). Every variable is two bytes 0x12-12: Example**:** **01-7B**-00-F7-**00-8A**-01-7A- **01**-**77**-00-F1-**00**-**83**-01-77-

	00-**14**-00-0F-**00**-**1A**-00-14- **01**-**8B**-01-01-**00**-**9D**-01-8B- **00**-**03**-00-05-**00**-**07**-00-03- **00**-**01**	
Input parameters		
Name	**Type**	**Description**
None		
Output parameters		
Name	**Type**	**Description**
Parameter1-20: 00 SPL 0-1.3 kHz 01 SPL 1.3-4.1 kHz 02 SPL 4.1-10 kHz 04 SPL 0-10 kHz 05 Noise floor 0-1.3 kHz 06 Noise floor 1.3-4.1 kHz 07 Noise floor 4.1-10 kHz 08 Noise floor 0-10 kHz 09 Modulation index 0-1.3 kHz 10 Modulation index 1.3-4.1 kHz 11 Modulation index 4.1-10 kHz 12 Modulation index 0-10 kHz 13 Modulation envelope 0-1.3 kHz 14 Modulation envelope 1.3-4.1 kHz 15 Modulation envelope 4.1-10 kHz 16 Modulation envelope 0-10 kHz 17 Signal to noise ratio 0-1.3 kHz 18 Signal to noise ratio 1.3-4.1 kHz 19 Signal to noise ratio 4.1-10 kHz 20 Signal to noise ratio 0-10 kHz	Array of Q2.7 fixed point representation of floats	10 bits; 1 sign bit, 2 integer bits, 7 fractional bits, (with scaling factor)
21 Sound environment parameter	2 bit ENUM	**The output of the sound environment classification unit.** 0: Quiet 1: Speech 2: Speech in noise 3: Noise

userChangeHAOP

Operation Description	**Hearing aid usage patterns**

	These two services are event based, either spawned when the user changes program/volume. They can also be read from the app to monitor which program is selected.	
Input parameters		
Name	**Type**	**Description**
Program change	0x00, 0x01, 0x02, 0x03	Changes the program of both devices when transmitted from the app
Volume	0xF8-01, F9-01, up to 0x 04-01	Changes the volume of the single hearing device when transmitted from the app
Output parameters		
Name	**Type**	**Description**
Program change	Unsigned Integer	The hearing aid transmits this message when the user changes program. The two devices link their programs, so there will be messages from both hearing aids Triggers: Program change or read request from Mobile App
Volume change	Signed Integer	The hearing aid transmits this message when the user adjusts the volume. The two devices link their programs, so there will be messages from both hearing aids. Triggers: Program change or read request from Mobile App

hearingTestModeHAOP

Operation Description	**Hearing test mode** The audiogram can be measured using Bekesy audiometry and using the Sound Pressure Levels transmitted from the hearing aid (**environmentDataHAOP**) to calibrate the outputs of the mobile phone to the acoustic level of the sound presented to the user.	
Input parameters		
Name	**Type**	**Description**
Current program	Unsigned Integer	The mobile device should read and store (locally) the current program identifier. Thereafter change to the first program

Current volume	Signed Integer	The mobile device should read and store (locally) the current volume step. Thereafter set the volume to 0
Output parameters		
Name	**Type**	**Description**
Current HA program	Unsigned Integer	After completion of the hearing test or auditory training restore the previously selected HA program
NoneCurrent HA volume	Signed Integer	After completion of the hearing test or auditory training the previously selected volume step

changeDefaultSettingsHAOP

Operation Description	**Change of default settings** This operation changes which program the hearing aids selects when it is turned on, and the volume step.	
Input parameters		
Name	**Type**	**Description**
Default settings	4 BYTE [0xXxYy]	Bytes Yy: default volume step (values depends on range) and bytes Xx : default boot program (values 1- 8)
Output parameters		
Name	**Type**	**Description**
None		

deviceIDHAOP:

Operation Description	**Hearing aid device ID** The device ID (serial number) allows the platform to link the data coming from the hearing device with the patient if the clinicians store the device	
Input parameters		
Name	**Type**	**Description**
None		
Output parameters		
Name	**Type**	**Description**
Device ID	8 byte HEX	Device ID that matches the serial number stored in GENIE and AuditBase

Mobile Application Interface

noiseMonitoringMAOP

Operation Description	This operation is triggered by the data received by the Mobile App from the environmentDataHAOP. On the Mobile App it transforms environmentDataHAOP into the A-weighted Sound Pressure Level (SPL dBA) which is the standard used for noise monitoring. The SPL dBA is then compared to the threshold, and integrated over two hours for comparison with the Long Term Equivalent threshold. With this the Mobile App is able to determine and flag whenever the patient is immersed in sound environments which are too loud.	
Input parameters		
Name	**Type**	**Description**
0-SPL 0-1.3 kHz from HA	dB Q2.7	From: environmentDataHAOP
1-SPL 1.3-4.1 kHz from HA	dB Q2.7	From: environmentDataHAOP
2-SPL 4.1-10 kHz from HA	dB Q2.7	From: environmentDataHAOP
Output parameters		
Name	**Type**	**Description**
SPL dBA	dB	10log(0.4494 x10.^("0-SPL"/10) +1.3007x10.^("1-SPL"/10) + 0.8595x10.^("2-SPL"/10))
SPL LEQ-2h dBA	dB	Two hour integration of SPL dBA
Exceed Max SPL dBA	Boolean	If SPL dBA > 100 dBA
Exceed Max SPL LEQ-2h	Boolean	IF SPL LEQ-2h > 85 dBA LEQ-2H

3.4.3 Related Requirements

This section will identify the requirements addressed (partially or fully by this component)

Requirement	**Operation**	**Notes**
PHAS.1: Prognosis of low HA usage CLIN.1: Retrieval of HA Usage data	environmentDataHAOP; deviceIDHAOP	The data from UserChangeHAOP shows the use of the hearing devices. The data is only collected when the hearing aid is connected to the mobile app. The relation between UserChangeHAOP data and the use logged in the device can be observed when the patient is in the clinic and connected to fitting software.

		deviceIDHAOP allows the hearing aid to be identified.
PHAS.3: Predicting urban physical planning based on HL	environmentDataHAOP;noiseMonitoringMAOP	The data logged from the hearing aid plus location data from mobile app can deliver a Sound Pressure Level map
PHAS.4: Explore the potential for personalization of HA administration and use follow-up; PSOS.3: Self-testing of hearing and self-adjustment of hearing aids	environmentDataHAOP; UserChangeHAOP; changeDefaultSettingsHAOP; deviceIDHAOP	environmentDataHAOP delivers data describing the situation and UserChangeHAOP the operation of the hearing aid (programs and volume). Taken together this data generates an overview of in which situations the patient selects which program which can be used to counsel the patient. Moreover, changeDefaultSettingsHAOP enables the updating of the default program either by audiologist or BDA. deviceIDHAOP allows the hearing aid to be identified.
PHAS.5: Policy on effective use of Assistive Listening Devices	environmentDataHAOP; UserChangeHAOP;	Similar to PHAS.4 where the hearing aid delivers the data on sound environments and the use of hearing aids.
CLIS.2: Sudden deterioration of hearing; CLIS.5-NIHL: Protection of people with hearing impairments from the harmful effects of loud noise: individualized risk assessment; CLIS.12-Tests:	changeDefaultSettingsHAOP; environmentDataHAOP; HearingTestModeHAOP; deviceIDHAOP.	Auditory test can be performed via the hearing aid by playing audio over air to hearing aid. The Hearing aid will record the sound levels etc (environmentDataHAOP) to get levels right, and provide information about the sound environment which the test was obtained in. The phone should be placed in front of the patient and program P1 selected (by Mobile app through audiogramHAOP) deviceIDHAOP allows the hearing aid to be identified. Hearing aid cannot measure evoked potentials
CLIS.3: "Ask the expert" hearing fitting á la Watson	environmentDataHAOP; UserChangeHAOP; deviceIDHAOP.	Through environmentDataHAOP and UserChangeHAOP the hearing aid delivers

		information about how the hearing aid was operated in different sound environments. When supplemented by location data from mobile app, preference ratings from mobile app, and data from the other patients patterns indicating good fittings can be extracted. deviceIDHAOP allows the hearing aid to be identified.
CLIS.6: Individualized auditory training	environmentDataHAOP; deviceIDHAOP	Hearing aid delivers measure of sound environment data (including the sound from the auditory training) deviceIDHAOP allows the hearing aid to be identified.

3.5 Data Repository

3.5.1 Purpose

The component provides a data management system which allows a large amount of data to be inserted and retrieved easily and efficiently. The data repository is constructed by integrating data from multiple heterogeneous sources. The data repository is a component which is used to support feeding, storage and management of health care data. It allows managing all types of data which are related to the health care. The data repository is to be developed using Apache HBase [7].

3.5.2 Functional Capabilities and Interfaces

This section describes the key functional capabilities of data repository. These are:

- ***PatientDataStorage*** interface to receive data from Data Acquisition layer specifically related to EVOTION patients. The functions include: InsertPatientData, insertHAUsingData, insertTTS-NIHLData, insertAudioTestData, insertCognitiveTestData, insertTrainingTaskData and insertPersonalLogData. These operations provide abilities to insert patient data in the Data Repository. The operation is designed only for the patient data. It will automatically convert the patient data into the data repository compatible format. It takes two parameters; a string that represents a table name and a map of all values. The table name indicates in which table the data should be inserted. The map contains a list of key-value pairs. The key represents the row key of the data. The list includes a column family, a column and one value. The row key, column family and column are used to identify the value. The value is the data that should be inserted in the Data Repository.
- ***SocialDataStorage*** interface which is a specific interface for storing social campaigning data. The functions include: *insertSocialData, insertEnvirData, insertQuesAnwser, insertRatingData, insertMobileSensorData and insertFrontData.* The operations provide abilities to insert social data in the repository. The operation is designed only for the social data. It will automatically convert the social data into the data repository compatible format. It takes two parameters; a string that represents a table name and a map of all values. The table name indicates in which table the data should be inserted. The map contains a list of key-value pairs. The key represents the row key of the data. The list includes a column family, a column and one value. The row key, column family

and column are used to identify the value. The value is the data that should be inserted in the Data Repository.

- ***AUDITBaseConnector*** interface to connect with AUDITBase databases for clinical data access.
    - The function of retrieveAUDITBaseData allows to retrieve data from auditBase and insert in the data repository. This function is designed only for auditBase. It takes one string parameter which indicates the location of the aubitbase.

- ***DataQuering*** interface for the execution data query needed for the BDA Engine execution.
    - The functions include queryData, deleteData and UpdateData. These functions provide abilities to update, delete and insert data in the Data Repository.

- ***DataIngestion*** interface to directly ingest data if needed for specific BDA processing. The function of insertBDAData provides an ability to insert BDA data in the repository. The operation is designed only for the BDA related data. It will automatically convert the BDA data into the data repository compatible format.

- ***StreamCollection*** interface to collect Streams from Mobile Apps. The functions include:
    - retrieveData, retrieveMobileMaterialData, retrieveMobileQuestionaires, retrieveMobileHearingCoachTrainingTasks, retrieveMobilePersonalLog, retrieveCongnativeTestData, retrieveFrontData and retrieveAUDITBaseData. These functions allow retrieve all kind of the data within the data repository. It takes one list parameter called identifier which contains 4 strings. The table name, rowkey, columnFamily and column.

insertData

Operation Description	The purpose of this operation is to provide a generic interface which receives all types of data and insert the data into data repository.	
Input parameters		
Name	**Type**	**Description**
tableName	string	The table which stores the data
receivedData	Map<key,arrayList<values>>	The key is a string composed by row key, column family and column. The ArrayList contains all the information about the values which are required to be inserted.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation. True(insert successful) False(insert fail)

InsertPatientData

Operation Description	The purpose of this operation is to provide a generic method receive data related to EVOTION patients from multiple heterogeneous sources through the internet.	
Input parameters		
Name	**Type**	**Description**
tableName	string	The table which stores the data
Patient data	Map<key,arrayList<values>>	The key is a string composed of row key, column family and column. The ArrayList contains all the information belongs to the patient.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation. True(insert successful) False(insert fail)

insertSocialData

Operation Description	The purpose of this operation is to receive social media data from a social network and store the data in the data repository.	
Input parameters		
Name	**Type**	**Description**
tableName	string	The table which stores the data
Social Media Data	Map<key,ArrayList<values>>	The key is a string composed by row key, column family and column. The ArrayList contains all the information about social media.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation. True(insert successful) False(insert fail)

insertBDAData

Operation Description	The purpose of this operation is to provide an interface which inserts data that is generated from BDA engine.	
Input parameters		
Name	**Type**	**Description**
tableName	string	The table which stores the data
BDA data	Map<key,arrayList<values>>	The key is a string composed by row key, column family and column. The ArrayList contains all the information generated by BDA engine
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation. True(insert successful) False(insert fail)

insertHAUsingData

Operation Description	The purpose of this operation is to receive hearing aid using data from users and insert data into the data repository.	
Input parameters		
Name	**Type**	**Description**
tableName	string	The table which stores the data
HA Data	Map<key,arrayList<values>>	The key is a string composed by row key, column family and column. The ArrayList contains all the information about HA. For example, HAs tone audiometry, HAs speech audiometry and HAs other audiological data
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation. True(insert successful) False(insert fail)

insertEnvirData

Operation Description	The purpose of this operation is to receive environmental data and insert the data into the data repository.	
Input parameters		
Name	**Type**	**Description**
tableName	string	The table which stores the data
EnvironmentData	Map<key,arrayList<values>>	The key is a string composed by row key, column family and column. The ArrayList contains all the information about current location and user route.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation. True(insert successful) False(insert fail)

insertTTS-NIHLData

Operation Description	The purpose of this operation is to receive information which comes from mobile sensors and insert into the data repository.	
Input parameters		
Name	**Type**	**Description**
tableName	string	The table which stores the data
TTS/NIHL episode Flag	Map<key,arrayList<values>>	The key is a string composed by row key, column family and column. The ArrayList contains all the information about episode Flag
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation. True(insert successful) False(insert fail)

insertQuesAnwser

Operation Description	The purpose of this operation is to receive questionnaire answers from the mobile platform and insert them into the data repository.	
Input parameters		
Name	**Type**	**Description**
tableName	string	The table which stores the data
QuestionaireAnswer	Map<key,arrayList<values>>	The key is a string composed by row key, column family and column. The ArrayList contains all the information about Questionnaire answer.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation. True(insert successful) False(insert fail)

insertRatingData

Operation Description	The purpose of this operation is to receive rating information from mobile phone and insert the data into the data repository.	
Input parameters		
Name	**Type**	**Description**
tableName	string	The table which stores the data
UserRatingData	Map<key,arrayList<values>>	The key is a string composed by row key, column family and column. The ArrayList contains all the information about User rating data.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation. True(insert successful) False(insert fail)

insertAudioTestData

Operation Description	The purpose of this operation is to receive audiological test data from mobile platform and insert the data into the data repository.	
Input parameters		
Name	**Type**	**Description**
tableName	string	The table which stores the data
audiologicalTestData	Map<key,arrayList<values>>	The key is a string composed by row key, column family and column. The ArrayList contains all the information about audiological test data.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation. True(insert successful) False(insert fail)

insertCognitiveTestData

Operation Description	The purpose of this operation is to receive cognitive test data from mobile platform and insert the data into the data repository.	
Input parameters		
Name	**Type**	**Description**
tableName	string	The table which stores the data
cognitiveTestData	Map<key,arrayList<values>>	The key is a string composed by row key, column family and column. The ArrayList contains all the information about cognitive test data.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation. True(insert successful) False(insert fail)

insertTrainingTaskData

Operation Description	The purpose of this operation is to receive training task data and store the data in the data repository.	
Input parameters		
Name	**Type**	**Description**
tableName	string	The table which stores the data
taskTrainingData	Map<key,arrayList<values>>	The key is a string composed by row key, column family and column. The ArrayList contains all the information about Task training data.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation.

insertPersonalLogData

Operation Description	The purpose of this operation is to receive personal log data and store the data in the data repository.	
Input parameters		
Name	**Type**	**Description**
tableName	string	The table which stores the data
personalData	Map<key,arrayList<values>>	The key is a string composed by row key, column family and column. The ArrayList contains all the information about personal data.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation.

insertMobileSensorData

Operation Description	The purpose of this operation is to receive information which comes from mobile sensors and insert the data into the data repository.	
Input parameters		
Name	**Type**	**Description**
tableName	string	The table which stores the data
mobileSensorData	Map<key,arrayList<values>>	The key is a string composed by row key,

		column family and column. The ArrayList contains all the information about mobile sensors.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation.

insertFrontData

Operation Description	The purpose of this operation is to receive data from front and insert in data repository.	
Input parameters		
Name	**Type**	**Description**
tableName	string	The table which stores the data
FrontData	Map<key,arrayList<values>>	The key is a string composed by row key, column family and column. The ArrayList contains all the information about front end.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation.

retrieveData

Operation Description	The purpose of this operation is to provide a method which retrieve all types of data from the data repository.	
Input parameters		
Name	**Type**	**Description**
dataIdentifier	ArrayList<tableName, rowKey, columnFamily, column>	The tableName indicates which table in the data repository. The Row key indicates which row in the data repository. The columnFamily and column indicate which column the data is stored.
Output parameters		
Name	**Type**	**Description**
values	values	The values retrieved from data repository

status	Boolean	A Boolean shows the status of the operation.

retrieveMobileMaterialData

Operation Description	The purpose of this operation is to retrieve data from the data repository.	
Input parameters		
Name	**Type**	**Description**
dataIdentifier	ArrayList<mobileID, tableName, rowKey, columnFamily, column>	The mobileID is an object indicates which mobile phone. The tableName indicates which table in the data repository. The Row key indicates which row in the data repository. The columnFamily and column indicate which column the data is stored.
Output parameters		
Name	**Type**	**Description**
infoItem	Text and Multimedia	An info item that can contain textual information as well as videos or images.
status	Boolean	A Boolean shows the status of the operation.

retrieveMobileQuestionaires

Operation Description	The purpose of this operation is to retrieve data from the data repository.	
Input parameters		
Name	**Type**	**Description**
dataIdentifier	ArrayList<mobileID, tableName, rowKey, columnFamily, column>	The mobileID is an object indicates which mobile phone. The tableName indicates which table in the data repository. The Row key indicates which row in the data repository. The columnFamily and column indicate which column the data is stored.
Output parameters		
Name	**Type**	**Description**

status	Boolean	A Boolean shows the status of the operation.
mobileQuestionaires	List<ArrayList<text>, ArrayList<Object>>	The text contains general Information of the questionnaire, e.g.title, description, etc

retrieveMobileHearingCoachTrainingTasks

Operation Description	The purpose of this operation is to send data from the data repository to a mobile device.	
Input parameters		
Name	**Type**	**Description**
dataIdentifier	ArrayList<mobileID, tableName, rowKey, columnFamily, column>	The mobileID is an object indicates which mobile phone. The tableName indicates which table in the data repository. The Row key indicates which row in the data repository. The columnFamily and column indicate which column the data is stored.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation.
trainingTask	List<ArrayList<text>, ArrayList<Object>>	The text contains general Information of the questionnaire, e.g.title, description, etc. The Object contains a list of all included steps. Each step contains its title, description and action to be performed.

retrieveMobilePersonalLog

Operation Description	The purpose of this operation is to send data from the data repository to a mobile device.	
Input parameters		
Name	**Type**	**Description**
dataIdentifier	ArrayList<mobileID, tableName, rowKey, columnFamily, column>	The mobileID is an object indicates which mobile phone. The tableName indicates

		which table in the data repository. The Row key indicates which row in the data repository. The columnFamily and column indicate which column the data is stored.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation.
questionaires	List<ArrayList<text>, ArrayList<Object>>	The text contains general Information of the questionnaire, e.g.title, description, etc. The Object contains all information about the questionires

retrieveCongnativeTestData

Operation Description	The purpose of this operation is to send data from the data repository to a mobile device.	
Input parameters		
Name	**Type**	**Description**
dataIdentifier	ArrayList<tableName, rowKey, columnFamily, column>	The tableName indicates which table in the data repository. The Row key indicates which row in the data repository. The columnFamily and column indicate which column the data is stored.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation.
congnativeTestData	List<ArrayList<text>, ArrayList<Object>>	The text contains general Information of the Congnative Test, e.g.title, description, etc. The Object contains all information about the congnative test.

retrieveFrontData

Operation Description	The purpose of this operation is to send data from data repository to Front.	
Input parameters		
Name	**Type**	**Description**
dataIdentifier	ArrayList<tableName, rowKey, columnFamily, column>	The tableName indicates which table in the data repository. The Row key indicates which row in the data repository. The columnFamily and column indicate which column the data is stored.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation.
Front Data	List<ArrayList<text>, ArrayList<Object>>	The text contains general Information of the front, e.g.title, description, etc. The Object contains all information about the front.

retrieveAUDITBaseData

Operation Description	The purpose of this operation is to provide an interface, which migrates data from the AuditBase to the data repository	
Input parameters		
Name	**Type**	**Description**
address	string	The location of AuditBase
Output parameters		
Name	**Type**	**Description**
statement	log	The file which summarise the data migration process

queryData

Operation Description	The purpose of this operation is to provide a generic method which provides operations of retrieving, updating and deleting from the data repository.	
Input parameters		
Name	**Type**	**Description**

tableName	string	The table which stores the data
	Map <key, arrayList<string> >	The key is a string which represents the operation (update, add, delete) of the query. The arrayList contains row key, column family and column and any other data.
Output parameters		
Name	**Type**	**Description**
requestedData	map	The requested data

deleteData

Operation Description	The purpose of this operation is to provide a method which deletes data from the data repository.	
Input parameters		
Name	**Type**	**Description**
dataIdentifier	ArrayList<tableName, rowKey, columnFamily, column>	The tableName indicates which table in the data repository. The Row key indicates which row in the data repository. The columnFamily and column indicate which column the data is stored.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation.

UpdateData

Operation Description	The purpose of this operation is to provide a generic interface, which updates data from the data repository.	
Input parameters		
Name	**Type**	**Description**
tableName	string	The table which stores the data
newData	Map<key,arrayList<values>>	The key is a string composed by row key, column family and column. The ArrayList contains all the information about the values which are

		required to be inserted.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean shows the status of the operation.

3.5.3 Related Requirements

The requirements which are addressed (partially or fully) by this component are listed below.

Requirement	Operation	Notes
FR(PHA)1: Mechanism for collecting data of different types	InsertPatientData insertSocialData retrieveAUDITBaseData queryData insertBDAData insertData insertHAUsingData insertEnvirData insertTTS-NIHLData insertQuesAnwser insertRatingData insertAudioTestData insertCognitiveTestData insertTrainingTaskData insertPersonalLogData insertMobileSensorData insertFrontData	
FR(PHAS)18: Support of progressive notifications and save of the outcomes on data analysis	*insertBDAData*	
FR(PHAS)7: Support different types of data analysis	retrieveData retrieveMobileMaterialData retrieveMobileQuestionaires retrieveMobileHearingCoachTrainingTasks retrieveMobilePersonalLog retrieveCongnativeTestData retrieveFrontData	
FR(PHAS)11: Administrate (create, update, delete) analysis' outcomes	queryData deleteData updateData	
FR(CLIS)39: Allow audiologists to access the recorded data	queryData retrieveData	
FR(CLIS)68: Record the patients' responses to various standardized questionnaires	insertData insertQuesAnwser	

FR(CLIS)107 Access to questionnaires' answers	retrieveData retrieveMobileQuestionaires	
FR(PSOS)146 Record up-to-date hearing research and health promotion information	insertData	

3.6 Mobile Application

3.6.1 Purpose

The mobile application will play a key role in the data gathering process of the EVOTION platform as it will be the main tool to collect information from the EVOTION HAs, the environment and the HA users. Following an easy-to-use modern design, it will be responsible to send all the aforementioned data to the main platform but also receive informational material and results from the data analysis having taken place by the platform.

The mobile application will be the main point of interaction between HA users and the EVOTION platform. Therefore, a large set of functional capabilities have been derived from the functional requirements defined in D2.1 [1] and presented in the following paragraph.

3.6.2 Functional Capabilities and Interfaces

The following list presents an overview of the functional capabilities that the EVOTION mobile application will provide. These capabilities aim at covering the functional requirements of the stakeholders and are envisaged to adapt to emerging user requirements during the course of the project. Every capability is accompanied by a detailed specification of the operations that implement it. Below are presented the mobile functional capabilities.

- HAs data collection - The application will be able to communicate with the HA embedded software and retrieve all the supplied information. This information will be temporarily stored to the mobile device and will be sent to the main platform for further analysis once an internet connection is available. The communication schema between HAs and application, as well as between the application and the platform will be based on a set of secure REST services. This functional capability is being implemented by the following operations that are presented below in details: collectHAsData, uploadHAsData, hearingLevelsOverTime and pushNotification;
- **HAs controlling** - The HA users will have the capability to adjust the operation of their HAs by using the mobile application. Moreover, an automatic adjustment of the HAs will be also available based on predefined fitting parameters. These changes will be triggered by changes in environmental or behavioural factors. In both cases, the adjustments will refer to a set of predefined programs so as to avoid the risk of accidentally configuring a potentially harmful setting of the HA. The update of settings in the EVOTION hearing aid is constrained to the programs defined by the clinician. Within this range, the mobile app and the user can select between these predefined programs and adjust the volume within the limits, which hearing aids normally allow. Therefore, neither the app nor the user can accidentally request a harmful setting. This functional capability is being implemented by the following operation that is presented below in details: controlHAsData;
- **Environmental data collection** - The mobile app will act as a sensor which can retrieve environmental information such as the user's current location and speed. Depending on the device hardware, more information such as counted steps could be also available (e.g. for devices having a pedometer). Upon user's consent, the EVOTION application will gather these pieces of information and send them to the platform so as to be analysed in conjunction with the HA

produced data. This functional capability is being implemented by the following operations that are presented below in details: collectEnvironmentalData and uploadEnvironmentalData;

- **TTS/NIHL event recording** - The mobile app will support easy recording of a TTS/NIHL episode. HA users must be able to access the relevant recording mechanism in as few as possible steps so as to accurately log the episode. The app will then have to send these events to the platform. This functional capability is being implemented by the following operations that are presented below in details: recordTTSNIHL and submitTTSNIHL;
- **Notifications/Alerts sending** - The app will make use of the notification system available by the device to issue notifications and alerts to the users. These messages can be also displayed in a prominent way inside the application to make sure that they are seen by the HA user. This capability is of great importance because it can be used to notify a user about a possible TTS/NIHL event and help him avoid it. The notification system can be also used by other modules of the application to issue notifications about new questionnaires, latest promotional material or even incoming messages from the user's clinician. This functional capability is being implemented by the following operations that are presented below in details: pushNotification and issueAlert;
- **Informational material presenting** - The app will provide a section with informational material for the users. This can include textual descriptions or other multimedia content related to HA research, medical help for urgent circumstances, etc. The content will be managed by the EVOTION platform, thus allowing easy updating and adding of new information. This functional capability is being implemented by the following operation that is presented below in details: presentMaterial;
- **Questionnaires** - The app will help clinicians to create and make surveys. These surveys will look like questionnaires that support a basic set of question types, in order to be quick and easy to fill in. The collected answers will be sent to the platform for further analysis. This functional capability is being implemented by the following operations that are presented below in details: retrieveQuestionnaire and submitQuestionnaire;
- **Rating system** - A rating system will allow the users to evaluate the HA operations and helpfulness. This mechanism will allow infinite number of ratings per user. Ratings will be a direct measure of the HAs effectiveness and proper operation. This functional capability is being implemented by the following operation that is presented below in details: submitRating;
- **Self-conducted audiological tests** - The mobile app will offer users the capability to take audiological tests on their own. The application will provide instructions to perform the tests and will store the results for further analysis made by the platform and the clinicians. Users taking the test will be able to monitor their current hearing levels and adjust the HA settings if needed. It will be also possible to configure a reminder for taking the test so as to help the users run it periodically. This functional capability is being implemented by the following operations that are presented below in details: initiateAudiologicalTest, submitAudiologicalTest and initiateAuditoryTraining;
- **Cognitive tests** - The app will include tests that allow users to perform self-testing for their cognitive capabilities. These tests will be able to capture cognitive data like reading span of HA user, verbal reaction time and reverse digit recall. The test results will be forwarded to the platform so as to allow clinicians assess the cognitive status of the patients. This functional capability is being implemented by the following operation that is presented below in details: submitCognitiveTest;
- **Voice recognition support** - The app will provide voice recognition support that will allow users to dictate problems or malfunctions that they have experienced while using the app. A speech-to-text mechanism will be in place in order to understand the user's voice and save the spoken notes. This functional capability is being implemented by the following operation that is presented below in details: startVoiceRecognition

- **Personal data storage and export** - The app will provide settings for the local storage of personal data. Moreover, an export format will be defined so as to allow sharing of these data with people that the user selects. The relevant settings will clearly state which is the information saved locally, so that the user is completely aware of how the system manages the data. This functional capability is being implemented by the following operation that is presented below in details: storePersonalData;
- **In-app messaging functionality** - A messaging module will be offered by the app. Other users that have the app installed in their devices, will be discoverable by this module, this will let the users create their contact lists, that include the user's clinician, their partners, etc. This functional capability is being implemented by the following operations that are presented below in details: sendMessage and receiveMessage;
- **Mobile hearing coach** - A specially designed hearing coach will be available by the app. This coach will consist in a number of components that can be turned off or on, based on the user's needs. The components will offer functionalities like:
    - Training (e.g. listen to words that are increasingly difficult for the user to hear)
    - Self-managing (e.g. identify where the user has hearing difficulties even though they are wearing their hearing aids, and propose concrete solutions)
    - Tracking achievements so as they remain engaged in their training

  This functional capability is being implemented by the following operations that are presented below in details: getHearingCoachTraining, submitHearingCoachTraining, showHearingCoachProposals and showHearingCoachAchievements;
- **Personal log space provision** - This capability refers to option of writing down notes in the form of a personal logging mechanism. The application will offer a module to support this functionality, which will include closed questions (having a fixed set of possible answers, mainly for common problems) as well as free-text writing. This information will be sent to the platform and will be available to clinicians in order to help them assess the patient's status. This functional capability is being implemented by the following operations that are presented below in details: getPersonalLogProvision and submitPersonalLog;
- **Social Network connection** - The mobile app will ask users to connect their social media accounts and allow EVOTION to gather information about their activity on them. Information about the user's current location, mood or activities will be recorded and stored in the platform so as to be correlated with other data. This functional capability is being implemented by the following operation that is presented below in details: submitSocialNetworkActivity
- **Supporting instruments** - The mobile app will provide supporting a set of supporting instruments to support and optimize the user interaction with the EVOTION solution. This functional capability is being implemented by the following operations that are presented below in details: authentication and transformExtractDataLocally.

collectHAsData

Operation Description	Records information about the user's hearing and their training coming from the HAs.
Pre-conditions	HA embedded software provides services to export timestamped logged data.
Post-conditions	HA data are stored in the device.
Input parameters	

Name	Type	Description
HAs tone audiometry	Timestamped value	Logged information about tone audiometry, recorded with the respective timestamp.
HAs speech audiometry	Timestamped value	Logged information about speech audiometry, recorded with the respective timestamp.
HAs other audiological data	Timestamped value	Logged information about audiological data, recorded with the respective timestamp.
Output parameters		
Name	**Type**	**Description**
Recording status	Integer	An integer showing the status of the data collection, possible values: 0(not receiving), 1(normal receiving), 2(interrupted receiving).

uploadHAsData

Operation Description	Sends HAs information to the platform	
Pre-conditions	HA data are stored in the device, Internet connection is available.	
Post-conditions	The HA data are successfully sent to the platform.	
Input parameters		
Name	**Type**	**Description**
Frequency	Time	How often should the app send the HAs data to the platform.
Output parameters		
Name	**Type**	**Description**
HA environment and usage data	Data arrays described in section 3.4 with timestamps	environmentDataHAOP, userchangeHAOP

HAs tone audiometry	Timestamped value	Logged information about tone audiometry, recorded with the respective timestamp.
HAs speech audiometry	Timestamped value	Logged information about speech audiometry, recorded with the respective timestamp.
HAs other audiological data	Timestamped value	Logged information about audiological data, recorded with the respective timestamp.

hearingLevelsOverTime

Operation Description	Check the hearing levels of over time	
Pre-conditions	HA data are stored in the device, Internet connection is available.	
Post-conditions		
Input parameters		
Name	**Type**	**Description**
currentTime	Time	Mobile's current time
hearingLevelsData		HAs hearing level data
Output parameters		
Name	**Type**	**Description**
localNotification	object	The message to the user that is showed at the EVOTION mobile app and may include action.

pushNotification

Operation Description	It shows EVOTION messages/alert to user through the EVOTION mobile app	
Pre-conditions	Installed and run the EVOTION app	
Post-conditions		
Input parameters		
Name	**Type**	**Description**

notificationData	Object	The notification data to be showed at mobile app
Output parameters		
Name	**Type**	**Description**
pushNotification	Object	The message to the user that is showed at the EVOTION mobile app and may include action.

Note: For simplicity reasons, the following operations will refer to all data coming from HAs as 'Has audiological data'

controlHAsData

Operation Description	Sets HA settings and parameters	
Pre-conditions	HA embedded software offers services that allow external components to control settings and paramaeters.	
Post-conditions	HA gets reconfigured with the sent parameters.	
Input parameters		
Name	**Type**	**Description**
Hearing Conditions	Predefined HA values	A set of HA values in a defined (by clinicians) set of recorded data.
User settings	HA settings	User provided HA settings.
Output parameters		
Name	**Type**	**Description**
HA parameters	HA settings	HA parameters that control the HA program and settings.

collectEnvironmentalData

Operation Description	Records information coming from the mobile device sensors.
Pre-conditions	User has allowed collection of mobile sensors data.
Post-conditions	Mobile sensor data are stored in the device.

Input parameters		
Name	**Type**	**Description**
Current location	Coordinates	A set of latitude/longitude values showing the user's current location and moving speed.
User routes	A set of coordinates	A collection of points (lat/lot pairs) showing a user's route.
Output parameters		
Name	**Type**	**Description**
Recording status	Integer	An integer showing the status of the data collection, possible values: 0(not receiving), 1(normal receiving), 2(interrupted receiving).

uploadEnvironmentalData

Operation Description	Sends information coming from the mobile device sensors to the platform.	
Pre-conditions	Mobile sensor data are stored in the device, Internet connection is available.	
Post-conditions	Mobile sensor data are stored in the platform.	
Input parameters		
Name	**Type**	**Description**
Frequency	Time	How often should the app send the HAs data to the platform
Output parameters		
Name	**Type**	**Description**
Current location	Coordinates	A set of latitude/longitude values showing the user's current location and moving speed.

User routes	A set of coordinates	A collection of points (lat/lot pairs) showing a user's route

Note: For simplicity reasons, the following operations will refer to all data coming from the mobile device as 'Environmental data'

recordTTSNIHL

Operation Description	Records HA and mobile device information when user perceived a TTS/NIHL episode.	
Pre-conditions	User initiates TTS/NIHL recording.	
Post-conditions	TTS/NIHL episode stored in the device.	
Input parameters		
Name	**Type**	**Description**
HAs audiological data	Timestamped value	Logged information about audiological data, recorded with the respective timestamp.
Environmental Data	Coordinates	All data recorded by the mobile device.
TTS/NIHL StartTime	DateTime	The exact moment that the user has perceived a TTS/NIHL event taking place.
TTS/NIHL EndTime	DateTime	The exact moment that the user has perceived a TTS/NIHL event finishing.
Output parameters		
Name	**Type**	**Description**
Recording Status	Integer	An integer showing the status of the episode recording, possible values: 0(not recorded), 1(successful recording).

submitTTSNIHL

Operation Description	Sends information about a TTS/NIHL episode to the platform.	
Pre-conditions	TTS/NIHL episode stored in the device, Internet connection available.	
Post-conditions	TTS/NIHL episode stored in the platform.	
Input parameters		
Name	**Type**	**Description**
Recorded TTS/NIHL episode Flag	binary	A flag showing is there is any recorded TTS/NIHL episode that hasn't been sent to the platform.
Output parameters		
Name	**Type**	**Description**
Recorded TTS/NIHL episode	HA values and datetime	All HA data values during the episode recording.

pushNotification

Operation Description	Issues push notifications using the OS notification infrastructure of the mobile device.	
Pre-conditions	Components have added tasks to the notifications queue.	
Post-conditions	Notifications appear at the user's mobile screen.	
Input parameters		
Name	**Type**	**Description**
Triggering Event	Text	The event that adds a notification for the user. It contains the text to be displayed which can be also accompanied by an action link/button.
Output parameters		
Name	**Type**	**Description**

Notification	Mobile Notification	The notification displayed on the mobile device.

issueAlert

Operation Description	Issues alerts that are visible when the application is visited by the user.	
Pre-conditions	Components have added tasks to the alerts queue.	
Post-conditions	Alerts appear at the user's mobile screen when opening the application.	
Input parameters		
Name	**Type**	**Description**
Triggering Event	Text	The event that adds an alert for the user. It contains the text to be displayed which can be also accompanied by an action link/button.
Output parameters		
Name	**Type**	**Description**
Alert	Text	The alert displayed on a designated screen inside the mobile application.

presentMaterial

Operation Description	Displays information and promotional material.	
Pre-conditions	Content is provided through the platform.	
Post-conditions	Content is displayed at the user's mobile screen when opening the application.	
Input parameters		
Name	**Type**	**Description**
Info Item	Text and Multimedia	An info item that can contain textual information as well as videos or images.

Output parameters		
Name	**Type**	**Description**
Rendered Info Item	Application page	The info item page displayed on the mobile device.

retrieveQuestionnaire

Operation Description	Gets the active questionnaires from the platform.	
Pre-conditions	Questionnaires have been added to the platform.	
Post-conditions	Questionnaires appear at the user's mobile screen.	
Input parameters		
Name	**Type**	**Description**
Questionnaire Info	Text	The general Information of the questionnaire, e.g. title, description, etc
Questions	Object list	A list of all included questions. Each question object contains its title, type and possible answer options.
Output parameters		
Name	**Type**	**Description**
Rendered Questionnaire	Application Page	The questionnaire displayed on the mobile device.

submitQuestionnaire

Operation Description	Submits the answers of a questionnaire to the platform.	
Pre-conditions	User has filled in the questionnaire.	
Post-conditions	Questionnaire responses are stored in the platform.	
Input parameters		
Name	**Type**	**Description**

User Answers	User input	The answers selected by the user through the mobile application.
Answered On	DateTime	The date and time that the questionnaire was answered.
Output parameters		
Name	**Type**	**Description**
Questionnaire ID	int	The Id of the questionnaire.
answers	Object list	A list of the answers to the questionnaire. Every object contains the questionID and the answerID.
Answered On	DateTime	The date and time that the questionnaire was answered.

submitRating

Operation Description	Submits the rating of the HA to the platform.	
Pre-conditions	User selects a rating value.	
Post-conditions	Rating is stored at the platform.	
Input parameters		
Name	**Type**	**Description**
User Rating	Star Rating	A standard star-rating widget for the HA use.
Answered On	DateTime	The date and time that the rating was given.
Output parameters		
Name	**Type**	**Description**
Rating	int	The rating value.
Answered On	DateTime	The date and time that the rating was given.

initiateAudiologicalTest

Operation Description	Initiate an audiological test to the mobile.	
Pre-conditions	AUD Tests are created in the platform, Instructions on how to run the tests are provided in the platform.	
Post-conditions	The user gets the audiological test at his mobile.	
Input parameters		
Name	**Type**	**Description**
TestID	ID	The audiological test identification number
Output parameters		
Name	**Type**	**Description**
Status	Bit	Initiation confirmation

submitAudiologicalTest

Operation Description	Submits the results of an audiological test to the platform.	
Pre-conditions	AUD Tests are created in the platform, Instructions on how to run the tests are provided in the platform.	
Post-conditions	Test results are stored at the platform.	
Input parameters		
Name	**Type**	**Description**
User Answers	User Input	The answers selected by the user through the mobile application.
Answered On	DateTime	The date and time that the test was taken.
Output parameters		
Name	**Type**	**Description**
AUD Test Result	Audiological Test Result	The result of the audiological test.
Answered On	DateTime	The date and time that the test was taken.

initiateAuditoryTraining

Operation Description	Initiate an auditory training to the mobile.	
Pre-conditions	Auditory training material are created in the platform, Instructions on how to run the material are provided in the platform.	
Post-conditions	The user gets the auditory training at his mobile.	
Output parameters		
Name	**Type**	**Description**
results	Bit	The status results of the auditory training

submitCognitiveTest

Operation Description	Submits the results of a cognitive test to the platform.	
Pre-conditions	COG Tests are created in the platform, Instructions on how to run the tests are provided in the platform.	
Post-conditions	The user gets the test results at his mobile screen. Test results are stored at the platform.	
Input parameters		
Name	**Type**	**Description**
User Answers	User Input	The answers selected by the user through the mobile application.
Answered On	DateTime	The date and time that the test was taken.
Output parameters		
Name	**Type**	**Description**
COG Test Result	Cognitive Test Result	The result of the cognitive test.
Answered On	DateTime	The date and time that the test was taken.

startVoiceRecognition

Operation Description	Accepts voice and transforms it to text.

Pre-conditions	Users select voice as the input type of their choice.	
Post-conditions	Recorded text is stored at platform.	
Input parameters		
Name	**Type**	**Description**
User Voice	Audio	Speaking of a user.
Output parameters		
Name	**Type**	**Description**
Recognized Text	Text	The result of the speech-to-text transformation.

storePersonalData

Operation Description	Stores data locally to the mobile device.	
Pre-conditions	Users have defined types of data to be stored locally at their device.	
Post-conditions	Personal Health records are available for export from the mobile device.	
Input parameters		
Name	**Type**	**Description**
HAs audiological data	Timestamped value	Logged information about audiological data, recorded with the respective timestamp.
Environmental Data	Coordinates	All data recorded by the mobile device.
Recorded TTS/NIHL episode	HA values and datetime	All HA data values during the episode recording.
Answered Questionnaires	Questionnaire Responses	A list of all the answered questionnaires the user has taken.
AUD Test Results	List of Audiological Test Results	The results of all the audiological tests the user has taken.

COG Test Results	List of Cognitive Test Results	The results of all the cognitive tests the user has taken.

sendMessage

Operation Description	Sends messages to contacts.	
Pre-conditions	User has added contacts, All participants have the app installed at their mobiles.	
Post-conditions	Message is delivered to the designated recipient.	
Input parameters		
Name	**Type**	**Description**
New Message	User Input	The text message that the user inserts.
Receiver	Contact Name	The receiver of the message.
Output parameters		
Name	**Type**	**Description**
Outgoing Message	Text	An outgoing message that the user sends.

receiveMessage

Operation Description	Receives messages from contacts.	
Pre-conditions	User has added contacts, All participants have the app installed at their mobiles.	
Post-conditions	Message is received and appears at the user's mobile screen.	
Input parameters		
Name	**Type**	**Description**
New Message	Text	The text message that the user receives.
Sender	Contact Name	The sender of the message.
Output parameters		
Name	**Type**	**Description**

Incoming Message	Text	An incoming message that the user receives.

getHearingCoachTraining

Operation Description	Gets the training tasks from the platform.	
Pre-conditions	Training Tasks have been added to the platform.	
Post-conditions	The tasks are available in the mobile app.	
Input parameters		
Name	**Type**	**Description**
Training Info	Text	The general Information of the training task, e.g. title, description, etc
Training steps	Object list	A list of all included steps. Each step contains its title, description and action to be performed.
Output parameters		
Name	**Type**	**Description**
Rendered Training Task	Application Page	The task displayed on the mobile device.

submitHearingCoachTraining

Operation Description	Submits the results of a training task to the platform.	
Pre-conditions	Training tasks are available in the mobile app, User has run one of the tasks.	
Post-conditions	Task results are sent to the platform.	
Input parameters		
Name	**Type**	**Description**
Task Execution	List of Completed Steps	The steps of the task executed by the user.
Run On	DateTime	The date and time that the task was run.

Output parameters		
Name	**Type**	**Description**
Training Task ID	int	The Id of the task.
Task Completion Rate	Percentage	Shows the level of completion of the test by the user.
Answered On	DateTime	The date and time that the questionnaire was answered.

showHearingCoachProposals

Operation Description	Displays proposals for better use of the HAs.	
Pre-conditions	Task results have been sent to the platform.	
Post-conditions	The platform generates proposals tailored to the user's needs according to prior task results and HA data gathered.	
Input parameters		
Name	**Type**	**Description**
Proposal	Text	Proposal identified by the clinicians or the system and retrieved by the platform.
Output parameters		
Name	**Type**	**Description**
Rendered Proposal	Application page	The Proposal displayed on the mobile device.

showHearingCoachAchievements

Operation Description	Displays achievements of the user.	
Pre-conditions	Users complete training tasks.	
Post-conditions	Gamified visual elements appear at the mobile application in order to let the users get recognition for their achievements.	
Input parameters		
Name	**Type**	**Description**

Achievement	Text	A label with the form of a category/level/badge that the users receive in recognition of their performance in training tasks.
Output parameters		
Name	**Type**	**Description**
Rendered Achievement	Visual Element	The achievement level of the user displayed in the mobile app in a gamified way, e.g. a badge.

getPersonalLogProvision

Operation Description	Gets the closed questions for common problems from the platform.	
Pre-conditions	Common problems have been categorised in specific questions available in the platform.	
Post-conditions	The questions are displayed in the relevant section of the mobile app.	
Input parameters		
Name	**Type**	**Description**
Questions	Object list	A list of all included questions. Each question object contains its title, type and possible answer options.
Output parameters		
Name	**Type**	**Description**
Rendered Questions	Application Page	The questions displayed on the mobile device.

submitPersonalLog

Operation Description	Submits the answers of the personal log questions to the platform.
Pre-conditions	User answers questions or adds personal notes.

Post-conditions	Personal logs are stored in the platform.	
Input parameters		
Name	**Type**	**Description**
User Answers	User input	The answers selected by the user through the mobile application.
Answered On	DateTime	The date and time that the questionnaire was answered.
User Note	Textarea	The free-text answer of the user.
Output parameters		
Name	**Type**	**Description**
User Answers	Object list	A list of the answers to the questionnaire. Every object contains the questionID and the answerID.
User Note	Textarea	The free-text answer of the user.
Answered On	DateTime	The date and time that the questionnaire was answered.

submitSocialNetworkActivity

Operation Description	Submits social media activities of the user to the platform.	
Pre-conditions	User allows social network connection with the mobile app.	
Post-conditions	Social Media Items are stored in the platform.	
Input parameters		
Name	**Type**	**Description**
Social Media Activities	Social Media Items	A list of predefined social media activities that are of interest to the clinicians.
Output parameters		
Name	**Type**	**Description**

Social Network Id	String	The social network the activity is retrieved from.
Social Media Activity	Social Media Item	The SM activity object.
Created On	DateTime	The date and time that the activity was retrieved.

authentication

Operation Description	Authenticates user to use the EVOTION mobile app	
Pre-conditions	To have installed the EVOTION mobile app	
Post-conditions		
Input parameters		
Name	**Type**	**Description**
username	string	User name to access the EVOTION system through the mobile app
password	string	Password that authenticates user to access the EVOTION system through the mobile app
Output parameters		
Name	**Type**	**Description**
isAuthenticatedUser	boolean	Validation of user authentication

transformExtractDataLocally

Operation Description	It transforms & extracts EVOTION data locally to the mobile app	
Pre-conditions	Available storage space at mobile device	
Post-conditions		
Input parameters		
Name	**Type**	**Description**
dataToBeExported	Object	The dataset that is requested to be transformed and exported locally

Output parameters		
Name	**Type**	**Description**
processedData	Object, binary file	The binary file with the requested transformed dataset

3.6.3 Related Requirements

The requirements, which are addressed (partially or fully) by this component are as follows:

FR(CLIS)29: Mobile app communicates with HA devices **FR(CLIS)30:** Mobile app collects data from HA devices	collectHAsData, initiateAudiologicalTest	
FR(CLIS)31: Mobile app provides a window to rate the HA ease of use **FR(CLIS)33:** Mobile app sends stream of user ratings to the EVOTION platform	submitRating	
FR(CLIS)32: Mobile app identifies problems in the communication with the HA device	submitPersonalLog	
FR(CLIS)35: Collect environmental noise and noise coming from user activities and send them to the EVOTION platform **FR(CLIS)73:** Mobile app should records ambient noise level data, duration of noise exposure and physiological data	CollectHAsData; UploadHAsData	

FR(CLIS)43: Communicate of the new fitting profile to the EVOTION mobile app **FR(CLIS)44:** Configure the HA device fitting parameters **FR(CLIS)90:** Platform and mobile app collects real-time listening environment data and automatically adjust the fitting settings **FR(CLIS)117:** HA gets calibrated (preferably automatically) based on HA test's results	controlHAsData	
FR(CLIS)45: Insert a new event **FR(CLIS)46:** Collect timestamped data related to an event for a configurable period between before the event occurrence and after it **FR(CLIS)67:** Mobile app allows patients to manually insert a TTS / NIHL episode **FR(CLIS)133:** Mobile app provides instructions to monitor TTS/NIHL and instructions to perform hearing test **FR(CLIS)137:** Mobile app (automatically/manually) records TTS/NIHL episodes	recordTTSNIHL	
FR(CLIS)47: Communication of a detected event record to the EVOTION platform	submitTTSNIHL	

FR(CLIS)62: Compose alerts for a patient, based on desired values for the factors affecting TTS / NIHL episodes **FR(CLIS)66:** Mobile app raises alerts for urgent medical attention **FR(CLIS)99:** Issue notifications with respect to actions that should be taken on detected BP events **FR(CLIS)136:** Mobile app alerts HA users to seek urgent medical attention **FR(CLIS)140:** Automatic alerts for urgent hearing TTS/NIHL episodes	pushNotification; issueAlert	The operations support the notification/alert sending on the mobile device. The mentioned FRs are responsible to create the notifications.
FR(CLIS)63: Allow TTS/NIHL data monitoring and provide a wizard to guide patients in performing a hearing test on their own **FR(CLIS)70:** Provide speech in noise tests and communicate results to the platform **FR(CLIS)119:** Mobile app performs audiological tests and records the test results (quiet/noisy environment sounds and AUD1-5 parameters) **FR(CLIS)122:** Mobile app communicates with the HA device in order to request simple	submitAudiologicalTest	

tests to monitor users' hearing over time **FR(CLIS)123:** Mobile app triggers hearing tests to take **FR(CLIS)126:** Mobile provides clearly the hearing testing results over time (for a selected period) **FR(CLIS)127:** Mobile app sends HA adjustments and hearing test results to EVOTION platform **FR(CLIS)135:** Mobile app provides hearing self-tests to HA users		
FR(CLIS)64: Mobile app should be able to record noise level and physiological data automatically **FR(CLIS)72:** Record END and BHD data	collectEnvironmentalData	
FR(CLIS)65: Mobile app allows patients to start a hearing test and declare NIHL events	submitAudiologicalTest; recordTTSNIHL	
FR(CLIS)68: Record the patient' responses to various standardized questionnaires **FR(CLIS)106:** Mobile app provides questionnaires to be filled-in by HA users and records HA users' answers	retrieveQuestionnaire; submitQuestionnaire	
FR(CLIS)74: Mobile app communicates with the platform	UploadHAsData; uploadEnvironmentalData; submitQuestionnaire; submitAudiologicalTest;	The basic operations are listed, the mobile app communicates with the platform for any other

	submitTTSNIHL; submitCognitiveTest	information needed to support the offered functionalities.
FR(CLIS)80: Retrieve respective auditory training sessions **FR(CLIS)83:** Provide auditory training sessions of various level of difficulty	getHearingCoachTraining	
FR(CLIS)81: Mobile app should allow patients to respond to auditory trainings and get assessment from the EVOTION platform	submitHearingCoachTraining; showHearingCoachProposals	
FR(CLIS)85: Mobile app records patient feedback on a training	submitHearingCoachTraining	
FR(CLIS)86: Maintain results and score of cognitive tests for each patient	SubmitCognitiveTest	
FR(CLIS)91: Mobile app connects to the user profile in the social networks **FR(CLIS)92:** Mobile app stores user consent action for accessing social networks **FR(CLIS)93:** Mobile app records different data streams **FR(CLIS)94:** Analyse patient activity in the social networks and relate it with events captured from the patient's HA and mobile devices	submitSocialNetworkActivity	FR94 is associated for the part of capturing the social media events
FR(CLIS)100: Compare sensors' data and data collected from HAs	CollectHAsData; UploadHAsData; CollectEnvironmentalData; UploadEnvironmentalData	

FR(CLIS)101: Mobile app should collect data from sensors and upload them to EVIOTION repository in a periodic basis	CollectEnvironmentalData; UploadEnvironmentalData	
FR(CLIS)105: Mobile app should notifies HA users to fill-in a questionnaire	retrieveQuestionnaire; pushNotification; issueAlerts	
FR(CLIS)112: Mobile app provides a multi-selection list with the most common sources of annoyance	getPersonalLogProvision	
FR(CLIS)113: Mobile app records interactions of HA user with the multi-selection list of the most common sources of annoyance **FR(CLIS)142**: Mobile app records issues, concerns and problems with hearing aid	submitPersonalLog	
FR(CLIS)120: Mobile app extracts personal data in an application-friendly standard format	storePersonalData	
FR(CLIS)121: Support peer-2-peer real-time text messaging	sendMessage; receiveMessage	
FR(CLIS)130: Send selected training material (words into sound) to EVOTION mobile app **FR(CLIS)131**: Mobile app should be able to play training material (words into sound) **FR(CLIS)132**: Mobile app provides the functionality to select the available training material	presentMaterial	

FR(CLIS)138: Mobile app provides a list of the available medical help for urgent circumstances **FR(CLIS)145**: Mobile app provides up-to-date hearing research and health promotion information to HA user		

3.7 Enabling Sensors

3.7.1 Purpose

The set of enabling drivers that will be developed will allow the connection of sensors with the EVOTION repository. These drivers will use interfaces offered by the sensors in order to collect the measured data. They will also format the retrieved data in a suitable way to be sent to the platform for further processing.

3.7.2 Functional Capabilities and Interfaces

The following list presents an overview of the functional capabilities provided by the EVOTION drivers that enable the sensors. The sensors will mainly provide physiological data that include heart and respiratory rate, blood pressure, temperature, skin conductance and oxygenation. Below are presented the sensors' functional capabilities.

- **Sensors data collection -** The component will be able to communicate with the sensors and retrieve all the recorded information. It will make use of the exposed APIs of each sensor in order to get the collected data. This functional capability is being implemented by the following operation that is presented below in details: collectSensorsData;
- **Sensors data uploading to the Platform** - The data collected by the sensors will have to be transformed into a defined data model before being uploaded to the cloud. The enabling drivers will handle this transformation and then send the data to the cloud using a set of RESTful services that the EVOTION repository will provide. This functional capability is being implemented by the following operation that is presented below in details: uploadSensorsData.

collectSensorsData

Operation Description	Records information coming from the Sensors.	
Pre-conditions	Sensors software provides services to export timestamped logged data	
Post-conditions	Sensor data are collected by the enabling drivers	
Input parameters		
Name	**Type**	**Description**
Heart Rate	Timestamped value	Logged information about Heart Rate, recorded with the respective timestamp.
Respiratory Rate	Timestamped value	Logged information about Respiratory Rate, recorded

		with the respective timestamp.
Blood pressure	Timestamped value	Logged information about Blood pressure, recorded with the respective timestamp.
Temperature	Timestamped value	Logged information about Temperature, recorded with the respective timestamp.
Skin conductance	Timestamped value	Logged information about Skin conductance, recorded with the respective timestamp.
Oxygenation	Timestamped value	Logged information about Oxygenation, recorded with the respective timestamp.
Output parameters		
Name	**Type**	**Description**
Recording status	Integer	An integer showing the status of the data collection, possible values: 0(not receiving), 1(normal receiving), 2(interrupted receiving).

uploadSensorsData

Operation Description	Sends Sensors information to the platform	
Pre-conditions	Sensor data are collected, Internet connection is available	
Post-conditions	Transformed Sensor data are stored in the platform	
Input parameters		
Name	**Type**	**Description**
Frequency	Time	How often should the app send the Sensors data to the platform.
Output parameters		
Name	**Type**	**Description**
Physiological Record	Object	Contains all the monitored physiological data coming from the sensors in the format defined by the data repository for storage.

3.7.3 Related Requirements

The requirements addressed (partially or fully) by this component are as follows:

Requirement	Operation	Notes
FR(CLIS)102: Mobile app should collect data from sensors and HAs and upload them to EVIOTION repository in an ad hoc basis in case of an event	collectSensorsData	Wearable sensors for every measurement should be deployed
FR(CLIS)100: Compare sensors' data and data collected from HAs **FR(CLIS)103:** Analyse sensors' and HAs' data	uploadSensorsData	

3.8 Big data analytics engine

3.8.1 Purpose

BDA Engine Component has a central role in the EVOTION platform allowing to i) process analytics tasks for PHPDM policy evaluation and tuning, ii) process simple query accessing to the repository, iii) provide results for visualization in the dashboard and as feedback to the Mobile App. We note that simple queries follow the same process as analytics although queries do not require any complex data mining processes.

BDA Engine Component interacts mainly with i) *Mobile App* to capture data from the HA and sensors and to provide feedback in case of analytic execution request, ii) *Ontology Reasoner* to update ontological model instances after each analytics execution, iii) *PHPDM Transformation* tool to receive analytics that need to be executed, iv) *Dashboard* for visualization of the analytics processing results, v) *Data repository* to retrieve/ingest data needed for analytics execution.

3.8.2 Functional Capabilities

The Big Data Analytic Engine principally addresses the functionalities required for the processing of analytics and giving back the feedback needed by the entity requiring the analytic. For doing this process, it interacts with Data Repository to retrieve data needed for the processing.

More in details:

Processing – Big Data Analytic component is responsible to execute analytic tasks and queries when required. In then interacts with the repository to retrieve the data to be analyzed and store analytic results if needed.

Providing feedback – When the result of an execution of a Big Data computation is available, the Big Data Engine is responsible to make it available for the entity that ask for it. Big Data Engine supports both push and pull approaches.

The above functional capabilities of Big Data Engine component are aggregated within two interfaces: i) *AnalyticsProcessing* interface *and ii) ProcessingResult* interface

AnalyticsExecution interface provides the following operations:

LoadAnalytic - it allows to load a given analytics as expressed by the PHPDM transformation tool. LoadAnalytic receives both the declarative form of the analytics, used for giving feedback to the ontology reasoner when the analytics tasks ended successfully, and the analytics in the procedural form to be instantiated and executed by the BDA Engine. It returns the analytics ID for further interactions with the BDA Engine. It is suitable for the preparation of a set of analytics for further executions, for instance when certain event occurs (e.g., availability of data).

ExecuteAnalytic - it receives the ID of the analytic to be executed, the format of the expected results and instantiates the analytic process by setting up the relative task to be executed. It gives back the reference for collecting the analytic process results depending on the format required. It is mandatory to start any processing work.

StopAnalytic - it received the ID of the analytic to be arrested and execute the termination procedure per the specific ID. It is suitable to arrest a given execution (e.g., an analytic task that is taking too much time).

RemoveAnalytic - it received the ID of the analytic to be removed from the loaded ones. The ID must refer to analytics that are not currently under execution. It is needed to remove one analytic to be replaced by a different version.

ProcessingResult interface provides the following operations:

AnalyticResults – It receives as input the reference obtained by the analytic execution and provide the results in the required format if already produced.

Normally the process for the execution of a given analytics is obtained with the following ordered set of functional calls: i) LoadAnalytic giving as input the procedural analytic to be executed and retrieving the ID; ii) ExecuteAnalytic giving as input the ID of the analytic to be executed, the type of the output and providing back the reference for capturing the execution results; iii) RemoveAnalytic (optional) for remouving the analytic from the list of executable ones

ExecuteAnalytic contacts repository via DataQuery interface, instantiate the relative tasks and produces an output. When the output of the execution is available, the Ontology Reasoner is contacted to update the models accordingly if needed. The output of an analytic execution is also available for the caller trough the AnalyticResults interface.

We note that if needed the procedural analytics can express processing before data ingestion. For instance, for achieving data anonymization that can be performed over data before storing it to the data Repository.

ID LoadAnalytic(ProcedurelAnalytic, DeclarativeAnalytic)

LoadAnalytic	It allows the load of a given executable analytics within the BDA Execution engine for consecutive execution. It provides as output the ID of the analytics to be executed	
Input parameters		
Name	**Type**	**Description**
ProceduralAnalytic	Structured type. It is a complex data type where all the phases of the analytic process is	It is the procedurel analytic description as provided by the PHPDM Transformation tool

	expressed in an executable way	
DeclarativeAnalytic	Structured type. It is a complex data type where all the phases of the analytic process is expressed in an declarative way	It is used as a reference to the EVOTIO model and as a way to notify the ontology about the results of a given analytic task
Output parameters		
Name	**Type**	**Description**
ID	Numeric	It represents the ID of the analytics for the following execution

Ref ExecuteAnalytic(ID, ResType)

ExecuteAnalytic	Instantiate and execute a given loaded analytic relative to the identifier ID. It set up the analytic task executing a procedural analytic identified with ID considering the type of result expressed in ResType. If provides as output the reference Ref for collecting the execution result.	
Pre-conditions	ID must refer to a loaded analytics	
Post-conditions	Ref is a unique identifier relative to the processing of the given analytic ID and the relative ResType	
Input parameters		
Name	**Type**	**Description**
ID	numeric	Unique identifier for a given procedural analytic provided as output of AnalyticLoad operation
ResType	Enumerative type. It can be: reference to a Zeppelin notebook, matrix of data, csv, etc.	It describes the format of the execution result.
Output parameters		
Name	**Type**	**Description**
Ref	numeric	Contains the reference to the result the can be used to retrieve it using AnalyticResult operation

ret StopAnalytic(ID)

StopAnalytic	Arrest the execution of a given analytic and perform the relative rollback activities if required
Pre-conditions	ID must refer to an analytic under execution
Post-conditions	Ref correspond to a valid output message
Input parameters	

Name	Type	Description
ID	numeric	Unique identifier for a given procedural analytic provided as output of AnalyticLoad operation
Output parameters		
Name	**Type**	**Description**
ret	numeric	Contains an id corresponding either to success or errors messages like analytic ID not available etc.

ret RemoveAnalytic(ID)

RemoveAnalytic	Remove a given analytic from the list of the available.	
Pre-conditions	ID must refer to a loaded analytic	
Post-conditions	Ref correspond to a valid output message	
Input parameters		
Name	**Type**	**Description**
ID	numeric	Unique identifier for a given procedural analytic provided as output of AnalyticLoad operation
Output parameters		
Name	**Type**	**Description**
ret	numeric	Contains an id corresponding either to success or errors messages like analytic ID not available etc.

ret AnalyticResults(Ref)

AnalyticResults	Returns the reference where the analytic results can be retrieved.	
Pre-conditions	Ref must correspond to a valid executed analytic	
Post-conditions	It returns error if the analytic is not completed when called	
Input parameters		
Name	**Type**	**Description**
Ref	numeric	Unique identifier an analytical task executed by the platform
Output parameters		
Name	**Type**	**Description**
ret	numeric	Contains an id corresponding either to success or errors messages like analytic ref not concluded.

3.8.3 Related Requirements

The requirements addressed (partially or fully) by this component are as follows:

Requirement	Operation	Notes
FR(PHAS)2 Discover factors of low HA usage	LoadAnalytic ExecuteAnalytic AnalyticResults	The analytic is chosen using the ontology and the DSS
FR(PHAS)3 Identify relevant studies and provide a summary of them	LoadAnalytic ExecuteAnalytic AnalyticResults	The analytic is chosen using the ontology and the DSS
FR(PHAS)4 Filter the relevant studies	LoadAnalytic ExecuteAnalytic AnalyticResults	
FR(PHAS)5 Cluster the relevant studies	LoadAnalytic ExecuteAnalytic AnalyticResults	The cluster technique is chosen using the ontology and the DSS module
FR(PHAS)7 Support different types of data analysis	LoadAnalytic ExecuteAnalytic AnalyticResults	BDA engine provides a set of different analytics
FR(PHAS)8 Support different types of data tests	LoadAnalytic ExecuteAnalytic AnalyticResults	BDA engine is able to load different kind of data
FR(PHAS)9 Produce and manage metrics for the quality of analysis Could have	LoadAnalytic ExecuteAnalytic AnalyticResults	
FR(PHAS)10 Initiate data analysis session	ExecuteAnalytic	
FR(PHAS)11 Administrate (create, update, delete) analysis' outcomes	LoadAnalytic ExecuteAnalytic StopAnalytic RemoveAnalytic AnalyticResults	BDA platform will provide a manager panel for the evotion administrator
FR(PHAS)12 Notification when analysis is complete	AnalyticResults	The notification wil be executed by a specific tool not included in the BDE
FR(PHAS)14 Suggest factors of analysis' outcome	LoadAnalytic ExecuteAnalytic AnalyticResults	
FR(PHAS)15 Re-analysing a specific dataset with different factors	LoadAnalytic ExecuteAnalytic AnalyticResults	The users can be able to re-load a specific dataset /result stored in the BDE
FR(PHAS)16 Data analysis, in a statistical way, between different data types	LoadAnalytic ExecuteAnalytic AnalyticResults	
FR(PHAS)17 Support multiple types of analysis' criteria	LoadAnalytic ExecuteAnalytic AnalyticResults	
FR(PHAS)18 Support of progressive notifications and save of the outcomes on data analysis	ExecuteAnalytic AnalyticResults	

FR(PHAS)20 Access management features for the analysis outcomes	ExecuteAnalytic AnalyticResults	
FR(PHAS)21 Analyze expressed evidence from the online discussions and suggestions	LoadAnalytic ExecuteAnalytic AnalyticResults	
FR(PHAS)24 Identification of the resulting tense and generation of a potential policy model for implementation	ExecuteAnalytic AnalyticResults	BDA Engine should be able to store data in the ontology module
FR(PHAS)26 Stop the relevant analytic activity	StopAnalytic	
FR(CLIS)49 Provide objective real data relevant to the detected event	LoadAnalytic ExecuteAnalytic AnalyticResults	
FR(CLIS)82 Analyze the responses to the auditory training tests	LoadAnalytic ExecuteAnalytic AnalyticResults	
FR(CLIS)100 Compare sensors' data and data collected from HAs	LoadAnalytic ExecuteAnalytic AnalyticResults	
FR(CLIS)103 Analyze sensors' and HAs' data	LoadAnalytic ExecuteAnalytic AnalyticResults	The data sensors can be load in the BDA engine.

3.9 Decision support system

3.9.1 Purpose

The purpose of the EVOTION Decision Support System (DSS) is to provide data retrieval and summarization functionalities for text-mining related tasks, aimed mainly at PHPD makers and clinicians, in order to define and produce decision-related scenarios, based on information produced by the EVOTION platform and external sources as well.

For the aforementioned purposes a text-mining (TM) based decision support system will be developed. A text-mining based DSS provides mainly data retrieval/summarization functionalities.

The most widely used text mining techniques are discussed briefly below to enable better understanding of their application in the concept of EVOTION.

1. Information extraction: Information extraction algorithms identify key phrases and relationships within text. This is done by looking for predefined sequences in text, using a process called 'pattern matching'.
2. Categorization: Categorization involves identifying the main themes of a document by placing the document into a pre-defined set of topics. It does not attempt to process the actual information as information extraction does.
3. Clustering: Clustering is a technique used to group similar documents, but it differs from categorization in that documents are clustered based on similarity to each other instead of using predefined topics. A basic clustering algorithm creates a vector of topics for each document and measures how well the document fits into each cluster.

4. Question answering: Another application area of text mining is answering of question answering, which deals with how to find the best answer to a given question. Question answering can utilize more than one text mining techniques.

TM systems can perform linguistic, semantic, and statistical analysis to produce reports such as a list of keywords, a table of facts, or a graph of concept associations.

3.9.2 Functional Capabilities and Interfaces

The DSS component offers the following functional capabilities:

1. **External Data/Document Upload Capability**. This will allow the user to upload documents and/or external data in pre-defined formats to the DSS Document Repository. These data are necessary for (TM) related purposes. This capability will be implemented by the following list of interfaces: dss_Upload{Census, ICD10Incidence, ICD10Prevalence, IncidenceICF, PrevalenceICFData, IncidenceChildICF, PrevalenceChildICF, Cost, DeviceFitiingCost, DeviceSuppliesCost, RiskFactor}Data, dss_UploadPapers and dss_UploadReports.
2. **EVOTION Data Import Capability**. This will allow the user to query data reports produced by the individual EVOTION platform components. These data are also necessary for (TM) related purposes. This capability will be implemented by the following list of interfaces: dss_Import{Social, PHPDMTrans, PHPDMSpec, Reas, DataRep}Data.
3. **Information Extraction and Question Scenarios Capabilities**. These two capabilities will allow the user to select analysis type and definition of factors via pattern matching algorithms, as well as to select questions (scenarios) to be run in order to produce decision-producing cases, based on TM algorithms and the data input from the two aforementioned capabilities. This capability will be implemented by the following list of interfaces:
   dss_TM(FactorAnalysis, StudAnalysis, Summary, Keywords, Clustering, DataCharacterization, Algorithms, DataTests, Metrics, Start, StopAnalysis, RetrieveList}Tasks
4. **DSS Scenarios Reports Capability**. This capability will allow the user to create, edit, delete or update the DSS-produced reports. This capability will be implemented by the following list of interfaces: dss_TM{CreateReport, UpdateReport, DeleteReport, CriteriaExt }Tasks.

The aforementioned capabilities are to be realised by operations of the DSS which are grouped into the following interfaces, analytically presented from that point onwards:

dss_UploadCensusData

Operation Description	Functions allowing the upload of census related data to the DSS	
Pre-conditions	Data should be given in table[integer/float] formats.	
Post-conditions	-	
Input parameters		
Name	**Type**	**Description**
CensusAgeData	table[integer]	Age distribution – for simulation what is going on and what will be concerning with possible aging, sex, race and connection with HL patient (what we can expect) – PREDICTION for HL clinical outputs regarding age. Needed 4 last censuses.

		PHAA from each country has to provide input data.
CensusRaceData	Table[integer]	Race distribution - for simulation what is going on and what will be concerning race, age, sex and HL patient (what we can expect) – PREDICTION for HL clinical outputs regarding race. Needed 4 last censuses. PHAA from each country has to provide input data.
CensusSexData	Table[integer]	Sex distribution - for simulation what is going on and what will be concerning sex, race, age and HL patient (what we can expect) – PREDICTION for HL clinical outputs regarding sex. Needed 4 last censuses. PHAA from each country has to provide input data.
CensusGDPData	Table[float]	Establishing GDP tend
CensusEducData	Table[integers]	Educational attainment in population 1. No formal education 2. ISCED Level 1. Primary education 3. ISCED Level 2. Lower secondary education 4. ISCED Level 3. Upper secondary education 5. ISCED Level 4. Post-secondary non-tertiary education 6. ISCED Level 5. First stage of tertiary education 7. ISCED Level 6. Second Stage of tertiary education 8. Not stated (of the persons aged 15 years or over) 9. Not applicable (persons under 15 years of age)
CensusActivData	Table[integers]	Employment, incidence and prevalence of employment and unemployment rate according sex, age. Activity status is of interest for comparison between state activity status in population and this among HL patients (EVOTION data) 1. Employed 2. Unemployed

		a. Unemployed, previously in employment b. Unemployed, never worked before 3. Currently not economically active a. Persons below the national minimum age for economic activity b. Pension or capital income recipients c. Students (not economically active) d. Homemakers and others i. Homemakers (optional) ii. Others (optional)
CensusMaritData	Table[integers]	Marital status is of interest for comparison between marital status in population and this among HL patients (EVOTION data) 1. Never married and never in a registered partnership 2. Married a. In an opposite-sex marriage b. In a same-sex marriage 3. Widowed (and not remarried or in a registered partnership) 4. Divorced (and not remarried or in a registered partnership) 5. In a registered partnership a. In an opposite-sex registered partnership b. In a same-sex registered partnership 6. Registered partnership ended with the death of partner (and not married or in a new registered partnership) 7. Registered partnership legally dissolved (and not married or in a new registered partnership)

		8. Not stated
CensusHLIData	Table[integers]	Health statistics provide annually data about the general number of cases of certified disability ("permanent reduction on functional capacity") due to hearing impairments according to ICD-10, class VIII. Such disabilities concern persons certified for not capable of working full-time due to hearing impairments. In addition to the general number of such cases, census provides also data for the number of such cases distributed by degree of disability (above 90%, 71-90%, 50-70%, under 50%).
Output parameters		
Population data tables	Table_TM	Tables in TM format.

dss_UploadICD10IncidenceData

Operation Description		Functions allowing the upload of ICD10 incidence related data to the DSS
Pre-conditions		Known census parameters, Known EVOTION data, Systemic review literature and meta-analysis. Clinicians should decide which of ICD-10 diagnosis (codes) could be of interest. Known **ICD-10 code incidence** and **Cost Data**
Post-conditions		Data should be used for economic modeling and simulating purposes.
Input parameters		
Name	**Type**	**Description**
ICD_10_H60IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H60** Otitis externa 1. H60.0 Abscess of external ear 2. H60.1 Cellulitis of external ear 3. H60.2 Malignant otitis externa 4. H60.3 Other infective otitis externa 5. H60.4 Cholesteatoma of external ear 6. H60.5 Acute otitis externa, noninfective 7. H60.8 Other otitis externa 8. H60.9 Otitis externa, unspecified
ICD_10_H61IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis.

		Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H61** Other disorders of external ear 1. H61.0 Perichondritis of external ear 2. H61.1 Noninfective disorders of pinna 3. H61.2 Impacted cerumen 4. H61.3 Acquired stenosis of external ear canal 5. H61.8 Other specified disorders of external ear 6. H61.9 Disorder of external ear, unspecified
ICD_10_H62IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95)**as a course of HL disability.** **H62**Disorders of external ear in diseases classified elsewhere 1. H62.0* Otitis externa in bacterial diseases classified elsewhere 2. H62.1* Otitis externa in viral diseases classified elsewhere 3. H62.2* Otitis externa in mycoses 4. H62.3* Otitis externa in other infectious and parasitic diseases classified elsewhere 5. H62.4* Otitis externa in other diseases classified elsewhere 6. H62.8* Other disorders of external ear in diseases classified elsewhere
ICD_10_H65IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H65**Nonsuppurative otitis media 1. H65.0 Acute serous otitis media 2. H65.1 Other acute nonsuppurative otitis media 3. H65.2 Chronic serous otitis media 4. H65.3 Chronic mucoid otitis media 5. H65.4 Other chronic nonsuppurative otitis media 6. H65.9 Nonsuppurative otitis media, unspecified

ICD_10_H66IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H66**Suppurative and unspecified otitis media 1. H66.0 Acute suppurative otitis media 2. H66.1 Chronic tubotympanic suppurative otitis media 3. H66.2 Chronic atticoantral suppurative otitis media 4. H66.3 Other chronic suppurative otitis media 5. H66.4 Suppurative otitis media, unspecified 6. H66.9 Otitis media, unspecified
ICD_10_H67IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H67**Otitis media in diseases classified elsewhere 1. H67.0* Otitis media in bacterial diseases classified elsewhere 2. H67.1* Otitis media in viral diseases classified elsewhere 3. H67.8* Otitis media in other diseases classified elsewhere
ICD_10_H68IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H68**Eustachian salpingitis and obstruction 1. H68.0 Eustachian salpingitis 2. H68.1 Obstruction of Eustachian tube
ICD_10_H69IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII

		Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H69**Other disorders of Eustachian tube 1. H69.0 Patulous Eustachian tube 2. H69.8 Other specified disorders of Eustachian tube 3. H69.9 Eustachian tube disorder, unspecified
ICD_10_H70IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H70**Mastoiditis and related conditions 1. H70.0 Acute mastoiditis 2. H70.1 Chronic mastoiditis 3. H70.2 Petrositis 4. H70.8 Other mastoiditis and related conditions 5. H70.9 Mastoiditis, unspecified
ICD_10_H71IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H71**Cholesteatoma of middle ear
ICD_10_H72IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H72**Perforation of tympanic membrane 1. H72.0 Central perforation of tympanic membrane 2. H72.1 Attic perforation of tympanic membrane 3. H72.2 Other marginal perforations of tympanic membrane 4. H72.8 Other perforations of tympanic membrane 5. H72.9 Perforation of tympanic membrane, unspecified
ICD_10_H73IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be

		made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H73**Other disorders of tympanic membrane 1. H73.0 Acute myringitis 2. H73.1 Chronic myringitis 3. H73.8 Other specified disorders of tympanic membrane 4. H73.9 Disorder of tympanic membrane, unspecified
ICD_10_H74IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H74**Other disorders of middle ear and mastoid 1. H74.0 Tympanosclerosis 2. H74.1 Adhesive middle ear disease 3. H74.2 Discontinuity and dislocation of ear ossicles 4. H74.3 Other acquired abnormalities of ear ossicles 5. H74.4 Polyp of middle ear 6. H74.8 Other specified disorders of middle ear and mastoid 7. H74.9 Disorder of middle ear and mastoid, unspecifie
ICD_10_H75IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H75**Other disorders of middle ear and mastoid in diseases classified elsewhere 1. H75.0* Mastoiditis in infectious and parasitic diseases classified elsewhere 2. H75.8* Other specified disorders of middle ear and mastoid in diseases classified elsewhere
ICD_10_H80IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**:

		International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H80**Otosclerosis 1. H80.0 Otosclerosis involving oval window, nonobliterative 2. H80.1 Otosclerosis involving oval window, obliterative 3. H80.2 Cochlear otosclerosis 4. H80.8 Other otosclerosis 5. H80.9 Otosclerosis, unspecified
ICD_10_H81IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H81**Disorders of vestibular function 1. H81.0 Ménière disease 2. H81.1 Benign paroxysmal vertigo 3. H81.2 Vestibular neuronitis 4. H81.3 Other peripheral vertigo 5. H81.4 Vertigo of central origin 6. H81.8 Other disorders of vestibular function 7. H81.9 Disorder of vestibular function, unspecified
ICD_10_H82IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H82**Vertiginous syndromes in diseases classified elsewhere
ICD_10_H83IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H83**Other diseases of inner ear 1. H83.0 Labyrinthitis 2. H83.1 Labyrinthine fistula 3. H83.2 Labyrinthine dysfunction 4. H83.3 Noise effects on inner ear

		5. H83.8 Other specified diseases of inner ear 6. H83.9 Disease of inner ear, unspecified
ICD_10_H90IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H90**Conductive and sensorineural hearing loss 1. H90.0 Conductive hearing loss, bilateral 2. H90.1 Conductive hearing loss, unilateral with unrestricted hearing on the contralateral side 3. H90.2 Conductive hearing loss, unspecified 4. H90.3 Sensorineural hearing loss, bilateral 5. H90.4 Sensorineural hearing loss, unilateral with unrestricted hearing on the contralateral side 6. H90.5 Sensorineural hearing loss, unspecified 7. H90.6 Mixed conductive and sensorineural hearing loss, bilateral 8. H90.7 Mixed conductive and sensorineural hearing loss, unilateral with unrestricted hearing on the contralateral side 9. H90.8 Mixed conductive and sensorineural hearing loss, unspecified
ICD_10_H91IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H91**Other hearing loss 1. H91.0 Ototoxic hearing loss 2. H91.1 Presbycusis 3. H91.2 Sudden idiopathic hearing loss 4. H91.3 Deaf mutism, not elsewhere classified 5. H91.8 Other specified hearing loss 6. H91.9 Hearing loss, unspecified
ICD_10_H92IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**:

		International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H92**Otalgia and effusion of ear 1. H92.0 Otalgia 2. H92.1 Otorrhoea 3. H92.2 Otorrhagia
ICD_10_H93IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H93**Other disorders of ear, not elsewhere classified 1. H93.0 Degenerative and vascular disorders of ear 2. H93.1 Tinnitus 3. H93.2 Other abnormal auditory perceptions 4. H93.3 Disorders of acoustic nerve 5. H93.8 Other specified disorders of ear 6. H93.9 Disorder of ear, unspecified
ICD_10_H94IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H94**Other disorders of ear in diseases classified elsewhere H94.0*Acoustic neuritis in infectious and parasitic diseases classified elsewhere H94.8*Other specified disorders of ear in diseases classified elsewhere
ICD_10_H95IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H95**Postprocedural disorders of ear and mastoid process, not elsewhere classified 1. H95.0 Recurrent cholesteatoma of postmastoidectomy cavity 2. H95.1 Other disorders following mastoidectomy

		3. H95.8 Other postprocedural disorders of ear and mastoid process 4. H95.9 Postprocedural disorder of ear and mastoid process, unspecified
ICD_10_Q16IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **Q16**Congenital malformations of ear causing impairment of hearing 1. Q16.0 Congenital absence of (ear) auricle 2. Q16.1 Congenital absence, atresia and stricture of auditory canal (external) 3. Q16.2 Absence of eustachian tube 4. Q16.3 Congenital malformation of ear ossicles 5. Q16.4 Other congenital malformations of middle ear 6. Q16.5 Congenital malformation of inner ear 7. Q16.9 Congenital malformation of ear causing impairment of hearing, unspecified
ICD_10_Z01IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **Z01**Other special examinations and investigations of persons without complaint or reported diagnosis 1. Z01.1 Examination of ears and hearing
ICD_10_Z13IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **Z13**Special screening examination for other diseases and disorders 1. Z13.5 Special screening examination for eye and ear disorders
ICD_10_Z82IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be

		made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **Z82**Family history of certain disabilities and chronic diseases leading to disablement 1. Z82.2 Family history of deafness and hearing loss
ICD_10_Z83IncidenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **Z83**Family history of other specific disorders 1. Z83.5 Family history of eye and ear disorders
Output parameters		
ICD-10 code incidence Table	Table	Table in TM format.
ICD-10 code incidence price Table	Table	
ICD-10 code incidence trend Table	Table	

dss_UploadICD10PrevalenceData

Operation Description	Functions allowing the upload of ICD10 Prevalence related data to the DSS	
Pre-conditions	Data should be given in table[integer] formats.	
Post-conditions	-	
Input parameters		
Name	**Type**	**Description**
ICD_10_H60PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**:

		International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H60** Otitis externa 9. H60.0 Abscess of external ear 10. H60.1 Cellulitis of external ear 11. H60.2 Malignant otitis externa 12. H60.3 Other infective otitis externa 13. H60.4 Cholesteatoma of external ear 14. H60.5 Acute otitis externa, noninfective 15. H60.8 Other otitis externa 16. H60.9 Otitis externa, unspecified
ICD_10_H61PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H61** Other disorders of external ear 7. H61.0 Perichondritis of external ear 8. H61.1 Noninfective disorders of pinna 9. H61.2 Impacted cerumen 10. H61.3 Acquired stenosis of external ear canal 11. H61.8 Other specified disorders of external ear 12. H61.9 Disorder of external ear, unspecified
ICD_10_H62PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H62**Disorders of external ear in diseases classified elsewhere 7. H62.0* Otitis externa in bacterial diseases classified elsewhere 8. H62.1* Otitis externa in viral diseases classified elsewhere 9. H62.2* Otitis externa in mycoses 10. H62.3* Otitis externa in other infectious and parasitic diseases classified elsewhere 11. H62.4* Otitis externa in other diseases classified elsewhere 12. H62.8* Other disorders of external ear in diseases classified elsewhere

ICD_10_H65PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H65**Nonsuppurative otitis media 7. H65.0 Acute serous otitis media 8. H65.1 Other acute nonsuppurative otitis media 9. H65.2 Chronic serous otitis media 10. H65.3 Chronic mucoid otitis media 11. H65.4 Other chronic nonsuppurative otitis media 12. H65.9 Nonsuppurative otitis media, unspecified
ICD_10_H66PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H66**Suppurative and unspecified otitis media 7. H66.0 Acute suppurative otitis media 8. H66.1 Chronic tubotympanic suppurative otitis media 9. H66.2 Chronic atticoantral suppurative otitis media 10. H66.3 Other chronic suppurative otitis media 11. H66.4 Suppurative otitis media, unspecified 12. H66.9 Otitis media, unspecified
ICD_10_H67PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H67**Otitis media in diseases classified elsewhere 4. H67.0* Otitis media in bacterial diseases classified elsewhere 5. H67.1* Otitis media in viral diseases classified elsewhere

		6. H67.8* Otitis media in other diseases classified elsewhere
ICD_10_H68PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability**. **H68**Eustachian salpingitis and obstruction 3. H68.0 Eustachian salpingitis 4. H68.1 Obstruction of Eustachian tube
ICD_10_H69PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability**. **H69**Other disorders of Eustachian tube 4. H69.0 Patulous Eustachian tube 5. H69.8 Other specified disorders of Eustachian tube 6. H69.9 Eustachian tube disorder, unspecified
ICD_10_H70PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability**. **H70**Mastoiditis and related conditions 6. H70.0 Acute mastoiditis 7. H70.1 Chronic mastoiditis 8. H70.2 Petrositis 9. H70.8 Other mastoiditis and related conditions 10. H70.9 Mastoiditis, unspecified
ICD_10_H71PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII

		Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H71**Cholesteatoma of middle ear
ICD_10_H72PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H72**Perforation of tympanic membrane 6. H72.0 Central perforation of tympanic membrane 7. H72.1 Attic perforation of tympanic membrane 8. H72.2 Other marginal perforations of tympanic membrane 9. H72.8 Other perforations of tympanic membrane 10. H72.9 Perforation of tympanic membrane, unspecified
ICD_10_H73PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H73**Other disorders of tympanic membrane 5. H73.0 Acute myringitis 6. H73.1 Chronic myringitis 7. H73.8 Other specified disorders of tympanic membrane 8. H73.9 Disorder of tympanic membrane, unspecified
ICD_10_H74PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H74**Other disorders of middle ear and mastoid 8. H74.0 Tympanosclerosis 9. H74.1 Adhesive middle ear disease 10. H74.2 Discontinuity and dislocation of ear ossicles

		11. H74.3 Other acquired abnormalities of ear ossicles 12. H74.4 Polyp of middle ear 13. H74.8 Other specified disorders of middle ear and mastoid 14. H74.9 Disorder of middle ear and mastoid, unspecifie
ICD_10_H75PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H75**Other disorders of middle ear and mastoid in diseases classified elsewhere 3. H75.0* Mastoiditis in infectious and parasitic diseases classified elsewhere 4. H75.8* Other specified disorders of middle ear and mastoid in diseases classified elsewhere
ICD_10_H80PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H80**Otosclerosis 6. H80.0 Otosclerosis involving oval window, nonobliterative 7. H80.1 Otosclerosis involving oval window, obliterative 8. H80.2 Cochlear otosclerosis 9. H80.8 Other otosclerosis 10. H80.9 Otosclerosis, unspecified
ICD_10_H81PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H81**Disorders of vestibular function 8. H81.0 Ménière disease 9. H81.1 Benign paroxysmal vertigo 10. H81.2 Vestibular neuronitis 11. H81.3 Other peripheral vertigo

		12. H81.4 Vertigo of central origin 13. H81.8 Other disorders of vestibular function 14. H81.9 Disorder of vestibular function, unspecified
ICD_10_H82PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H82**Vertiginous syndromes in diseases classified elsewhere
ICD_10_H83PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H83**Other diseases of inner ear 7. H83.0 Labyrinthitis 8. H83.1 Labyrinthine fistula 9. H83.2 Labyrinthine dysfunction 10. H83.3 Noise effects on inner ear 11. H83.8 Other specified diseases of inner ear 12. H83.9 Disease of inner ear, unspecified
ICD_10_H90PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H90**Conductive and sensorineural hearing loss 10. H90.0 Conductive hearing loss, bilateral 11. H90.1 Conductive hearing loss, unilateral with unrestricted hearing on the contralateral side 12. H90.2 Conductive hearing loss, unspecified 13. H90.3 Sensorineural hearing loss, bilateral 14. H90.4 Sensorineural hearing loss, unilateral with unrestricted hearing on the contralateral side

		15. H90.5 Sensorineural hearing loss, unspecified 16. H90.6 Mixed conductive and sensorineural hearing loss, bilateral 17. H90.7 Mixed conductive and sensorineural hearing loss, unilateral with unrestricted hearing on the contralateral side 18. H90.8 Mixed conductive and sensorineural hearing loss, unspecified
ICD_10_H91PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H91**Other hearing loss 7. H91.0 Ototoxic hearing loss 8. H91.1 Presbycusis 9. H91.2 Sudden idiopathic hearing loss 10. H91.3 Deaf mutism, not elsewhere classified 11. H91.8 Other specified hearing loss 12. H91.9 Hearing loss, unspecified
ICD_10_H92PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H92**Otalgia and effusion of ear 4. H92.0 Otalgia 5. H92.1 Otorrhoea 6. H92.2 Otorrhagia
ICD_10_H93PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H93**Other disorders of ear, not elsewhere classified 7. H93.0 Degenerative and vascular disorders of ear 8. H93.1 Tinnitus

		9. H93.2 Other abnormal auditory perceptions 10. H93.3 Disorders of acoustic nerve 11. H93.8 Other specified disorders of ear 12. H93.9 Disorder of ear, unspecified
ICD_10_H94PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H94**Other disorders of ear in diseases classified elsewhere H94.0*Acoustic neuritis in infectious and parasitic diseases classified elsewhere H94.8*Other specified disorders of ear in diseases classified elsewhere
ICD_10_H95PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **H95**Postprocedural disorders of ear and mastoid process, not elsewhere classified 5. H95.0 Recurrent cholesteatoma of postmastoidectomy cavity 6. H95.1 Other disorders following mastoidectomy 7. H95.8 Other postprocedural disorders of ear and mastoid process 8. H95.9 Postprocedural disorder of ear and mastoid process, unspecified
ICD_10_Q16PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **Q16**Congenital malformations of ear causing impairment of hearing 8. Q16.0 Congenital absence of (ear) auricle 9. Q16.1 Congenital absence, atresia and stricture of auditory canal (external) 10. Q16.2 Absence of eustachian tube

		11. Q16.3 Congenital malformation of ear ossicles 12. Q16.4 Other congenital malformations of middle ear 13. Q16.5 Congenital malformation of inner ear 14. Q16.9 Congenital malformation of ear causing impairment of hearing, unspecified
ICD_10_Z01PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **Z01**Other special examinations and investigations of persons without complaint or reported diagnosis 2. Z01.1 Examination of ears and hearing
ICD_10_Z13PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **Z13**Special screening examination for other diseases and disorders 2. Z13.5 Special screening examination for eye and ear disorders
ICD_10_Z82PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **Z82**Family history of certain disabilities and chronic diseases leading to disablement 2. Z82.2 Family history of deafness and hearing loss
ICD_10_Z83PrevalenceData	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**:

		International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 2, 2010, Chapter VIII Diseases of the ear and mastoid process (H60-H95) **as a course of HL disability.** **Z83**Family history of other specific disorders 2. Z83.5 Family history of eye and ear disorders
Output parameters		
ICD-10 code prevalence Table	Table_TM	Table in TM format.
ICD-10 code prevalence price Table		
ICD-10 code prevalence trend Table		

dss_UploadIncidenceICFData

Operation Description	Functions allowing the upload of ICF Incidence related data to the DSS	
Pre-Conditions	Data should be given in table[integer] formats.	
Post-Conditions	-	
Input parameters		
Name	**Type**	**Description**
Incidence ICF_b144Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **b144** Memory functions - Specific mental functions of registering and storing information and retrieving it as needed. Inclusions: functions of short-term and long-term memory, immediate, recent and remote memory; memory span; retrieval of memory; remembering; functions used in recalling and learning, such as in nominal, selective and dissociative amnesia. a) b1440 Short-term memory - Mental functions that produce a temporary, disruptable memory store of around 30 seconds duration from which information is lost if not consolidated into long-term memory. b) b1441 Long-term memory - Mental functions that produce a memory system permitting the long-term storage of information from short-term memory and both autobiographical memory for past events and semantic memory for language and facts.

		c) b1442 Retrieval of memory - Specific mental functions of recalling information stored in long-term memory and bringing it into awareness. d) b1448 Memory functions, other specified e) b1449 Memory functions, unspecified
Incidence ICF_b156Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. b 156 Perceptual functions - Specific mental functions of recognizing and interpreting sensorystimuli. a) **b1560** Auditory perception: Mental functions involved in discriminating sounds, tones, pitches and other acoustic stimuli.
Incidence ICF_b160Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **b160** Thought functions - Specific mental functions related to the ideational component of themind.Inclusions: functions of pace, form, control and content of thought; goaldirected thought functions, non-goal directed thought functions; logical thought functions, such as pressure of thought, flight of ideas, thoughtblock, incoherence of thought, tangentiality, circumstantiality, delusions,obsessions and compulsion. a) b1600 Pace of thought - Mental functions that govern speed of the thinking process.ICF Body Functions b) b1601 Form of thought - Mental functions that organize the thinking process as to its coherence and logic. Inclusions: impairments of ideational perseveration, tangentiality and circumstantiality c) b1602 Content of thought - Mental functions consisting of the ideas that are present in the thinking process and what is being conceptualized. Inclusions: impairments of delusions, overvalued ideas and somatization. d) b1603 Control of thought - Mental functions that provide volitional control of thinking and are recognized as such by the person. Inclusions: impairments of rumination, obsession, thought broadcast and thought insertion. e) b1608 Thought functions, other specified f) b1609 Thought functions, unspecified
Incidence ICF_b164Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis.

		Annual incidence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **b164** Higher-level cognitive functions - Specific mental functions especially dependent on the frontal lobe ofthe brain, including complex goal-directed behaviours such as decisionmaking, abstract thinking, planning and carrying out plans, mentalflexibility, and deciding which behaviours are appropriate under whatcircumstances; often called executive functions. a) b1640 Abstraction - Mental functions of creating general ideas, qualities or characteristics out of, and distinct from, concrete realities, specific objects or actual instances. b) b1641 Organization and planning - Mental functions of coordinating parts into a whole, of systematizing; the mental function involved in developing a method of proceeding or acting.Body Functions ICF c) b1642 Time management - Mental functions of ordering events in chronological sequence, allocating amounts of time to events and activities. d) b1643 Cognitive flexibility - Mental functions of changing strategies, or shifting mental sets, especially as involved in problem-solving. e) b1644 Insight - Mental functions of awareness and understanding of oneself and one's behaviour. f) b1645 Judgement - Mental functions involved in discriminating between and evaluating different options, such as those involved in forming an opinion. g) b1646 Problem-solving - Mental functions of identifying, analysing and integrating incongruent or conflicting information into a solution. h) b1648 Higher-level cognitive functions, other specified i) b1649 Higher-level cognitive functions, unspecified
Incidence ICF_b230Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. Hearing and vestibular functions (b2300-b2309): **b230** Hearing functions - Sensory functions relating to sensing the presence of sounds and discriminating the location, pitch, loudness and quality of sounds. a) b2300 Sound detection - Sensory functions relating to sensing the presence of sounds. b) b2301 Sound discrimination - Sensory functions relating to sensing the presence of sound

		involving the differentiation of ground and binaural synthesis, separation and blending. c) b2302 Localization of sound source - Sensory functions relating to determining the location of the source of sound. d) b2303 Lateralization of sound - Sensory functions relating to determining whether the sound is coming from the right or left side. e) b2304 Speech discrimination - Sensory functions relating to determining spoken language and distinguishing it from other sounds. f) b2308 Hearing functions, other specified g) b2309 Hearing functions, unspecified
Incidence ICF_b235Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. Hearing and vestibular functions (b2300-b2309): **b235** Hearing and vestibular functions - Sensory functions of the inner ear related to position, balance and movement. a) b2350 Vestibular function of position - Sensory functions of the inner ear related to determining the position of the body. b) b2351 Vestibular function of balance - Sensory functions of the inner ear related to determining the balance of the body. c) b2352 Vestibular function of determination of movement Sensory functions of the inner ear related to determining movement of the body, including its direction and speed. d) b2358 Vestibular functions, other specified e) b2359 Vestibular functions, unspecified
Incidence ICF_b240Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. Hearing and vestibular functions (b2300-b2309): **f 240** Sensations associated with hearing and vestibular function a. b2400 Ringing in ears or tinnitus - Sensation of low-pitched rushing, hissing or ringing in the ear. b. b2401 Dizziness - Sensation of motion involving either oneself or one's environment; sensation of rotating, swaying or tilting. c. b2402 Sensation of falling - Sensation of losing one's grip and falling. d. b2403 Nausea associated with dizziness or vertigo - Sensation of wanting to vomit that arises from dizziness or vertigo.

		e. b2404 Irritation in the ear - Sensation of itching or other similar sensations in the ear. f. b2405 Aural pressure - Sensation of pressure in the ear. g. b2408 Sensations associated with hearing and vestibular function, other.
Incidence ICF_b249Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. Hearing and vestibular functions (b2300-b2309): **b249** Hearing and vestibular function, other specified or no specified.
Incidence ICF_s240Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **s240** Structure of external ear
Incidence ICF_s250Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **s250** Structure of middle ear. a) s2500 Tympanic membrane b) s2501 Eustachian canal c) s2502 Ossicles d) s2508 Structure of middle ear, other specified e) s2509 Structure of middle ear, unspecified
Incidence ICF_s260Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **s260** Structure of inner ear a) s2600 Cochlea b) s2601 Vestibular labyrinth c) s2602 Semicircular canals d) s2603 Internal auditory meatus e) s2608 Structure of inner ear, other specified f) s2609 Structure of inner ear, unspecified

Incidence ICF_s298Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. a) **s298** Eye, ear and related structures, other specified
Incidence ICF_s299Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. a) **s299** Eye, ear and related structures, unspecified
Incidence ICF_e115Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **e115** Products and technology for personal use in daily living - Equipment, products and technologies used by people in daily activities,including those adapted or specially designed, located in, on or near theperson using them.Inclusions: general and assistive products and technology for personal use. a) e1150 General products and technology for personal use in daily living - Equipment, products and technologies used by people in daily activities, such as clothes, textiles, furniture, appliances, cleaning products and tools, not adapted or specially designed. b) e1151 Assistive products and technology for personal use in daily living - Adapted or specially designed equipment, products and technologies that assist people in daily living, such as prosthetic and orthotic devices, neural prostheses (e.g. functional stimulation devices that control bowels, bladder, breathing and heart rate), and environmental control units aimed at facilitating individuals' control over their indoor setting (scanners, remote control systems, voice-controlled systems, timer switches). c) e1158 Products and technology for personal use in daily living, other specified d) e1159 Products and technology for personal use in daily living, unspecified
Incidence ICF_e120Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**:

		International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **e120** Products and technology for personal indoor and outdoor mobilityand transportation - Equipment, products and technologies used by people in activities ofmoving inside and outside buildings, including those adapted orspecially designed, located in, on or near the person using them.Inclusions: general and assistive products and technology for personalindoor and outdoor mobility and transportation. a) e1200 General products and technology for personal indoor and outdoor mobility and transportation - Equipment, products and technologies used by people in activities of moving inside and outside buildings, such as motorized and non-motorized vehicles used for the transportation of people over ground, water and air (e.g. buses, cars, vans, other motor-powered vehicles and animal-powered transporters), not adapted or specially designed. b) e1201 Assistive products and technology for personal indoor and outdoor mobility and transportation - Adapted or specially designed equipment, products and technologies that assist people to move inside and outside buildings, such as walking devices, special cars and vans, adaptations to vehicles, wheelchairs, scooters and transfer devices. c) e1208 Products and technology for personal indoor and outdoor mobility and transportation, other specified. d) e1209 Products and technology for personal indoor and outdoor mobility and transportation, unspecified.
Incidence ICF_e125Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **e125** Products and technology for communication - Equipment, products and technologies used by people in activities ofsending and receiving information, including those adapted or speciallydesigned, located in, on or near the person using them. Inclusions: general and assistive products and technology for communication. a) e1250 General products and technology for communication - Equipment, products and technologies used by people in activities of sending and receiving information, such as optical and auditory devices, audio recorders and receivers, television and video equipment, telephone devices, sound transmission systems and face-to-face communication devices, not adapted or specially designed.

		b) e1251 Assistive products and technology for communication - Adapted or specially designed equipment, products and technologies that assist people to send and receive information, such as specialized vision devices, electro-optical devices, specialized writing devices, drawing or handwriting devices, signalling systems and special computer software and hardware, cochlear implants, hearing aids, FM auditory trainers, voice prostheses, communication boards, glasses and contact lenses. c) e1258 Products and technology for communication, other specified. d) e1259 Products and technology for communication, unspecified.
Incidence ICF_e130Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **e130** Products and technology for education - Equipment, products, processes, methods and technology used foracquisition of knowledge, expertise or skill, including those adapted orspecially designed.Inclusions: general and assistive products and technology for education. a) e1300 General products and technology for education - Equipment, products, processes, methods and technology used for acquisition of knowledge, expertise or skill at any level, such as books, manuals, educational toys, computer hardware or software, not adapted or specially designed. b) e1301 Assistive products and technology for education Adapted and specially designed equipment, products, processes, methods and technology used for acquisition of knowledge, expertise or skill, such as specialized computer technology. c) e1308 Products and technology for education, other specified. d) e1309 Products and technology for education, unspecified.
Incidence ICF_e135Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **e135** Products and technology for employment - Equipment, products and technology used for employment to facilitate work activities. Inclusions: general and assistive products and technology for employment a) e1350 General products and technology for employment Equipment, products and technology

		used for employment to facilitate work activities, such as tools, machines and office equipment, not adapted or specially designed. b) e1351 Assistive products and technology for employment Adapted or specially designed equipment, products and technology used for employment to facilitate work activities, such as adjustable tables, desks and filing cabinets; remote control entry and exit of office doors; computer hardware, software, accessories and environmental control units aimed at facilitating an individual's conduct of work-related tasks and aimed at control of the work environment (e.g. scanners, remote control systems, voice-controlled systems and timer switches). c) e1358 Products and technology for employment, other specified. d) e1359 Products and technology for employment, unspecified.
Incidence ICF_e140Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **e140** Products and technology for culture, recreation and sport - Equipment, products and technology used for the conduct and enhancement of cultural, recreational and sporting activities, including those adapted or specially designed. Inclusions: general and assistive products and technology for culture, recreation and sport a) e1400 General products and technology for culture, recreation and sport - Equipment, products and technology used for the conduct and enhancement of cultural, recreational and sporting activities, such as toys, skis, tennis balls and musical instruments, not adapted or specially designed. b) e1401 Assistive products and technology for culture, recreation and sport - Adapted or specially designed equipment, products and technology used for the conduct and enhancement of cultural, recreational and sporting activities, such as modified mobility devices for sports, adaptations for musical and other artistic performance. c) e1408 Products and technology for culture, recreation and sport, other specified. d) e1409 Products and technology for culture, recreation and sport, unspecified.
Incidence ICF_e145Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**:

		International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **e1450** General products and technology for the practice of religion or spirituality - Products and technology, unique or mass-produced, that are given or take on a symbolic meaning in the context of the practice of religion or spirituality, such as spirit houses, maypoles, headdresses, masks, crucifixes, menorahs and prayer mats, not adapted or specially designed. a) e1451 Assistive products and technology for the practice of religion or spirituality Adapted or specially designed products and technology that are given, or take on a symbolic meaning in the context of the practice of religion or spirituality, such as Braille religious books, Braille tarot cards, and special protection for wheelchair wheels when entering temples. b) e1458 Products and technology for the practice of religion or spirituality, other specified. c) e1459 Products and technology for the practice of religion or spirituality, unspecified.
Incidence ICF_e250Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. a) **e250** Sound - A phenomenon that is or may be heard, such as banging, ringing, thumping, singing, whistling, yelling or buzzing, in any volume, timbre or tone, and that may provide useful or distracting information about the world. Inclusions: sound intensity; sound quality b) e2500 Sound intensity - Level or volume of auditory phenomenon determined by the amount of energy being generated, where high energy levels are perceived as loud sounds and low energy levels as soft sounds. c) e2501 Sound quality - Nature of a sound as determined by the wavelength and wave pattern of the sound and perceived as the timbre and tone, such as harshness or melodiousness, and which may provide useful information about the world (e.g. sound of dog barking versus a cat miaowing) or distractions (e.g. background noise). d) e2508 Sound, other specified. e) e2509 Sound, unspecified.
Output parameters		
ICF code incidence Table	Table_TM	1. Table ready for Text-Mining (TM) tasks
ICF code incidence	Table_TM	Table ready for Text-Mining (TM) tasks

price Table		
ICF code incidence trend Table	Table_TM	Table ready for Text-Mining (TM) tasks

dss_UploadPrevalenceICFData

Operation Description		Functions allowing the upload of ICF Prevalence related data to the DSS
Pre-conditions		Data should be given in table[integer] formats.
Post-conditions		-
Input parameters		
Name	**Type**	**Description**
PrevalenceICF_b144Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **b144** Memory functions - Specific mental functions of registering and storing information and retrieving it as needed. Inclusions: functions of short-term and long-term memory, immediate, recent and remote memory; memory span; retrieval of memory; remembering; functions used in recalling and learning, such as in nominal, selective and dissociative amnesia. f) b1440 Short-term memory - Mental functions that produce a temporary, disruptable memory store of around 30 seconds duration from which information is lost if not consolidated into long-term memory. g) b1441 Long-term memory - Mental functions that produce a memory system permitting the long-term storage of information from short-term memory and both autobiographical memory for past events and semantic memory for language and facts. h) b1442 Retrieval of memory - Specific mental functions of recalling information stored in long-term memory and bringing it into awareness. i) b1448 Memory functions, other specified j) b1449 Memory functions, unspecified
PrevalenceICF_b156Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. b 156 Perceptual functions - Specific mental functions of recognizing and interpreting sensorystimuli. b) **b1560** Auditory perception: Mental functions involved in discriminating sounds, tones, pitches and other acoustic stimuli.
PrevalenceICF_	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made

b160Data		using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **b160** Thought functions - Specific mental functions related to the ideational component of themind.Inclusions: functions of pace, form, control and content of thought; goaldirected thought functions, non-goal directed thought functions; logicalthought functions, such as pressure of thought, flight of ideas, thoughtblock, incoherence of thought, tangentiality, circumstantiality, delusions,obsessions and compulsion. g) b1600 Pace of thought - Mental functions that govern speed of the thinking process.ICF Body Functions h) b1601 Form of thought - Mental functions that organize the thinking process as to its coherence and logic. Inclusions: impairments of ideational perseveration, tangentiality and circumstantiality i) b1602 Content of thought - Mental functions consisting of the ideas that are present in the thinking process and what is being conceptualized. Inclusions: impairments of delusions, overvalued ideas and somatization. j) b1603 Control of thought - Mental functions that provide volitional control of thinking and are recognized as such by the person. Inclusions: impairments of rumination, obsession, thought broadcast and thought insertion. k) b1608 Thought functions, other specified l) b1609 Thought functions, unspecified
PrevalenceICF_b164Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **b164** Higher-level cognitive functions - Specific mental functions especially dependent on the frontal lobe of the brain, including complex goal-directed behaviours such as decisionmaking, abstract thinking, planning and carrying out plans, mentalflexibility, and deciding which behaviours are appropriate under whatcircumstances; often called executive functions. j) b1640 Abstraction - Mental functions of creating general ideas, qualities or characteristics out of, and distinct from, concrete realities, specific objects or actual instances. k) b1641 Organization and planning - Mental functions of coordinating parts into a whole, of systematizing; the mental function involved in developing a method of proceeding or acting. l) b1642 Time management - Mental functions of ordering events in chronological sequence, allocating amounts of time to events and activities.

		m) b1643 Cognitive flexibility - Mental functions of changing strategies, or shifting mental sets, especially as involved in problem-solving. n) b1644 Insight - Mental functions of awareness and understanding of oneself and one's behaviour. o) b1645 Judgment - Mental functions involved in discriminating between and evaluating different options, such as those involved in forming an opinion. p) b1646 Problem-solving - Mental functions of identifying, analysing and integrating incongruent or conflicting information into a solution. q) b1648 Higher-level cognitive functions, other specified r) b1649 Higher-level cognitive functions, unspecified
PrevalenceICF_b230Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. Hearing and vestibular functions (b2300-b2309): **b230** Hearing functions - Sensory functions relating to sensing the presence of sounds and discriminating the location, pitch, loudness and quality of sounds. h) b2300 Sound detection - Sensory functions relating to sensing the presence of sounds. i) b2301 Sound discrimination - Sensory functions relating to sensing the presence of sound involving the differentiation of ground and binaural synthesis, separation and blending. j) b2302 Localization of sound source - Sensory functions relating to determining the location of the source of sound. k) b2303 Lateralization of sound - Sensory functions relating to determining whether the sound is coming from the right or left side. l) b2304 Speech discrimination - Sensory functions relating to determining spoken language and distinguishing it from other sounds. m) b2308 Hearing functions, other specified n) b2309 Hearing functions, unspecified
PrevalenceICF_b235Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. Hearing and vestibular functions (b2300-b2309): **b235** Hearing and vestibular functions - Sensory functions of the inner ear related to position, balance and movement.

		f) b2350 Vestibular function of position - Sensory functions of the inner ear related to determining the position of the body. g) b2351 Vestibular function of balance - Sensory functions of the inner ear related to determining the balance of the body. h) b2352 Vestibular function of determination of movement Sensory functions of the inner ear related to determining movement of the body, including its direction and speed. i) b2358 Vestibular functions, other specified j) b2359 Vestibular functions, unspecified
PrevalenceICF_b240Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. Hearing and vestibular functions (b2300-b2309): **f 240** Sensations associated with hearing and vestibular function h. b2400 Ringing in ears or tinnitus - Sensation of low-pitched rushing, hissing or ringing in the ear. i. b2401 Dizziness - Sensation of motion involving either oneself or one's environment; sensation of rotating, swaying or tilting. j. b2402 Sensation of falling - Sensation of losing one's grip and falling. k. b2403 Nausea associated with dizziness or vertigo - Sensation of wanting to vomit that arises from dizziness or vertigo. l. b2404 Irritation in the ear - Sensation of itching or other similar sensations in the ear. m. b2405 Aural pressure - Sensation of pressure in the ear. n. b2408 Sensations associated with hearing and vestibular function, other.
PrevalenceICF_b249Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. Hearing and vestibular functions (b2300-b2309): **b249** Hearing and vestibular function, other specified or no specified.
PrevalenceICF_s240Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**:

		International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **s240** Structure of external ear
PrevalenceICF_s250Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **s250** Structure of middle ear. f) s2500 Tympanic membrane g) s2501 Eustachian canal h) s2502 Ossicles i) s2508 Structure of middle ear, other specified j) s2509 Structure of middle ear, unspecified
PrevalenceICF_s260Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **s260** Structure of inner ear g) s2600 Cochlea h) s2601 Vestibular labyrinth i) s2602 Semicircular canals j) s2603 Internal auditory meatus k) s2608 Structure of inner ear, other specified l) s2609 Structure of inner ear, unspecified
PrevalenceICF_s298Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. b) **s298** Eye, ear and related structures, other specified
PrevalenceICF_s299Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. b) **s299** Eye, ear and related structures, unspecified
PrevalenceICF_e115Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **e115** Products and technology for personal use in daily living - Equipment, products and technologies used by people in daily activities,including those adapted or

		specially designed, located in, on or near theperson using them.Inclusions: general and assistive products and technology for personal use. e) e1150 General products and technology for personal use in daily living - Equipment, products and technologies used by people in daily activities, such as clothes, textiles, furniture, appliances, cleaning products and tools, not adapted or specially designed. f) e1151 Assistive products and technology for personal use in daily living - Adapted or specially designed equipment, products and technologies that assist people in daily living, such as prosthetic and orthotic devices, neural prostheses (e.g. functional stimulation devices that control bowels, bladder, breathing and heart rate), and environmental control units aimed at facilitating individuals' control over their indoor setting (scanners, remote control systems, voice-controlled systems, timer switches). g) e1158 Products and technology for personal use in daily living, other specified h) e1159 Products and technology for personal use in daily living, unspecified
PrevalenceICF_e120Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **e120** Products and technology for personal indoor and outdoor mobilityand transportation - Equipment, products and technologies used by people in activities ofmoving inside and outside buildings, including those adapted orspecially designed, located in, on or near the person using them.Inclusions: general and assistive products and technology for personalindoor and outdoor mobility and transportation. e) e1200 General products and technology for personal indoor and outdoor mobility and transportation - Equipment, products and technologies used by people in activities of moving inside and outside buildings, such as motorized and non-motorized vehicles used for the transportation of people over ground, water and air (e.g. buses, cars, vans, other motor-powered vehicles and animal-powered transporters), not adapted or specially designed. f) e1201 Assistive products and technology for personal indoor and outdoor mobility and transportation - Adapted or specially designed equipment, products and technologies that assist people to move inside and outside buildings, such as walking devices, special cars and vans, adaptations to vehicles, wheelchairs, scooters and transfer devices.

		g) e1208 Products and technology for personal indoor and outdoor mobility and transportation, other specified. h) e1209 Products and technology for personal indoor and outdoor mobility and transportation, unspecified.
PrevalenceICF_e125Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **e125** Products and technology for communication - Equipment, products and technologies used by people in activities of sending and receiving information, including those adapted or specially designed, located in, on or near the person using them. Inclusions: general and assistive products and technology for communication. e) e1250 General products and technology for communication - Equipment, products and technologies used by people in activities of sending and receiving information, such as optical and auditory devices, audio recorders and receivers, television and video equipment, telephone devices, sound transmission systems and face-to-face communication devices, not adapted or specially designed. f) e1251 Assistive products and technology for communication - Adapted or specially designed equipment, products and technologies that assist people to send and receive information, such as specialized vision devices, electro-optical devices, specialized writing devices, drawing or handwriting devices, signalling systems and special computer software and hardware, cochlear implants, hearing aids, FM auditory trainers, voice prostheses, communication boards, glasses and contact lenses. g) e1258 Products and technology for communication, other specified. h) e1259 Products and technology for communication, unspecified.
PrevalenceICF_e130Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **e130** Products and technology for education - Equipment, products, processes, methods and technology used for acquisition of knowledge, expertise or skill, including those adapted or specially designed. Inclusions: general and assistive products and technology for education. e) e1300 General products and technology for education - Equipment, products, processes, methods and technology used for acquisition of

		knowledge, expertise or skill at any level, such as books, manuals, educational toys, computer hardware or software, not adapted or specially designed. f) e1301 Assistive products and technology for education Adapted and specially designed equipment, products, processes, methods and technology used for acquisition of knowledge, expertise or skill, such as specialized computer technology. g) e1308 Products and technology for education, other specified. h) e1309 Products and technology for education, unspecified.
PrevalenceICF_e135Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **e135** Products and technology for employment - Equipment, products and technology used for employment to facilitate work activities. Inclusions: general and assistive products and technology for employment e) e1350 General products and technology for employment Equipment, products and technology used for employment to facilitate work activities, such as tools, machines and office equipment, not adapted or specially designed. f) e1351 Assistive products and technology for employment Adapted or specially designed equipment, products and technology used for employment to facilitate work activities, such as adjustable tables, desks and filing cabinets; remote control entry and exit of office doors; computer hardware, software, accessories and environmental control units aimed at facilitating an individual's conduct of work-related tasks and aimed at control of the work environment (e.g. scanners, remote control systems, voice-controlled systems and timer switches). g) e1358 Products and technology for employment, other specified. h) e1359 Products and technology for employment, unspecified.
PrevalenceICF_e140Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **e140** Products and technology for culture, recreation and sport - Equipment, products and technology used for the conduct and enhancement of cultural, recreational and sporting activities, including those adapted or specially designed. Inclusions: general and assistive

		products and technology for culture, recreation and sport e) e1400 General products and technology for culture, recreation and sport - Equipment, products and technology used for the conduct and enhancement of cultural, recreational and sporting activities, such as toys, skis, tennis balls and musical instruments, not adapted or specially designed. f) e1401 Assistive products and technology for culture, recreation and sport - Adapted or specially designed equipment, products and technology used for the conduct and enhancement of cultural, recreational and sporting activities, such as modified mobility devices for sports, adaptations for musical and other artistic performance. g) e1408 Products and technology for culture, recreation and sport, other specified. h) e1409 Products and technology for culture, recreation and sport, unspecified.
PrevalenceICF_e145Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. **e1450** General products and technology for the practice of religion or spirituality - Products and technology, unique or mass-produced, that are given or take on a symbolic meaning in the context of the practice of religion or spirituality, such as spirit houses, maypoles, headdresses, masks, crucifixes, menorahs and prayer mats, not adapted or specially designed. d) e1451 Assistive products and technology for the practice of religion or spirituality Adapted or specially designed products and technology that are given, or take on a symbolic meaning in the context of the practice of religion or spirituality, such as Braille religious books, Braille tarot cards, and special protection for wheelchair wheels when entering temples. e) e1458 Products and technology for the practice of religion or spirituality, other specified. f) e1459 Products and technology for the practice of religion or spirituality, unspecified.
PrevalenceICF_e250Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual prevalence will be calculate **according to**: International Classification of Functioning, Disability and Health (ICF). WHO. 2001. f) **e250** Sound - A phenomenon that is or may be heard, such as banging, ringing, thumping, singing, whistling, yelling or buzzing, in any volume, timbre or tone, and that may provide useful or distracting information about the

		world. Inclusions: sound intensity; sound quality g) e2500 Sound intensity - Level or volume of auditory phenomenon determined by the amount of energy being generated, where high energy levels are perceived as loud sounds and low energy levels as soft sounds. h) e2501 Sound quality - Nature of a sound as determined by the wavelength and wave pattern of the sound and perceived as the timbre and tone, such as harshness or melodiousness, and which may provide useful information about the world (e.g. sound of dog barking versus a cat miaowing) or distractions (e.g. background noise). i) e2508 Sound, other specified. j) e2509 Sound, unspecified.
Output parameters		
ICF code prevalence Table	Table_TM	Table ready for Text-Mining (TM) tasks
ICF code prevalence price Table	Table_TM	Table ready for Text-Mining (TM) tasks
ICF code prevalence trend Table	Table_TM	Table ready for Text-Mining (TM) tasks

dss_UploadIncidenceChildICFData

Operation Description	Functions allowing the upload of ICF Child Incidence related data to the DSS	
Pre-conditions	Data should be given in table[integer] format.	
Post-conditions	-	
Input parameters		
Name	**Type**	**Description**
IncidenceChildICF_b230Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate according to: International classification of functioning, disability and health: children & youth version. ICF-CY.WHO. 2001. **b230** Hearing functions - Sensory functions relating to sensing the presence of sounds and discriminating the location, pitch, loudness and quality of sounds. Inclusions: functions of hearing, auditory discrimination, localization of sound source, lateralization of sound, speech discrimination;

		impairments such as deafness, hearing impairment and hearing loss. Exclusions: perceptual functions (b156) and mental functions of language (b167) 1. b2300 Sound detection - Sensory functions relating to sensing the presence of sounds. 2. b2301 Sound discrimination - Sensory functions relating to sensing the presence of sound involving the differentiation of ground and binaural synthesis, separation and blending. 3. b2302 Localisation of sound source - Sensory functions relating to determining the location of the source of sound. 4. b2303 Lateralization of sound - Sensory functions relating to determining whether the sound is coming from the right or left side. 5. b2304 Speech discrimination - Sensory functions relating to determining spoken language and distinguishing it from other sounds. 6. b2308 Hearing functions, other specified 7. b2309 Hearing functions, unspecified
Incidence ChildICF_ b235Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate according to: International classification of functioning, disability and health: children & youth version. ICF-CY.WHO. 2001. **b235** Vestibular functions - Sensory functions of the inner ear related to position, balance and movement. Inclusions: functions of position and positional sense; functions of balance of the body and movement. Exclusion: sensation associated with hearing and vestibular functions (b240) 1. b2350 Vestibular function of position - Sensory functions of the inner ear related to determining the position of the body. 2. b2351 Vestibular function of balance - Sensory functions of the inner ear related to determining the balance of the body. 3. b2352 Vestibular function of determination of movement - Sensory functions of the inner ear related to determining movement of the body, including its direction and speed. 4. b2358 Vestibular functions, other specified 5. b2359 Vestibular functions, unspecified
Incidence ChildICF_ b240Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate according to: International classification of functioning, disability and health: children & youth version. ICF-CY.WHO. 2001. **b240** Sensations associated with hearing and vestibular function. Sensations of dizziness, falling, tinnitus and vertigo. Inclusions: sensations of ringing in ears, irritation in ear, aural pressure, nausea associated with dizziness or

		vertigo. Exclusions: vestibular functions (b235); sensation of pain (b280) 1. 2400 Ringing in ears or tinnitus - Sensation of low-pitched rushing, hissing or ringing in the ear. 2. b 2401 Dizziness - Sensation of motion involving either oneself or one's environment; sensation of rotating, swaying or tilting. 3. b 2402 Sensation of falling - Sensation of losing one's grip and falling. 4. b 2403 Nausea associated with dizziness or vertigo - Sensation of wanting to vomit that arises from dizziness or vertigo. 5. b 2404 Irritation in the ear - Sensation of itching or other similar sensations in the ear. 6. b 2405 Aural pressure - Sensation of pressure in the ear. 7. b 2408 Sensations associated with hearing and vestibular function, other specified 8. b 2409 Sensations associated with hearing and vestibular function, unspecified
Incidence ChildICF_ b249Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate according to: International classification of functioning, disability and health: children & youth version. ICF-CY.WHO. 2001. **b249** Hearing and vestibular functions, other specified and unspecified Additional sensory functions (b250-b279)
Incidence ChildICF_ d115Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate according to: International classification of functioning, disability and health: children & youth version. ICF-CY.WHO. 2001. **d115** Listening - Using the sense of hearing intentionally to experience auditory stimuli, such as listening to a radio, the human voice, to music, a lecture, or to a story told.
Incidence ChildICF_ e125Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate according to: International classification of functioning, disability and health: children & youth version. ICF-CY.WHO. 2001. **E125** Products and technology for communication Equipment, products and technologies used by people in activities of sending and receiving information, including those adapted or specially designed, located in, on or near the person using them. Inclusions: general and assistive products and technology for communication.

		1. e 1250 General products and technology for communication Equipment, products and technologies used by people in activities of sending and receiving information, such as optical and auditory devices, audio recorders and receivers, television and video equipment, telephone devices, sound transmission systems and face-to-face communication devices, not adapted or specially designed. 2. e 1251 Assistive products and technology for communication Adapted or specially designed equipment, products and technologies that assist people to send and receive information, such as specialized vision devices, electro-optical devices, specialized writing devices, drawing or handwriting devices, signalling systems and special computer software and hardware, cochlear implants, hearing aids, FM auditory trainers, voice prostheses, communication boards, glasses and contact lenses. 3. e 1258 Products and technology for communication, other specified 4. e 1259 Products and technology for communication, unspecified
Output parameters		
Child ICF code incidence Table	Table_TM	Table ready for Text-Mining (TM) tasks
Child ICF code incidence price Table	Table_TM	Table ready for Text-Mining (TM) tasks
Child ICF code incidence trend Table	Table_TM	Table ready for Text-Mining (TM) tasks

dss_UploadPrevalenceChildICFData

Operation Description	Functions allowing the upload of ICF Child Prevalence related data to the DSS	
Pre-Conditions	Data should be given in table[integer] formats.	
Post-Conditions	-	
Input parameters		
Name	**Type**	**Description**
PrevalenceChildICF_b230Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate according to: International classification of functioning, disability and health: children & youth version. ICF-CY.WHO. 2001.

		b230 Hearing functions - Sensory functions relating to sensing the presence of sounds and discriminating the location, pitch, loudness and quality of sounds. Inclusions: functions of hearing, auditory discrimination, localization of sound source, lateralization of sound, speech discrimination; impairments such as deafness, hearing impairment and hearing loss. Exclusions: perceptual functions (b156) and mental functions of language (b167) 8. b2300 Sound detection - Sensory functions relating to sensing the presence of sounds. 9. b2301 Sound discrimination - Sensory functions relating to sensing the presence of sound involving the differentiation of ground and binaural synthesis, separation and blending. 10. b2302 Localisation of sound source - Sensory functions relating to determining the location of the source of sound. 11. b2303 Lateralization of sound - Sensory functions relating to determining whether the sound is coming from the right or left side. 12. b2304 Speech discrimination - Sensory functions relating to determining spoken language and distinguishing it from other sounds. 13. b2308 Hearing functions, other specified 14. b2309 Hearing functions, unspecified
PrevalenceChildICF_b235Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate according to: International classification of functioning, disability and health: children & youth version. ICF-CY.WHO. 2001. **b235** Vestibular functions - Sensory functions of the inner ear related to position, balance and movement. Inclusions: functions of position and positional sense; functions of balance of the body and movement. Exclusion: sensation associated with hearing and vestibular functions (b240) 6. b2350 Vestibular function of position - Sensory functions of the inner ear related to determining the position of the body. 7. b2351 Vestibular function of balance - Sensory functions of the inner ear related to determining the balance of the body. 8. b2352 Vestibular function of determination of movement - Sensory functions of the inner ear related to determining movement of the body, including its direction and speed. 9. b2358 Vestibular functions, other specified 10. b2359 Vestibular functions, unspecified
PrevalenceChildICF_b240Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate according to:

		International classification of functioning, disability and health: children & youth version. ICF-CY.WHO. 2001. **b240** Sensations associated with hearing and vestibular function. Sensations of dizziness, falling, tinnitus and vertigo. Inclusions: sensations of ringing in ears, irritation in ear, aural pressure, nausea associated with dizziness or vertigo. Exclusions: vestibular functions (b235); sensation of pain (b280) 9. 2400 Ringing in ears or tinnitus - Sensation of low-pitched rushing, hissing or ringing in the ear. 10. b 2401 Dizziness - Sensation of motion involving either oneself or one's environment; sensation of rotating, swaying or tilting. 11. b 2402 Sensation of falling - Sensation of losing one's grip and falling. 12. b 2403 Nausea associated with dizziness or vertigo - Sensation of wanting to vomit that arises from dizziness or vertigo. 13. b 2404 Irritation in the ear - Sensation of itching or other similar sensations in the ear. 14. b 2405 Aural pressure - Sensation of pressure in the ear. 15. b 2408 Sensations associated with hearing and vestibular function, other specified 16. b 2409 Sensations associated with hearing and vestibular function, unspecified
PrevalenceChildICF_b249Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate according to: International classification of functioning, disability and health: children & youth version. ICF-CY.WHO. 2001. **b249** Hearing and vestibular functions, other specified and unspecified Additional sensory functions (b250-b279)
PrevalenceChildICF_d115Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate according to: International classification of functioning, disability and health: children & youth version. ICF-CY.WHO. 2001. **d115** Listening - Using the sense of hearing intentionally to experience auditory stimuli, such as listening to a radio, the human voice, to music, a lecture, or to a story told.
PrevalenceChildICF_e125Data	Table[integer]	PHAA or any stakeholder must provide input data by itself. If not possible, estimation should be made using EVOTION data, systemic literature review and meta-analysis. Annual incidence will be calculate according to:

		International classification of functioning, disability and health: children & youth version. ICF-CY.WHO. 2001. **E125** Products and technology for communication Equipment, products and technologies used by people in activities of sending and receiving information, including those adapted or specially designed, located in, on or near the person using them. Inclusions: general and assistive products and technology for communication. 5. e 1250 General products and technology for communication Equipment, products and technologies used by people in activities of sending and receiving information, such as optical and auditory devices, audio recorders and receivers, television and video equipment, telephone devices, sound transmission systems and face-to-face communication devices, not adapted or specially designed. 6. e 1251 Assistive products and technology for communication Adapted or specially designed equipment, products and technologies that assist people to send and receive information, such as specialized vision devices, electro-optical devices, specialized writing devices, drawing or handwriting devices, signalling systems and special computer software and hardware, cochlear implants, hearing aids, FM auditory trainers, voice prostheses, communication boards, glasses and contact lenses. 7. e 1258 Products and technology for communication, other specified 8. e 1259 Products and technology for communication, unspecified
Output parameters		
PCRep_TM	Table	Table regarding Prevalence in children, ready for Text-Mining (TM) tasks

dss_UploadCostData

Operation Description	Functions allowing the upload of Cost related data to the DSS	
Pre-Conditions	Data should be given in table[integer] formats	
Post-Conditions	-	
Input parameters		
Name	**Type**	**Description**
ExternalEarCostData	Table[integer]	This is a copy of the Alpha 2015 version of the International Classification of Health Interventions (ICHI) prepared by the WHO ICHI Development Project October 2015. **CA – EXTERNAL EAR** 1) CAA AB AH Size measurement of external ear 2) CAA AD AA Biopsy of external ear 3) CAA AZ AZ Other diagnostic interventions on external ear

		4) CAA DK AH Dressing of external ear, not elsewhere classified a) Application and mould dressing of ear 5) CAA FA AA Incision of external ear, not elsewhere classified 6) CAA GA AA Destruction of lesion of external ear a) Cauterisation of external ear; b) Coagulation of external ear; c) Cryosurgery of external ear; d) Curettage of external ear; e) Electrocoagulation of external ear 7) CAA JB AA Drainage of external ear a) Aspiration of external ear 8) CAA JD AA Removal of foreign body external ear a) Extraction of (infected) earring, NEC b) CAA JI AA Excision of lesion of external ear c) Excludes biopsy of external ear (CAA AD AA); d) radical excision of lesion (CAA JL AA); e) removal of cerumen (CZZ JA AC) 9) CAA JJ AA Excision of external ear a) Enucleation of external ear 10) CAA JK AA Total excision of external ear a) Amputation of ear, NOS 11) CAA JL AA Extended excision of external ear a) Radical excision of external ear with concomitant lymph node dissection; b) Radical excision of external ear with repair of resulting defect 12) CAA LB AA Suture of laceration of external ear a) Reattachment of (amputated) external ear 13) CAA LJ AA Transfer of external ear a) Repositioning of external ear remnant as the lobule; b) Stage 2 of construction of congenitally absent external ear; c) Transfer of auricle; d) Transposition of lobule with excision of remnant 14) CAA MK AA Correction of prominent ear a) Cartilage otoplasty; b) Correction of protruding ear; c) Ear pinning or setback; d) Fixation, outstanding ear; e) Otoplasty NOS; f) Pinnaplasty; g) Repair of external ear deformity NOS; h) Repair, auricle; i) Repair, lop ear 15) CAA ML AA Reconstruction of external ear 16) CAA SZ AZ Other interventions on external ear a) Excludes irrigation of ear (CZZ JA AC); b) packing of external auditory canal (CAE DK AC); c) removal of cerumen (CZZ JA AC); d) removal of foreign body (without incision) (CAA JD AA) 17) CAC AD AA Biopsy of auricle 18) CAC FA AA Incision of auricle of ear a) Piercing of ear lobe; b) Piercing of pinna

		19) CAC JB AA Drainage of auricle 20) CAC JD AA Removal of foreign body, auricle a) Extraction of (infected) earring from auricle of ear 21) CAC JJ AA Excision of auricle of ear a) Excision of preauricular remnant [appendage]; b) Excision of preauricular sinus; c) Radical excision of preauricular sinus or cyst 22) CAC JL AA Radical excision of auricle of ear 23) CAC LB AA Suture of laceration of auricle a) Reattachment of auricle 24) CAC ML AA Construction of auricle of ear a) Prosthetic appliance for absent ear; b) Reconstruction of auricle; c) Reconstruction of ear 25) CAE AD AA Biopsy of external auditory canal 26) CAE DK AC Packing of external auditory canal a) Dressing, external auditory meatus 27) CAE FA AC Incision of external auditory canal 28) CAE JD AC Removal of foreign body from external auditory canal a) Removal of internal device from external auditory canal (auditory meatus) 29) CAE JI AC Other excision of external auditory canal a) Excision of exostosis of external auditory canal; b) Excision of lesion of external auditory canal 30) CAE ML AA Reconstruction of external auditory canal a) Canaloplasty of external auditory meatus; b) Construction [reconstruction] of external meatus of ear; c) Construction [reconstruction] of osseous portion; d) Construction [reconstruction] of skin-lined portion (with skin graft)
MiddleEar CostData	Table[integer]	This is a copy of the Alpha 2015 version of the International Classification of Health Interventions (ICHI) prepared by the WHO ICHI Development Project October 2015. **CB – Middle Ear** 1) CBA AD AC Biopsy of middle ear 2) CBA AZ AZ Other diagnostic interventions on middle ear 3) CBA DN AC Implantation of internal device in middle ear, not elsewhere classified a) Bone conduction hearing device; b) Implantation of electromagnetic hearing device; c) Implanted vibrating ossicular prosthesis [VORP] d) Excludes cochlear prosthetic device (CCB DN AC); e) grommets (CBB JB AC); f) cochlear implants (CCB DN AC) 4) CBA FA AC Incision of middle ear a) Atticotomy 5) CBA FC AC Lysis of adhesions of middle ear a) Excludes division of otosclerotic process (CBC FC AC); b) stapediolysis (CBC FC AC);

		c) that with stapedectomy (CBC JJ AC) 6) CBA JB AC Aspiration of middle ear, not elsewhere classified 7) CBA JD AC Removal of foreign body from middle ear, not elsewhere classified a) Removal of electromagnetic hearing device; b) Removal of internal device from middle ear, NEC 8) CBA JI AC Excision of lesion of middle ear a) Excludes biopsy of middle ear (CBA AD AC) 9) CBA JJ AZ Other excision of middle ear, not elsewhere classified a) Apicectomy of petrous pyramid; b) Partial excision of middle ear 10) CBA LA AC Obliteration of tympanomastoid cavity 11) CBA MK AC Repair of middle ear, not elsewhere classified a) Closure of mastoid fistula; b) Mastoid myoplasty 12) CBA SZ AZ Other interventions on middle ear a) Excludes adjustment (external components) of cochlear prosthetic device (CCB SM AH) 13) CBB DB AC Injection of tympanic membrane 14) CBB FA AC Other myringotomy 15) CBB FB AC Division of tympanum 16) CBB JB AC Myringotomy with insertion of tube a) Myringostomy 17) CBB JD AC Removal of device from tympanic membrane a) Removal of tympanostomy tube 18) CBB JJ AC Tympanectomy a) Partial excision of tympanic membrane; b) Tympanosympathectomy 19) CBB MK AC Myringoplasty a) Epitympanic, type I; b) Myringoplasty by:; c) cauterisation; d) graft 20) CBB ML AC Restoration of tympanic membrane a) Closure of perforation with graft against incus or malleus; b) Fenestra in horizontal semicircular canal covered by graft; c) Graft placed in contact with mobile and intact stapes; d) Mobile footplate left exposed with air pocket between round window and graft; e) Tympanoplasty Type I; f) Tympanoplasty Type II; g) Tympanoplasty Type III; h) Tympanoplasty Type IV; i) Tympanoplasty Type V 21) CBC FC AC Mobilisation of stapes a) Division of otosclerotic material; b) Division of otosclerotic process; c) Remobilisation of stapes; d) Stapediolysis; e) Transcrural stapes mobilisation f) Excludes that with synchronous stapedectomy (CBC JJ AC)

		22) CBC JJ AC Stapedectomy 23) CBC ML AC Reconstruction of stapes a) Stapedectomy with incus homograft; b) Stapedectomy with incus prosthesis 24) CBF JJ AC Excision of other auditory ossicle a) Incudectomy 25) CBF ML AC Reconstruction of other auditory ossicle a) Reconstruction of ossicles, second stage 26) CBF SZ AC Other interventions on ossicular chain 27) CBH DB AC Injection of eustachian tube a) Injection Teflon paste of eustachian tube 28) CBH DL AC catheterisation of eustachian tube 29) CBH JB AC Drainage of eustachian tube 30) CBH JD AC Removal of device from eustachian tube 31) CBH LG AC Dilatation of eustachian tube a) Inflation of eustachian tube; b) Insufflation (boric acid-salicylic acid); c) Intubation of eustachian tube; d) Politserisation of eustachian tube 32) CBH SZ AZ Other interventions on eustachian tube
InternalEarCostData	Table[integer]	This is a copy of the Alpha 2015 version of the International Classification of Health Interventions (ICHI) prepared by the WHO ICHI Development Project October 2015. **CC – Internal Ear** 1) CCA AD AC Biopsy of inner ear 2) CCA AZ AZ Other diagnostic interventions on inner ear a) Excludes vestibular function tests (CTE AC ZZ) 3) CCA DB AC Injection into inner ear 4) CCA FA AC Other incision of inner ear a) Fistulisation of endolymphatic sac; b) Fistulisation of labyrinth; c) Incision of endolymphatic sac; d) Labyrinthotomy; e) Opening of bony labyrinth f) Excludes biopsy of inner ear (CCA AD AC) 5) CCA FC AA Decompression of inner ear 6) CCA GA AC Destruction of inner ear a) Destruction, labyrinth; b) Destruction by injection (alcohol):; c) inner ear; d) semicircular canals; e) vestibule 7) CCA JB AC Drainage of inner ear a) Perilymphatic tap 8) CCA JJ AC Other excision of inner ear a) Labyrinthectomy (transtympanic) 9) CCA LI AA Endolymphatic shunt a) Decompression of endolymphatic sac with shunt; b) Shunt, endolymph perilymph; c) Shunt, endolymphatic (subarachnoid); d) that terminating in mastoid; e) that terminating in subarachnoid space; f) that with dilation of endolymphatic duct 10) CCA MK AA Repair of inner ear, not elsewhere classified a) Closure of fistula of oval window;

		b) Closure of fistula of perilymph; c) Closure of fistula of round window 11) CCA ML AA Fenestration of inner ear a) Fenestration of labyrinth with graft (skin) (vein); b) Fenestration of semicircular canals with graft (skin) (vein); c) Fenestration of vestibule with graft (skin) (vein) d) Excludes that with tympanoplasty, type V (CBB ML AC) 12) CCA SZ AZ Other interventions on inner ear, not elsewhere classified 13) CCB AC AC Electrocochleography 14) CCB DN AC Implantation of cochlear prosthetic device a) Implantation of receiver (within skull) and insertion of electrode in the cochlea b) Includes mastoidectomy c) Excludes electromagnetic hearing device (CBA DN AC) 15) CCB JD AC Removal of cochlear prosthetic device a) Removal of cochlear prosthetic device (receiver) (electrode) 16) CCB SM AH Adjustment of cochlear prosthetic device
MastoidCostData	Table[integer]	This is a copy of the Alpha 2015 version of the International Classification of Health Interventions (ICHI) prepared by the WHO ICHI Development Project October 2015. **CD – MASTOID** 1) CDA FA AC Incision of mastoid 2) CDA JJ AC Mastoidectomy, not elsewhere classified a) Revision of mastoidectomy 3) CDA JK AC Total mastoidectomy a) Atticoantrostomy 4) CDA JL AC Radical mastoidectomy a) Modified radical mastoidectomy
EarFunctionsCostData	Table[integer]	This is a copy of the Alpha 2015 version of the International Classification of Health Interventions (ICHI) prepared by the WHO ICHI Development Project October 2015. **CT – Ear Functions** 1. CTB AA ZZ Assessment of hearing functions a) Evaluating sensory functions relating to sensing the presence of sounds and discriminating the location, pitch, loudness and quality of sounds - to establish functioning, or a diagnosis, or identify appropriate intervention(s) b) Assessing functions of:; c) auditory discrimination; d) hearing; e) lateralisation of sound; f) localisation of sound source; g) speech discrimination 2. CTB AC ZZ Test of hearing functions a) Performing a specific review or examination of sensory functions relating to sensing the presence of sounds and discriminating the

		location, pitch, loudness and quality of sounds by using a test 3. CTB AF ZZ Auditory evoked responses 4. CTE AA ZZ Assessment of vestibular functions a) Evaluating sensory functions of the inner ear related to position, balance and movement - to establish functioning, or a diagnosis, or identify appropriate intervention(s) b) Assessing functions of position and positional sense; c) Functions of balance of the body and movement 5. CTE AC ZZ Test of vestibular functions a) Performing a specific review or examination of sensory functions of the inner ear related to position, balance and movement by using a test 6. CTK AA ZZ Assessment of sensations associated with hearing and vestibular functions a) Evaluating sensations of ringing in ears, irritation in ear, aural pressure, nausea associated with dizziness or vertigo - to establish functioning, or a diagnosis, or identify appropriate intervention(s) b) Assessing sensations of:; c) aural pressure; d) irritation in ear; e) nausea associated with dizziness or vertigo; f) ringing in ears 7. CTK AC ZZ Test of sensations associated with hearing and vestibular functions a) Performing a specific review or examination pf sensations of ringing in ears, irritation in ear, aural pressure, nausea associated with dizziness or vertigo by using a test 8. CTK PH ZZ Training management of sensations associated with hearing and vestibular functions a) Teachings, enhancing or developing skills of managing sensations of ringing in ears, irritation in ear, aural pressure, nausea associated with dizziness or vertigo through context-specific practice 9. CTK PM ZZ Education about sensations associated with hearing and vestibular functions a) Providing structured information in a manner conducive to improving the knowledge of sensations of ringing in ears, irritation in ear, aural pressure, nausea associated with dizziness or vertigo
HearingAndEarUnspecifiedCostData	Table[integer]	This is a copy of the Alpha 2015 version of the International Classification of Health Interventions (ICHI) prepared by the WHO ICHI Development Project October 2015. **CZ – Hearing and ear, unspecified** 10. CZZ AA ZZ Assessment of ear, not elsewhere classified 11. CZZ AE AD Otoscopy a) Auriscopy; b) Inspection of ear canal 12. CZZ JA AC Irrigation of ear, not elsewhere classified a) Ear toilet NOS;

		b) Flushing of earwax; c) Irrigation of external ear; d) Irrigation with removal of cerumen 13. CZZ JD AC Removal of intraluminal foreign body from ear without incision 14. CZZ JJ AA Partial excision of ear, not elsewhere classified 15. CZZ LB AA Reattachment of ear 16. CZZ ML AA Other plastic repair of ear a) Otoplasty NOS; b) Postauricular skin graft; c) Repair of lop ear 17. CZZ SZ AZ Other interventions on ear, not elsewhere classified
LearningAndApplyingKnowledgeCostData	Table[integer]	This is a copy of the Alpha 2015 version of the International Classification of Health Interventions (ICHI) prepared by the WHO ICHI Development Project October 2015. **SA – Learning and applying knowledge** 1. SAD AA ZZ Assessment of listening a) Evaluating the ability to use the sense of hearing intentionally to experience auditory stimuli - to establish functioning, or a diagnosis, or identify appropriate intervention(s) 2. SAD AC ZZ Test for listening a) Performing a specific review or examination of the ability to use the sense of hearing intentionally to experience auditory stimuli by using a test 3. SAD PG ZZ Observation of listening a) Visual acquisition of information (not continuous) to evaluate the ability to use the sense of hearing intentionally to experience auditory stimuli 4. SAD PH FB Training in use of animal assistance with hearing a) Teaching, enhancing and developing skills to use a guide dog to use the sense of hearing intentionally to experience auditory stimuli 5. SAD PH ZZ Training in listening a) Teaching, enhancing or developing skills to use the sense of hearing intentionally to experience auditory stimuli through context specific practice 6. SAD PM ZZ Education about listening a) Providing structured information in a manner conducive to improving knowledge about to use the sense of hearing intentionally to experience auditory stimuli 7. SAD PN ZZ Advising about listening a) Providing advice to encourage a change of or to maintain the ability to use the sense of hearing intentionally to experience auditory stimuli in relation to health (or risks) 8. SAD RB FA Emotional support for listening a) Providing comfort, empathy or motivational support to enable to use the sense of hearing intentionally to experience auditory stimuli
Output parameters		

PPI_TM	Table	Table ready for Text-Mining (TM) tasks

dss_UploadDevice{Fitting,Supplies}CostData

Operation Description	Functions allowing the upload of Device Fitting Cost and Device Supplies Cost related data to the DSS	
Pre-conditions	Price per intervention Type of HAs, list	
Post-conditions	Data should be used for economic modeling and simulating (cost-effectiveness,…)	
Input parameters		
Name	**Type**	**Description**
dss_UploadDeviceFittingCostData	Table[integer]	Device fitting price per intervention according to the type of HAs
dss_UploadDeviceSuppliesCostData	Table[integer]	Supplies material to the type of HAs
Output parameters		
DC_Rep_TM	Table	Table ready for Text-Mining (TM) tasks

dss_UploadRiskFactorData

Operation Description	Functions allowing the upload of Risk Factors related data to the DSS	
Pre-conditions	Risk factors determinated through EVOTION according to the range	
Post-conditions	Data should be used for economic modeling and simulating	
Input parameters		
Name	**Type**	**Description**
Dss_UploadRiskFactorData	Table[integer]	Risk factors range in the immediacy of their effect on disease events from more distant exposures (“distal risk factors”), which are several steps away from disease events in the chain of causation, to more proximate exposures (“proximal risk factors”), which are more immediately connected to disease events. 1. Distal risk factors 2. Intermediate risk factors 3. Proximal risk factors
Output parameters		
RF_TM	Report	Report ready for Text-Mining (TM) tasks

dss_UploadReports

Operation Description	Functions allowing the upload of Reports to the DSS
Pre-conditions	Reports should be in predefined format.
Post-conditions	Reports should be in appropriate format for text mining
Input parameters	

Name	Type	Description
Report	.txt, .pdf	Reports in .txt or .pdf format
Output parameters		
TMReport	TMreport	Report ready for Text-Mining (TM) tasks

dss_UploadPapers

Operation Description	Functions allowing the upload of Papers to the DSS	
Pre-conditions	Papers should be in predefined format.	
Post-conditions	Papers should be in appropriate format for text mining	
Input parameters		
Name	**Type**	**Description**
Report	.pdf	Papers in .pdf format
Output parameters		
TMReport	TMpaper	Paper ready for Text-Mining (TM) tasks

dss_Import{SocialCamp, PHPDMTrans, PHPDMSpec, Reas, DataRep}Data

Operation Description	Functions allowing the import of data coming from the rest of EVOTION components (Social Campaign Tool, PHPDM Transfromation Tool, PDPDM Specification Tool, Ontology Reasoner and Data Repository) to the DSS	
Pre-conditions	Data should be in predefined format.	
Post-conditions	Data should be in appropriate format for text mining	
Input parameters		
Name	**Type**	**Description**
SocialCampaingData	.txt, .csv	Data in .txt or .csv format
PHPDMTransData	.txt, .csv	Data in .txt or .csv format
PHPDMSpecData	.txt, .csv	Data in .txt or .csv format
ReasData	.txt, .csv	Data in .txt or .csv format
DataRepData	.txt, .csv	Data in .txt or .csv format
Output parameters		
SCTMData_TM	TMData	Data ready for Text-Mining (TM) tasks
PHPDMTData_TM	TMData	Data ready for Text-Mining (TM) tasks
PHPDMSData_TM	TMData	Data ready for Text-Mining (TM) tasks
ReasData_TM	TMData	Data ready for Text-Mining (TM) tasks
DataRep_TM	TMData	Data ready for Text-Mining (TM) tasks

dss_TM(FactorAnalysis/StudAnalysis/Summary/Keywords/Clustering/DataCharacterization/Algorithms/DataTests/Metrics/StartAnalysis/CreateReport/UpdateReport/DeleteReport/CriteriaExt/StopAnalysis/RetrieveList)Tasks

Operation Description	List of text-mining related functions to be performed by the DSS
Pre-conditions	Data should be in Text-Mining (TM)-format for various processes related to TM

	(FactorAnalysis/StudAnalysis/Summary/Keywords/Clustering/ DataCharacterization/Algorithms/DataTests/Metrics/StartAn alysis/CreateReport/UpdateReport/DeleteReport/CriteriaExt /StopAnalysis/RetrieveList) tasks.	
Post-conditions	Outcomes should include all available data and in appropriate format.	
Input parameters		
Name	**Type**	**Description**
TM_Data/Reports	TMData, TMReport	Data in TM format.
Output parameters		
Factor Analysis Report	Report	Report related to factor analysis
Study Analysis Report	Report	Report related to relevant studies analysis
Summary Report	Report	Summary Report of a study/report.
Keywords	text	Text including keywords from studies/reports.
Clustering	program	TM-clustering related algorithms
Data Characterization	program	TM-data characterizations algorithms
Algorithms	program	TM-related algorithms
Data Tests	program	TM-data testing algorithms
Metrics	Graphs, tables	Graphs, tables to be used in produced reports for simulation purposes.
StartAnalysis/Create/Update/Delete/StopAnalysis/ Retrieve/Extract Functions	program	TM-related functions

dss_notification

Operation Description	Function allowing the time-monitoring of analysis when performing a text-mining related analysis task.	
Pre-conditions	dss_TMStartTasks should be activated first	
Post-conditions	notification if dss_TMStopAnalysisTasks was activated or not	
Input parameters		
Name	**Type**	**Description**
TMAnalysis_time	Timestamped value	Logged information about TMAnalysis, initiated with dss_TMStartTAnalysisTasks recorded with the respective timestamp.
Output parameters		
Report_notification	Timestamped value	Notification produced showing the time taken for analysing, whether it was completed on time, or stopped by the dss_TMStopAnalysis

3.9.3 Related Requirements

The requirements addressed (partially or fully) by this component are as follows

Requirement	Operation	Notes
FR(PHAS)1: Mechanism for collecting data of different types	dss_UploadCensusData dss_UploadICD10IncidenceData dss_UploadICD10IPrevalenceData dss_UploadIncidenceICFData dss_UploadPrevalenceICFData dss_UploadIncidenceChildICFData dss_UploadPrevalenceChildICFData dss_UploaCostData dss_UploadDeviceFittingCostData dss_UploadDeviceSuppliesCostData dss_UploadRiskFactorData dss_UploadReports dss_UploadPapers dss_ImportSocialCampData dss_ImportPHPDMTransData dss_ImportPHPDMSpecData dss_ImportReasData dss_ImportDataRepData	
FR(PHAS)2: Discover factors of low HA usage	dss_TMFactorAnalysis	
FR(PHAS)3: Identify relevant studies and provide a summary of them	dss_TMStudAnalysis dss_TMSummary dss_TMKeywords	
FR(PHAS)4: Filter the relevant studies	dss_TMKeywords	
FR(PHAS)5: Cluster the relevant studies	dss_TMClustering	

FR(PHAS)6: Characterize data to define the size of the dataset	dss_TMDataCharacterization	
FR(PHAS)7: Support different types of data analysis	dss_TMAlgorithms	
FR(PHAS)8: Support different types of data tests	dss_TMDataTests	
FR(PHAS)9: Produce and manage metrics for the quality of analysis	dss_TMMetrics	
FR(PHAS)10: Initiate data analysis session	dss_TMStart	
FR(PHAS)11: Administrate (create, update, delete) analysis' outcomes	dss_TMCreateReport dss_TMUpdateReport dss_TMDeleteReport	
FR(PHAS)12: Notification when analysis is complete	dss_notification	
FR(PHAS)14: Suggest factors of analysis' outcome	dss_TMFactorAnalysis	
FR(PHAS)15: Re-analysing a specific dataset with different factors	dss_TMClustering dss_TMDataCharacterization dss_TMAlgorithms dss_TMDataTests	
FR(PHAS)16: Data analysis, in a statistical way, between different data types	dss_TMClustering dss_TMDataCharacterization dss_TMAlgorithms dss_TMDataTests	
FR(PHAS)17: Support multiple	dss_TMDataCharacterization dss_TMAlgorithms	

types of analysis' criteria	dss_TMDataTests	
FR(PHAS)18: Support of progressive notifications and save of the outcomes on data analysis	dss_notification dss_TMUpdateReport	
FR(PHAS)25: Extend the criteria for the data collection process	dss_TMCriteriaExt	
FR(PHAS)26: Stop the relevant analytic activity	dss_TMStopAnalysis	
FR(CLIS)57: Provide a list of studies for inspection	dss_TMRetrieveList	
FR(PSOS)146: Record up-to-date hearing research and health promotion information	dss_UploadReports dss_UploadPapers dss_TMUpdateReport	

3.10 Social media campaigning and feedback collection component

3.10.1 Purpose

The Social media campaigning and feedback collection component will be able to create social media campaigns in Twitter based on policies generated by PHPDM models (e.g. information about the final decisions, the issues considered, the expected benefits, highlights of the evidence underpinning the policies) and subsequently collect and analyse feedback from different stakeholder groups for the policies as it will be the main tool to publish and collect social information from Twitter. Following an easy-to-use modern design, the component will be responsible not only to send all the aforementioned data to the main platform, but also to receive results from the analysis having taken place by the platform.

3.10.2 Functional Capabilities

The following list presents an overview of the functional capabilities that the EVOTION Social media campaigning and feedback collection component will provide. These capabilities envisaged to adapt to emerging user requirements during the course of the project. Every capability is accompanied by a detailed specification of the operations that implement it. Below are presented the Social media campaigning and feedback collection component's functional capabilities.

- **Create campaign** - This functionality will support the initialization of a social media campaign. The component will create (through a web form or an API request) a tweet and a campaign-specific

social media stream, which will be related to the posted tweet. The campaign will be general, by choosing text which will include a keyword and/or hashtag (e.g. “HearingAid”, “TTS”, “#EU”, etc.), or could combine both source and topic (e.g. posts on #EU posted by @CNN). In some cases, the component automatically will be able to detect Named Entities (as persons, locations or organisations) in the content of the stream and will provide them as a list under campaign’s post text. In some cases, some indicative categories will be also detected and listed together with the Named Entities. This functional capability is being implemented by the following operation that is presented below in details: createCampaign

- **Analyze campaign** - This functionality will engage metrics to determine the effectiveness of campaign’s tweet by checking the number of people who clicked the favourite button under campaign’s tweet, the number of people who click the retweet button under campaign’s tweet, the number of mentions of connected campaign’s twitter account. In addition, it will measure the number of new followers of a connected twitter account gained on Twitter over a set period a campaign run and compares that to a predetermined target. Finally, this functionality will provide an aggregate measure of social perceptions, moods and attitudes that can be attributed to a created campaign. This functional capability is being implemented by the following operation that is presented below in details: analyzeCampaign
- **Analyze tweet** - This functionality will analyse a post and will be performed in real time when a post is selected so there will be a few seconds delay before the following information will be provided summarising the results of the analysis on a circular diagram. Selecting on any of the three categories (Contributor, Content and Context: CCC) will reveal web diagrams summarising the results of the metrics corresponding to the specific category. Selecting any of the metrics will bring the detailed results for the selected metric. It will provide a sense on how influential tweet’s user is by providing information on the most recent retweets and replies received, along with sentiment analysis, timelines and tag clouds accessible by scrolling down the right column. If a post contains an image, this functionality will be able to provide whether the posted image (or a visually similar one) can be found somewhere on the web. These results are received by using the TInEye reverse image search service. This functional capability is being implemented by the following operation that is presented below in details: AnalyzeTweet

createCampaign

Operation Description	Creates a new campaign in Social Media (Twitter)	
Pre-conditions	Connect a twitter account	
Post-conditions		
Input parameters		
Name	**Type**	**Description**
Twitter ID	Text	Unique identifier of the connected twitter account
Post text	Text	Text of the campaign that may include hashtags and/or mentions to be posted
Target number of followers	Integer	Predetermined number of followers gained on Twitter over a set period of time (optional)
Output parameters		
Name	**Type**	**Description**
Campaign ID	Text	The unique identifier of the created campaign

Campaign Stream	Object list	A stream of tweets related to campaign
Detect Named Entities	Object list	A list of the automatically detected Named Entities (as persons, locations or organisations) in the content of the stream
Indicative categories	Object list	A list of the automatically detected indicative categories in the content of the stream

analyzeCampaign

Operation Description	Analyze a social media campaign	
Pre-conditions	Connected twitter account and a created campaign	
Post-conditions		
Input parameters		
Name	**Type**	**Description**
Campaign ID	Text	The unique identifier of the created campaign
Output parameters		
Name	**Type**	**Description**
Campaign ID	Text	The unique identifier of the created campaign
Favs	Integer	Number of favourites that campaigns tweet gained
Retweets	Integer	Number of people who click the retweet button under campaign's tweet
Predetermined target of followers	Integer	Target number of new followers, of a connected twitter account, over a set period a campaign run
Number of followers	Integer	Number of new followers, of a connected twitter account, gained on Twitter over a set period a campaign run and compares
Positive reaction	Percentage	Percentage of positive reactions in campaign's stream
Negative reaction	Percentage	Percentage of negative reactions in campaign's stream
Neutral reaction	Percentage	Percentage of neutral reactions in campaign's stream

analyzeTweet

Operation Description	Analyse a tweet	
Pre-conditions	Connected twitter account and a created campaign	
Post-conditions		
Input parameters		
Name	**Type**	**Description**
Tweet ID	Integer	The unique identifier of a tweet
Output parameters		
Name	**Type**	**Description**
Tweet	Object list	Published tweet (Twitter account and tweet)
Contributor's Reputation	Object list	Sentiment of what people in twitter think of this source of information
Contributor's History	Object list	Sentiment of what is the past activity of the source
Contributor's Presence	Object list	Sentiment of if the source does exist
Contributor's Popularity	Object list	Sentiment of how follows the source
Contributor's Influence	Object list	Sentiment of if the source interacts with other twitter accounts
Content's Reputation	Object list	Sentiment of what is the reputation of linked web content
Content's History	Object list	Sentiment of what is the history of linked web content
Content's Popularity	Object list	Sentiment of what is the social interaction with this post
Content's Originality	Object list	Sentiment of if the same content has been used in the past
Content's Quality	Object list	Sentiment of what is the text style of the post
Context's Cross-check	Object list	Sentiment of if there are any similar reports
Context's Diversity	Object list	Checks if the multiple reports are coherent in terms of sentiment
Context's Provenance	Object list	Sentiment of the original source of the content
Context's Proximity	Object list	Provides info regarding the locations mentioned related to where the report originates
Context's Influence	Object list	Checks if this tweet triggers discussions

3.11 Front component

3.11.1 Purpose

The main purpose of the front (visualization dashboard) component is to enable users to access the EVOTION platform. This dashboard will act as the front end offering access to the services available from the PHPDM tool, the BDA engine, the Decision Support System and the Data Repository of the platform. The dashboard will also offer visualization capabilities for viewing the BDA outcomes, and their connections to public health policies and models that have led to their generation.

The EVOTION front end component is responsible to handle the interaction with the end user. It includes the EVOTION Front aimed at helping EVOTION users in interaction with the EVOTION Platform and providing visualization facilities mainly for showing the results of a given analytic task. It interacts with Data Acquisition Layer for showing the results of the Social Campaigning, with Data ingestion and Execution Layer for visualization of analytics and for suggestion obtained by the Decision Support System, and with Modelling layer for providing interface to the model specification.

3.11.2 Functional Capabilities and Interfaces

The Front component offers the following functional capabilities:

1. **Social Component Visualization Capability**. This will allow users to interact with the social component as far as the visualization aspect is concerned. This capability will be implemented by the **frontend_SC_API** interface.
2. **DSS Visualization Capability**. This will allow users to interact with the DSS component as far as the visualization aspect is concerned. This capability will be implemented by the **frontend_DSS_API** interface.
3. **BDA Visualization Capability**. This will allow users to interact with the BDA component as far as the visualization aspect is concerned. This capability will be implemented by the **frontend_BDA_API** interface.
4. **PHPDTrans Visualization Capability**. This will allow users to interact with the PHPDTran component as far as the visualization aspect is concerned. This capability will be implemented by the **frontend_PHPDTrans_API** interface.
5. **Data Repository Visualization Capability.** This will allow users to interact with the Data Repository component as far as the visualization aspect is concerned. This capability will be implemented by the **frontend_DataRep_API** interface.

The aforementioned capabilities are to be realised by operations of the Front Component which are grouped into the following interfaces, analytically presented from that point onwards:

frontend_adminInterface extends **isValid**

Operation Description	This operation is used to verify the identity of the administrator.	
Input parameters		
Name	**Type**	**Description**
adminUN	string	Administrator’s username
adminPW	string	Administrator’s password
Output parameters		
Name	**Type**	**Description**

admin	Boolean, string	A Boolean indicate operation status: true->success; false->fail
adminInterface	HTML5 page	

frontend_{admin, user}login extends **login**

Operation Description	This operation enables a frontend admin/user to log in onto the front end visualization component and checks if the provided credentials (i.e., password and user name) match with those held in the platform for the specific user.	
Input parameters		
Name	**Type**	**Description**
frontend_credentials	Set<string>	A set stores user's username and password.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean indicate operation status: true->success; false->fail

frontend_{admin, user}logoff extends **logoff**

Operation Description	This operation enables a frontend admin/user to log off from the front end visualization component.	
Input parameters		
Name	**Type**	**Description**
frontend_logoff	Boolean	A Boolean indicate operation status: true->success; false->fail
Output parameters		
Name	**Type**	**Description**
frontend_logoff	Boolean	A Boolean indicate operation status: true->success; false->fail

frontend_userInterface extends **isValid**

Operation Description	This operation is used to verify the identity of the user.	
Input parameters		
Name	**Type**	**Description**
userUN	string	user's username
userPW	string	user's password
Output parameters		
Name	**Type**	**Description**
user	Boolean, string	A Boolean indicate operation status: true->success; false->fail
userInterface	HTML5 page	The starting page for a frontend user

frontend_homepage

Operation Description	The homepage of the frontend component.	
Input parameters		
Name	**Type**	**Description**
frontendURL	URL	Frontend's URL
Output parameters		
Name	**Type**	**Description**
frontHomePage	HTML5 page	The frontend's homepage.

frontend_indexedSearch

Operation Description	This operation is used to search keywords via the frontend and index them.	
Input parameters		
Name	**Type**	**Description**
keywords	HTML5 search box	Keywords used as input from user
Output parameters		
Name	**Type**	**Description**
results	HTML5 page	A page showing the results based on the keywords used as input

frontend_SC_API

Operation Description	Provides access to the SC for registered users	
Input parameters		
Name	**Type**	**Description**
Social_Campaign_Data	REST API	A REST API to query data from the SC
Output parameters		
Name	**Type**	**Description**
Social_Campaign_Report	Report	Reports generated from SC
Social_Campaign_Graphs	Graphs	Graphs generated from SC

frontend_DSS_API

Operation Description	Provides access to the DSS for registered users	
Input parameters		
Name	**Type**	**Description**
DSS_Data	REST API	A REST API to query data from the DSS
Output parameters		
Name	**Type**	**Description**
DSS_Report	Report	Report generated from DSS
DSS_Graphs	Graphs	Graphs generated from DSS

frontend_BDA_API

Operation Description	Provides access to the BDA for registered users	
Input parameters		
Name	**Type**	**Description**
BDA_Data	REST API	A REST API to query data from the BDA
Output parameters		
Name	**Type**	**Description**
BDA_Report	Report	Report generated from BDA
BDA_Graphs	Graphs	Graphs generated from BDA

frontend_PHPDTrans_API

Operation Description	Provides access to the PHPDTrans for registered users	
Input parameters		
Name	**Type**	**Description**
PHPDTrans_Data	REST API	A REST API to query data from the PHPDTrans
Output parameters		
Name	**Type**	**Description**
PHPDTrans _Report	Report	Report generated from PHPDTrans
PHPDTrans_Graphs	Graphs	Graphs generated from PHPDTrans

frontend_DataRep_API

Operation Description	Provides access to the DataRep for registered users	
Input parameters		
Name	**Type**	**Description**
DataRep_Data	REST API	A REST API to query data from the DataRep
Output parameters		
Name	**Type**	**Description**
DataRep _Report	Report	Report generated from DataRep
DataRep_Graphs	Graphs	Graphs generated from DataRep

3.11.3 Related Requirements

This section identifies the requirements, which are addressed (partially or fully) by the platform Front End and Visualisation component.

Requirement	Operation	Notes
FR(PHAS)13: Visualizations of the analysis outcomes	frontend_DataRep_API frontend_BDA_API frontend_DSS_API frontend_SC_API	
FR(PHAS)28: Visualize comparative policy models for implementation	frontend_BDA_API frontend_DSS_API	
FR(CLIS)34: Manage and visualize the history of ratings on the HA ease	frontend_BDA_API frontend_DataRep_API	
FR(CLIS)38: Different visualization modes of the recorded data	frontend_BDA_API frontend_DataRep_API	
FR(CLIS)47: Manage and visualize a detected event record	frontend_BDA_API frontend_DataRep_API	
FR(CLIS)56: Visualize a list of data types that are collected in the platform	frontend_DataRep_API frontend_BDA_API frontend_DSS_API frontend_SC_API	
FR(CLIS)57: Provide a list of studies for inspection	frontend_DSS_API	
FR(CLIS)58: Select from a list of data types	frontend_DataRep_API frontend_BDA_API frontend_DSS_API frontend_SC_API	
FR(CLIS)59: Visualize TTS/NIHL data recorded for a selected patient	frontend_DataRep_API	
FR(CLIS)77: Visualize aggregated data sets	frontend_DataRep_API frontend_BDA_API	
FR(CLIS)78: Visualize HA usage data with respect to various noise parameters	frontend_DataRep_API frontend_BDA_API	

4. Interactions Specifications

This section specifies interactions between the components of the EVOTION platform, which will realise the use cases of the platform that have been specified in the D2.1 deliverable [1]. These interactions are specified using UML sequence diagrams. The main purpose of specifying interactions in this manner is to indicate the flows of data and the flow of control between the different components of the EVOTION platform, as the platform operates to realise the different use cases.

The interacting components for every use case are listed at below subsections.

4.1.1 SD - CLIS.1 Retrieval of HA usage data

This use case captures scenario regarding the clinical use of the EVOTION platform in regards to improvement of hearing aid fitting, increased patient satisfaction and upgrade of hearing aid assessment to evidence based on streaming data

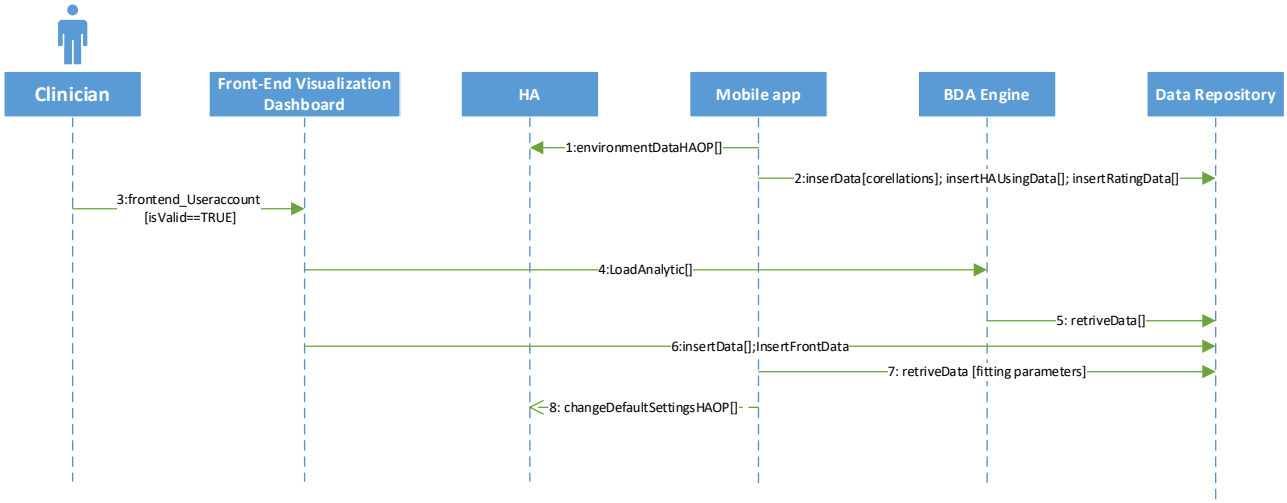

Figure 2 SD-CLIS.1 Retrieval of HA usage data

4.1.2 SD - CLIS.2 Sudden Deterioration of Hearing

This use case describes the need to allow patients indicate through the smart-phone application that an event of sudden hearing alterations has occurred.

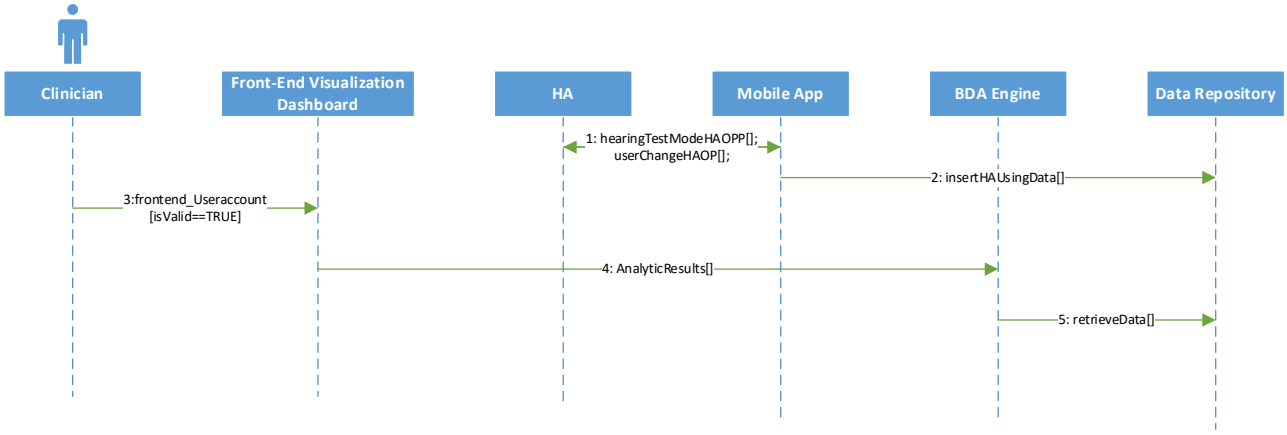

Figure 3 SD-CLIS.2 Sudden Deterioration of Hearing

4.1.3 SD - CLIS.3 “Ask the expert” hearing aid fitting (à la Watson)

The clinician fitting hearing aids has an option in the fitting software called “ask the expert”. When the clinician selects this option, the software takes into account the information the clinician has entered about a specific patient (age, hearing impairment, cognitive status, activity level, etc) to suggest the best hearing aid type and hearing aid settings for that person. These recommendations are based on studies and can be modified buy the clinician.

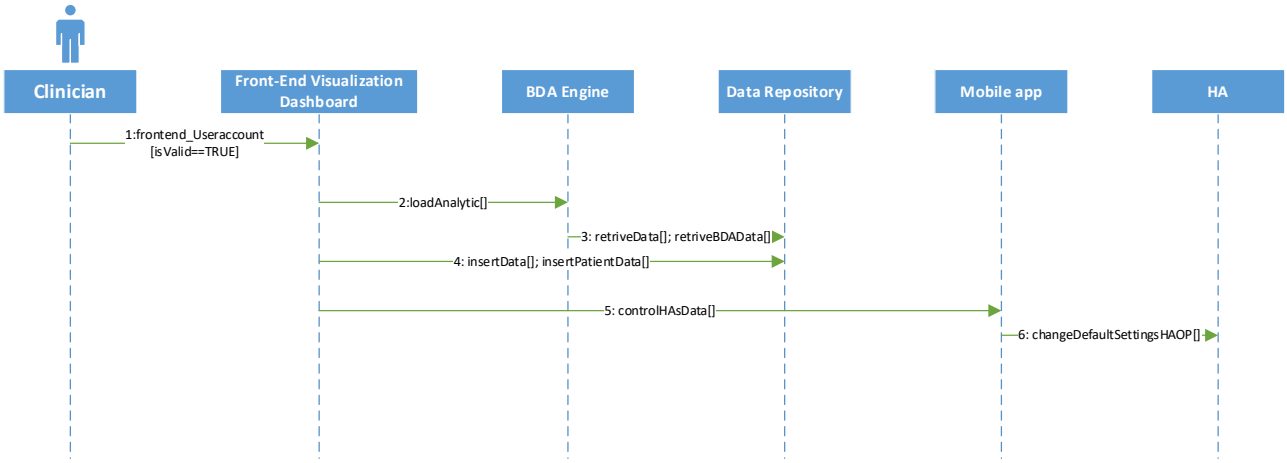

Figure 4 SD-CLIS.3 “Ask the expert” hearing aid fitting

4.1.4 SD - CLIS.4 Assessment of initial follow up policies

This use case captures scenarios regarding the assessment and formation of protocols for follow up appointments in the initial phase following the fitting of HAs, with the aim to increase the cost effectiveness of such policies.

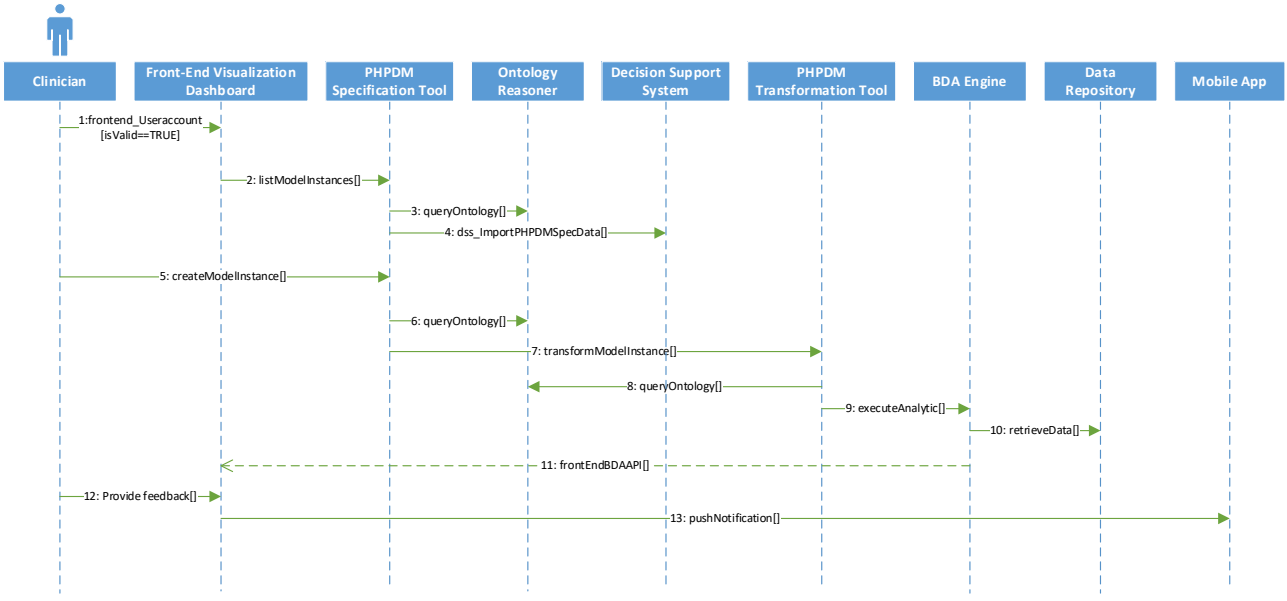

Figure 5 3.1.4 SD - CLIS.4 Assessment of initial follow up policies

4.1.5 SD - CLIS.5-NIHL Protection of people with hearing impairments from the harmful effects of loud noise individualized risk

This use case captures scenario regarding determination of individualised (environmental, physiological) factors associated with increased risk for Temporary Threshold Shift (TTS) or noise induced hearing loss (NIHL) for prevention of further TTS/NIHL episodes.

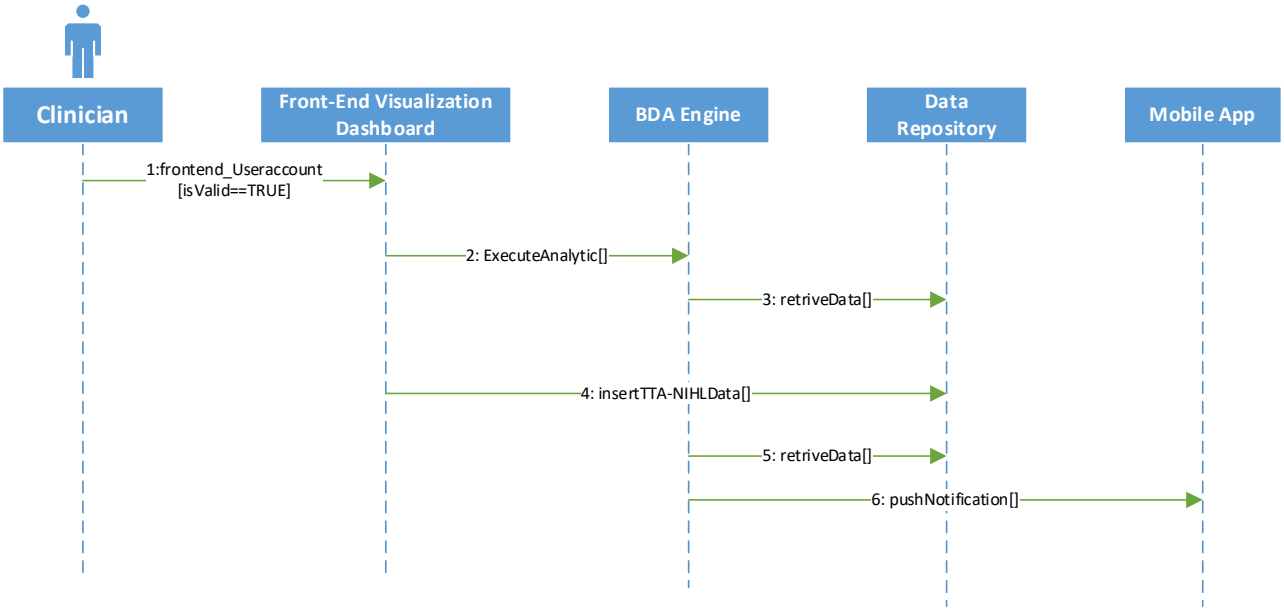

Figure 6 SD - CLIS.5-NIHL Protection

4.1.6 SD - CLIS.6 Individualized auditory training (AT)

This use case captures scenarios regarding determination of individualized auditory training in cases who do not fulfil “classic” criteria to prescribe AT. AT will be determined on the basis of real life HA user experienced communication difficulties and association of such difficulties with HA usage. AT aims at optimizing HA benefits and preventing or delaying cognitive and auditory processing deterioration.

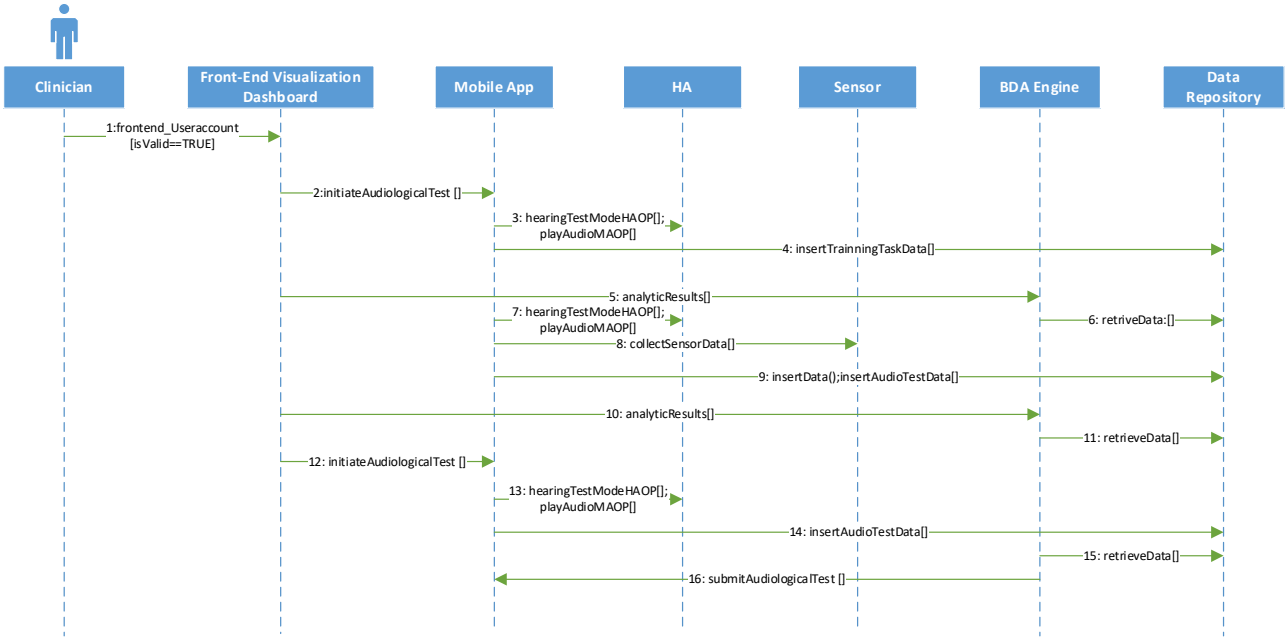

Figure 7 SD - CLIS.6 Individualized auditory training (AT)

4.1.7 SD - CLIS.7 Collection of HL related web and social network data

This use case captures a scenario in which the EVOTION platform will capture data from social networks for which the patient has provided consent to be used.

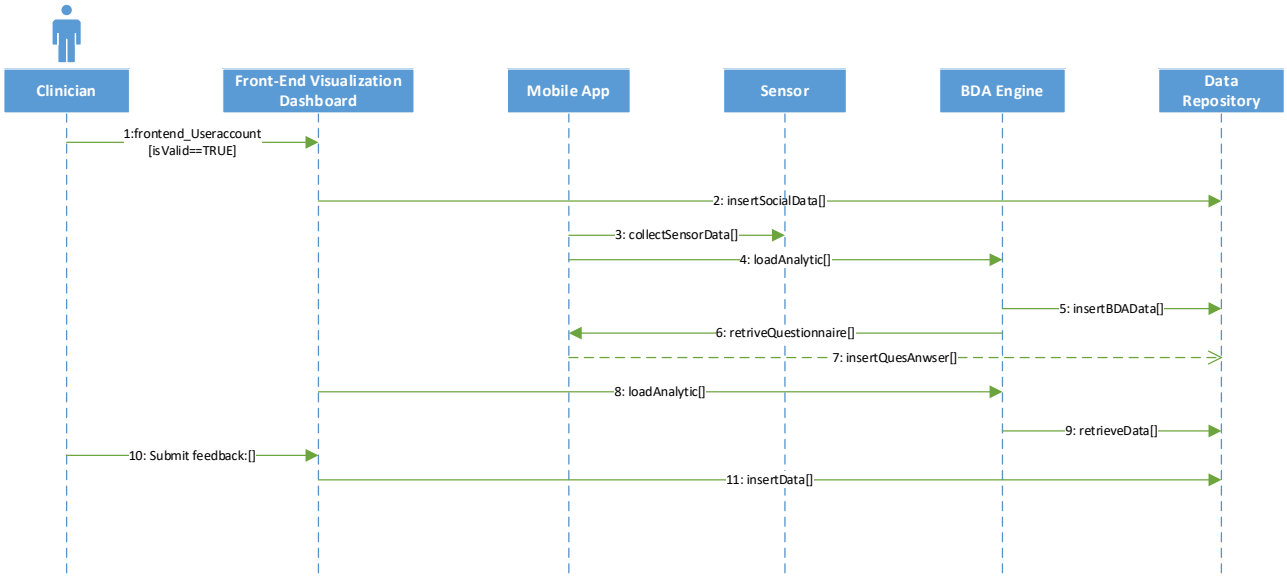

Figure 8 SD - CLIS.7 Collection of HL related web and social network data

4.1.8 SD - CLIS.8 Collection of sensors data and upload to the Cloud

Throughout the use of the EVOTION platform, data of various types will be collected by sensors. They will mainly provide Physiological data that include heart and respiratory rate, blood pressure, temperature, skin conductance and oxygenation. This will be stored and compared with data coming from HA.

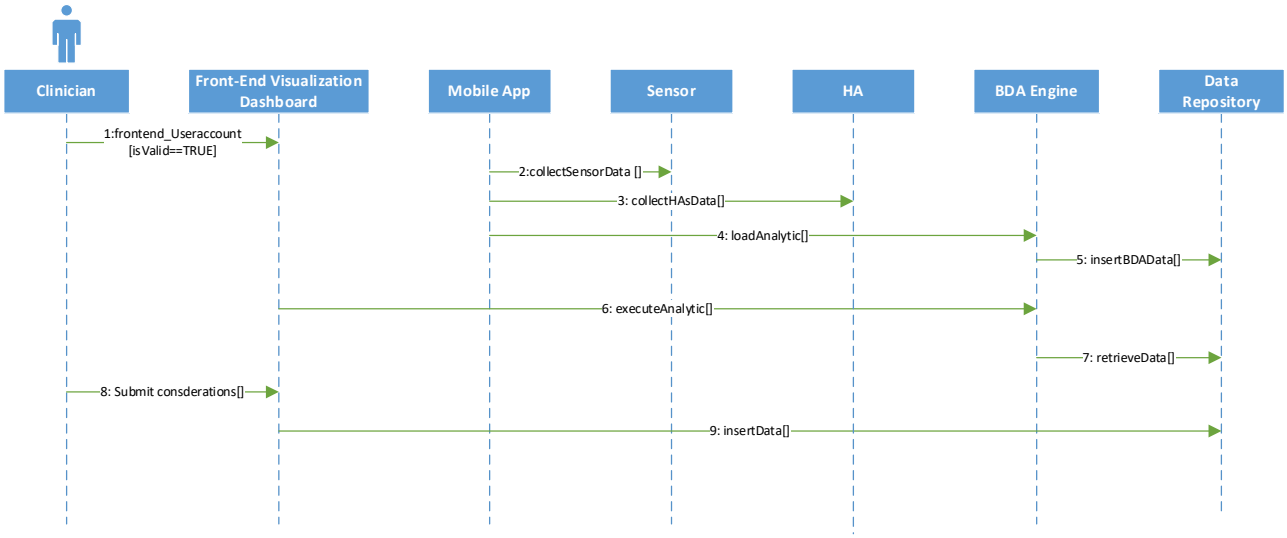

Figure 9 SD - CLIS.8 Collection of sensors data and upload to the Cloud

4.1.9 SD - CLIS.9 Cognitive data

Cognitive factors may affect audiological rehabilitation in terms of assessment capability and also in terms of selection of rehabilitation tools. In this use case a clinician identifies cognitive impairment using standardized assessment tool, enters the results in the platform and can tailor rehabilitations accordingly.

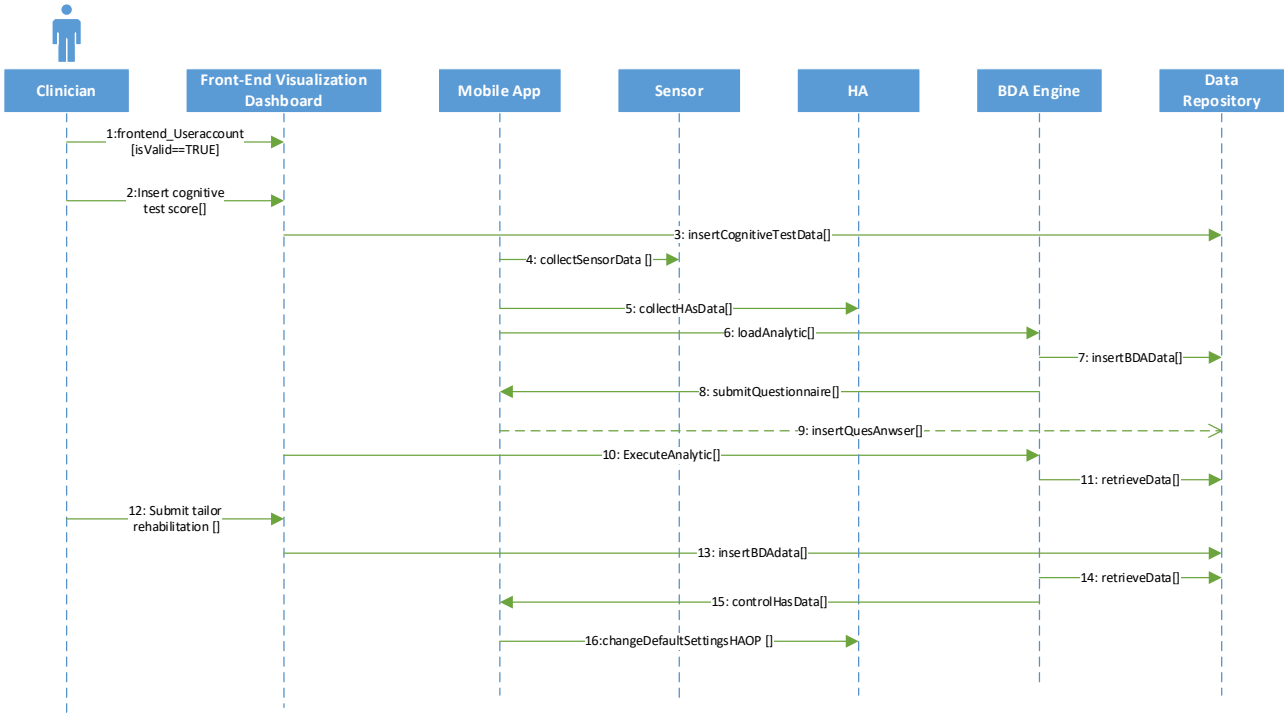

Figure 10 SD - CLIS.9 Cognitive data

4.1.10 SD - CLIS.10 Collection of questionnaire answers through the platform

Throughout the period of patients' data collection for the EVOTION platform the patients will need to answer to specific questionnaires in order to facilitate remote assessment of auditory disability, hearing-aid benefit etc. These questionnaires can be provided through the smart-phone EVOTION application.

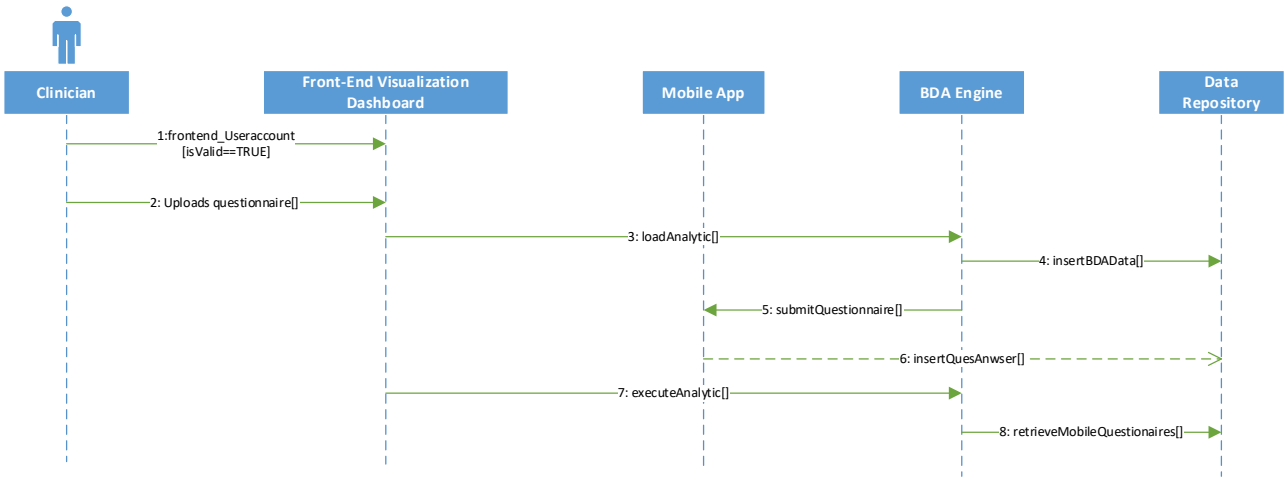

Figure 11 SD - CLIS.10 Collection of questionnaire answers

4.1.11 SD - CLIS.11 Diary of HL related event and HA malfunctions and problems

This use case captures scenario regarding ability of the EVOTION platform user to record events related to HL as well as problems and malfunctions of the HA.

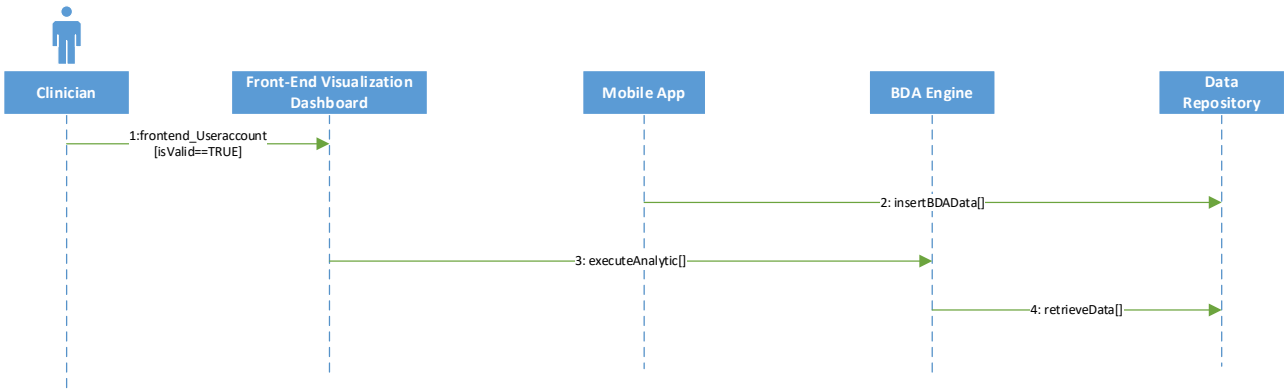

Figure 12 SD - CLIS.11 Diary of HL related event and HA malfunctions and problems

4.1.12 SD - CLIS.12 Performing audiological tests through HA

This use case captures scenario regarding the clinical use of the EVOTION platform in regards to remote, platform based performance of audiological tests (pure tone audiogram, speech in noise test, auditory evoked potentials).

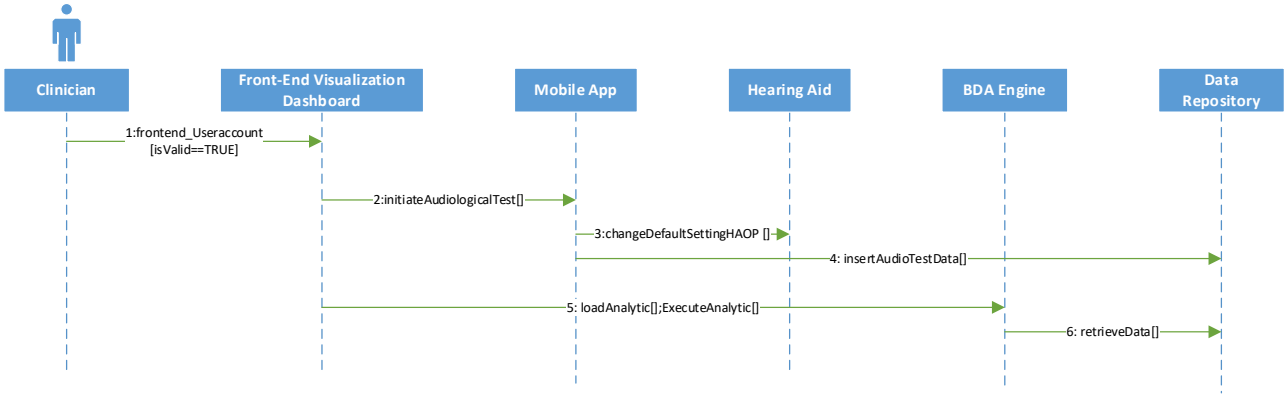

Figure 13 SD - CLIS.12 Performing audiological tests through HA

4.1.13 SD - PHAS.1 Prognosis of low HA usage

This use case captures scenarios regarding the formation of public health policy for exploring the potential of interventions aimed at preventing the low usage of HAs.

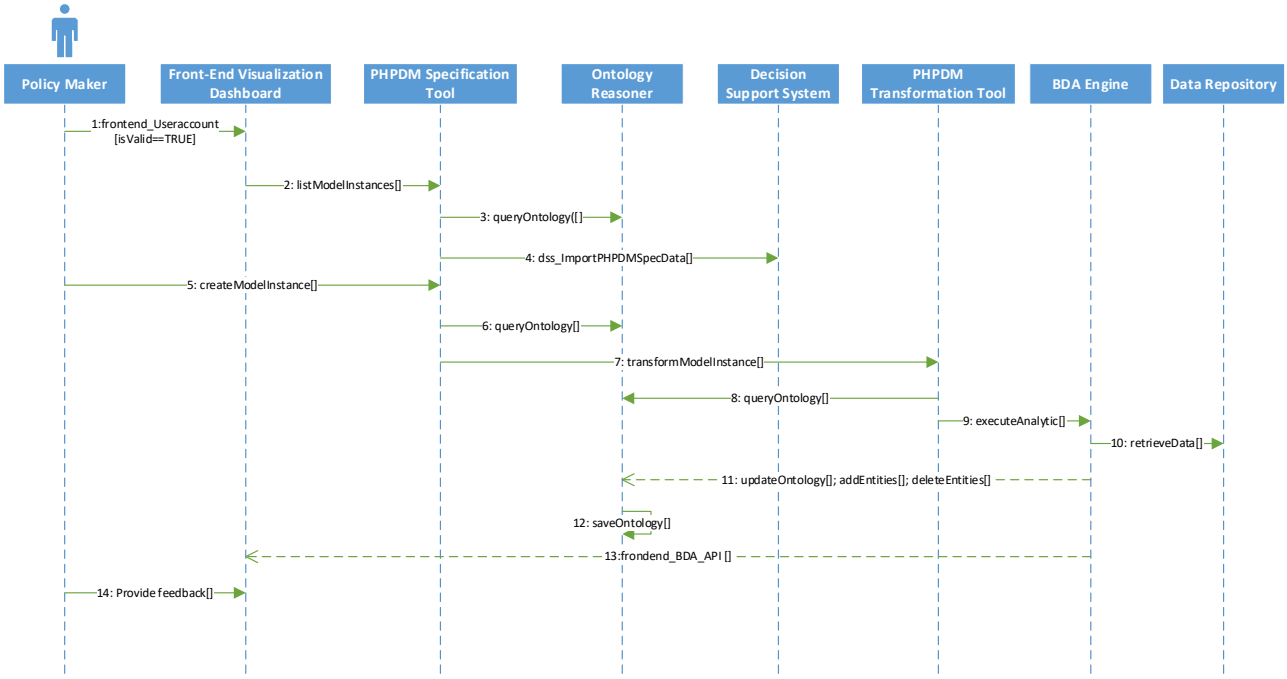

Figure 14 SD - PHAS.1 Prognosis of low HA usage

4.1.14 SD - PHAS.2 Predicting early retirement due to hearing impairments

This use case includes exploring of the potential for public policy interventions aimed at preventing early retirement due to hearing impairments.

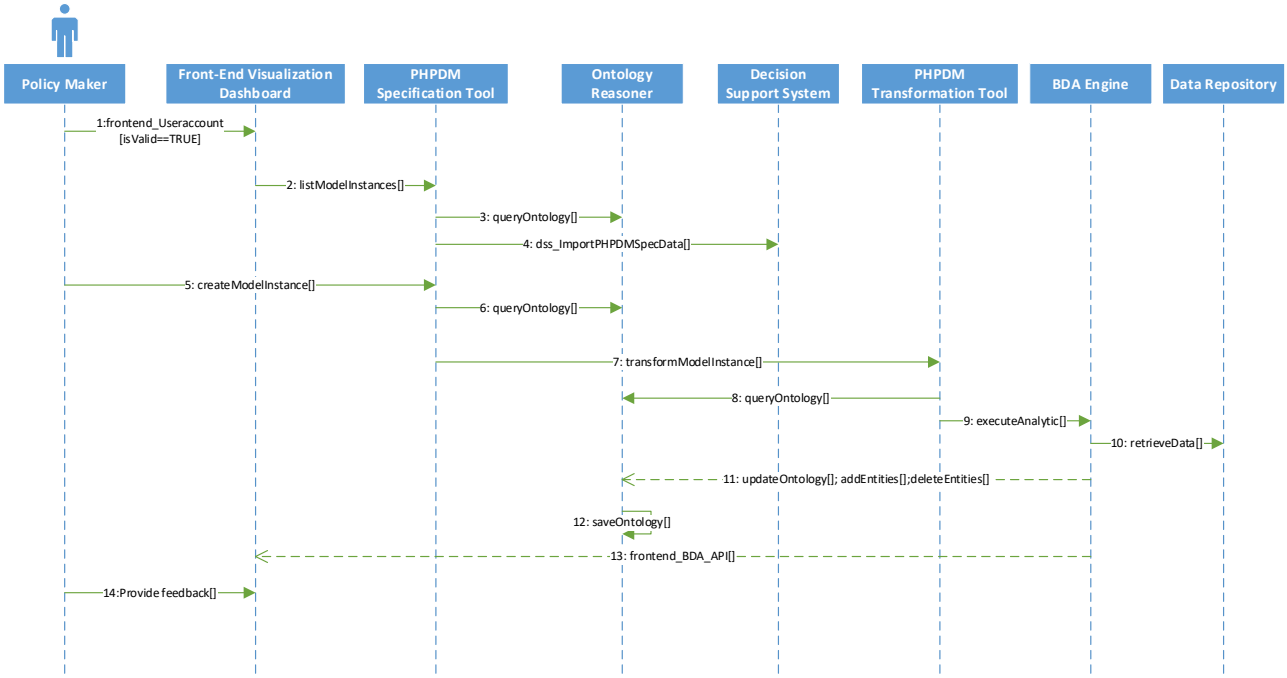

Figure 15 SD - PHAS.2 Predicting early retirement due to hearing impairments

4.1.15 SD - PHAS.3 Predicting urban physical planning based on HL

This use case includes exploring of the potential for public policy interventions aimed at preventing HL by means of predictive urban physical planning.

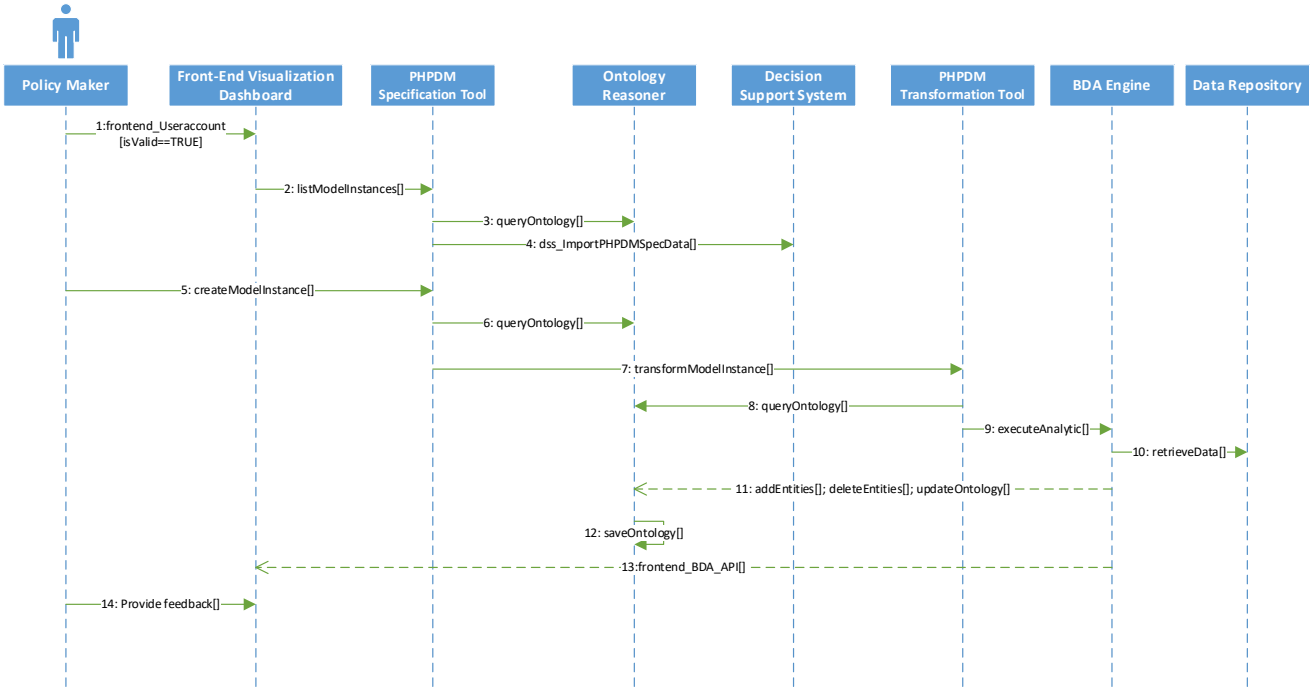

Figure 16 SD - PHAS.3 Predicting urban physical planning based on HL

4.1.16 SD - PHAS.4 Explore the potential for personalization of HA administration and use follow-up

This use case includes exploring of the potential of possible public policy interventions aimed at personalization of HA administration and use follow-up for risk groups of patients.

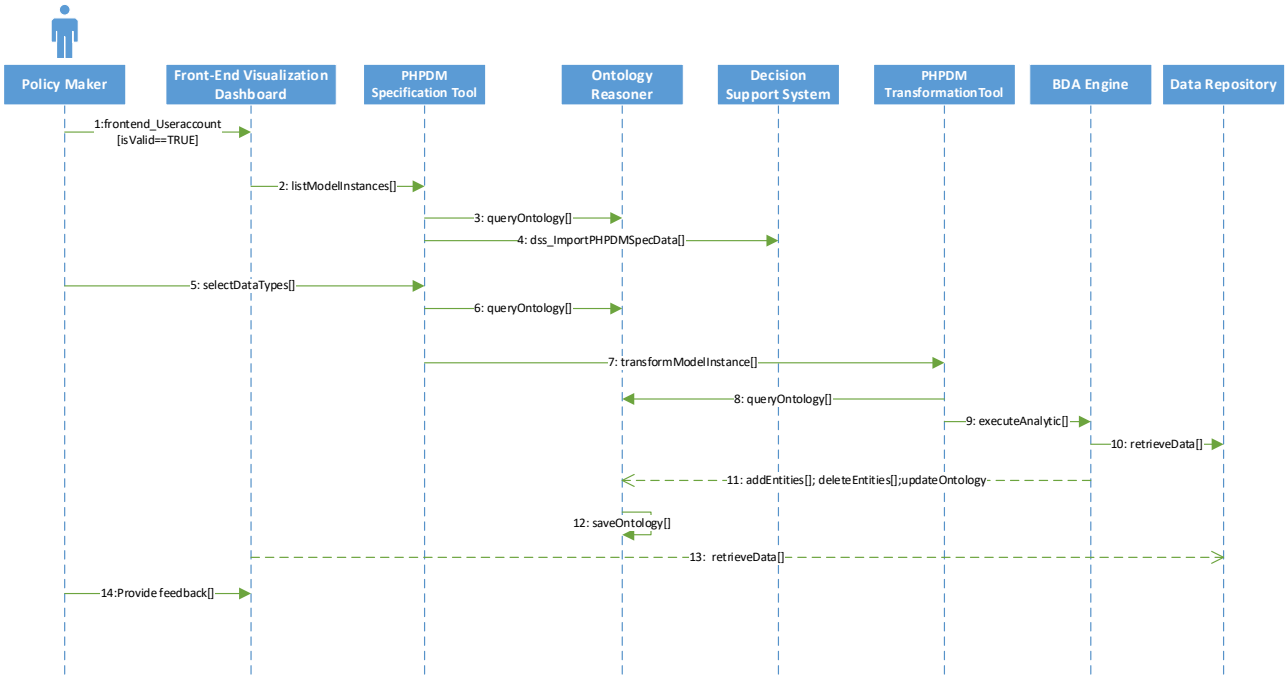

Figure 17 SD - PHAS.4 Explore the potential for personalization of HA administration and use follow-up

4.1.17 SD - PHAS.5 Policy on Effective Use of Assistive Listening Devices

This use case captures scenarios regarding the formation of public health policy for exploring the effectiveness of Hearing Loops. The scenario is aimed at collecting logs of sound transmitted to hearing aids given to participants of the EVOTION projects and the feedback obtained by EVOTION HA users regarding the effectiveness of use of HLs.

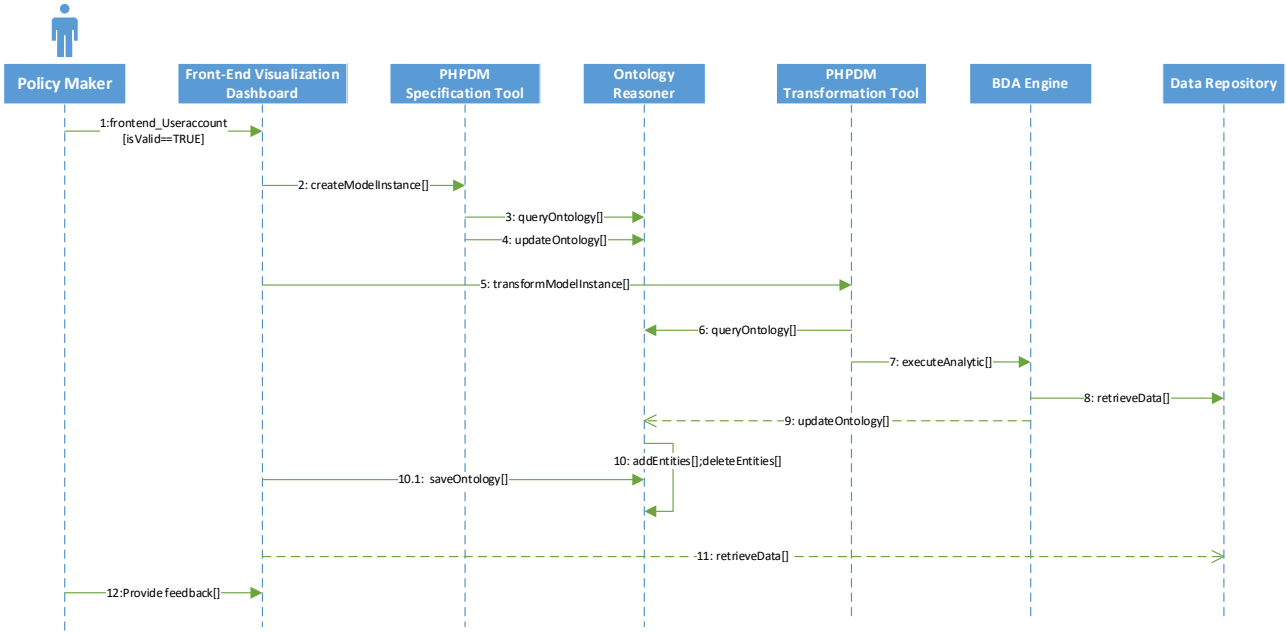

Figure 18 SD - PHAS.5 Policy on Effective Use of Assistive Listening Devices

4.1.18 SD - PHAS.6 Exploration of factors for prevention of cognitive decline

This use case captures scenarios focusing on the exploration of cognitive decline in HA users. This is important as there have been studies suggesting that people with mild (moderate) hearing loss are more likely to develop some form of cognitive decline (e.g., dementia) than people without any HL.

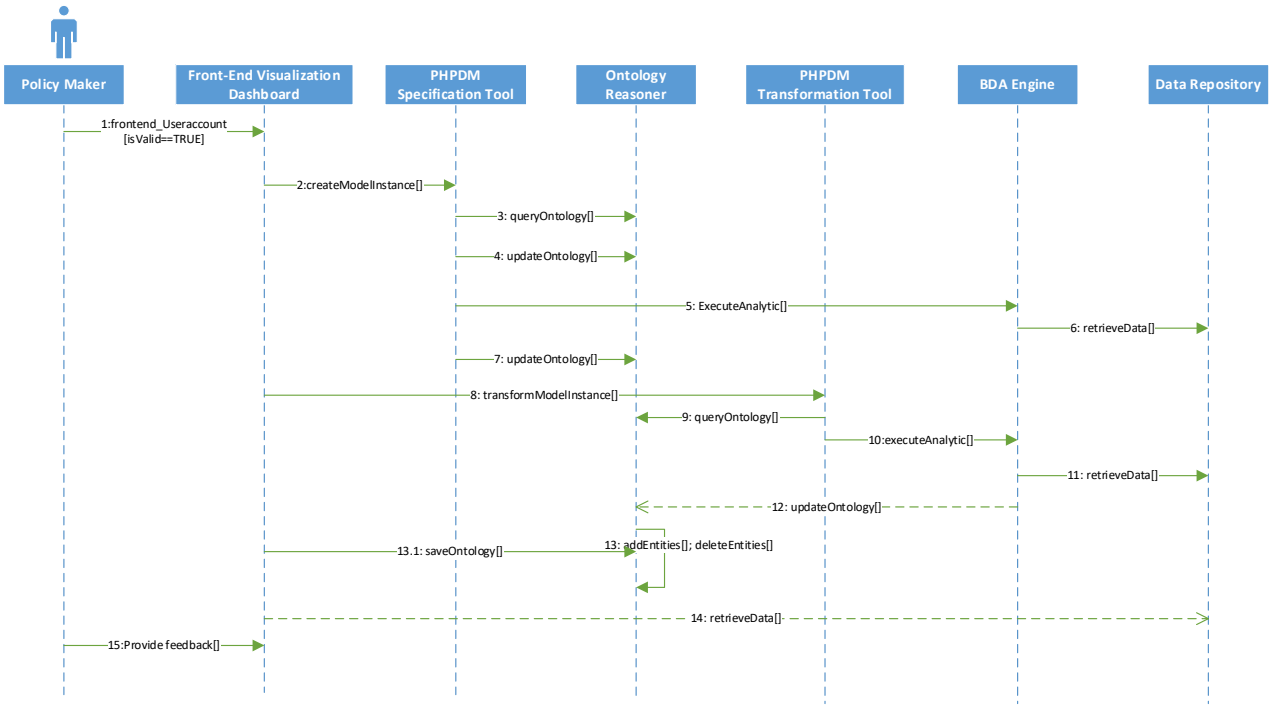

Figure 19 SD - PHAS.6 Exploration of factors for prevention of cognitive decline

4.1.19 SD - PSOS.1 Downloading of personal data to a Personal Health Record

This use case describes the ability to locally store and also export personal data that are collected by the EVOTION platform.

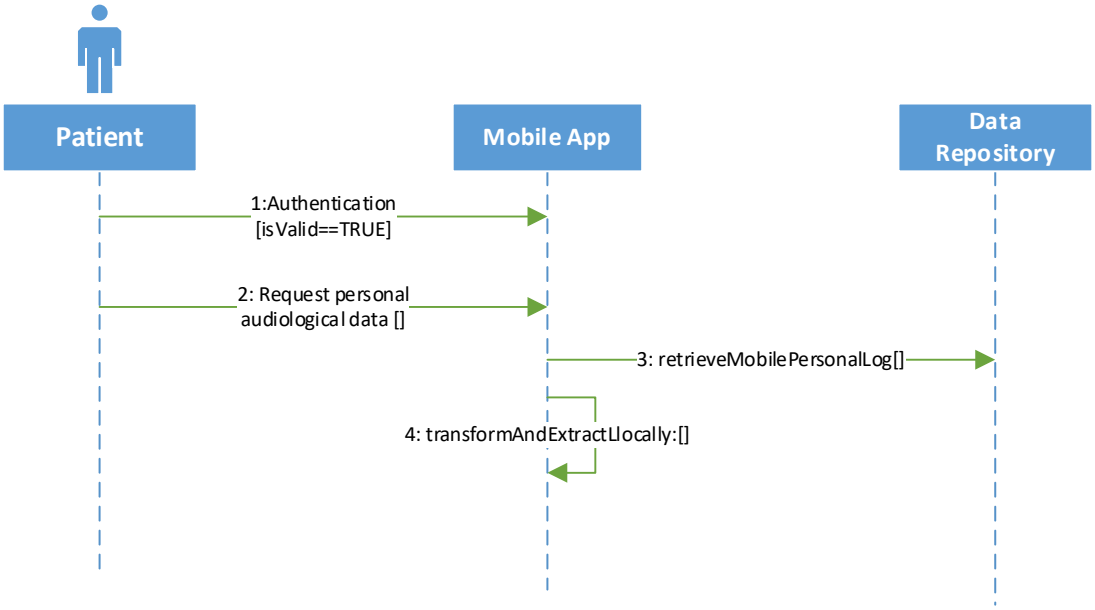

Figure 20 SD - PSOS.1 Downloading of personal data to a Personal Health Record

4.1.20 SD - PSOS.2 Text-based communication of the Hearing aid user

This use case describes text messaging between clinicians and patients.

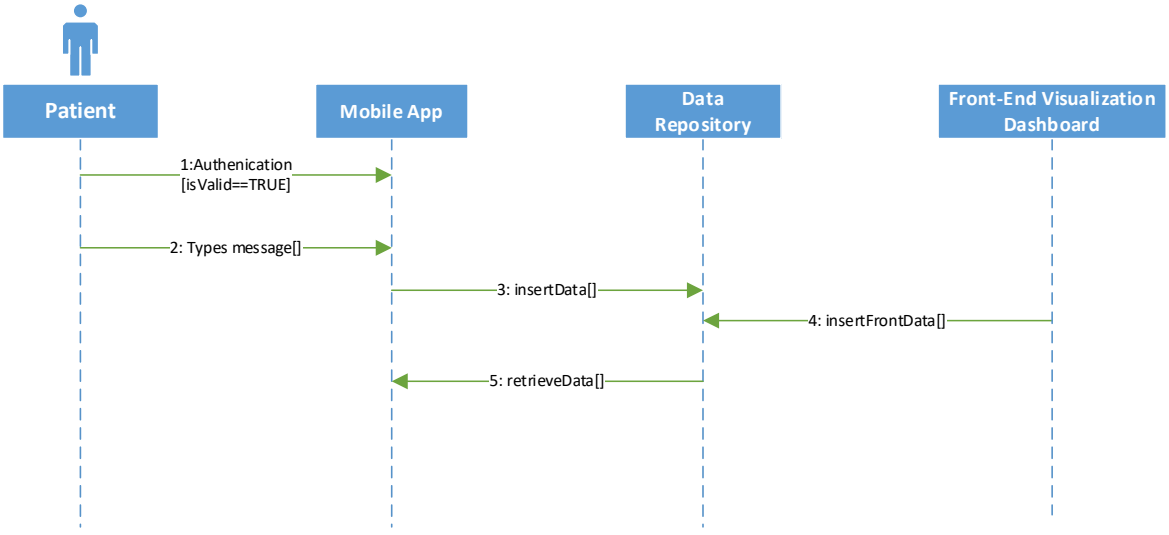

Figure 21 SD - PSOS.2 Text-based communication of the Hearing aid user

4.1.21 SD - PSOS.3 Self-testing of hearing and self-adjustment of hearing aids

The hearing aid user can test their hearing and adjust their hearing aids.

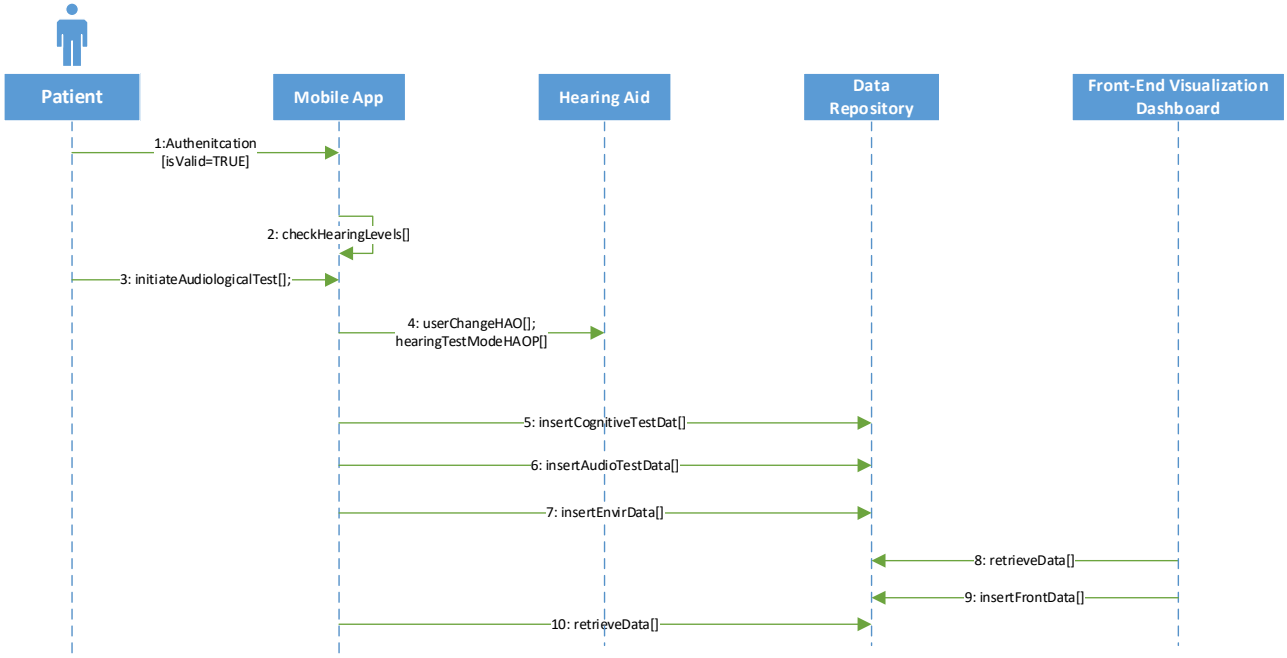

Figure 22 SD - PSOS.3 Self-testing of hearing and self-adjustment of hearing aids

4.1.22 SD - PSOS.4 Mobile hearing coach

The Mobile Hearing Coach is like a personal trainer towards hearing fitness. It makes the patients train, self-manage and involve other people to their condition.

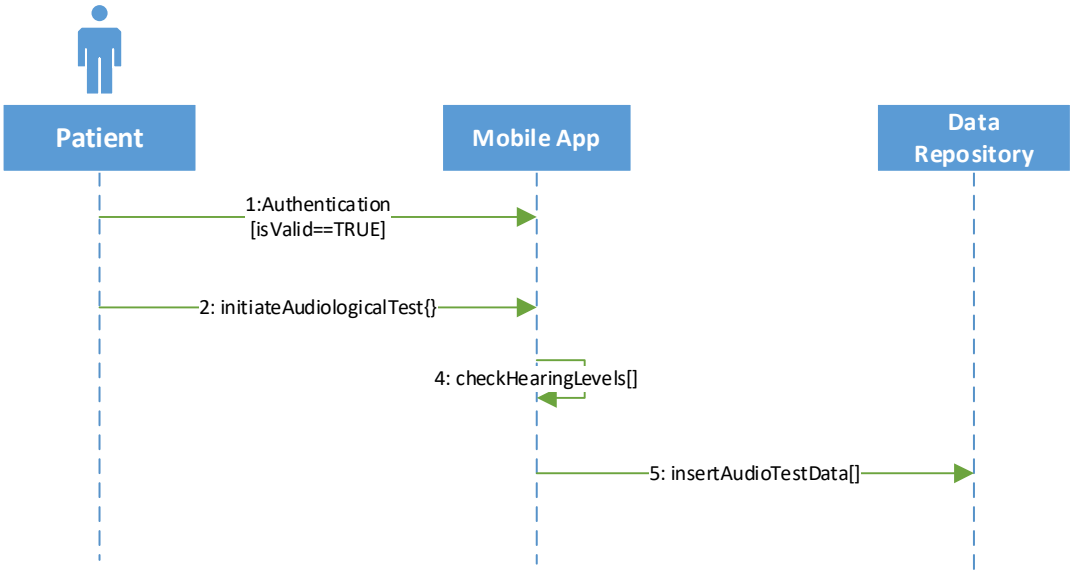

Figure 23 SD - PSOS.4 Mobile hearing coach

4.1.23 SD - PSOS.5 Protection of people with hearing impairments from the harmful effects of loud noise

This use case captures scenarios regarding determination of individualized (environmental, physiological) factors associated with increased risk for Temporary Threshold Shift (TTS) or noise induced hearing loss (NIHL) for prevention of further TTS/NIHL episodes.

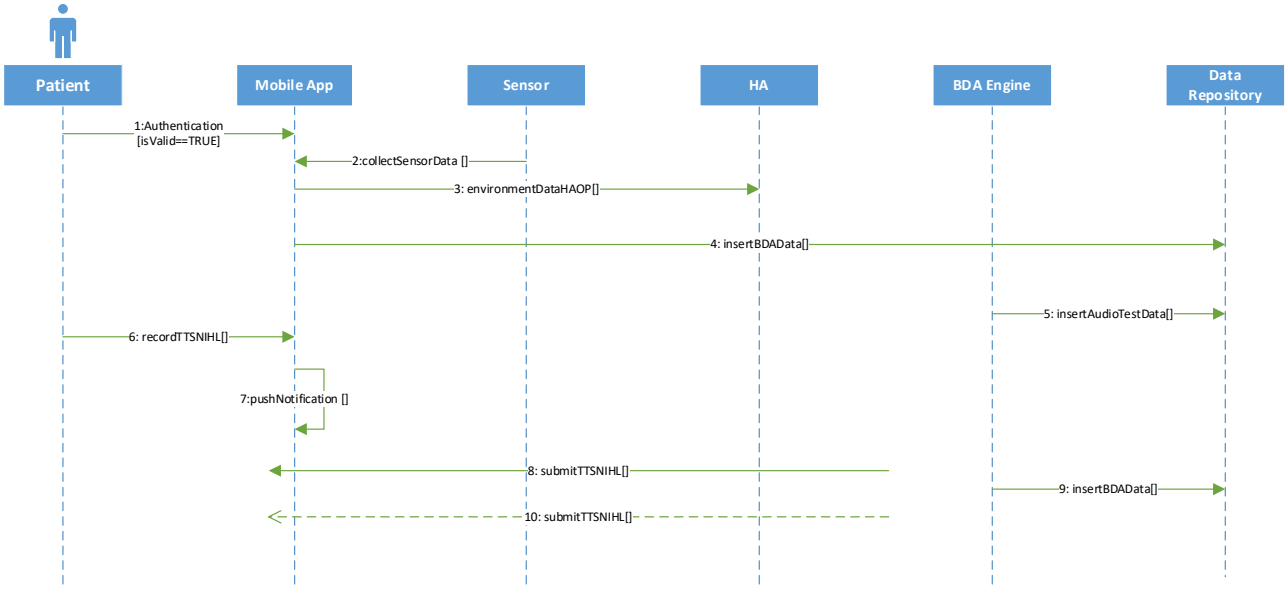

Figure 24 SD - PSOS.5 Protection of people with hearing impairments from the harmful effects of loud noise

4.1.24 SD - PSOS.6 Early Support for hearing aid uptake

This use case covers issues with hearing aid uptake. A proportion of individuals who could theoretically benefit from hearing aids eventually reject devices. Reasons for this are complex, but can include factors such as sound quality. Individuals who reject hearing aids have limited alternatives to help with hearing health.

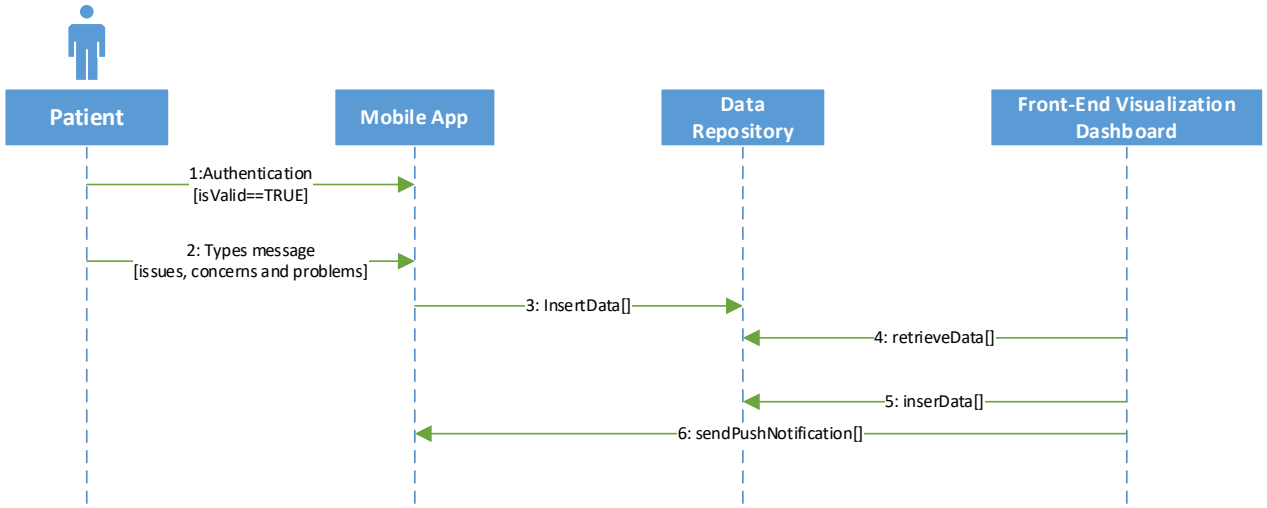

Figure 25 SD - PSOS.6 Early Support for hearing aid uptake

4.1.25 SD - PSOS.7 Better hearing for better health globally in older age

This use case covers longer term benefits of hearing aid use in relation to both individuals and more broadly to populations.

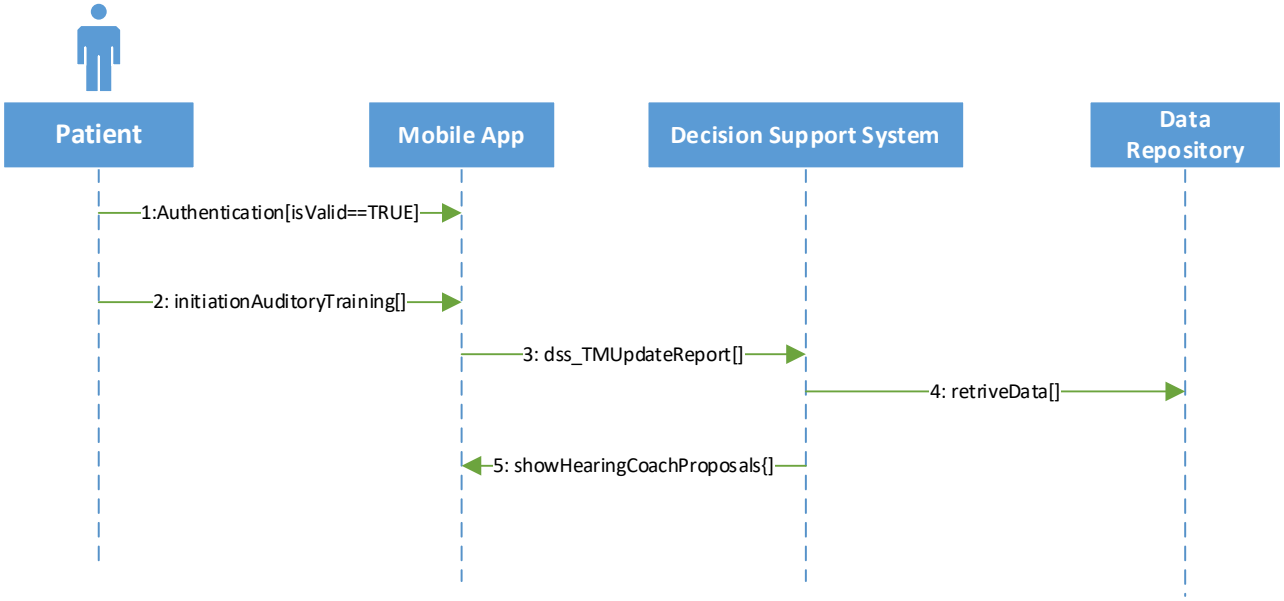

Figure 26 SD - PSOS.7 Better hearing for better health globally in older age

5. Platform Security

5.1 Overview

The design of the security and privacy capabilities required for the EVOTION platform has been based on an analysis of potential threats. To ensure that due consideration has been given to this critical aspect of the EVOTION platform design, our threat analysis has been based on threats identified as part of Common Criteria protection profiles for all the key types of components that constitute part of the EVOTION platform, namely the mobile applications, the data repository, the big data analytic platform, and the web based platform dashboard. To cover these component, we have considered the following Common Criteria protection profiles and threat analysis documents:

- The protection profile for mobile applications produced by U.S. Government [8]
- The protection profile for database management systems produced by U.S. Government [9]
- The protection profile for secure (physical) storage devices produced by Standard Protection Profile [10]
- The protection profile for general software applications produced by National Information Assurance Partnership [11]
- The threat and risk analysis for big data analytic platforms produced by ENISA [12]

In the following, we provide an overview specification of the identified threats and the security objectives that we have adopted and aim to address in the EVOTION platform, as well as the security objectives which arise from them and the security capabilities that are needed to address them. For the purposes of this document, we have assumed the following definitions for threats, security objectives and capabilities:

- Threat – A threat is an adverse action performed by a threat agent on an asset of the system that is to be secured. Threat agents are human actors, software or hardware components, which cause the occurrence of a threat. A threat agent can be described by aspects such as expertise, resources, opportunity, and motivation.
- Security objective – A security objective defines a desired security state of the system. It represents the primary goal of the security policy which is identified by the system requirements. The security objectives are defined based on the threats described above.
- Security capability – A security capability represents functions which the system is required to achieve. It identifies the solution based on the threats and security objectives. The functions illustrate an implementation of the security objectives.

It should be noted that a more complete specification of the EVOTION platform as a target of evaluation (TOE) system, in the sense of Common Criteria, is also provided in Appendix 1. This specification constitutes the initial version of a document that will be updated as the implementation of the security features of the EVOTION platform will progress. The reason for introducing such a document is to have a reference specification for testing the correctness and effectiveness of the security of the EVOTION platform once it is fully implemented in a process following a Common Criteria like approach (although the full certification of the security of the EVOTION platform it is certainly outside the scope of the project).

5.2 Security Threats

- In this section, we provide the list of the security threats that we have assumed for the EVOTION platform and we intend to develop mechanisms to address. These threats have been classified with respect to the type of the behaviours of the attackers. The threat and risk analysis for big data analytic platforms produced by ENISA [12]

Users with enhanced administration rights

T.Administrative errors of omission	Administrators, Operators, Officers or Auditors fail to perform some function essential to security.
T.User abuses authorization to collect and/or send data	User abuses granted authorizations to improperly collect and/or send sensitive or security-critical data.
T.User error makes data inaccessible	User accidentally deletes user data rendering user data inaccessible.
T.Administrators, Operators, Officers and Auditors commit errors	An Administrator, Operator, Officer or Auditor commits errors that change the intended security policy of the system or application or maliciously modify the system's configuration to allow security violations to occur.
T.Unidentified Action	Administrator fails to identify and act upon an unauthorized action
System Components	
T.Critical system component fails	Failure of one or more system components results in the loss of system critical functionality.
T.Malicious code exploitation	An authorized user, IT system, or hacker downloads and executes malicious code, which causes abnormal processes that violate the integrity, availability, or confidentiality of the system assets.
T.Message content modification	A hacker modifies information that is intercepted from a communications link between two unsuspecting entities before passing it on to the intended recipient.
T.Flawed code	A system or applications developer delivers code that does not perform according to specifications or contains security flaws.
T.FLAWAPP	Applications loaded onto the Mobile Device may include malicious or exploitable code. This code could be included intentionally by its developer or unknowingly by the developer, perhaps as part of a software library. Malicious apps may attempt to exfiltrate data to which they have access. They may also conduct attacks against the platform's system software which will provide them with additional privileges and the ability to conduct further malicious activities. Malicious applications may be able to control the device's sensors (GPS, camera, microphone) to gather intelligence about the user's surroundings even when those activities do not involve data resident or transmitted from the device. Flawed applications may give an attacker access to perform network-based or physical attacks that otherwise would have been prevented.
T.Poor Test	Insufficient tests to demonstrate that all TOE security functions operate correctly may result in incorrect TOE behaviour and cause a security vulnerability
Cryptography	
T.Disclosure of private and secret keys	A private or secret key is improperly disclosed.
T.Modification of private/secret keys	A secret/private key is modified.
T.Sender denies sending information	The sender of a message denies sending the message to avoid accountability for sending the message and for subsequent action or inaction.
T.Plaintext_Compromise	Unlike full disk encryption, selectable encryption products also need to protect against data leaks to other

	applications on the machine. Many file creators and editors store temporary files as the user is working on a file, and restore files if the machine experiences an interrupt while a file is open. Any of these files, if not properly protected or deleted, could leak information about a protected file to an attacker. Other applications might also access volatile or non-volatile memory released by the file encryption product, and the software used to create files prior to encryption may retain information about the file even after it has been encrypted. As the user creates and saves a new document, the plaintext will be stored on the machine's hard drive. An attacker could then search for the plaintext of the sensitive, encrypted information. An attacker may not even have to access the encrypted file for the protected information to be compromised. When the user wishes to encrypt the document, this plaintext file should be replaced with the new encrypted version. For non-mobile devices, it is expected that if the volatile and/or non-volatile memory space where the plaintext file was stored is merely released back to the machine without being first wiped clean of the data that was stored there, then the information the user wishes to protect will still be accessible. While protection of the encryption algorithm itself is vital, memory must also be properly managed by the file encryption product or the TOE platform in order for security to remain intact. For mobile devices, it is assumed that the File Encryption product will not be responsible for providing memory management cleanup and the environment's platform has met the Mobile Device Fundamentals Protection Profile.
External Attacks	
T.Hacker gains access	A hacker masquerades as an authorized user to perform operations that will be attributed to the authorized user or a system process or gains undetected access to a system due to missing, weak and/or incorrectly implemented access control causing potential violations of integrity, confidentiality, or availability.
T.Hacker physical access	A hacker physically interacts with the system to exploit vulnerabilities in the physical environment, resulting in arbitrary security compromises.
T.Social engineering	A hacker uses social engineering techniques to gain information about system entry, system use, system design, or system operation.
T.Plaintext_Data_spoofing	For certain modes of encryption, it is possible for a malicious person to modify cipher text data to force unintended modification to the underlying plaintext data, without the user being notified. There are various failures that may occur on the part of the TOE, to include: failure to verify the integrity of the data prior to decryption, failure to provide integrity on the sensitive data, failure

	to use a cryptographic or secure hashing code and failure to differentiate the File Authentication Key (FAK) from the FEK; the FAK is any secret value used as input to a keyed hashing function or as part of an asymmetric authentication process.
T.NETWORK	An attacker is positioned on a communications channel or elsewhere on the network infrastructure. Attackers may engage in communications with the application software or alter communications between the application software and other endpoints in order to compromise it.
T.PHYSICAL	**Physical Access** The loss or theft of the Mobile Device may give rise to loss of confidentiality of user data including credentials. These physical access threats may involve attacks which attempt to access the device through external hardware ports, through its user interface, and also through direct and possibly destructive access to its storage media. The goal of such attacks is to access data from a lost or stolen device which is not expected to return to its user. **Note: Defending against device re-use after physical compromise is out of scope for this protection profile.**
T.PERSISTENT	**Persistent Presence** Persistent presence on a device by an attacker implies that the device has lost integrity and cannot regain it. The device has likely lost this integrity due to some other threat vector, yet the continued access by an attacker constitutes an on-going threat in itself. In this case the device and its data may be controlled by an adversary at least as well as by its legitimate owner.
T.NETWORK_EAVESDROP	Attacker may monitor and gain access to data exchanged between the application and other endpoints.
Secure Storage Devices	
T.TSF_COMPROMISE	A malicious user or process may cause TSF data or executable code (e.g., the firmware on the USB flash drive) to be inappropriately accessed (viewed, modified, or deleted) to gain access to key material or user data
T.Keying_Material_Compromise	Material Attacks against the encryption product could take several forms; for example, if there is a weakness in the random number generation mixing algorithm or the data sources used in random number generation are guessable, then the output may be guessable as well. If an attacker can guess the output of the pseudorandom number generator (PRNG) at the time an encryption key is made, then the output may be used to recreate the keying material and decrypt the protected files. As the encryption program runs, it will store a variety of information in memory. Some of this information, such as

	random bit generation (RBG) inputs, RBG output, copies of the plaintext file, and other keying material, could be very valuable to an attacker who wishes to decrypt an encrypted file. If the encryption product does not wipe these memory spaces appropriately, an attacker may be able to recreate the encryption key and access encrypted files.
T.MALWARE_PROPOGATION	A malicious entity on the host device places a (malicious) system file on the USB flash drive that automatically transfers itself to hosts into which the TOE is inserted, thus compromising the integrity and security features of that host.

5.3 Security assumptions, objectives and key capabilities

5.3.1 Security Assumptions

In the following, we list assumptions, which are made regarding the operation of the EVOTION platform, and whose satisfaction is a prerequisite for the effective protection of the security and privacy of the platform and/or its users. The term "TOE" in the following means "Target of Evaluation" and refers to the EVOTION platform.

A.CONFIG	It is assumed that the TOE's security functions are configured correctly in a manner to ensure that the TOE security policies will be enforced on all applicable network traffic flowing among the attached networks.
A.NOTIFY	It is assumed that the mobile user will immediately notify the administrator if the Mobile Device is lost or stolen.
A.PRECAUTION	It is assumed that the mobile user exercises precautions to reduce the risk of loss or theft of the Mobile Device.
A.De-personalisation	of individual patient data transferred and held in the EVOTION platform (this does not cover data of the same patient held in other hospital systems as, for example, in AuditBase)
A.Confidentiality	Confidentiality of patient data held in the EVOTION platform (this does not cover data of the same patient held in other hospital systems as, for example, in AuditBase)
A.No_General_Purpose	There are no general purpose computer capabilities, e.g. compilers, available on DBMS servers, other than those services necessary for the operation, administration and support of the DBMS.
A.Connect	All connections to and from remote trusted IT systems and between separate parts are physically or logically protected within the TOE environment to ensure the integrity and confidentiality of the data transmitted and to ensure the authenticity of the communication end points.
A.PLATFORM	The TOE relies upon a trustworthy computing platform for its execution. This includes the underlying platform and whatever runtime environment it provides to the TOE.

A.PROPER_USER	The user of the application software is not will fully negligent or hostile, and uses the software in compliance with the applied enterprise security policy.
A.PROPER_ADMIN	The administrator of the application software is not careless, will fully negligent or hostile, and administers the software within compliance of the applied enterprise security policy.

5.3.2 Security Objectives

The security objectives listed below are based on the protection profiles [3][8][9][10][11]. Security objectives are distinguished into those referring to the EVOTION platform and those referring to its operational environment.

5.3.2.1 EVOTION Security Objectives

O.COMMS	**Protected Communications** To address the network eavesdropping and network attack threats described in Section 3.1, concerning wireless transmission of Enterprise and user data and configuration data between the TOE and remote network entities, conformant TOEs will use a trusted communication path. The TOE will be capable of communicating using one (or more) of these standard protocols: IPsec, TLS, HTTPS, or Bluetooth. The protocols are specified by RFCs that offer a variety of implementation choices. Requirements have been imposed on some of these choices (particularly those for cryptographic primitives) to provide interoperability and resistance to cryptographic attack. While conformant TOEs must support all of the choices specified in the ST, they may support additional algorithms and protocols. If such additional mechanisms are not evaluated, guidance must be given to the administrator to make clear the fact that they were not evaluated.
O.STORAGE	**Protected Storage** To address the issue of loss of confidentiality of user data in the event of loss of a Mobile Device (T.PHYSICAL), conformant TOEs will use data-at-rest protection. The TOE will be capable of encrypting data and keys stored on the device and will prevent unauthorized access to encrypted data.
O.CONFIG	**Mobile Device Configuration** To ensure a Mobile Device protects user and enterprise data that it may store or process, conformant TOEs will provide the capability to configure and apply security policies defined by the user and the Enterprise Administrator. If Enterprise security policies are configured these must be applied in precedence of user specified security policies.
O.AUTH	**Authorization and Authentication** To address the issue of loss of confidentiality of user data in the event of loss of a Mobile Device (T.PHYSICAL), users are required to enter an authentication factor to the device prior to accessing protected functionality and data. Some non-sensitive functionality (e.g., emergency calling, text notification) can be accessed prior to entering the authentication factor. The device will automatically

	lock following a configured period of inactivity in an attempt to ensure authorization will be required in the event of the device being lost or stolen. Authentication of the endpoints of a trusted communication path is required for network access to ensure attacks are unable to establish unauthorized network connections to undermine the integrity of the device. Repeated attempts by a user to authorize to the TSF will be limited or throttled to enforce a delay between unsuccessful attempts.
O.INTEGRITY.MD	**Mobile Device Integrity** To ensure the integrity of the Mobile Device is maintained conformant TOEs will perform self-tests to ensure the integrity of critical functionality, software/firmware and data has been maintained. The user shall be notified of any failure of these self-tests. (This will protect against the threat T.PERSISTENT.) To address the issue of an application containing malicious or flawed code (T.FLAWAPP), the integrity of downloaded updates to software/firmware will be verified prior to installation/execution of the object on the Mobile Device. In addition, the TOE will restrict applications to only have access to the system services and data they are permitted to interact with. The TOE will further protect against malicious applications from gaining access to data they are not authorized to access by randomizing the memory layout.
O.Integrity.SRV	**Data Integrity** Integrity of raw patient data and data produced by data analytic tasks
O.Privacy	**Data Privacy** Protection of privacy of users of EVOTION platform
O.ACCESS_HISTORY	**Auditability** The TOE should store all relevant information related to previous attempts to establish a session and make that information available to administrator.
O.AUDIT_GENERATION	**Auditability** Record defined security-relevant events. The information recorded for security relevant events must contain the date and time the event happened and, if possible, the identification of the user caused the event. This will help the authorized user to detect attempted security violations or potential misconfiguration of the TOE security features.
O.QUALITY	**Quality** To ensure quality of implementation, conformant TOEs leverage services and APIs provided by the runtime environment rather than implementing their own versions of these services and APIs. This is especially important for cryptographic services and other complex operations such as file and media parsing. Leveraging this platform behaviour relies upon using only documented and supported APIs.
O.FEK_SECURITY	**Cryptography** In order to ensure that brute force attacks are infeasible, the TOE must ensure that the cryptographic strength of the keys and authorization factors used to generate and protect the keys is sufficient to withstand attacks in the near-to-mid-term future. Password/passphrase complexity and conditioning requirements

	are also levied to help ensure that a brute force attack against these authorization factors (when used) has a similar level of resistance.
O.DEK_SECURITY	**Cryptography** The TOE will mask the Data Encryption Key (DEK) using a key encryption key (KEK) created from one or more submasks (which in turn are derived from the authorization factors) so that a threat agent who does not have authorization factor(s) will be unable to gain access to the user data by obtaining the DEK
O.OWNERSHIP	**Cryptography** The TOE shall ensure that ownership is taken (that is, a DEK is created, authorization factors are established, any default authorization factors are changed, a KEK is formed from the derived submasks, and the DEK is associated with the KEK) prior to any user data being stored on the TOE.
O.KEY_MATERIAL_COMPROMISE	The TOE shall ensure that no unencrypted/unmasked keys or keying material are written to persistent memory on the USB flash drive.
O.PROPOGATION_PREVENTION	The TOE shall implement mechanisms to prevent the USB flash drive from being used as a mechanism for the automated spread of malicious software.

5.3.2.2 Security Objectives for the Operational Environment

The following table contains security objectives specific to the operational environments of the EVOTION platform.

Security Objective Name	Security Objective Definition
OE.CONFIG	TOE administrators will configure the Mobile Device security functions correctly to create the intended security policy
OE.NOTIFY	The Mobile User will immediately notify the administrator if the Mobile Device is lost or stolen.
OE.PRECAUTION	The Mobile User exercises precautions to reduce the risk of loss or theft of the Mobile Device.
OE.AvailabilityData	Availability of data
OE.AvailabilityPlattform	Availability of EVOTION platform services
OE.No_General_Purpose	There will be no general-purpose computing capabilities (e.g., compilers or user applications) available on DBMS servers, other than those services necessary for the operation, administration, and support of the DBMS.
OE.Info_Protect	The responsible parts of the TOE must establish and implement procedures to ensure that information is protected in an appropriate manner. For instance: • DAC protections on security-relevant files (e.g. audit trails and authorization databases) shall always be set up correctly • Users are authorized to access parts of the data managed by the TOE and are trained to exercise control over their own data
OE.IT_Trusted_System	The remote trusted IT systems implement the protocols and mechanisms (such as Auditbase) required by the TSF to support the enforcement of the security policy
OE.PLATFORM	The TOE relies upon a trustworthy computing platform for its execution. This includes the underlying operating system and any discrete execution environment provided to the TOE.

5.3.3 Security capabilities

The primary security capabilities required for the EVOTION platform are as follows:

- Web Service Security
- Audit covering security-related events
- Security Management for user and domain administration
- Protection of User and TSF data through secure channels
- Cryptographic functionality, including cryptographic algorithms, support of the Transport Layer Security (TLS) protocol, and key management
- Protected storage: encryption of data and keys stored on the device to prevent unauthorized access to encrypted data. Access to encrypted data is only provide once the user has been successfully authenticated.

5.4 Security Manager

5.4.1 Purpose

The Security Manager One is used to protect the EVOTION platform on the server side and provide administrative services. The Security Manager One controls the data flow inside the EVOTION platform.

The Security Manager One provides encryption and administrative services. The encryption provides the capability of EVOTION to encrypt the data flow from inside and outside the platform. The administration provides the capability of data access controls.

5.4.2 Functional Capabilities and Interfaces

The functional capabilities required for securing the EVOTION platform with respect to the threats identified in Sect. 5.2, the assumptions listed in Sect. 5.3.1 are as follows:

- **Cryptography**: This capability includes the functionality that enables the encryption and decryption of different types of data transmitted to and from the EVOTION platform, and stored by it whether temporarily or permanently. This capability support for the encryption and decryption of data.
- **Key management**: This capability includes the functionality covering the generation, storage, distribution and management of keys required for the encryption and decryption of data transmitted to and from the EVOTION platform, and stored by it whether temporarily or permanently.
- **Authentication:** This capability includes the functionality that is necessary for authenticate the different types of users of the EVOTION platform as well as all the devices (e.g., biosensors, hearing aids, mobile phones) and applications, which may interact with it. Successful authentication will be required before accessing both certain types of protected EVOTION functionality (e.g., mobile devices, back end repository administrative functions) and data. The capability will also enable automatic locks following a configured period of inactivity in order to minimise risks arising from loss or steals of devices and/or user negligence.
- **Integrity**: This capability includes the functionality that is necessary for checking the integrity of data transmitted across different components of the EVOTION platform. It also covers mobile device and software integrity, i.e., secure device booting and performing self-tests to ensure the integrity of critical functionality, software/firmware and data has been maintained. A key element in this is that the user should be notified of any failure of these self-tests.

- **Authorization/access control:** This capability includes the functionality that checks the authorization rights of the different types of users of the EVOTION platform as well as all the devices (e.g., biosensors, hearing aids, mobile phones) and applications to access specific data held in different parts of the EVOTION platform as well as to invoke and execute different operations of it.
- **Auditing**: This capability provides functionality that audit the operations which they are used to modify the data in the data repository, updating personal credential and adjust security setting.
- **Security configuration:** This capability will support the configuration and application of security policies defined by the users and/or administrators of the EVOTION platform. Administrator security policies will have precedence over user specified security policies.

The above functional capabilities have been mapped onto different operations and interfaces of the Security Manager component, which are specified below. It should be noted that the specification of these interfaces should be seen as a facade level specification. In other words, the actual realization of the functionality of an operation of any of the interfaces listed below may be delegated by the Security Manager to a lower level component as, for example, the operating system of a device in the case of encryption and/or access control. Hence, the main purpose of their specification is to provide an initial definition of what is required at an abstract design level.

5.4.3 Cryptography interfaces

generateKey

Operation Description	Generate a pair of public and private keys.	
Input parameters		
Name	**Type**	**Description**
randomTxt	txt	A random txt
Output parameters		
Name	**Type**	**Description**
keys	Array<publickKey, privateKey>	A pair of encryption key
status	Boolean	A Boolean indicate operation status: true->success; false->fail

generateHash

Operation Description	Create a HashContext that uses the specified algorithm to calculate a message digest.	
Input parameters		
Name	**Type**	**Description**
algorithm	algorithm	An instance of HashAlgorithm.
Output parameters		
Name	**Type**	**Description**
HashContext	hashContext object	A HashContext
status	Boolean	A Boolean indicate operation status: true->success; false->fail

generateRandomBit

Operation Description	The operation generates a random txt	
Input parameters		
Name	**Type**	**Description**
void		
Output parameters		
Name	**Type**	**Description**
txt	txt	A random txt
status	Boolean	A Boolean indicate operation status: true->success; false->fail

encrypt

Operation Description	Encrypt a message	
Input parameters		
Name	**Type**	**Description**
cipherAlgorithm	cipher	An instance of Cipher Algorithm
mode	A txt	A message
Output parameters		
Name	**Type**	**Description**
encryptedMessage	txt	An encrypted message
status	Boolean	A Boolean indicate operation status: true->success; false->fail

decrypt

Operation Description	Decrypt a message	
Input parameters		
Name	**Type**	**Description**
decryptionKeys	Text	Decryption key(s)
encryptedMessage	Text	Encrypted message text
Output parameters		
Name	**Type**	**Description**
decryptedMessage	Text	A decrypted message
status	Boolean	A Boolean indicate operation status: true->success; false->fail

5.4.4 Key management interfaces

addKey

Operation Description	Add a key to the key database	
Input parameters		
Name	**Type**	**Description**
userCredential	Set<string>	A set stores user's username, password, birthday, organization and so on.

Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean indicate operation status: true-> success; false->fail

deleteKey

Operation Description	Delete a key in the key database	
Input parameters		
Name	**Type**	**Description**
publicKey	string	A public key
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean indicate operation status: true-> success; false->fail

getKey

Operation Description	Send a key to a client	
Input parameters		
Name	**Type**	**Description**
userID	string	An ID of a user
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean indicate operation status: true-> success; false->fail

viewKey

Operation Description	The operation allows user to list all stored encryption keys in the system.	
Input parameters		
Name	**Type**	**Description**
void		
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean indicate operation status: true-> success; false->fail

5.4.5 Authentication interfaces

isValid

Operation Description	This operation is used to verify an identity of a user. A user sends an identity which wants the server to verify the identity.
Input parameters	

Name	Type	Description
userCredential	Set<string>	A set stores user's username, password, birthday, organization and so on.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean indicate operation status: true-> success; false->fail

5.4.6 Authorisation/access control interfaces

signup

Operation Description	This operation enables a human user to sign up for the first time in the EVOTION platform and checks if the selected credentials (i.e., password and user name satisfy the strength conditions set by the security policy of the platform).	
Input parameters		
Name	**Type**	**Description**
userCredential	Set<string>	A set stores user's username, password, birthday, organization and so on.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean indicate operation status: true-> success; false->fail

login

Operation Description	This operation enables a human user to log in onto the EVOTION platform and checks if the provided credentials (i.e., password and user name) match with those held in the platform for the specific user. In cases where the EVOTION security policy requires regular password updates or the conditions regarding the strength of the user password have been changed, the operation prevents the user from logging in until new credentials satisfying the policy are provided. The operation updates the credentials in such cases.	
Input parameters		
Name	**Type**	**Description**
userCredential	Set<string>	A set stores user's username and password.
Output parameters		
Name	**Type**	**Description**

status	Boolean	A Boolean indicate operation status: true-> success; false->fail

logoff

Operation Description	This operation enables a human user to log off from the EVOTION platform and checks if the provided credentials (i.e., password and user name) match with those held in the platform for the specific user. This operation may be triggered automatically if a certain period of user inactivity has elapsed, depending on the security policy operated by the platform.	
Input parameters		
Name	**Type**	**Description**
userCredential	Set<string>	A set stores user's username, password, birthday, organization and so on.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean indicate operation status: true-> success; false->fail

addSecurityGroup

Operation Description	The operation provides a function to add a user into a particular security group. The data is grouped into different security authority group. Only the users who have the correct authority can access specific data.	
Input parameters		
Name	**Type**	**Description**
userCredential	Set<string>	A set stores user's username, password, birthday, organization and so on.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean indicate operation status: true-> success; false->fail

5.4.7 Auditing interfaces

updateAuthority

Operation Description	The operation will audit and update whether a user can be added to a particular security group. The user will be added to the security group only when the user passes the auditing strategy.

Input parameters		
Name	**Type**	**Description**
newAuthority	string	A string represents a authority group
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean indicate operation status: true-> success; false->fail

updateCredential

Operation Description	The operation will audit whether a user's new credential data satisfies particular requirements. The data will only be updated when the new credential data satisfies the auditing strategy.	
Input parameters		
Name	**Type**	**Description**
userCredential	Set<string>	A set stores user's username, password, birthday, organization and so on.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean indicate operation status: true-> success; false->fail

auditData

Operation Description	The operation will audit whether the data can be updated or not. The data will only be updated when the new data satisfies the auditing strategy.	
Input parameters		
Name	**Type**	**Description**
userCredential	Set<string>	A set stores user's username, password, birthday, organization and so on.
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean indicate operation status: true-> success; false->fail

updatePassword

Operation Description	The operation will audit the new password and update the old password of a user. The password will only be updated when the new password satisfies the auditing strategy.

Input parameters		
Name	**Type**	**Description**
oldPasswd	string	Old password
newPasswd	string	New password
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean indicate operation status: true-> success; false->fail

5.4.8 Security configuration interfaces

setSecurityConfiguration

Operation Description	The operation set the security configuration in the system. It allows external users and internal users to set the security requirements of the EVOTION platform.	
Input parameters		
Name	**Type**	**Description**
securitySetting	Set<String>	A set stores all security setting
Output parameters		
Name	**Type**	**Description**
status	Boolean	A Boolean indicate operation status: true-> success; false->fail

5.4.9 Related Requirements

This section will identify the requirements addressed (partially or fully by this component)

Requirement	**Operation**	**Notes**
FR(PHAS)20: Access management features for the analysis outcomes	generateKey generateHash generateRandomBit encrypt decrypt addKey deleteKey getKey viewKey isValid signup login logoff addSecurityGroup updateAuthority updateCredential auditData updatePassword setSecurityConfiguration	

6. Deployment infrastructure

The back-end components of the EVOTION platform, i.e., the components of the Data Ingestion and Execution Layer, the PHP Modelling Layer and the Visualisation Layer in Figure *1* will be deployed in a cloud cluster set up and operated by CITY.

At the time of the production of this deliverable, this cluster is equipped with seven multi-core server machines operating OpenStack. Each machine is a Dell Inc. PowerEdge R520 with a 4-core processor Intel Xeon E5-2407 running each core at 2.20GHz. Each PowerEdge R520 has 8GM of main memory, 450GB of disk space and two 1Gb Broadcom 5720 DP network cards. CITY will expand this cluster with additional multi-core server machines with similar hardware specifications, as necessary for the purposes of EVOTION. It will also ensure that EVOTION data and software will be the sole tenants of the nodes of the cluster where they will reside to ensure enhanced security.

7. Concluding Remarks

This deliverable has specified the overall architecture of the EVOTION platform, including: (a) the key components of the platform and the overall architecture that structures them into a coherent system; (b) the main functional capabilities that the components should realise and the programming interfaces through which these capabilities will be accessible to other components; (c) the functional, quality and security requirements that are addressed by the different components, and (d) the envisaged interactions of the components in order to realise the use cases specified for the EVOTION platform.

The architecture of the platform has been specified using the Unified Modelling Language using two types of UML models: (a) architecture level component diagrams and (b) component interaction diagrams.

Special attention has been given to the design of the security and privacy mechanisms of the EVOTION platform. To ensure that security and privacy would receive due consideration as part of the design process, we followed an established approach in the industry. This approach was based on the Common Criteria framework for specifying security features, requirements and capabilities of systems in a manner than can enable a systematic assessment of their effectiveness and ultimately providing system security certification and security assurance.

It should be noted that although we have tried to provide a comprehensive specification of the EVOTION platform architecture, it is inevitable that the architecture presented in this deliverable will be subject to changes during the implementation of the EVOTION platform, when the full extent of constraints around the interaction of components and the use of the envisaged development mechanisms (e.g., third party components etc.) will emerge. Our expectation is that deviations from the architecture as specified in this document will be minimal. Should such deviations arise, however, we commit to document them as part of an updated specification of the architecture in forthcoming project deliverables, which will document the implementation of the integrated version of the EVOTION platform. Hence, eventually the prospective users of the EVOTION platform will get an architectural specification of the platform that is fully aligned with its implementation.

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