EVOTION

727521 – EVOTION

DELIVERABLE No: D5.9

Platform dashboard and visualization component

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Dissemination level	
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Subject and keywords	This report presents the platform dashboard and visualization component of the EVOTION project Dashboard, visualization, website
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List of Abbreviations

API	APPLICATION PROGRAMMING INTERFACE
BDA	BIG-DATA ANALYTICS
CPE	COMMON PLATFORM ENUMERATION
CSS	CASCADING STYLE SHEETS
CVE	COMMON VULNERABILITY EXPOSURE
CVSS	COMMON VULNERABILITY SCORING SYSTEM
DOA	DESCRIPTION OF ACTION
DR	DATA REPOSITORY
DSS	DECISION SUPPORT SYSTEM
ED	EVOTION DASHBOARD
EDR	EVOTION DATA REPOSITORY
GHABP	GLASGOW HEARING AID BENEFIT PROFILE
HADS	HOSPITAL ANXIETY AND DEPRESSION SCALE
HTML	HYPERTEXT MARKUP LANGUAGE
HTTP	HYPERTEXT TRANSFER PROTOCOL
HUI-3	HEALTH UTILITY INDEX MARK 3
JSON	JAVASCRIPT OBJECT NOTATION
LDAP	LIGHTWEIGHT DIRECTORY ACCESS PROTOCOL
MOCA	MONTREAL COGNITIVE ASSESSMENT
NVD	NATIONAL VULNERABILITY DATABASE
PHPDM(s)	PUBLIC HEALTH POLICY DECISION MODEL(S)
REST	REPRESENTATIONAL STATE TRANSFER
SMPC	SOCIAL MEDIA CAMPAIGNING AND FEEDBACK COLLECTION COMPONENT
URL	UNIFORM RESOURCE LOCATOR
WP5	WORK PACKAGE 5

Executive Summary

This deliverable describes the functionalities of the EVOTION Dashboard (ED), in the context of the Task 5.8 of Work Package (WP) 5 of the EVOTION project. This has involved mainly the expansion of the role and inevitably the underlying functionalities of the ED, to serve as the main interaction gateway to any of the EVOTION functionality indented to be provided to its potential end-users (mainly policymakers, data analysts and clinicians). Work undertaken aimed to enhance and co-ordinate reutilisation of resources, ensuring data outputs having a user-friendly, suitable form for visualization purposes.

Based on the description of the EVOTION scenarios supported, as well as functional requirements and the overall architecture of the EVOTION platform presented in previous deliverables, ED provided web interaction elements (and associated RESTfull APIs) to three (3) out of four (4) "dashboard related" components: i) the BDA engine, ii) the EVOTION Data Repository and iii) the PHPDM Specification Tool (including the Ontology Maker). To this extent, integrating the Decision Support System (DSS) functionalities into the ED and upgrading the latter's role (as the main gateway to all EVOTION e-services), can be considered as a logical step serving a dual purpose: providing a common interaction metaphor ensuring the user-friendliness and the contextual relevance of the presented information to all EVOTION functionality, as well as safeguarding all connections triggered to EVOTION components (via REST API calls).

The first section of the deliverable provides background information about the EVOTION Dashboard. Section 2 introduces the list of requirements underpinning the principles and the enchased role of the ED, while Section 3 presents the security and privacy issues considered. Section 4 concludes the report.

Updated version of the ED (ver. 2.00) is currently available at: https://evotion.city.ac.uk/

1 Introduction

The EVOTION Dashboard (also referred to simply as ED or “Dashboard” in the following) is a web-based platform that is designed and implemented to enable EVOTION end-users to access the supported e-services of EVOTION solution. Initially, its primary role defined to provide access to the EVOTION Data Repository (EDR). This deliverable describes the ED updated functionalities and the technical infrastructure utilised for the implementation of the services currently been supported, reflecting the status of the ED in May 2019.

Currently, the ED serves as the front-end offering access to services related to the mobile registration, the data handling as for the four (4) supported types of questionnaires, the administration of the PHPDM tool (and indirectly the BDA engine) offering also visualisation capabilities for viewing BDA outcomes, and the triggering of the Decision Support System. A comprehensive presentation of the visual identity of the ED (e.g., interaction elements, overall presentation and structure) for the specific module of the PHPDM e-service can be found in D4.2 (Section 2: Design of PHPDM E-service Front-End) and in D3.2 (Section 6: Demonstrator). These design aspects have been reutilised in all e-services supported to maintain the same look-and-feel. Consequently, this part can be viewed as a user manual, describing the available functionality been offered, while at the same time it provides a deeper insight on how these interaction elements interlink to EDR and other EVOTION components.

As presented in D4.2, a user-centered approach for the design and implementation of workflows and supporting interaction elements has been followed, with the aim to deliver highly usable services which can be easily operated by non-experienced end-users (e.g., policy experts, clinicians), who might not be highly experienced in using data-analytics tools. In that respect, the PHPDM e-service that serves as the core function been retrofitted by all types of data have been stored in the context of EVOTION studies, is expected to bring together policy makers, data analysts and clinicians by offering to them basic policy making and data analytics tools and a very large set of data (both in terms of types and size) through which they can enable the investigation of whether particular health conditions (in particular hearing loss related) have comorbidities and reveal contextual factors, social, behavioural and economic, life cycle and other factors affecting civilians.

2 Dashboard Component Overview

Task 5.8 of the EVOTION's Description of Action (DOA) is about the development of a dashboard (ED) enabling end-users to access the EVOTION platform. Thus, ED acts as the front-end offering access to the Public Health Policy Decision Model (PHPDM) tool (described in Deliverable D4.2 (Basdekis et al., 2018)), the Big Data Analytics (BDA) engine (described in Deliverable D5.4 (Anisetti et al., 2018)), the Decision Support System (DSS) (described in Deliverable D5.6 (Katrakazas et al., 2018)) and the Data Repository (EDR) (described in Deliverable D5.2 (Basdekis et al., 2017)) of the platform (Figure 1). As expected, ED should also offer visualisation capabilities for viewing the BDA outcomes, and their connections to PHPDMs that have led to their generation.

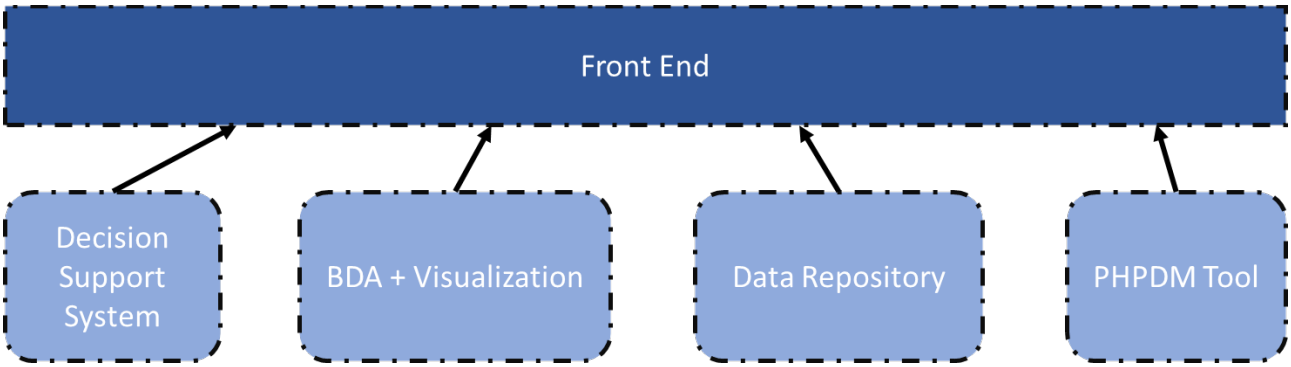


Figure 1: Sematic illustration of the Dashboard

In brief, the ED component is responsible for supporting end-users to perform:

- administration of 4 types of questionnaires (Questionnaires support): HUI-3, HADS, MOCA and GHABP
- patient-mobile correlation support
- administration of PHPDM e-service and in particular
    - handling of policies/workflows/analytics tasks to be executed via the BDA engine
    - handling DSS queries, in the context of a specific policy

The following sections describe the available features of the current version (ver. 2.0) of the ED, thus the presentation elements and functionality implemented according to user input and requirements that have been elicited specifically in the context of the EVOTION project. Implemented features presented onwards were made available on March 2019 (at https://evotion.city.ac.uk/). Subsequent sections present the dashboard's services offered to its end-users (omitting functionality already presented in previous deliverables submitted such as in D4.2). As for the currently available e-services, for each one of them a screen accompanied with a description is given.

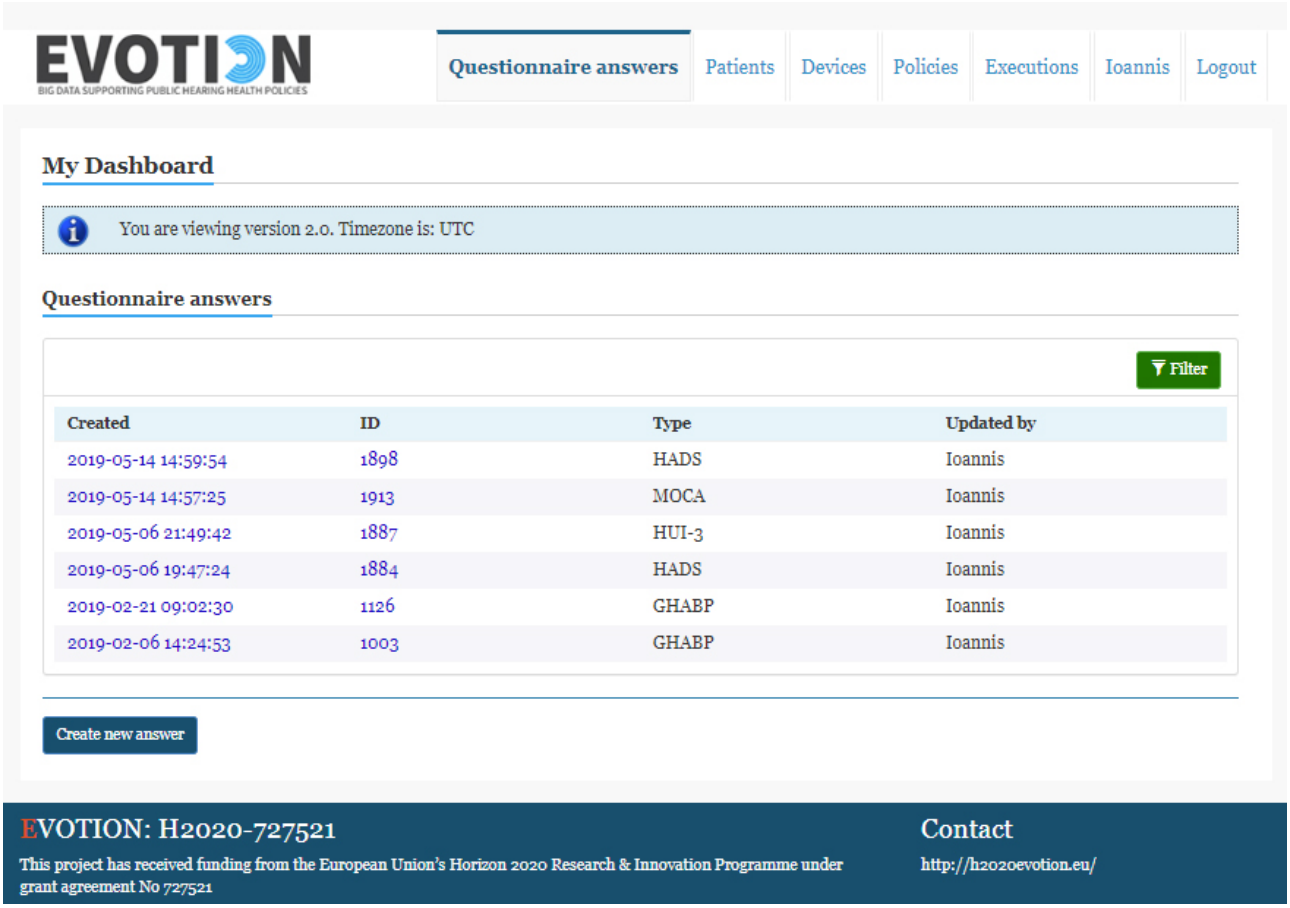


Figure 2: Main page of EVOTION Dashboard (signed-in end-user)

2.1 Questionnaires support

As described in D7.1 (Bamiou et al, 2017), recruited in the study patients gave a short clinical interview based on selected structured questionnaires regarding clinical, medical and occupational history. Serving this purpose assessments utilised:

1. The Glasgow Hearing Aid Benefit Profile (GHABP) (Gatehouse, 1999). The mean of applicable data is computed for initial disability, handicap, aid use, aid benefit, residual disability, and satisfaction and scaled to lie between 0 and 100.
2. The validated Montreal Cognitive Assessment (MoCA) (Nasreddine et al, 2005). MoCA scores range between 0 and 30, while having a score of 26 or over is considered as normal.
3. The Hospital Anxiety and Depression Scale (HADS) (Zigmund and Snaith, 1983). The HADS is a fourteen-item scale scored from 0-3 for each item. Seven of the items relate to anxiety and the other seven relate to depression. For each sub-scale, anxiety or depression, the scores are categorized as: normal (0-7), mild (8-10), moderate (11-14) and sever (15-12).
4. The 15-item Health Utilities Index (HUI-3) questionnaire (15Q) is designed for self-completion and includes 15 multiple-choice HUI questions. The 15 questions of the HUI descriptive system classify respondents into either HUI2 or HUI3 health states. (Grutters et al., 2007).

Rights to access these anonymised data of questionnaires answers stored in the EDR granted to authorised researchers of different clinical partners (role-based access control) of the EVOTION consortium, as required for the execution of the EVOTION research programme. In this respect, ED provides (ver. 0.47 onwards, presented in D5.2) the following functionality to the end-users (mainly to Senior Clinicians):

- Performing case-insensitive search (Figure 3) for items in the data table that displays all questionnaire answers created by an end-user,
- Creating (Figure 4, Figure 5, Figure 6, Figure 7, Figure 9, Figure 12 and Figure 14), editing (e.g., Figure 11) and deleting (e.g., Figure 17) a questionnaire answer, and
- Calculating the score (totals and situation specific if applicable) for each response.

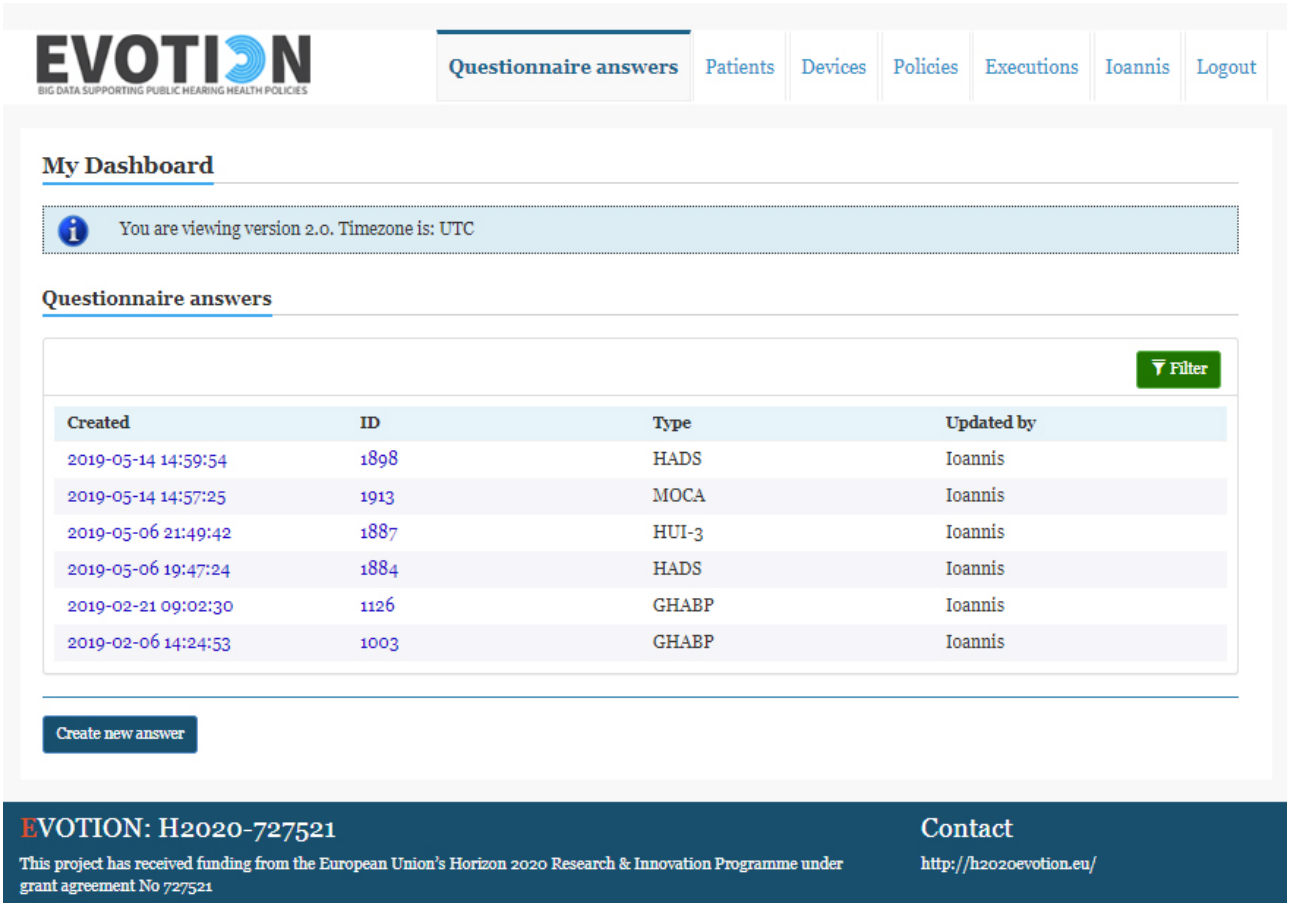


Figure 3: Home page of signed-in end-user (available answers)

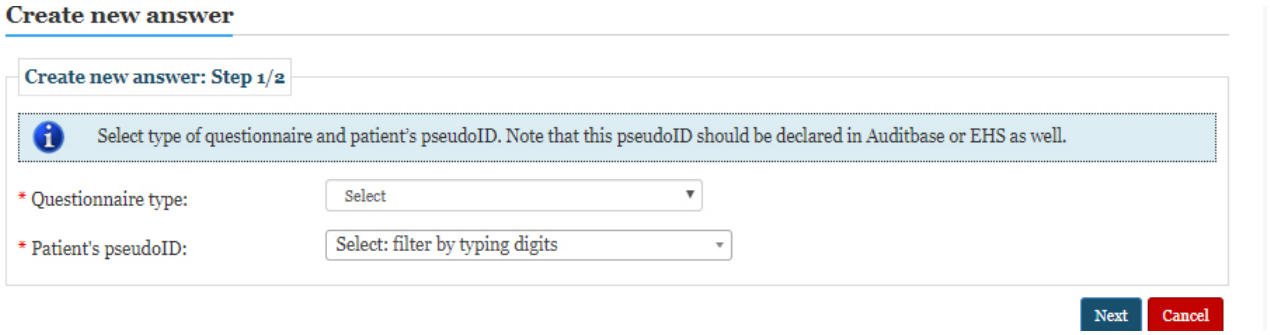


Figure 4: Step 1a: creating a questionnaire answer

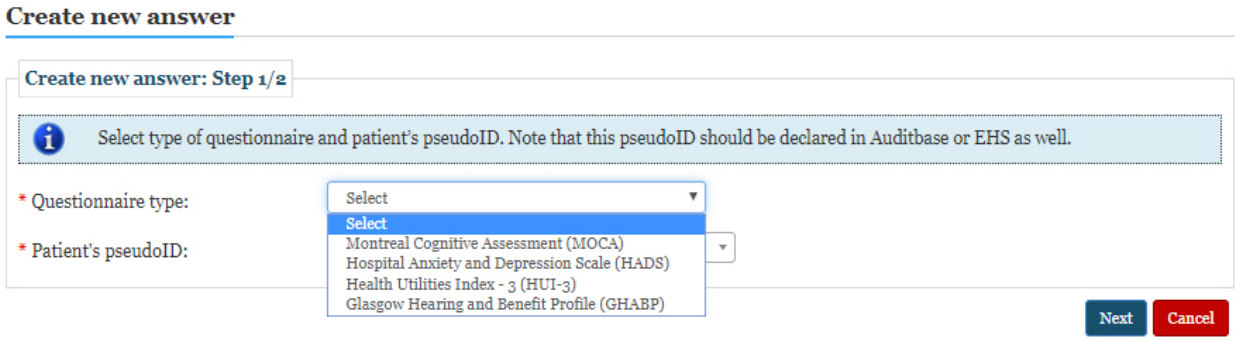


Figure 5: Step 1b: choosing a type of questionnaire answer

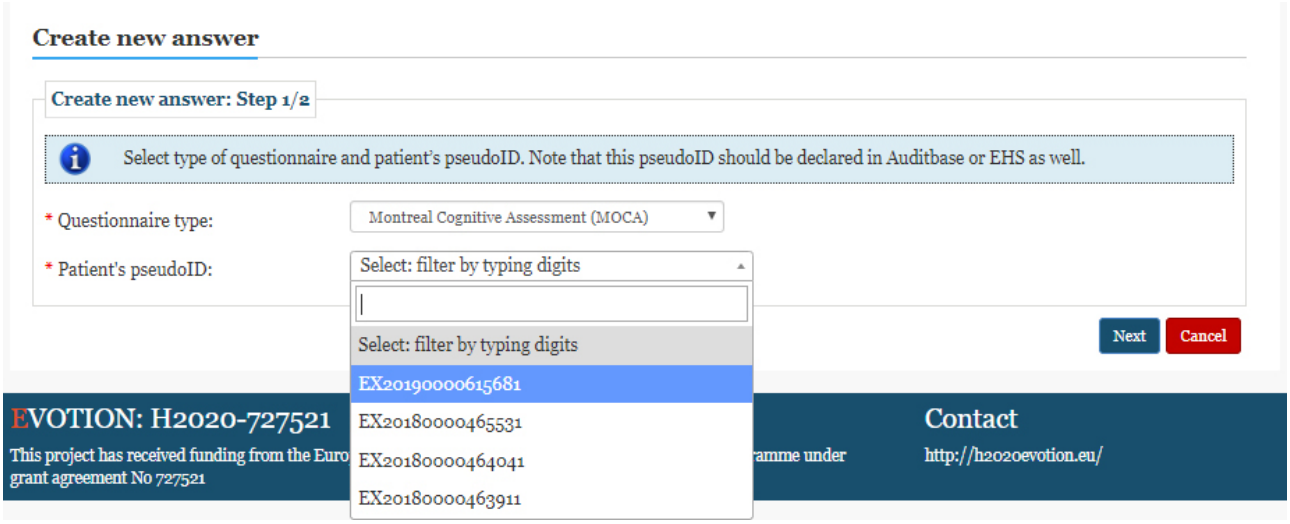


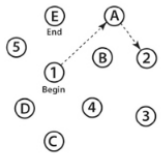
Figure 6: Step 1c: choosing an external patient ID (pseudo ID)

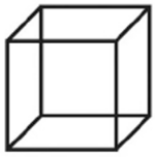
Create new MOCA answer

Create new answer: Step 2/2 (MOCA)

This questionnaire contains a set of questions that asks about various aspects of patient's health.

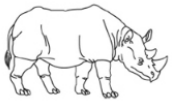
Visual spatial / Executive

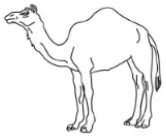




* Trail making: * Copy cube: * Contour: * Numbers: * Hours:

Naming





* Naming: * Naming: * Naming:

Memory

	Face	Velvet	Church	Daisy	Red
* 1st trial:					
2nd trial:					

Attention

Read list of digits (1 digit / sec): * Repetition of numbers (forward order - 2 1 8 5 4):

* Repetition of numbers (backward order - 7 4 2):

Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors. * F B A C M N A A J K L B A F A K D E A A A J A M O F A A B:

Serial 7 subtraction starting at 100: * 93: * 86: 79: * 72: * 65:

Language

Repeat: * I only know that John is the one to help today:

* The cat always hid under the couch when dogs were in the room:

Fluency / Name maximum number of words in one minute that begin with the letter F: * N ≥ 11:

Abstraction

Similarity between e.g., banana - orange = fruit: * train - bicycle: * watch - ruler:

Delayed recall

	Face	Velvet	Church	Daisy	Red
* Has to recall words WITH NO CUE:					
Category cue:					
Multiple choice cue:					

Orientation

* Date: * Month: Year: * Day: Place: * City:

Education

* Years of education: 0

Previous Create Cancel

Figure 7: Creating a MOCA answer for an external patient ID

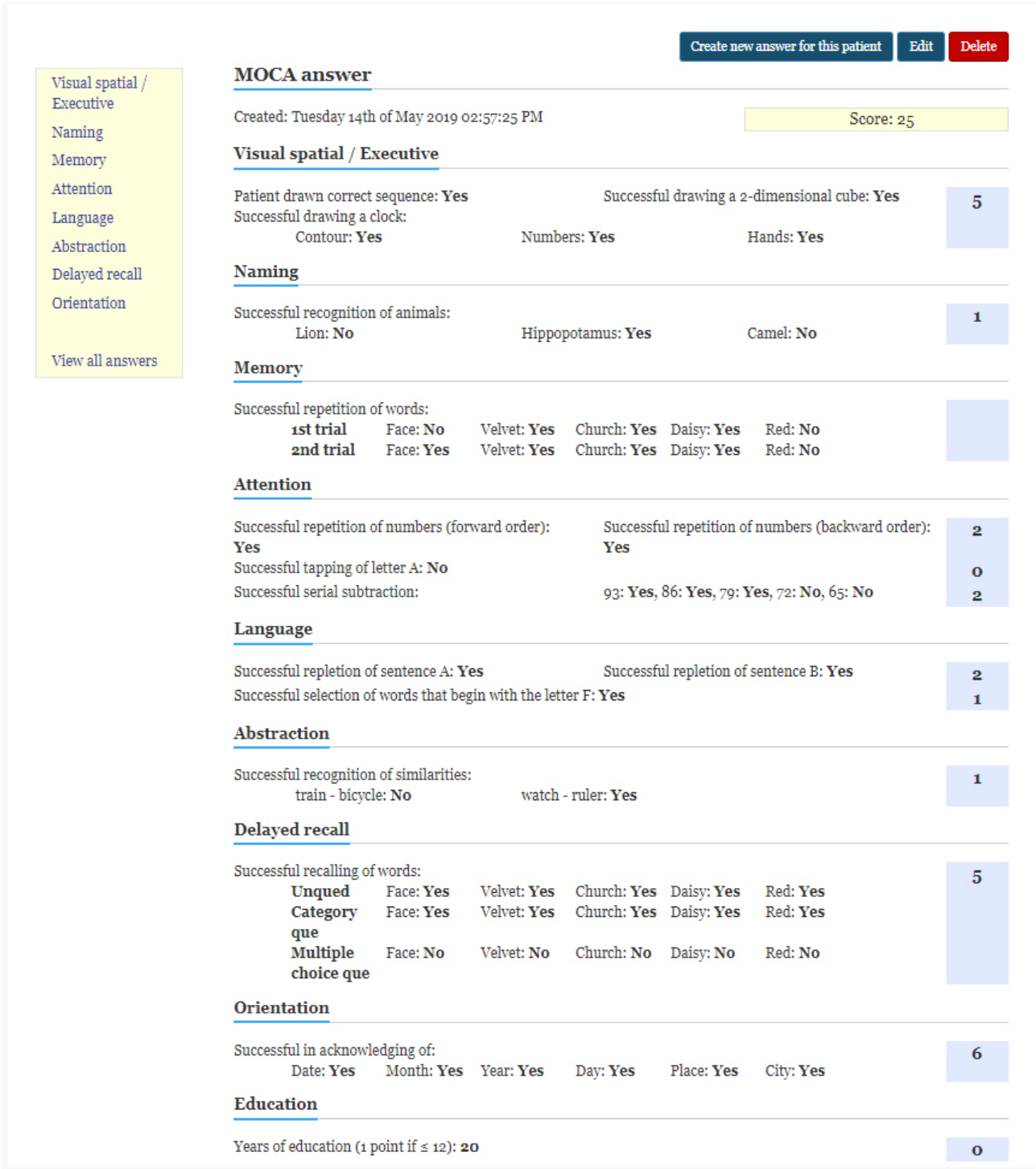


Figure 8: Displaying MOCA answer, total and sub-scores

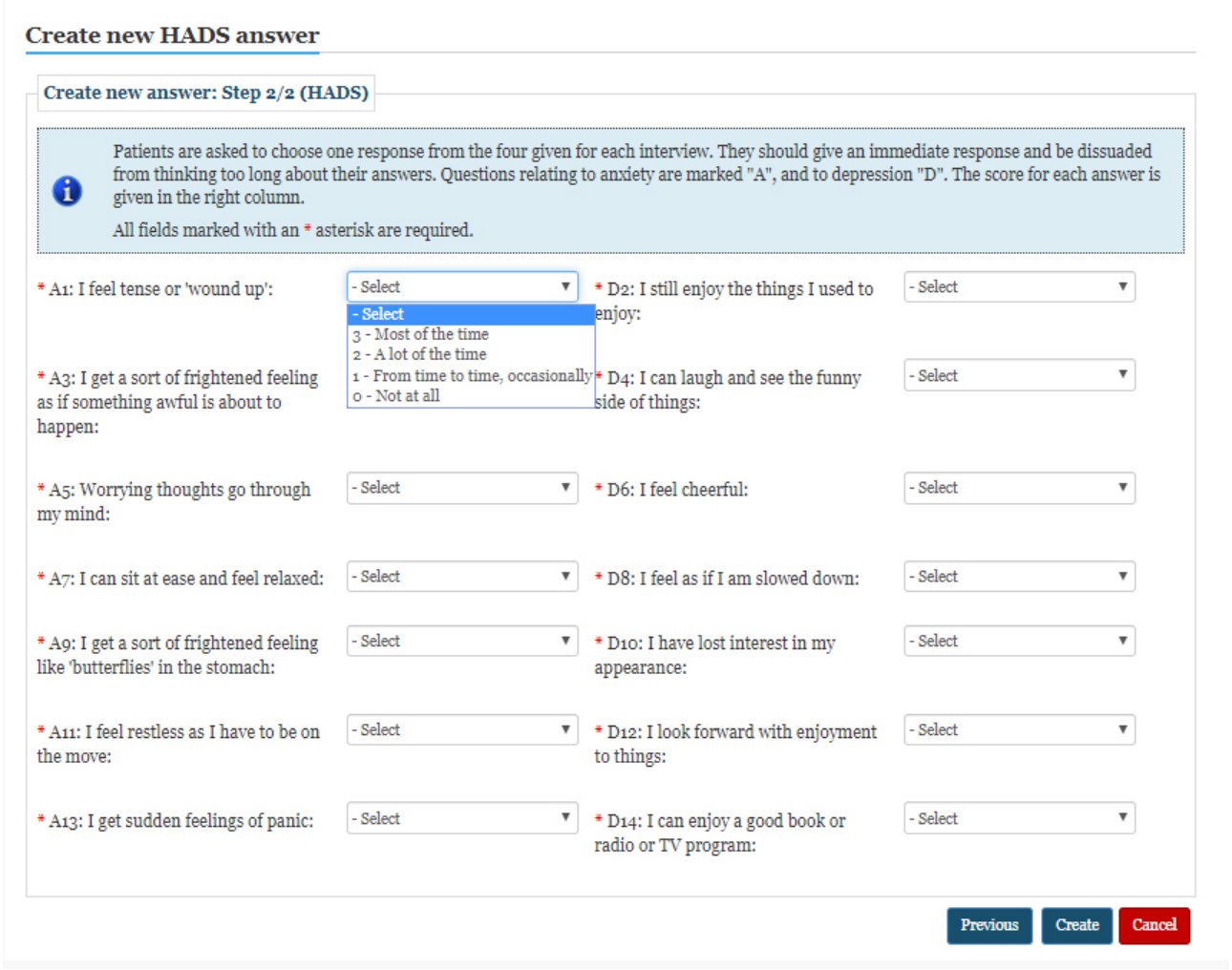


Figure 9: Creating a HADS answer for an external patient ID

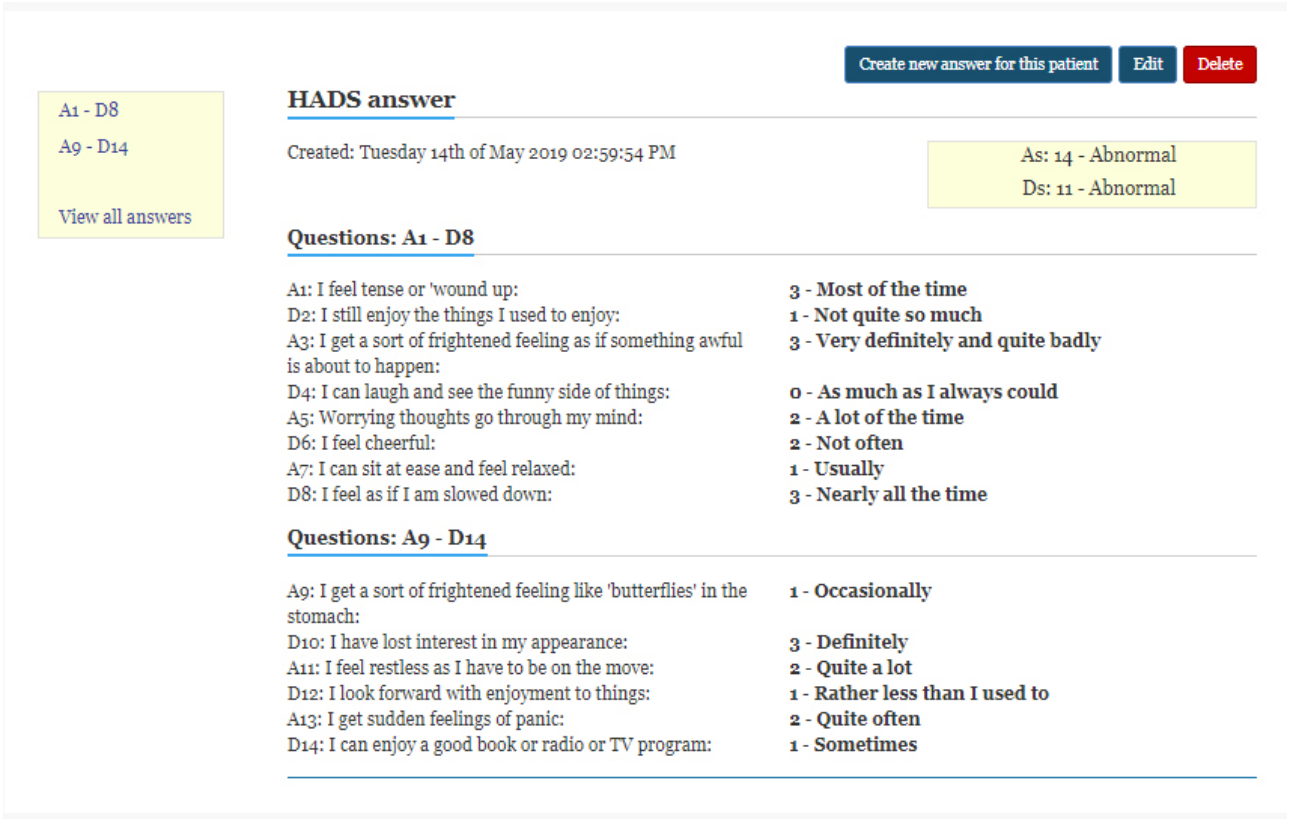


Figure 10: Displaying HADS answer and As and Ds scores

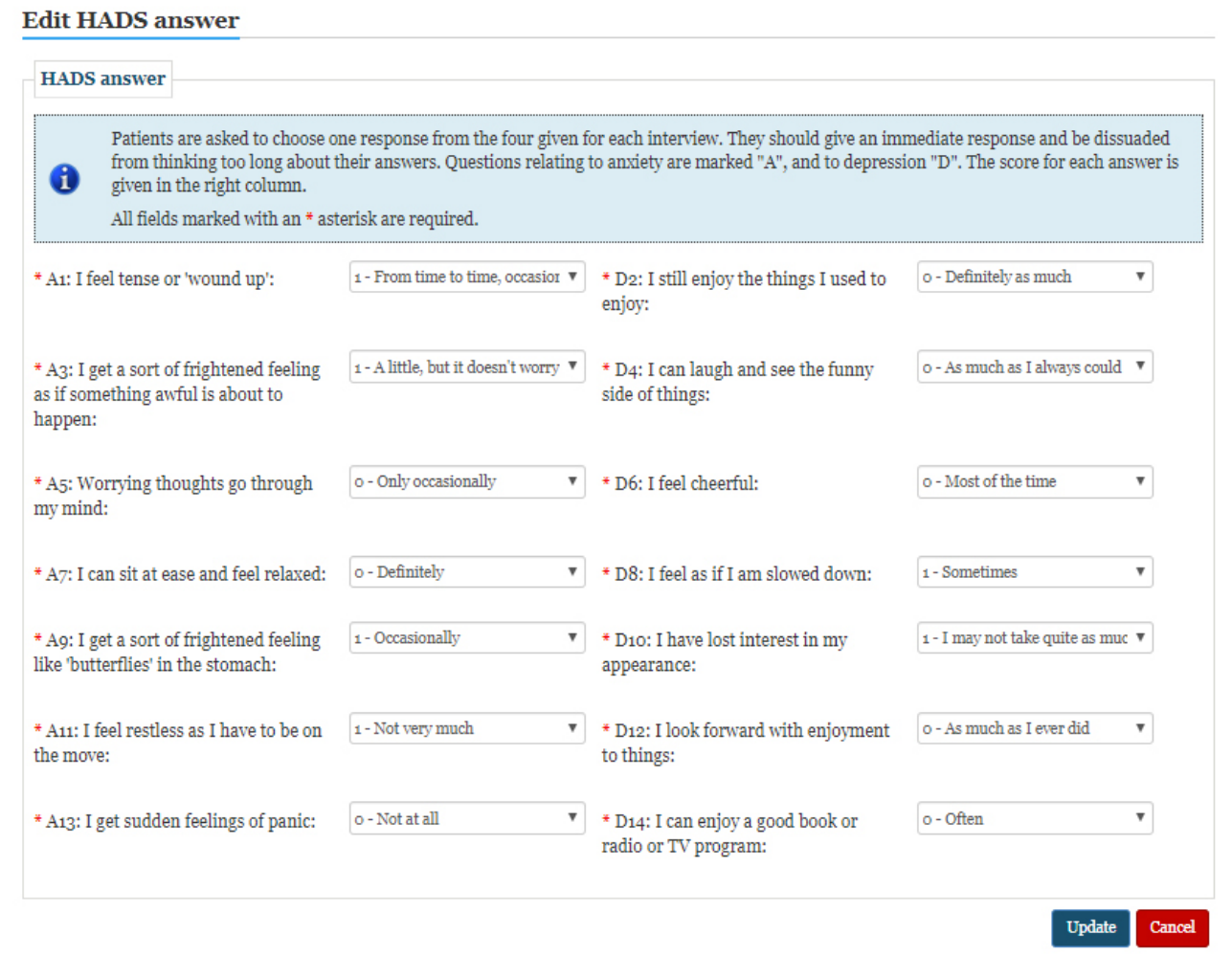


Figure 11: Editing a HADS answer

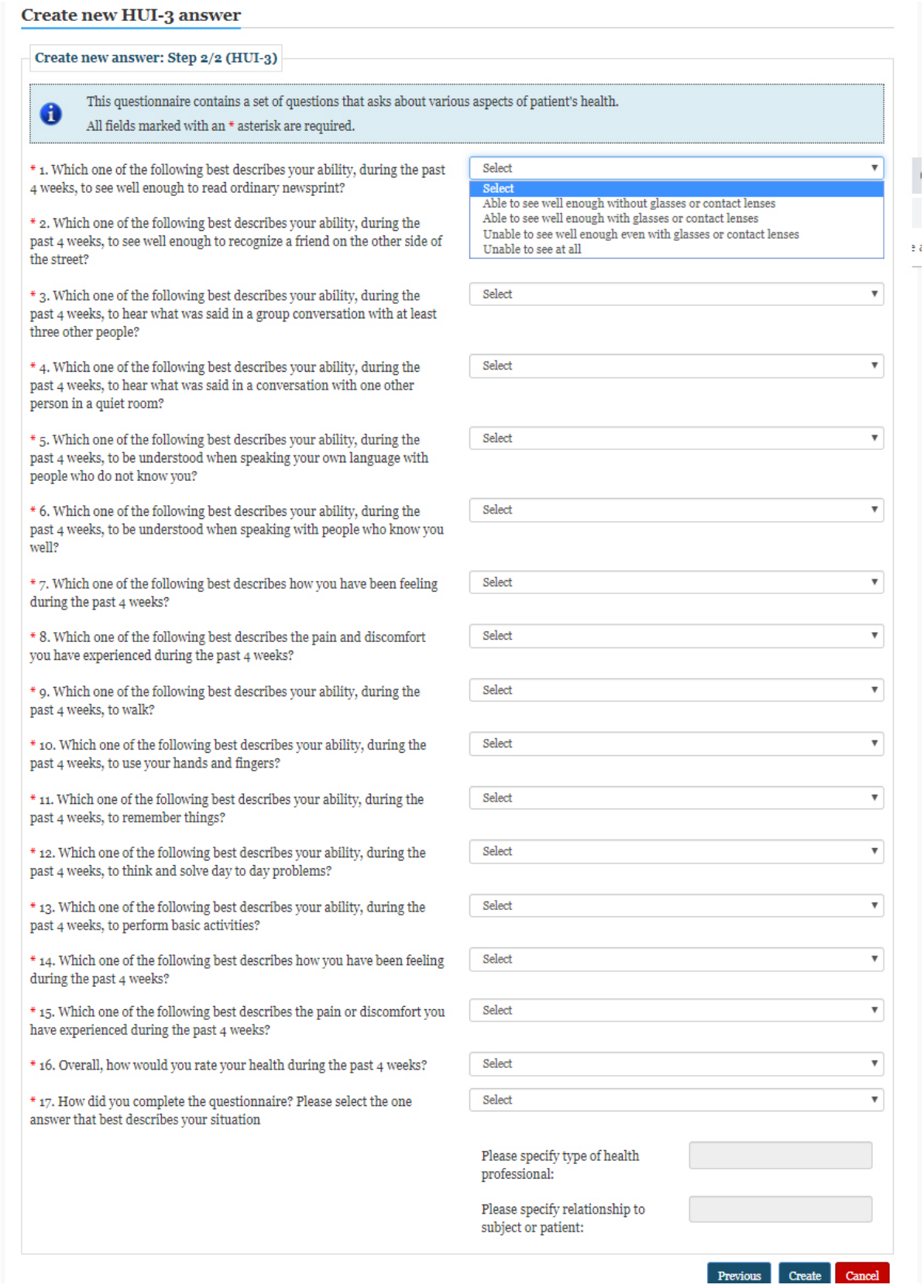


Figure 12: Creating a HUI-3 answer for an external patient ID

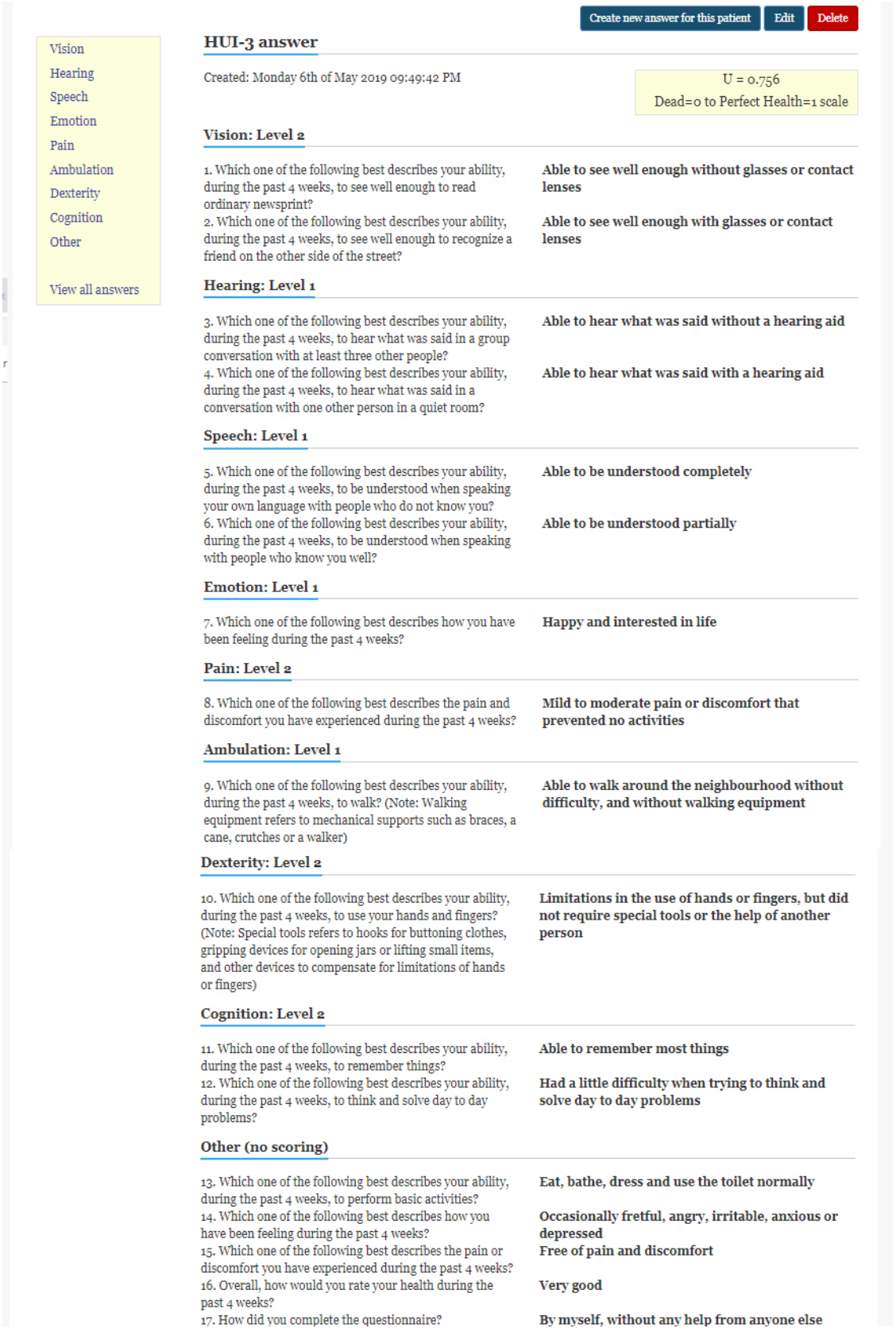


Figure 13: Displaying HUI-3 answer and U score

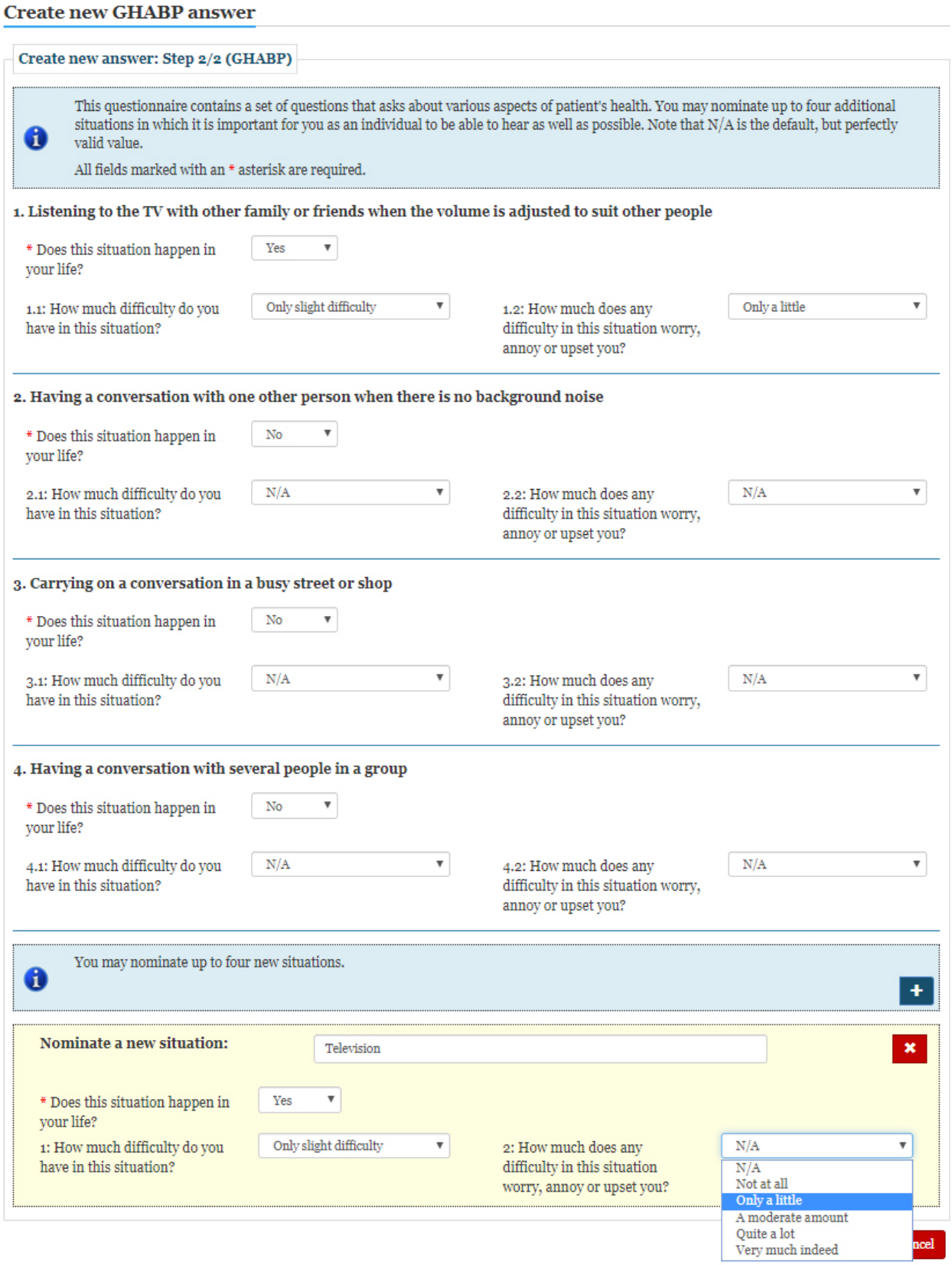


Figure 14: Creating a GHABP answer for an external patient ID

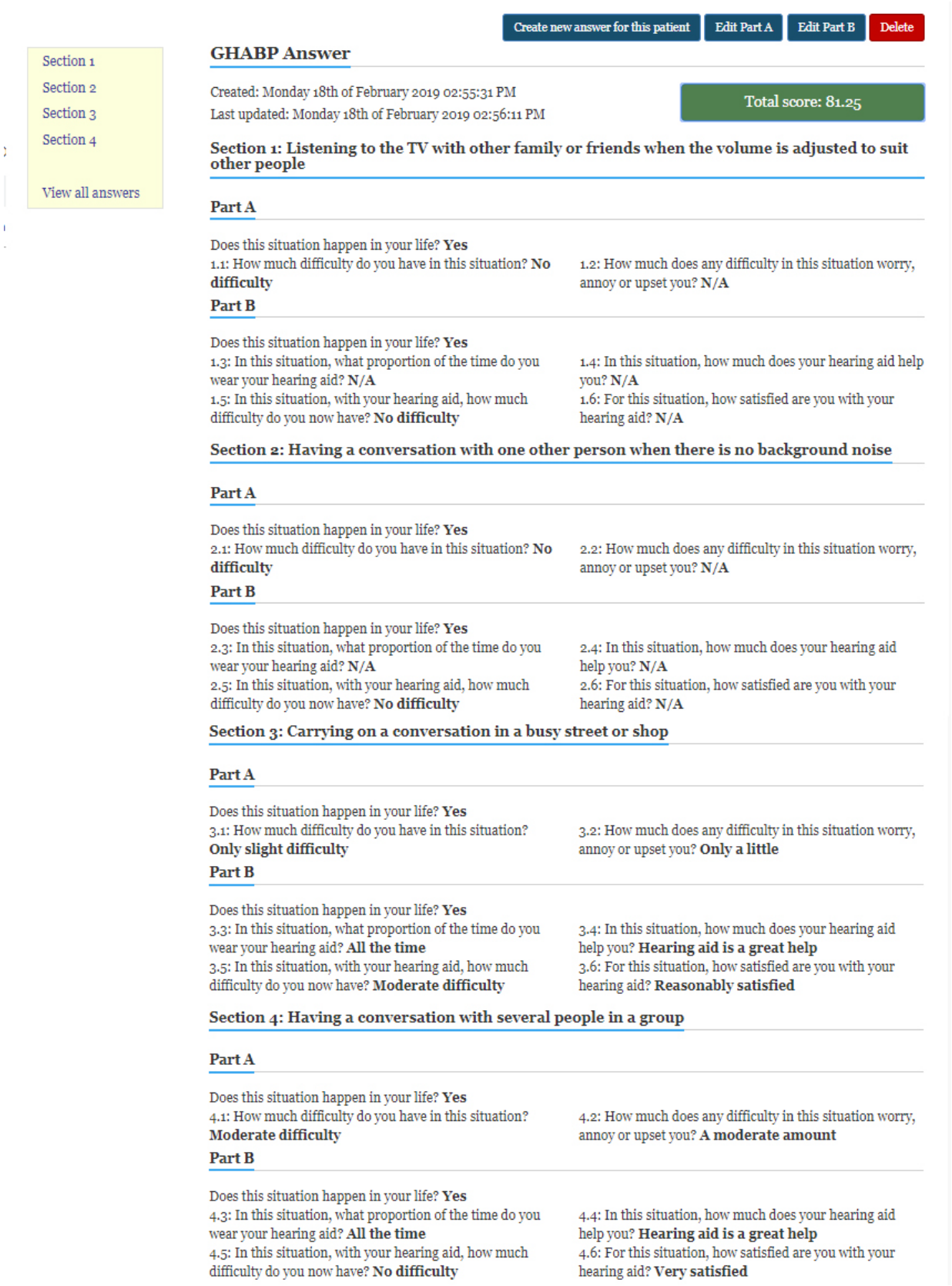


Figure 15: Displaying GHABP answer and total score

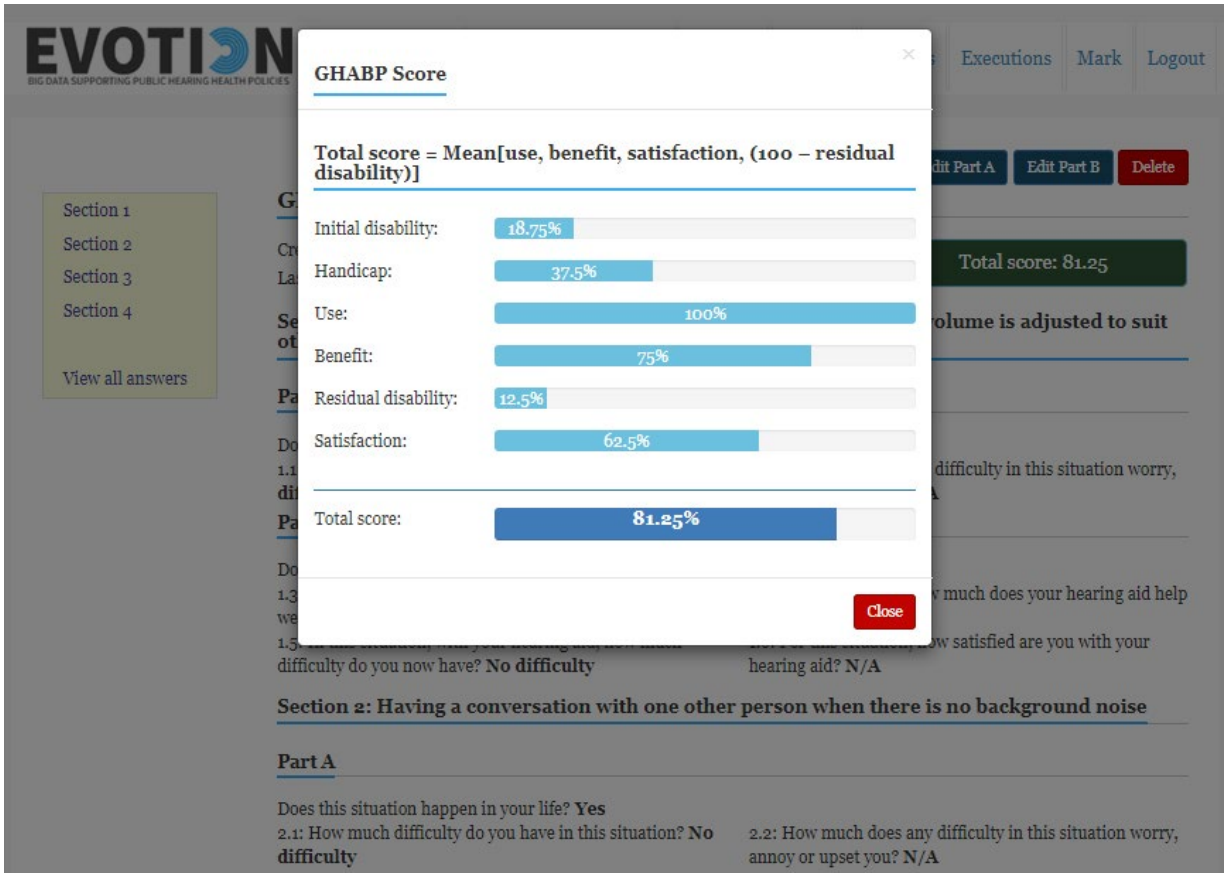


Figure 16: Displaying GHABP scores for each situation

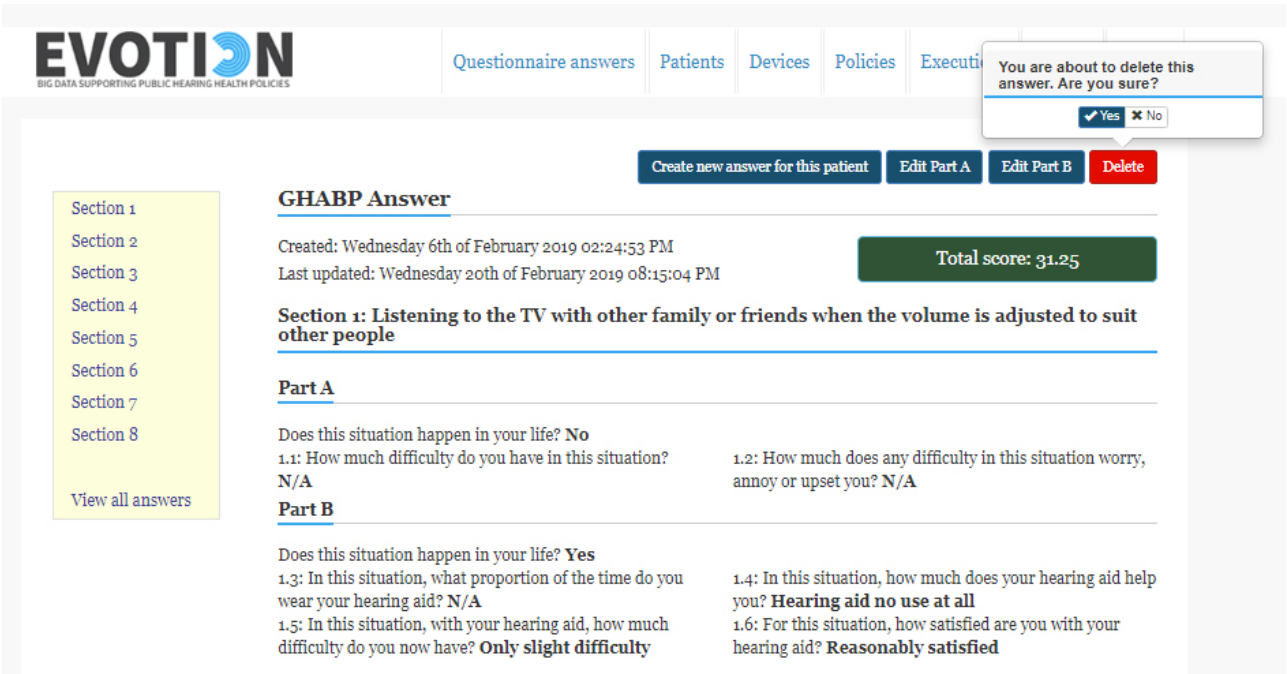


Figure 17:Deleting a GHABP answer: end-user confirmation is required

2.2 Patient-Mobile correlation support

During the registration of a mobile process (Figure 18), a mobile device is registered to the EVOTION platform via the completion of an IMEI, patient's pseudo ID, and the phone's number. All this input is validated by the LDAP service in order the mobile device to be registered as a verified EVOTION mobile device. Authorized mobile devices (Figure 19) communicate every 8 hours with the EDR, to transmit patient's usage data.

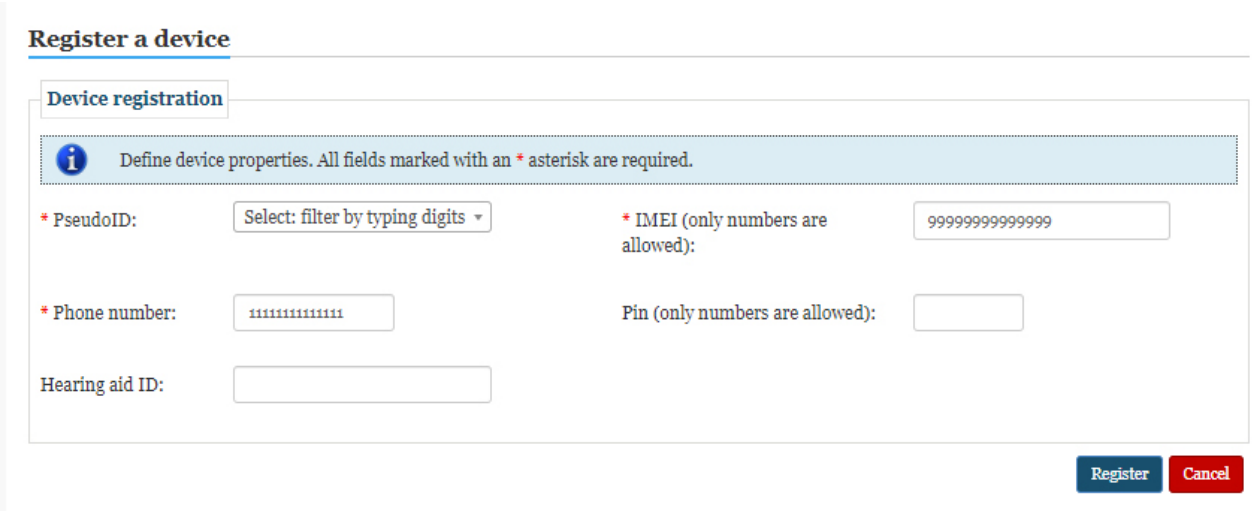


Figure 18: Registering (and authenticating) a mobile-patient pair

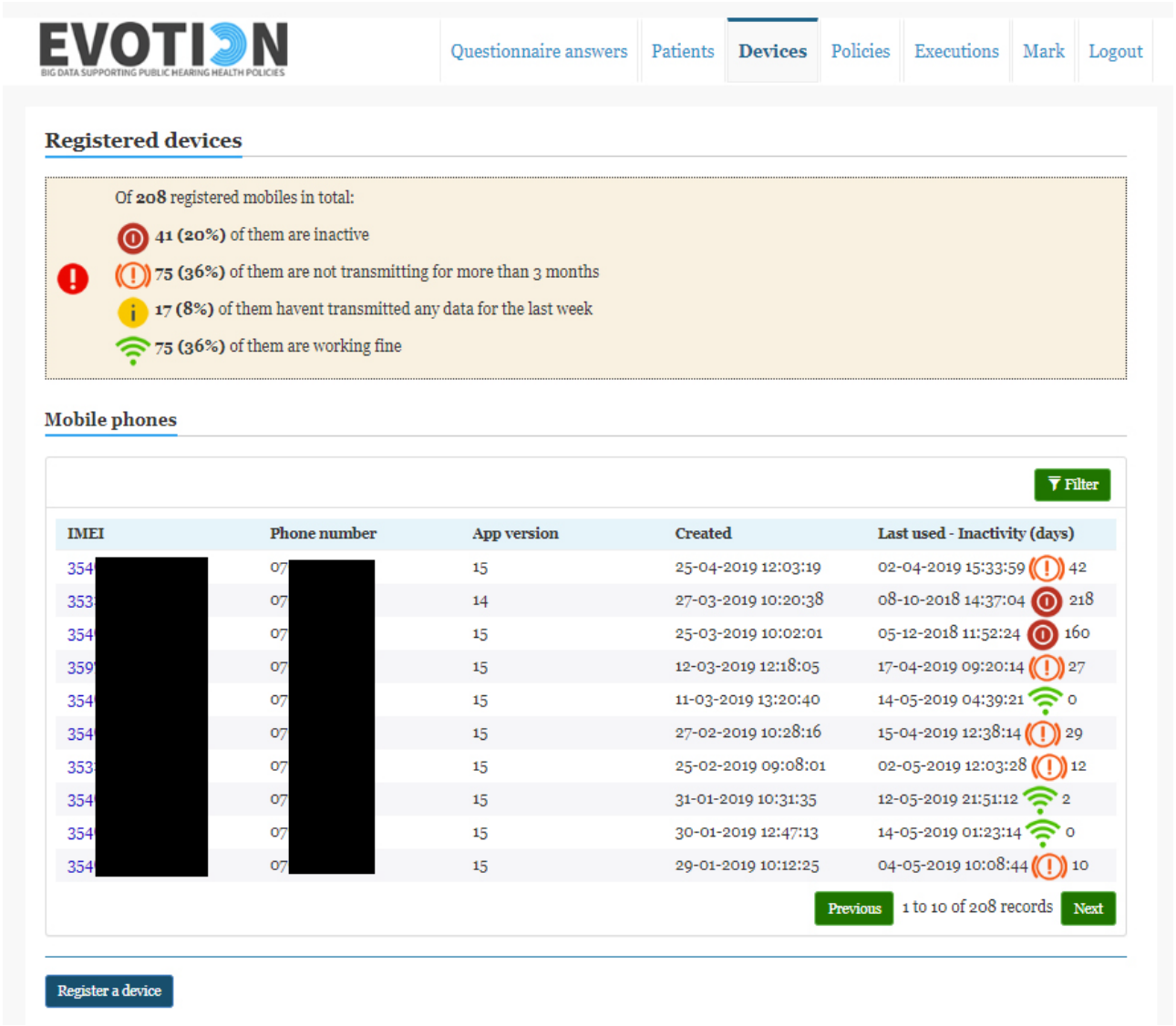


Figure 19: Displaying authenticated mobiles and their activity

2.3 PHPDM e-service

The PHPDM model specification tool, as presented in detailed D4.2, is the component that allows end-users of the EVOTION platform (mainly policy makers) to administer public health policy decision-making models (PHPDM models) and the execution of data analytics tasks which constitute them. As such, this component (e-service) assists them in defining instances of PHPDM models by dynamically adapting the possible choices (e.g., of input datasets and parameters, method(s) to be applied upon them, thresholds or other execution criteria to be fulfilled) logically defined by the PHPDM ontology (presented in D4.1). In brief, this e–service allows end-users to administer:

- Policies, each of them having Goal(s), Objective(s) (Figure 20 and Figure 22)
- Policy's Action(s) to be associated to previously created Data Analytics Workflow(s) (Figure 21)
- Criteria of each Policy Action (Figure 23)
- Workflows and their execution plan (Figure 24 and Figure 25)

- One or many data analytics tasks of each Data Analytics Workflow (Figure 26, Figure 27 and Figure 28)

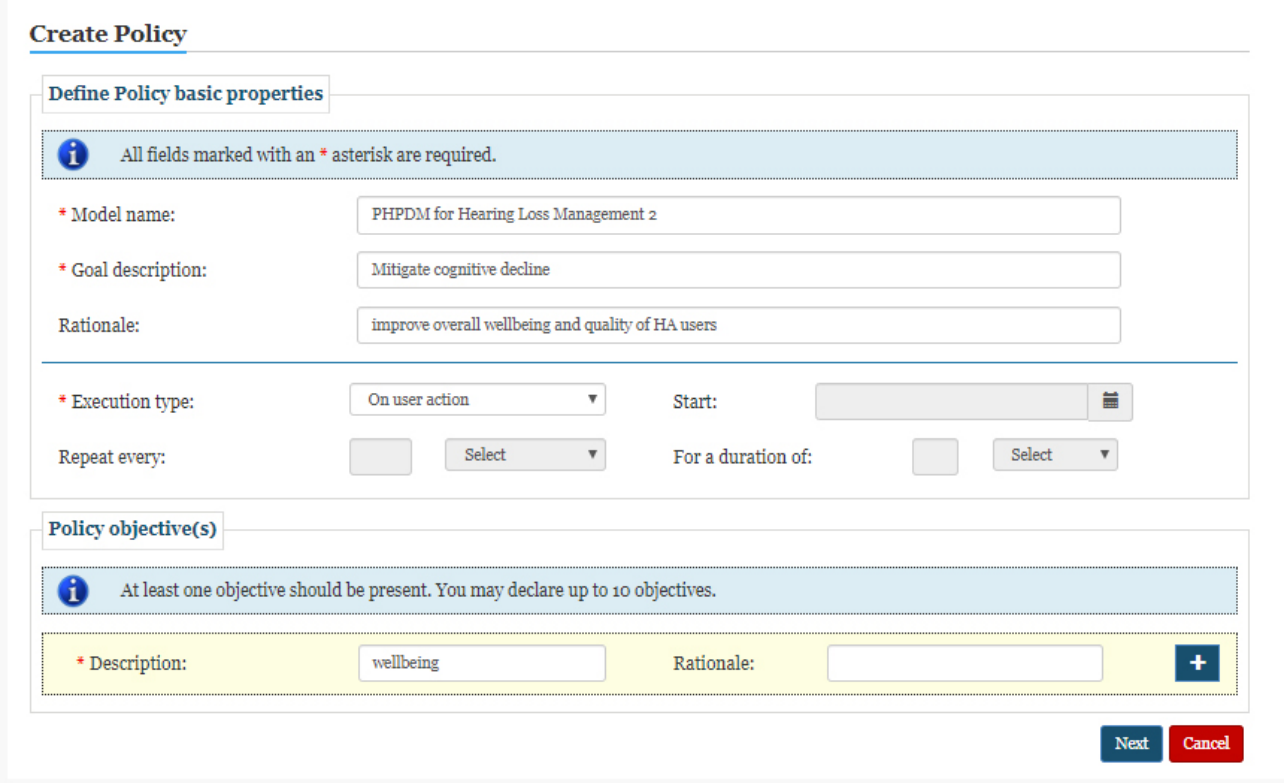


Figure 20: Step 1/2: Creating a policy to be executed on user action

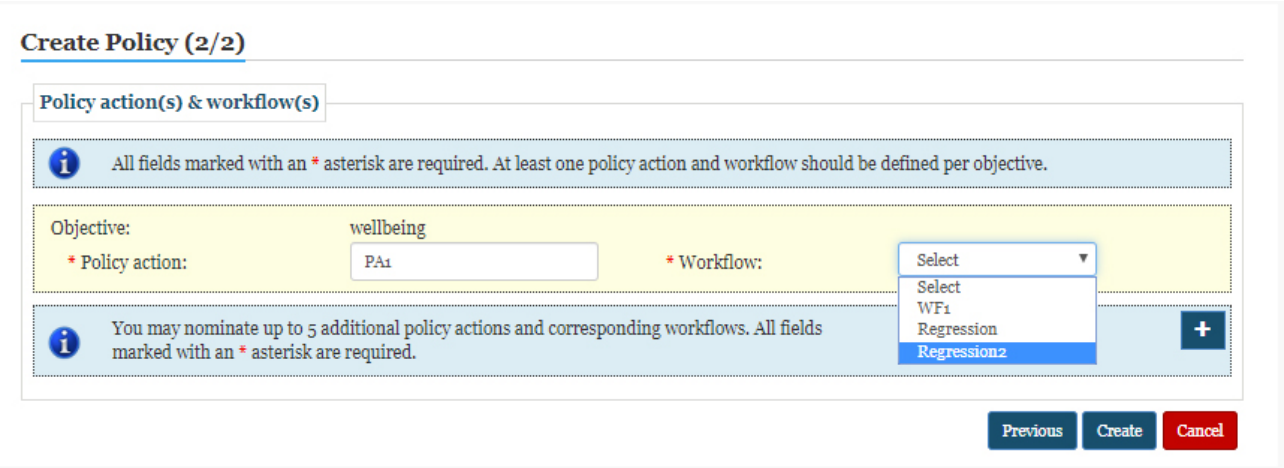


Figure 21: Step 2/2: Creating a policy having a policy action and a previously specified workflow

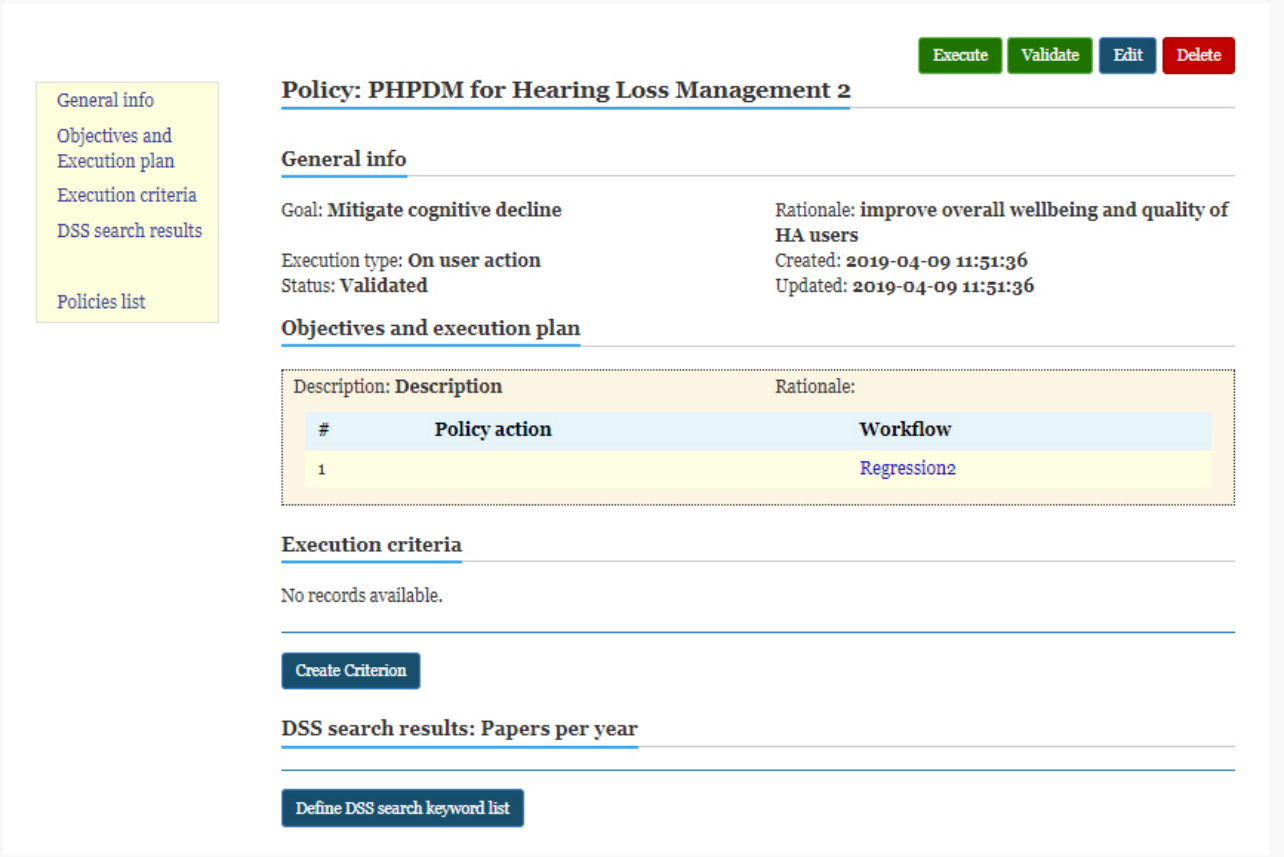


Figure 22: Displaying policy's info

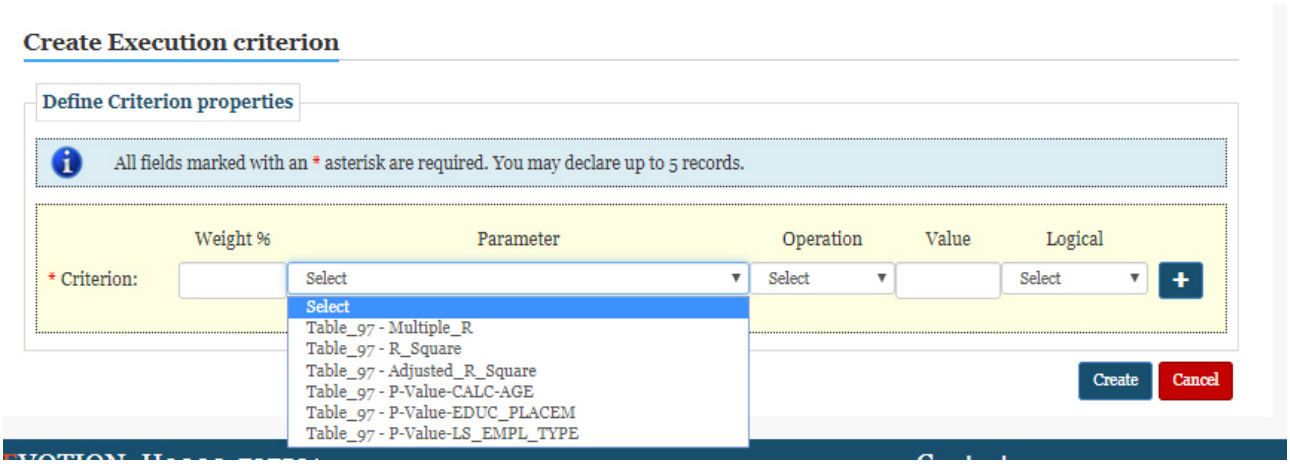


Figure 23: Creating an execution criterion for a policy

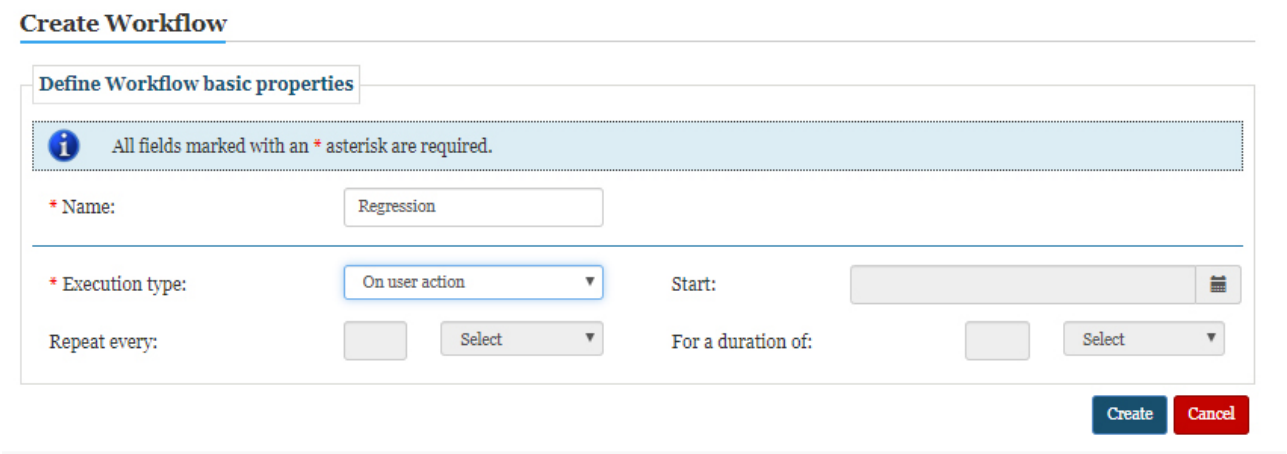


Figure 24: Creating a workflow to be executed on user action

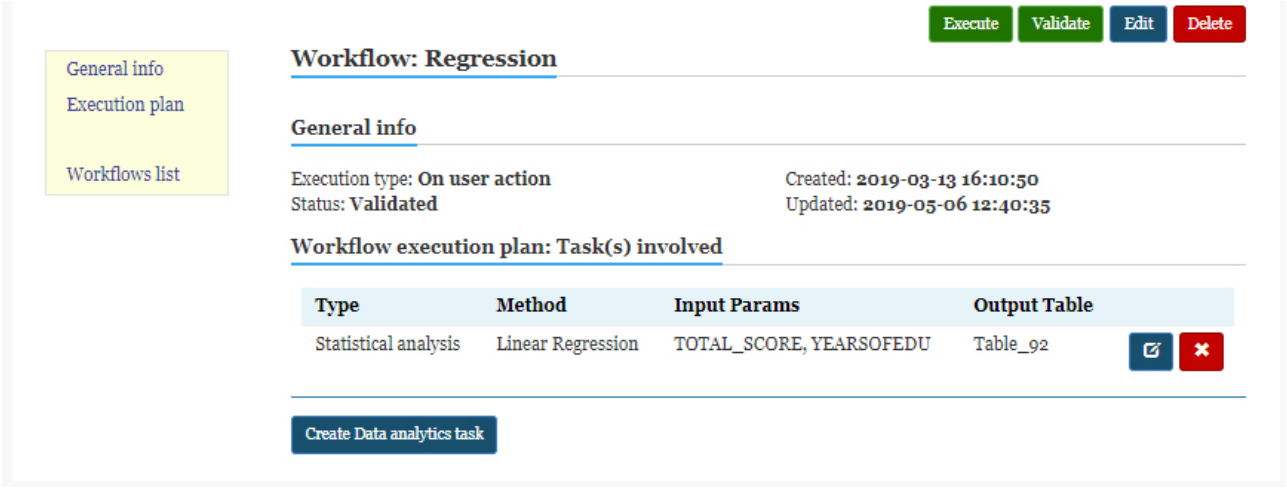


Figure 25: Displaying workflow's info

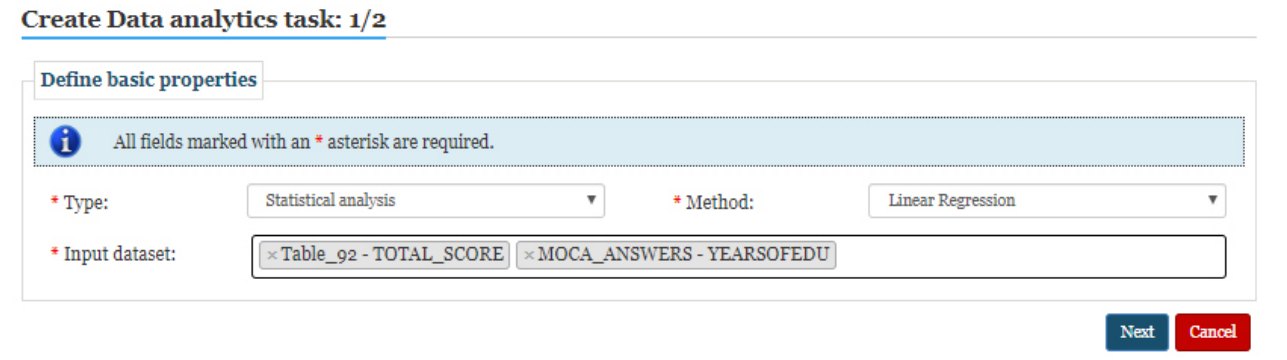


Figure 26: Step 1/2: Creating a data analytics task for a workflow

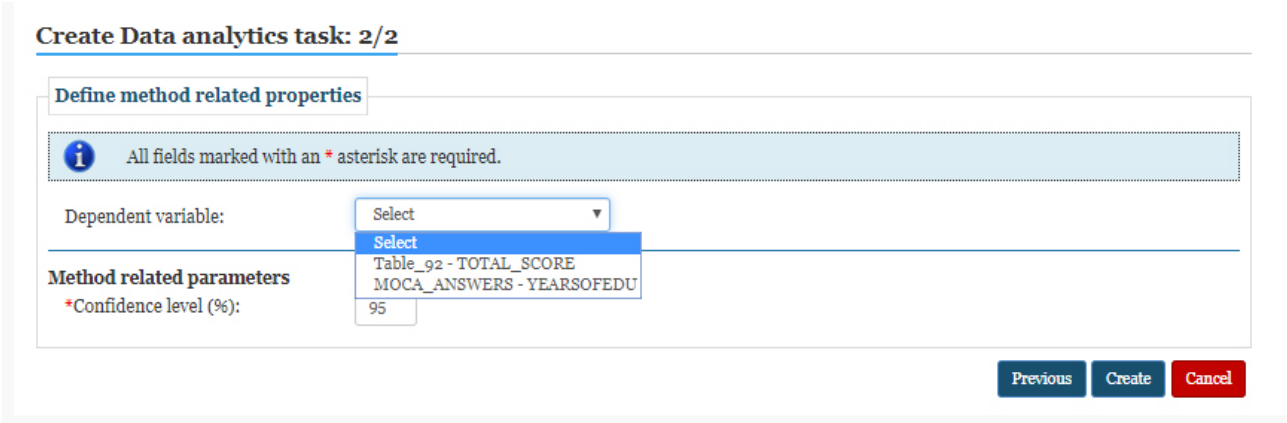


Figure 27: Step 2/2: Creating a data analytics task for a workflow

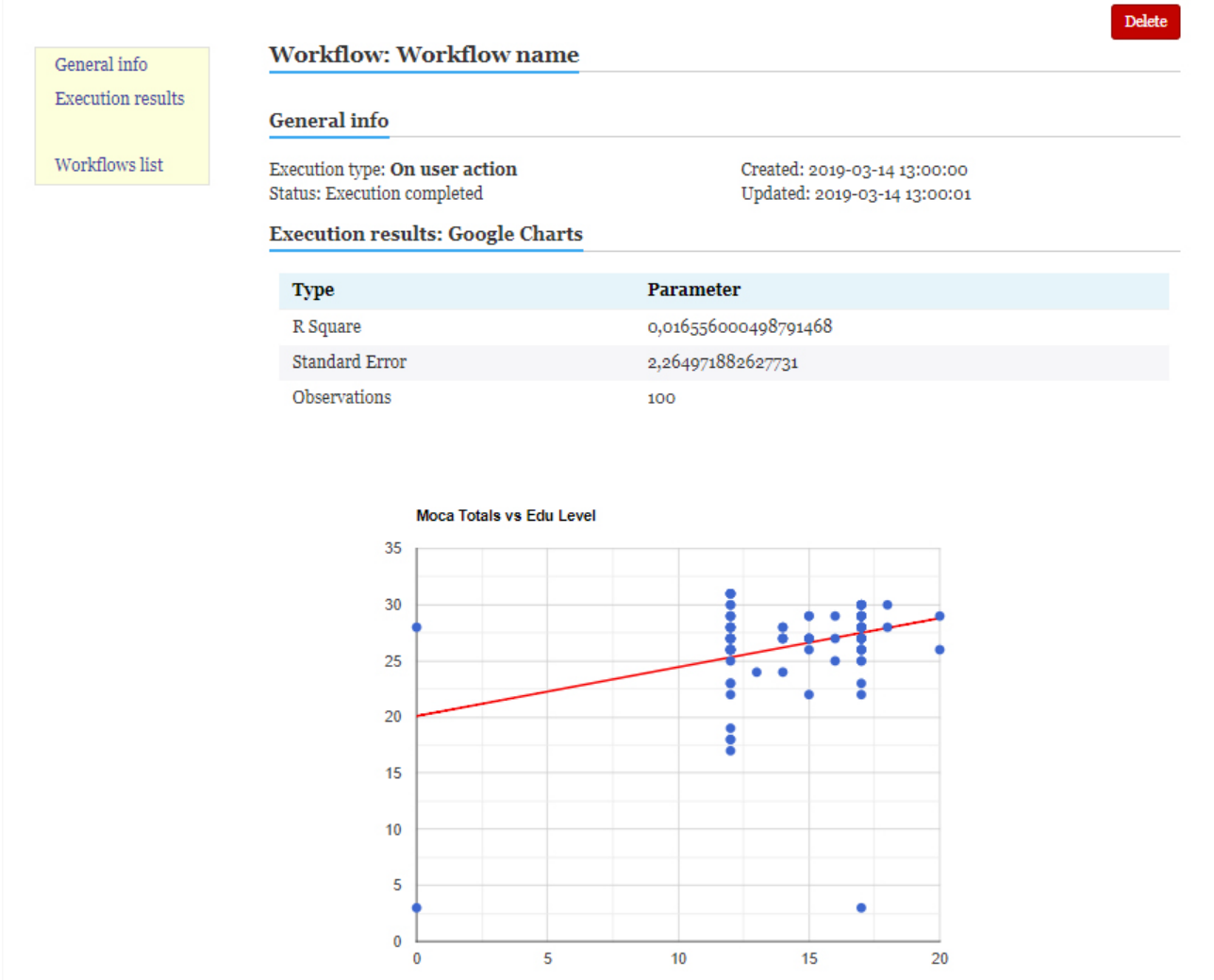


Figure 28: Displaying data analytics task execution result (e.g., Linear regression)

2.4 EVOTION's decision support system

EVOTION's decision support system (DSS) is a system that provides aid to policy makers relevant to the objectives of the policy in question. In particular, DSS is an asynchronous component of the EVOTION Platform that allows them to use text-mining algorithms on online sources and inspect past policies for comparison purposes independently and without needing immediate results at the BDA level or at the Ontology level. As such, its functionality is not directly associated to the execution of PHPDM policy in hand. As with all aforementioned components, ED acts as the gateway that enables the activation of the DSS service upon the provision of list of keywords and a time period to be searched. To ensure that flows and interaction elements to be implemented are consistent and usable, some versions of the prototypes (mock-ups) were compose and made available to potential end-users (members of the consortium). As a result, a final design (presented in Annex A) reflects the principle of using highly usable and minimalistic e-services, which can be easily operated by non-experienced end-users.

Technical details regarding the operation of this services is presented in D5.6 (Katrakazas et al., 2018), and in the upcoming D4.3 "PHPDM Transformation Tool" and D5.8 "Social Campaigning Tool" scheduled to be released at the same time with the current deliverable. In brief, DSS allows end-user to:

- Define list of keywords to be search and specific time-period (Figure 29)
- View the external resources matching search criteria (Figure 30 and Figure 31)

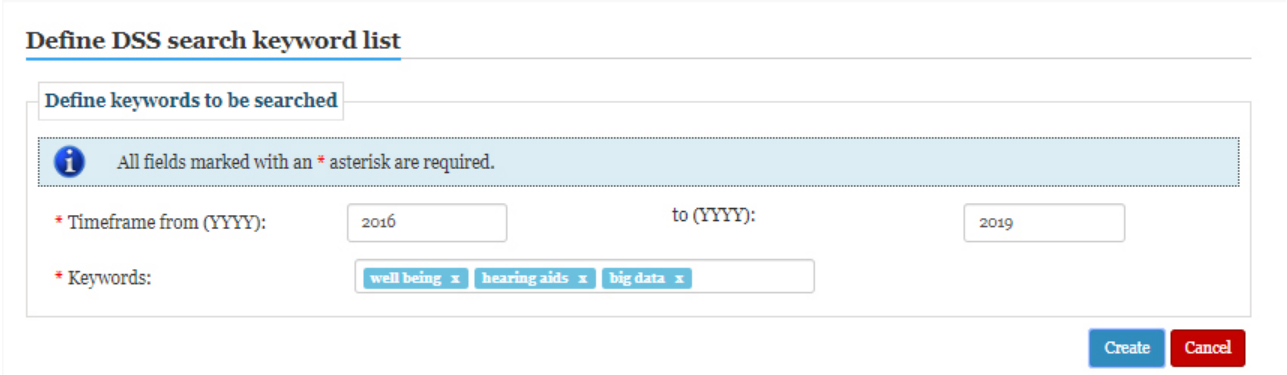


Figure 29: Defining DSS search criteria

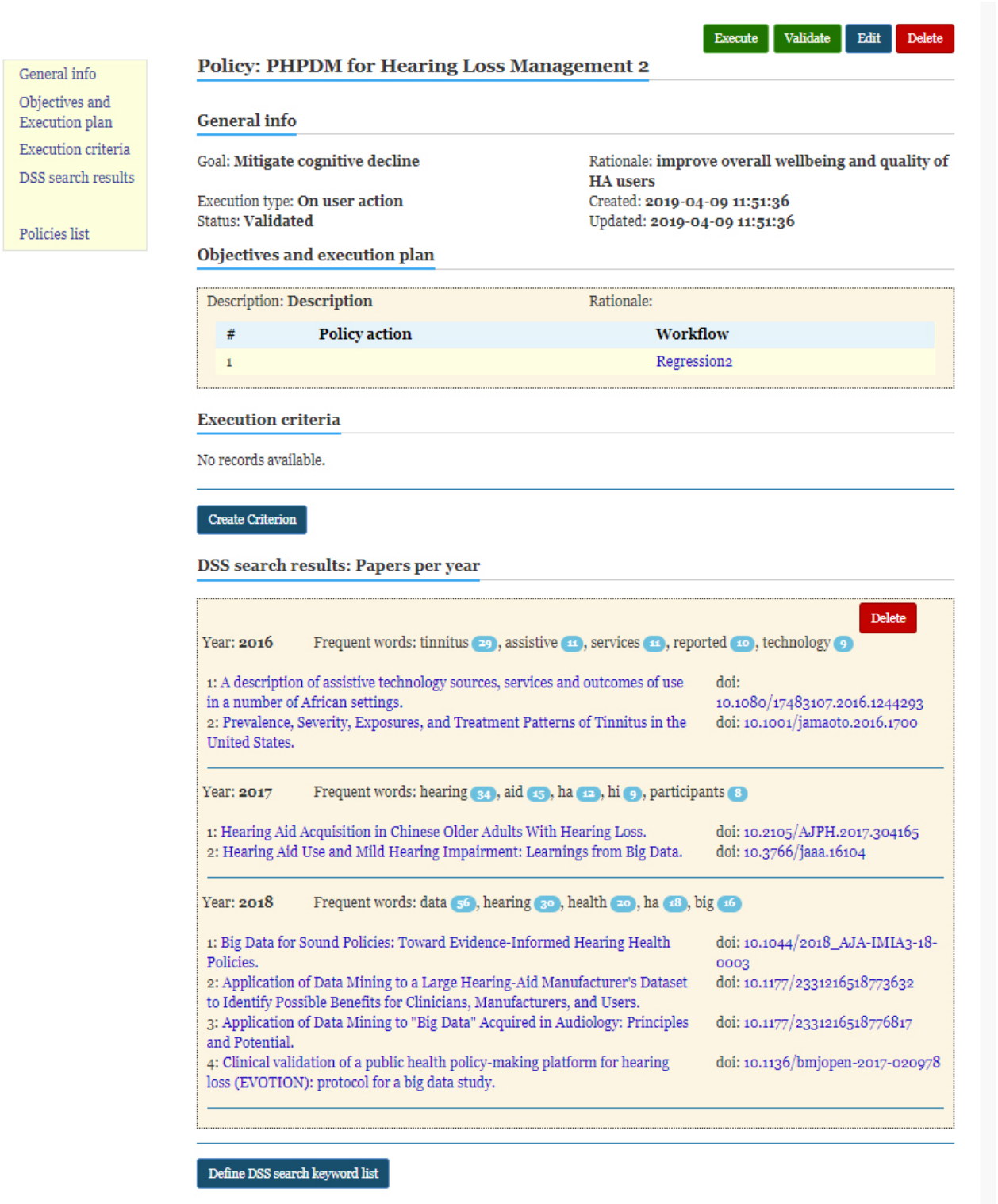


Figure 30:Displaying search results in chronological order

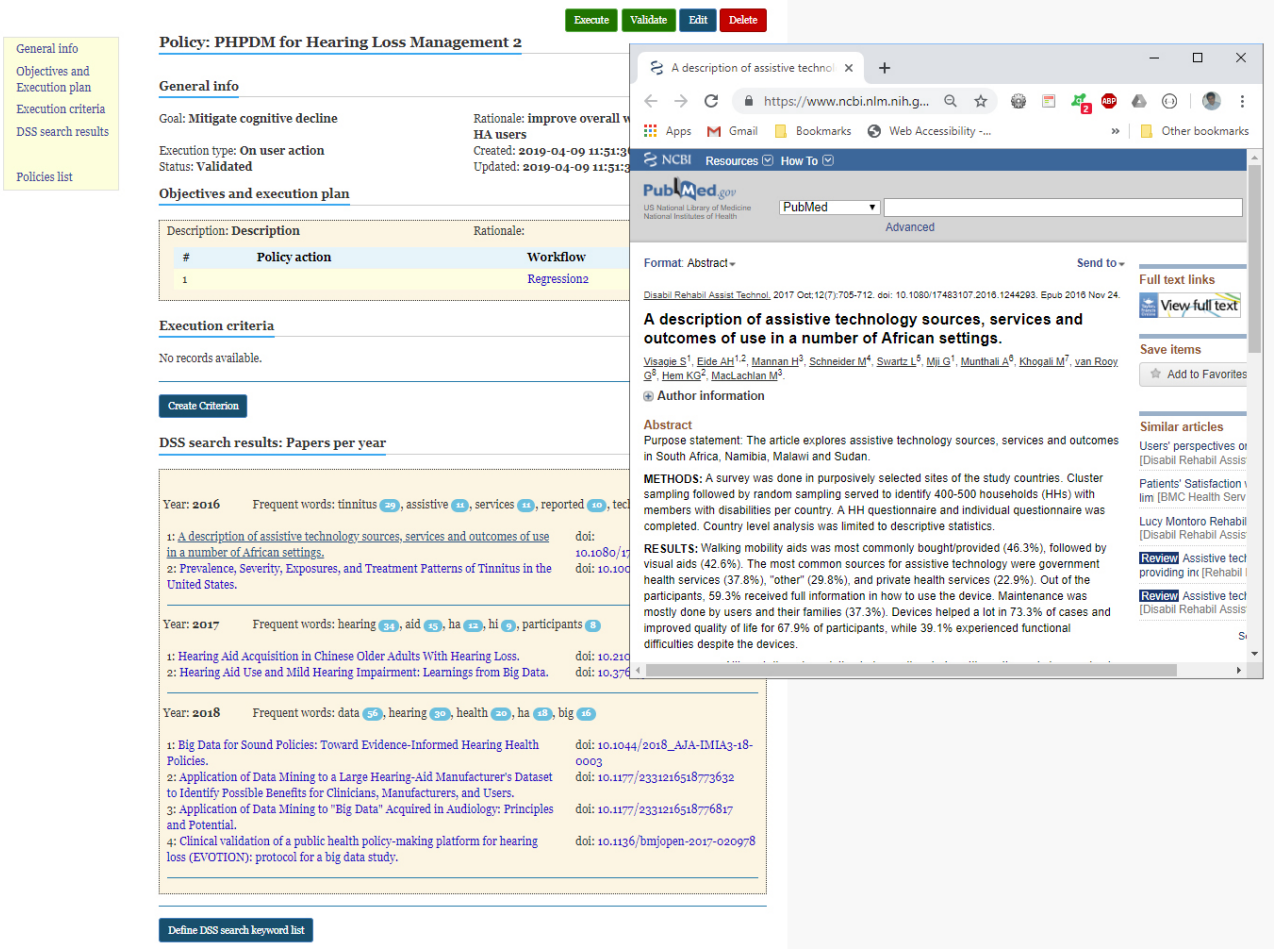


Figure 31: Accessing external resources (e.g., research paper)

2.5 EVOTION Architecture: The role of the EVOTION Dashboard

Figure 32 depicts the described connections of the Dashboard component inside the EVOTION platform architecture, as these were described in D2.2 “EVOTION Architecture and Detailed Design” (Ye et al., 2017). As an aftermath of several technical meetings that took place between ICCS, CITY and EMP (the main contributors of Task 5.9), it was decided that ED (web interface) should act as the main gateway to all implemented functionality, thus to extent the initial role ED was initially served (i.e., provide access to PHPDM e-service functionality, and basic access to EDR described in D4.2) and become as well the gateway for the DSS (and Simulation Component Tool), which serves as a decision-making assistant to the public health policy maker.

Figure 32 depicts the currently implemented connections for the ED component as it was progressed.

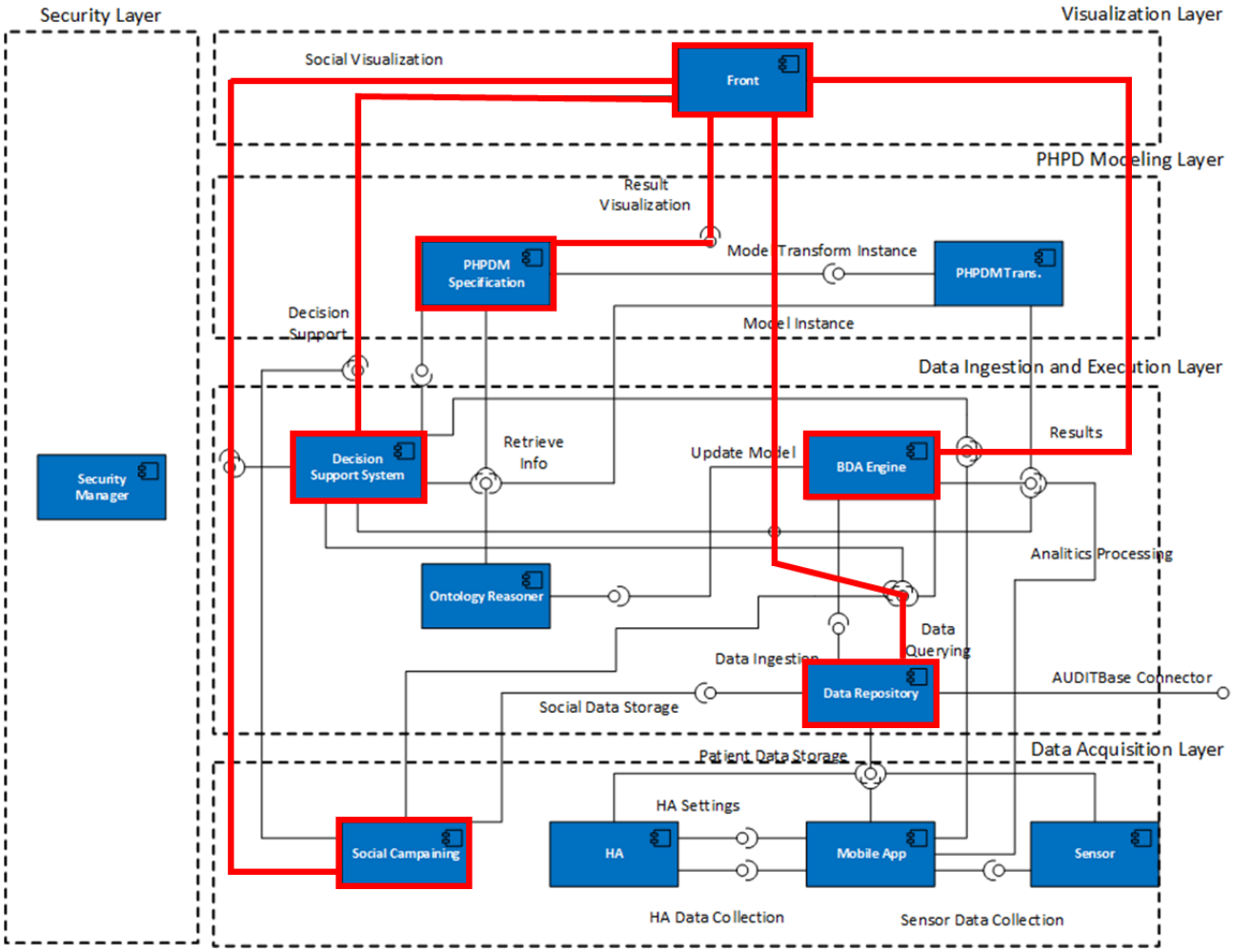


Figure 32: Initial Dashboard connections in the EVOTION platform architecture

In more details:

1. Green-coloured connections show the active connection of the Dashboard with the PHPDM e-service module and the to-be-developed connection of the social campaigning tool with it.
2. Light green coloured connections indicate the connections of the dashboard connected components (Big Data Analytics engine, Data Repository and Decision Support System)
3. Yellow coloured connections indicate the previously described and now obsolete connections.

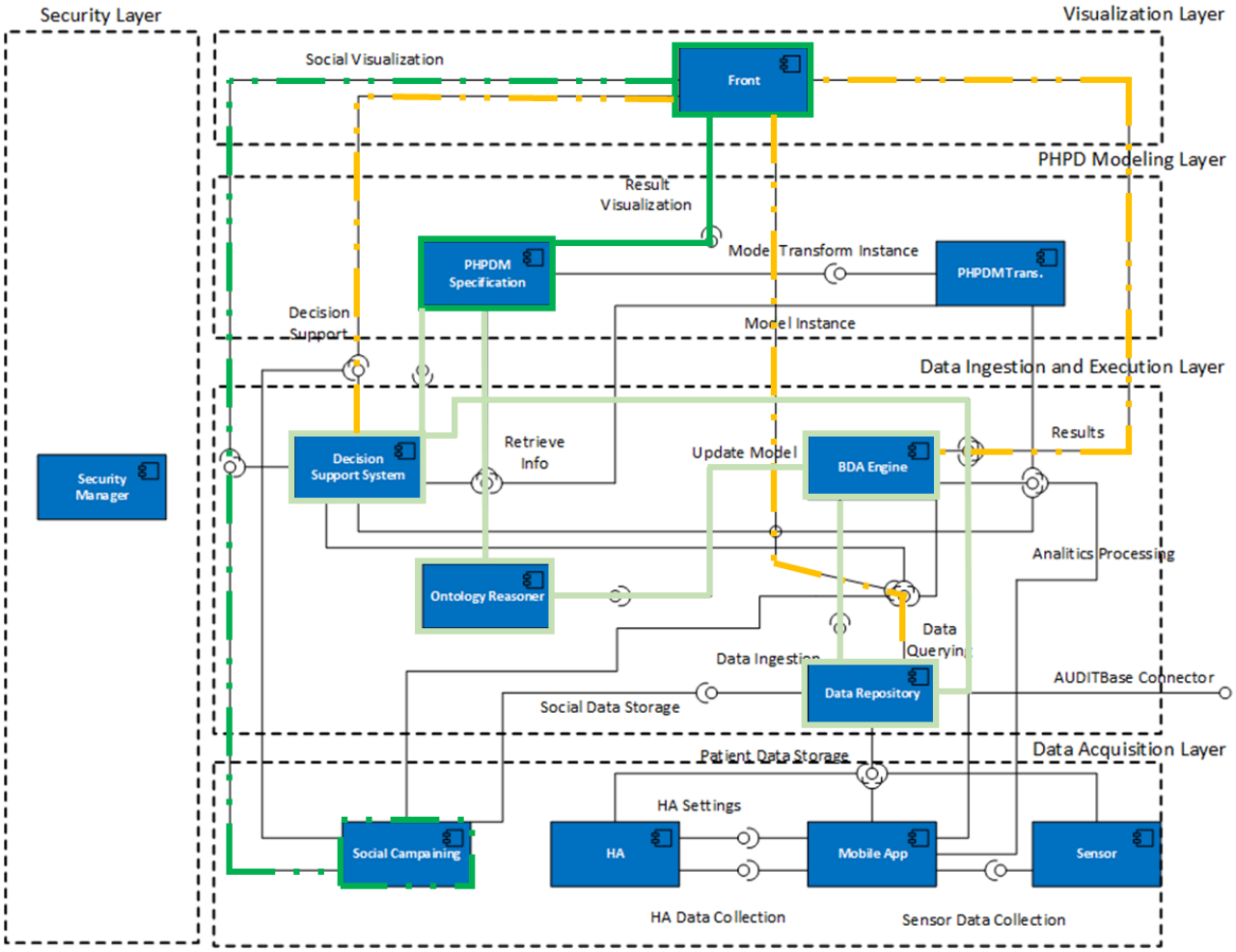


Figure 33: Current Dashboard connections in the EVOTION platform architecture

D4.2 presented the PHPDMe-service used for administering PHPDM objects (e.g., Policies, Workflows, Data Analytics Task and others). The reutilisation of the same interaction components serves a dual purpose. Firstly, it provides the same user-friendly interaction paradigm throughout the available functionality. At the same time, accessing DSS underneath functionality via the ED component reutilises the same secure communication channel (via the EVOTION authentication login mechanism) to ensure the security of data and protect the integrity of all the components of the latter.

3 Security and Privacy

An important feature for ED components concerns the security and privacy aspects of them. In the context of the ED, the security measures implemented or reutilized are:

- EDR data security: ED connection to any of the REST services and the access to the underlying EDR is password protected. For this, a REST service enables the authorization of valid end-users. Each end-user will have a unique token, generated by the EVOTION security mechanism, that will be updated every six (6) seconds.
- User authentication: For a registered end-user to use the ED, he/she must type in a username and a password. The credentials that are typed in are compared against a list of users that are stored in the user's database. This process happens dynamically every time the end-user logs into the system. The credentials are being stored in an LDAP (Lightweight Directory Access Protocol) server in an encrypted form. Each password can be edited by the end-user, so it is known only to the person of interest. SQL injections and use of special character are forbidden.
- API service invocation user authentication: The same authentication manager used to ensure that every invocation of each service of the REST API that acts against the EDR is made by a user who has a valid user credentials (user name and password). If no credentials are provided or if they do not correspond to a valid user, then the service will respond with an HTTP Error 401 - Unauthorized: Access is denied due to invalid credentials. This feature guarantees that the services performing operations against the data in the database cannot be invoked without a valid username and a password even if one tries to access the EDR without using proper REST services.
- Preventing Cross-Site Scripting Attacks: Data validation for all input elements: Ensuring that user in-put has the correct form. In most cases HTML5 input type="number", multiple selects, and radio options are used (free text inputs are seldomly used).
- URL vulnerabilities: POST method will be utilized in most cases as parameters are not stored in browser history or URL or in web server logs.

3.1 Implementation

For the implementation of the ED, the server-side language PHP (ver. 5) was used. PHP was utilised to produce HTML5 mark-up (i.e., the latest revision of the HTML standard). These were complemented by custom-made CSS 2.1 and CSS Bootstrap v3.3.7 style sheets, jQuery 3.2.1 and Bootstrap v3.3.7, all of them been provided freely as open-source software using the permissive MIT Licenses.

4 Conclusion

The current document includes the available features of the current version (ver. 2.0) of the EVOTION Dashboard. The presented elements and functionality implemented have been elaborated according to the user input and requirements (reference to D2.1). The EVOTION dashboard has been designed to provide access to the four key EVOTION components namely, the Data Repository, the BDA Engine, the Decision Support System and the Public Health Policy Decision Model Tool.

This document is complemented by the access link to the EVOTION ED component, which can be found at https://evotion.city.ac.uk/.

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6 Appendix A: Detailed web interface design for the DSS

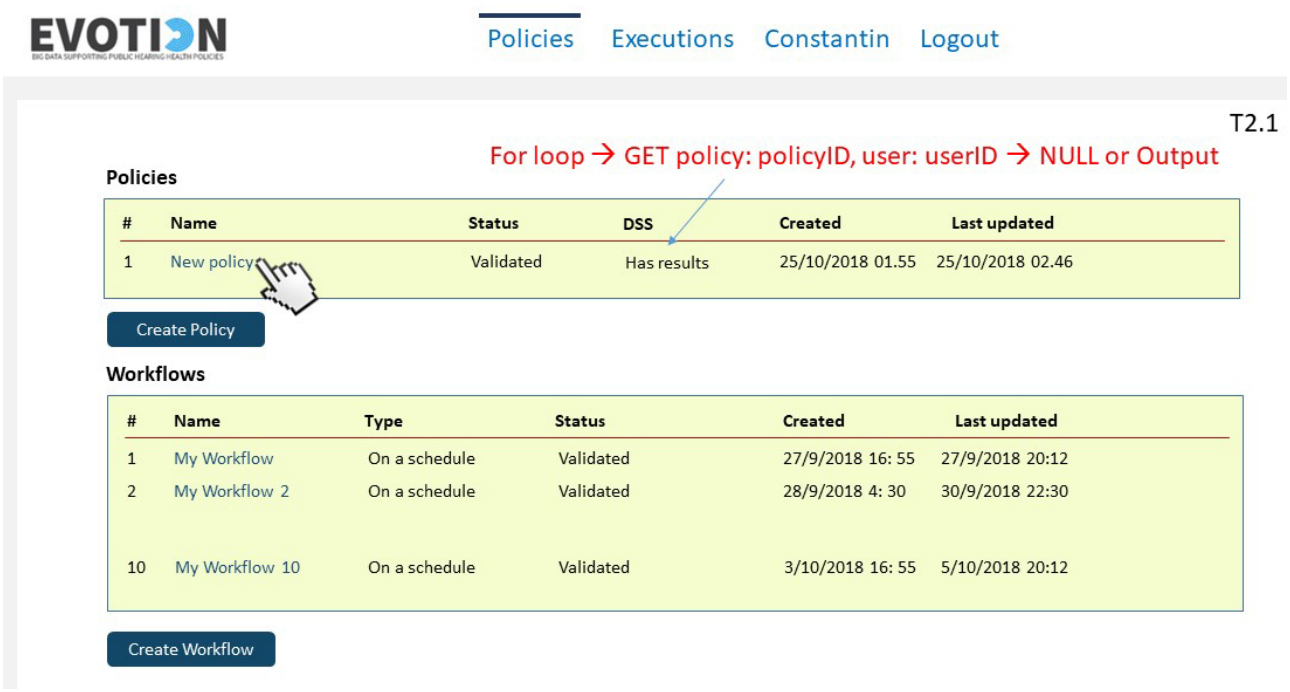

Figure 34:Policies initial page

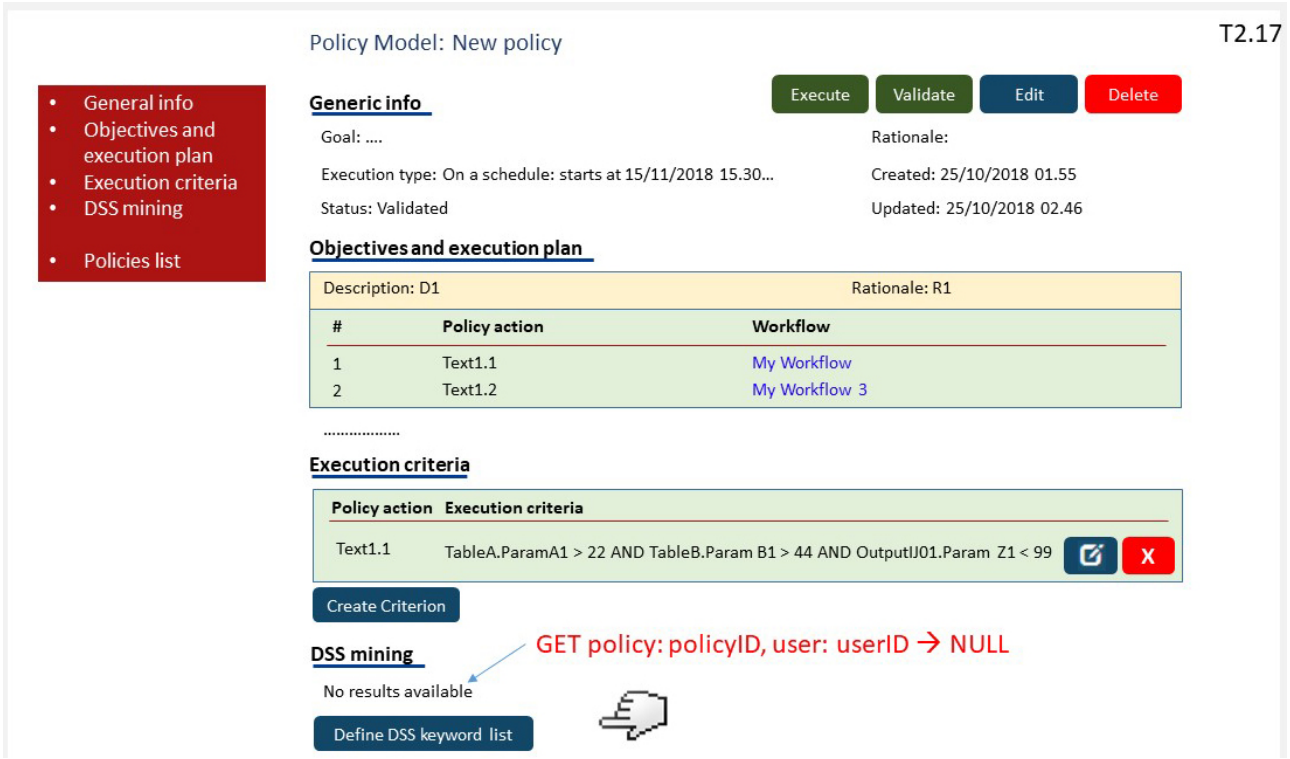

Figure 35:Policy info page: end-user initiates DSS functionality

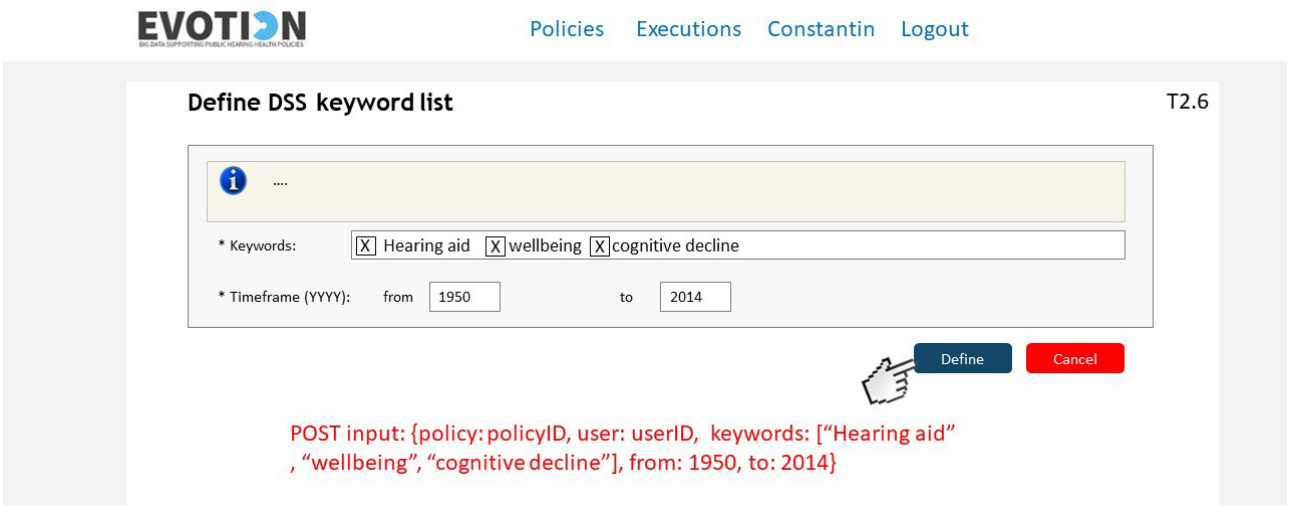

Figure 36:End-user defines DSS search criteria

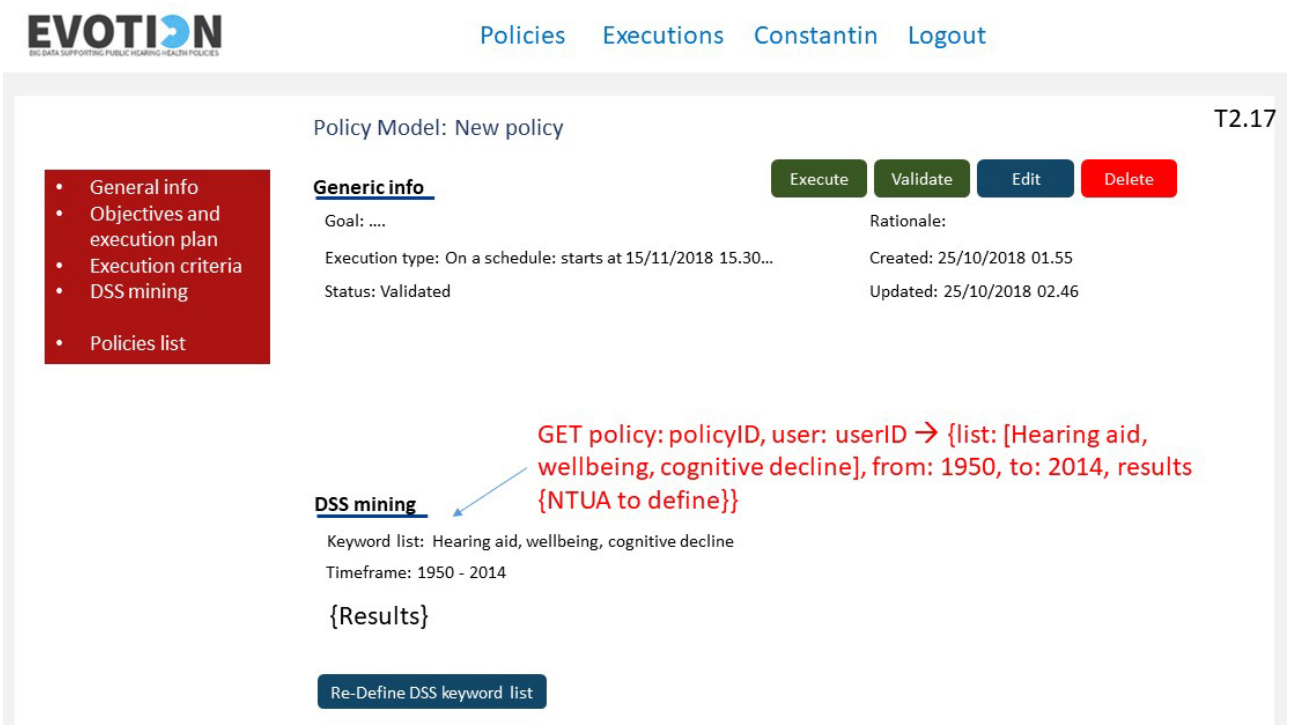

Figure 37:Updated policy info page that displays DSS search results