POWER2DM

"Predictive model-based decision support for diabetes patient empowerment"

Research and Innovation Project
PHC 28 – 2015: Self-management of health and disease and decision support systems based on predictive computer modelling used by the patient him or herself

Deliverable D1.5

Prototype and Integrated POWER2DM System Release 1 (D1.4.2.a)

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

Document History:

Version	Date	Changes	From	Review
V0.1	14 July 2017	Initial revision with screenshots and descriptions of the demos of UC3 and UC4 delivered by PD and SRFG.	PD	
V1.0	19 July 2017	Final revision with screenshots and descriptions of all use case demos for Prototype 1.	PD	

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EXECUTIVE SUMMARY

This document contains a textual description and screenshots of available showcases for Prototype 1 for POWER2DM System Release 1. This document is meant as a guide for demo videos and online content, which can be found via links and on the SharePoint project collaboration site:

https://365tno.sharepoint.com/teams/pdm/EU%20project%20reviews/D1.5%20(D1.4.2.a)%20Demo%20movies%20for%20Prototype%20and%20Integrated%20POWER2DM%20System%20Releases%20I

The following use case scenarios are covered in the demonstrator videos:

UC#	Use case	Component	Responsible Party
UC1	Register a Patient	Patient registration application	PD
UC3	Second patient visit: Treatment planning with KADIS simulation	Shared decision-making application	PD
UC4	Look at treatment plan. Make patient goals and plans	SMSS web interface – Action Plan Engine	SRFG
UC5	Look at glucose measurements (simulated) and general use of the entire application	SMSS mobile application	iHealth
UC6	Look at weekly review and at barrier identification process	SMSS web interface – Action Plan Engine	SRFG

POWER2DM Consortium Partners

Abbv	Participant Organization Name	Country
TNO	Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek	Netherlands
IDK	Institute of Diabetes "Gerhardt Katsch" Karlsburg	Germany
SRDC	SRDC Yazilim Arastirma ve Gelistirme ve Danismanlik Ticaret Limited Sirketi	Turkey
LUMC	Leiden University Medical Center	Netherlands
SAS	SAS Servicio Andaluz de Salud	Spain
SRFG	Salzburg Research Forschungs Gesellschaft	Austria
PD	PrimeData	Netherlands
iHealth	iHealthLabs Europe	France

OPEN ISSUES

No:	Date	Issue	Resolved
1	20-07-2017	Not all functionality of the system is completed in prototype 1. Open tasks and bugs are managed in the software management web application Redmine.	**M22**

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Purpose and Scope

This document contains a textual description and screenshots of available showcases for Prototype 1 for POWER2DM System Release 1. This document is meant as a guide for demo videos and online content, which can be found via links and on the SharePoint project collaboration site:

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Finally, this document also contains a description of the Personal Data Model with links to online content of this component.

1.2 References to POWER2DM Documents

- POWER2DM Description of Work (Proposal)

1.3 Definitions, Abbreviations and Acronyms

Table 1 List of Abbreviations and Acronyms

Abbreviation/ Acronym	DEFINITION
APE	POWER2DM Action Plan Engine
Demo	Demonstrator video
SDMA	POWER2DM Shared Decision Making Application
SMSS	POWER2DM Self-Management Support System
PDS	Personal Data Model

2 DEMONSTRATORS PROTOTYPE 1

2.1 UC1 Patient registration – Patient registration application

2.1.1 New patient registration

Figure 1 shows the Patient Registration Form where a new patient can be registered into the system. A nurse enters the user data into the registration form and saves it to the system.

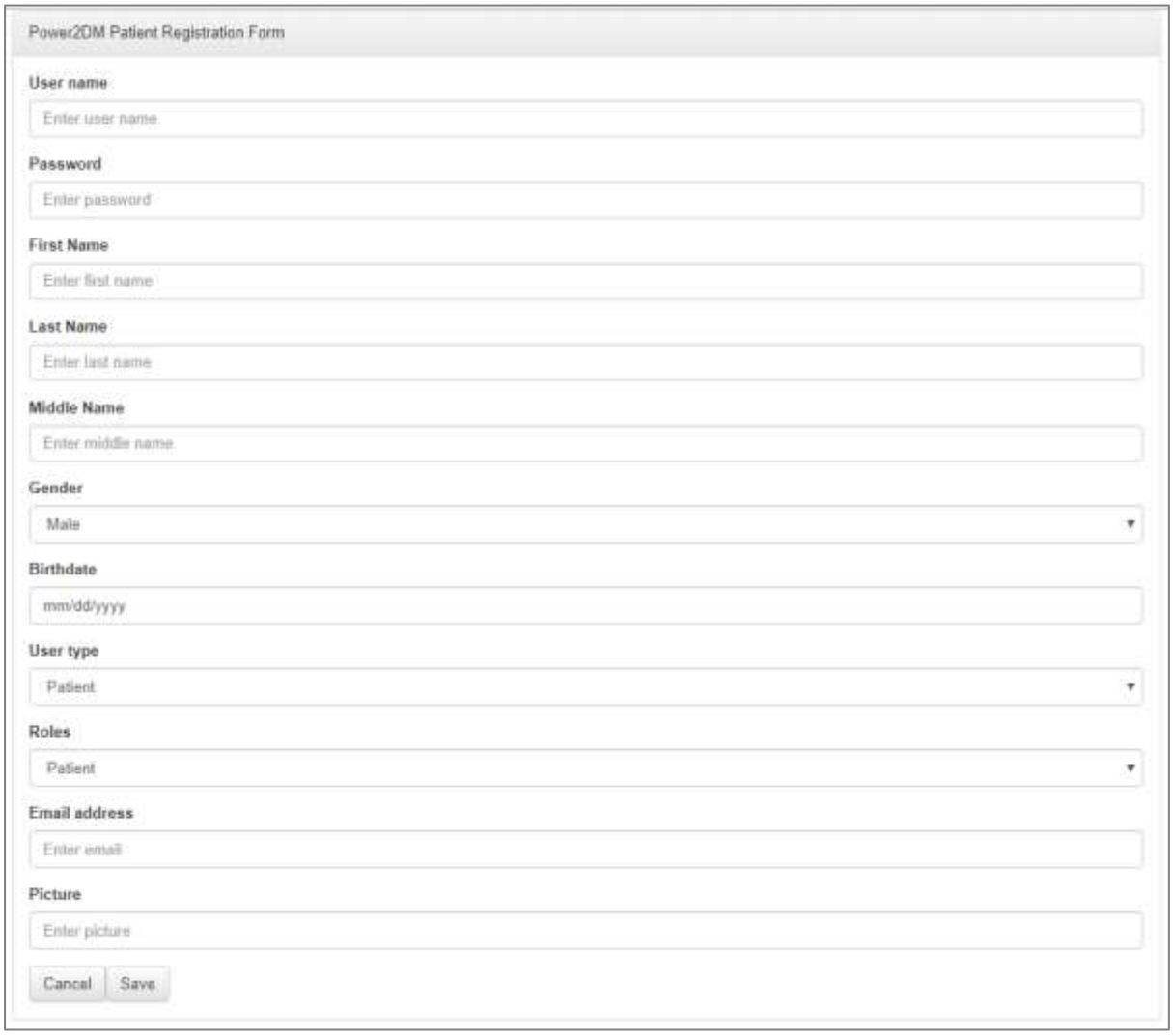

Figure 1, Patient Registration Form

2.1.2 Update patient registration

When the patient registration data of an existing patient registration needs to be updated, the Patient Registration Form can be accessed again and the patient information can be updated, apart from the user credentials. This is shown in Figure 2.

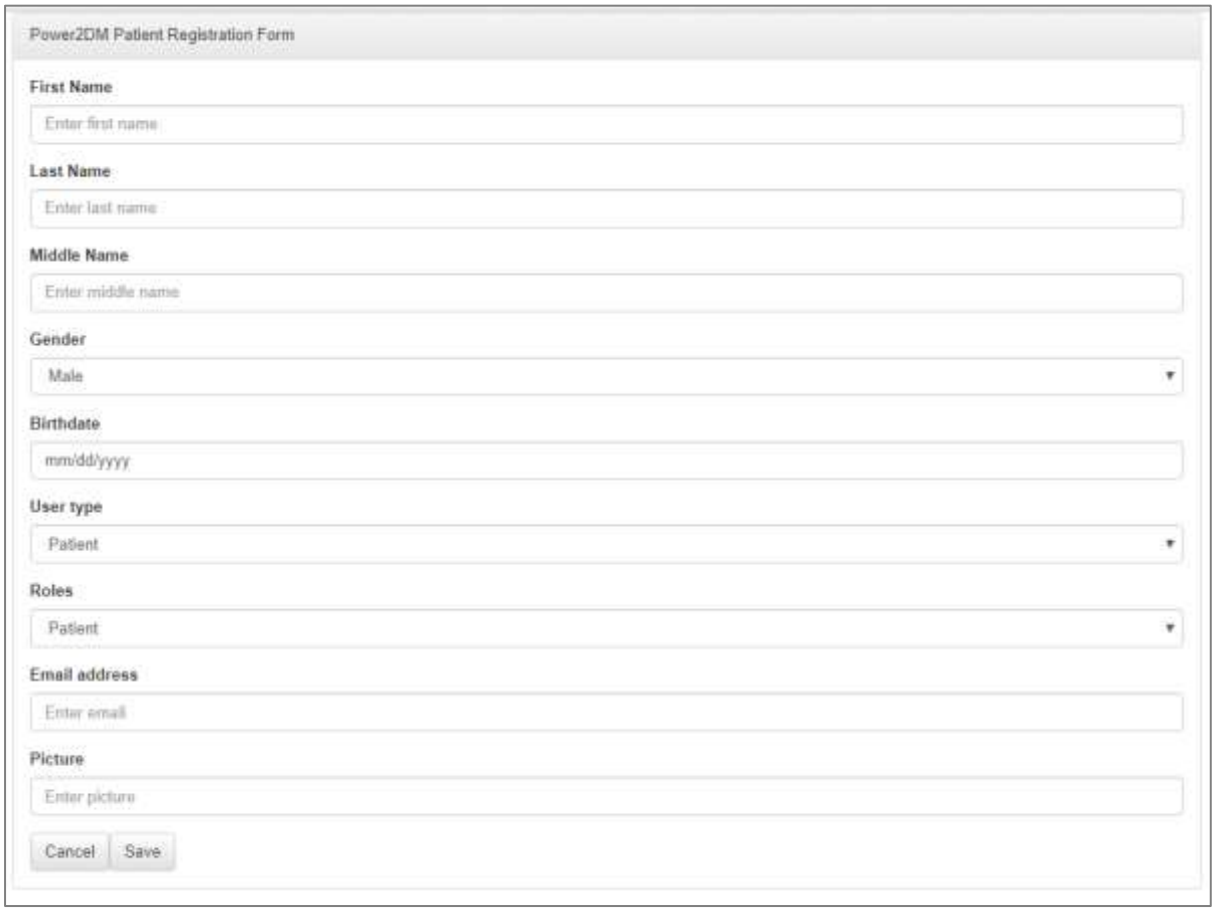

Figure 2, Update patient registration

2.2 UC3 Second patient visit: Treatment planning with KADIS simulation – SDMA

2.2.1 Patient Information Page

Figure 3, Patient Information page SDMA

This Patient Information page, shown in Figure 3, is the first page on which the physician will arrive after login on the SDMA and selecting a patient. The main goal is to have all relevant information available in a single overview so the physician, together with the patient, can make a quick health status assessment and decide which treatment to follow.

Some characteristics:

- The Profile panel will include basic patient information and will be re-used on all subsequent pages.
- The Blood Glucose Graph shows real time patient information.
- The Patient Compasses can currently be found on a separate page, but these will be included in this Patient Information Page screen later on.
- The Data Entry panel will be moved to a separate page later on. The data entry forms (currently found in modal screens, see Figure 4) can then be changed quickly.

Figure 4, Diabetes Anamnesis data entry form

2.2.2 Patient Compasses Page

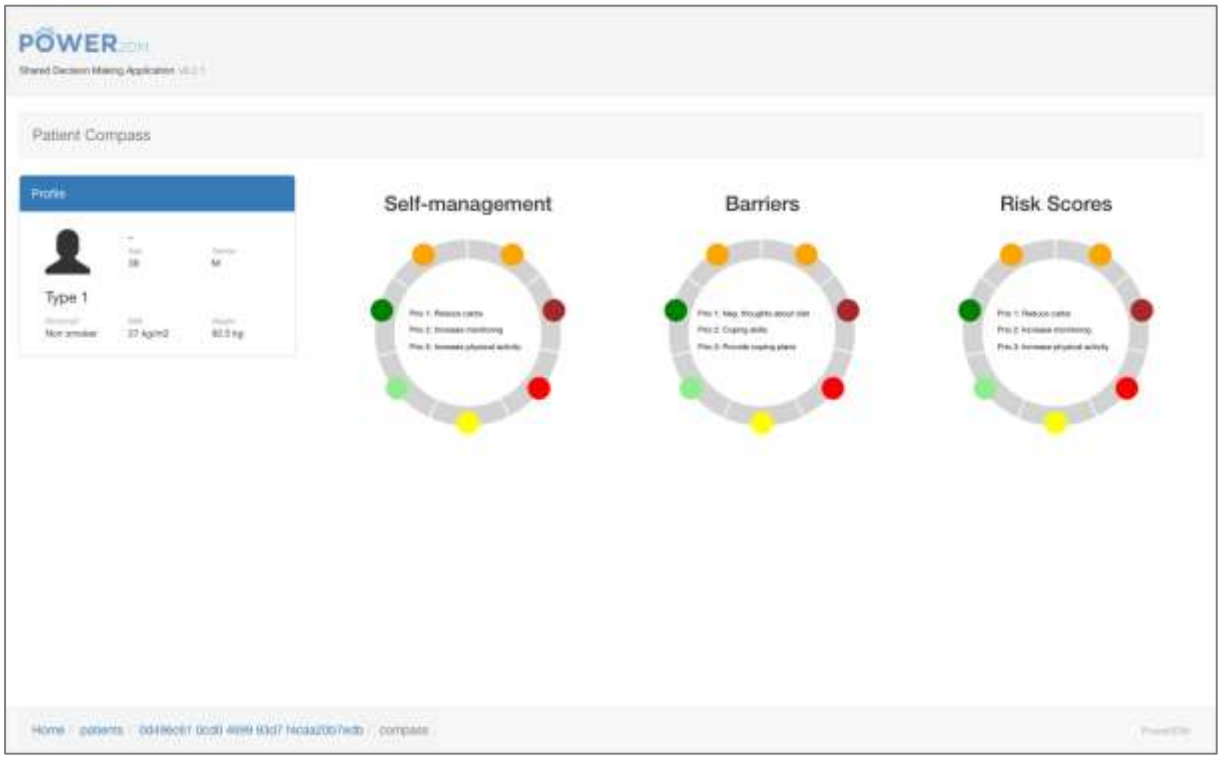

Figure 5, Patient Compasses page SDMA

This page, see Figure 5, currently contains examples of the three patient compasses. These compasses will be used to make a quick health status assessment of the patient. These will be moved to the Patient Information Page later on.

2.2.3 Blood Glucose Management Page

This Blood Glucose Management page, shown in Figure 6, shows all information related to the current blood glucose measurements and statistics, plus the latest related treatment plan (if any).

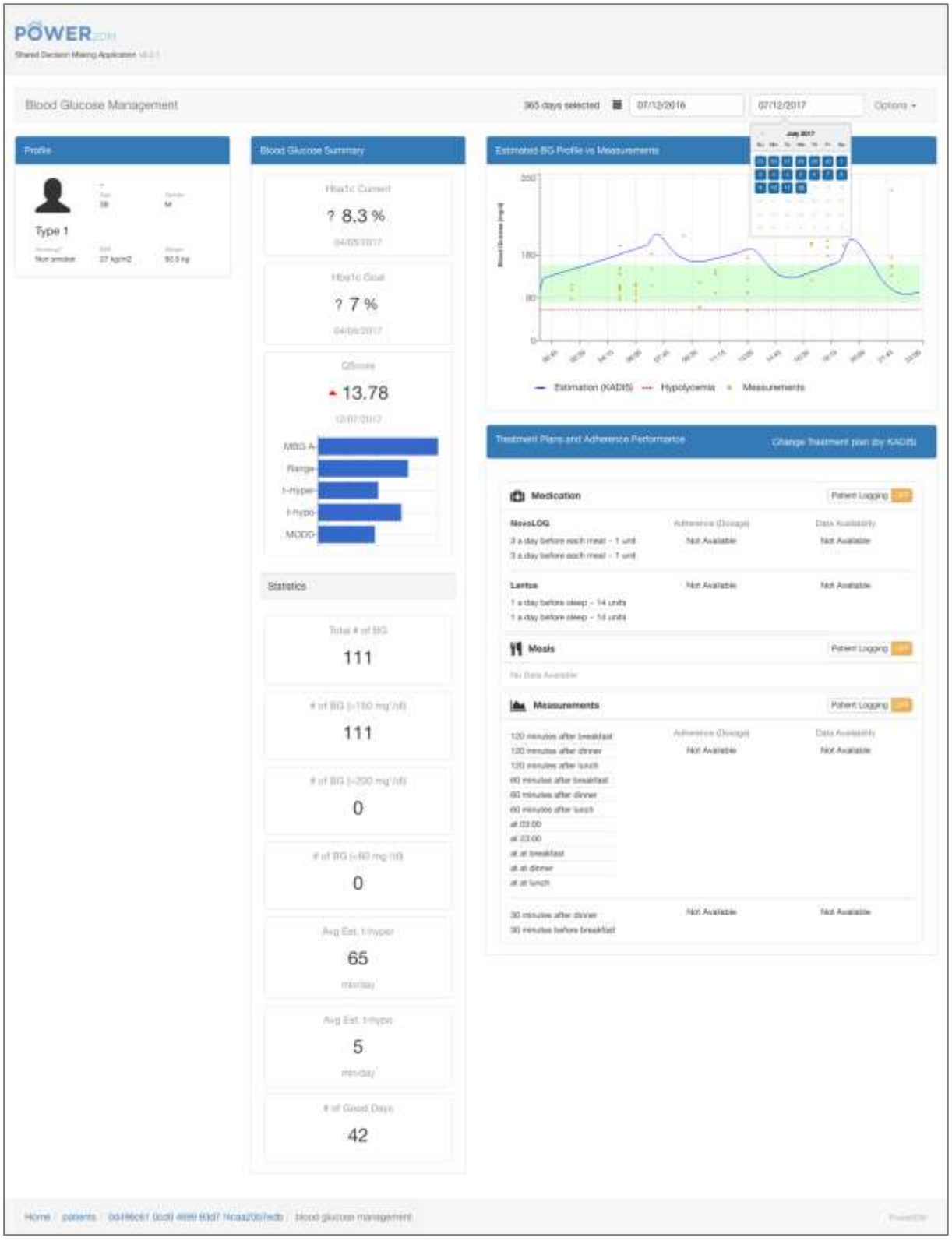

Figure 6, Blood Glucose Management page SDMA

The Blood Glucose Summary panel shows the current Hba1c value, and the Hba1c goal coupled with the current treatment plan. Also shown is the QScore (if available), which is a generalized prediction metric supplied by the KADIS simulation. Below that is a summary of all available statistics related to the self-management phase of the patient.

The Estimated BG Profile vs Measurements graph will show the latest blood glucose measurements and prediction if available. The physician can hover over the different parts of the graph to get more detailed information if needed.

Below is the Treatment Plans and Adherence Performance panel which shows a detailed summary of the current treatment plan, and blood glucose measurements. Clicking on 'Change Treatment Plan' will lead to the KADIS simulation page.

Currently this page shows information belonging to test patient ‘Simon’ which already has some treatments assigned. In the case of a preparation visit the ‘Treatment Plans and Adherence Performance’ panel will be empty and clicking on the ‘Change Treatment plan (by KADIS)’ will lead to the Treatment Planning page.

2.2.4 KADIS Treatment Planning Page

This KADIS Treatment Planning page, shown in Figure 7, shows the current treatment plan (if any), and the latest simulation graph. If no simulation is stored only the collected Blood Glucose values will be shown.

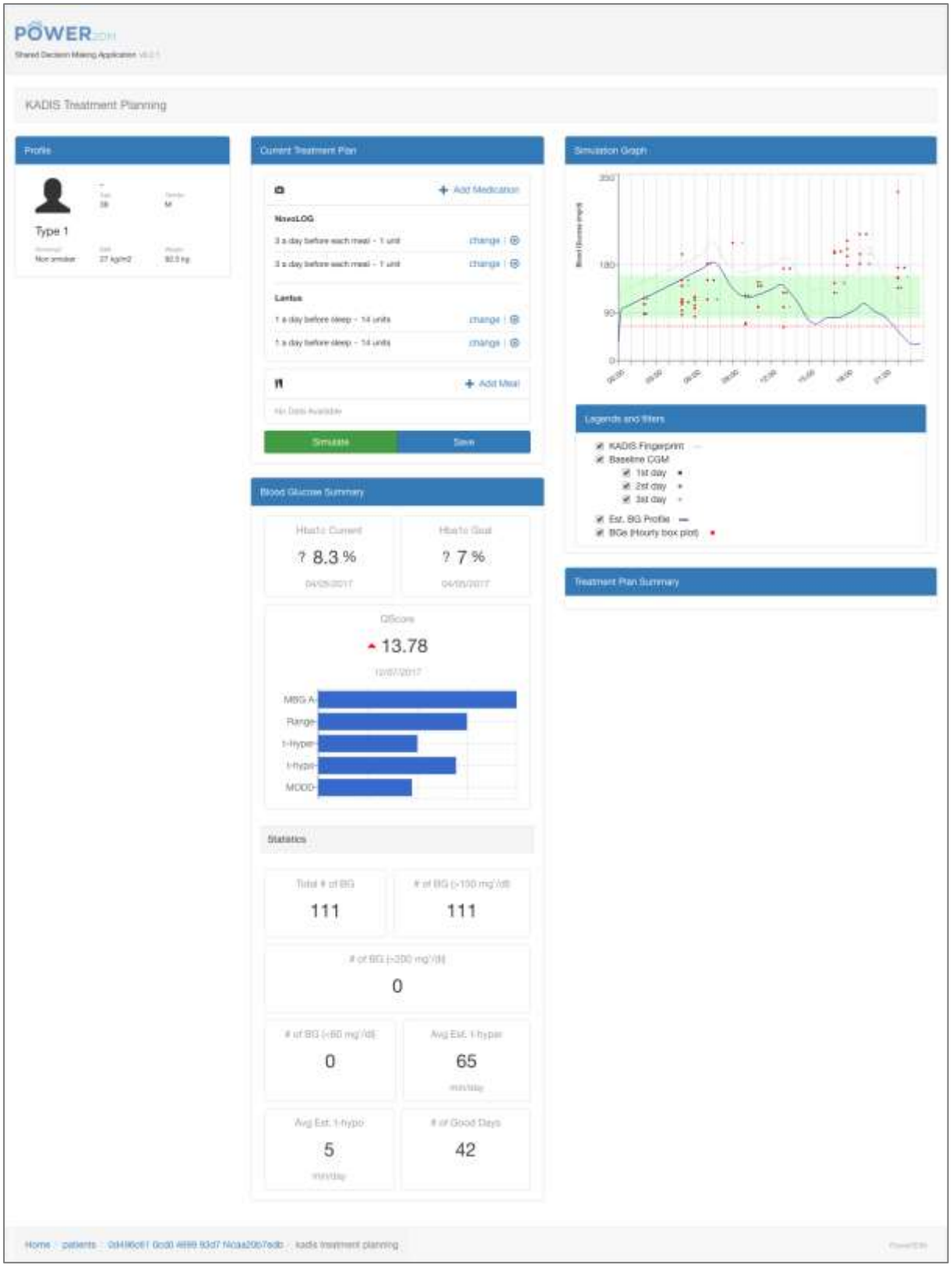

Figure 7, KADIS Treatment Planning page SDMA

The physician, together with the patient, will decide on a new treatment plan and run the KADIS simulation based on that. see Figure 8 for an example of the "Add Medication" modal. Running the simulation can be done multiple times until a satisfactory result is achieved which then can be stored

using the ‘Save’ button. The resulting treatment plan will then be visible in the Blood Glucose Management Page for review in a following patient visit.

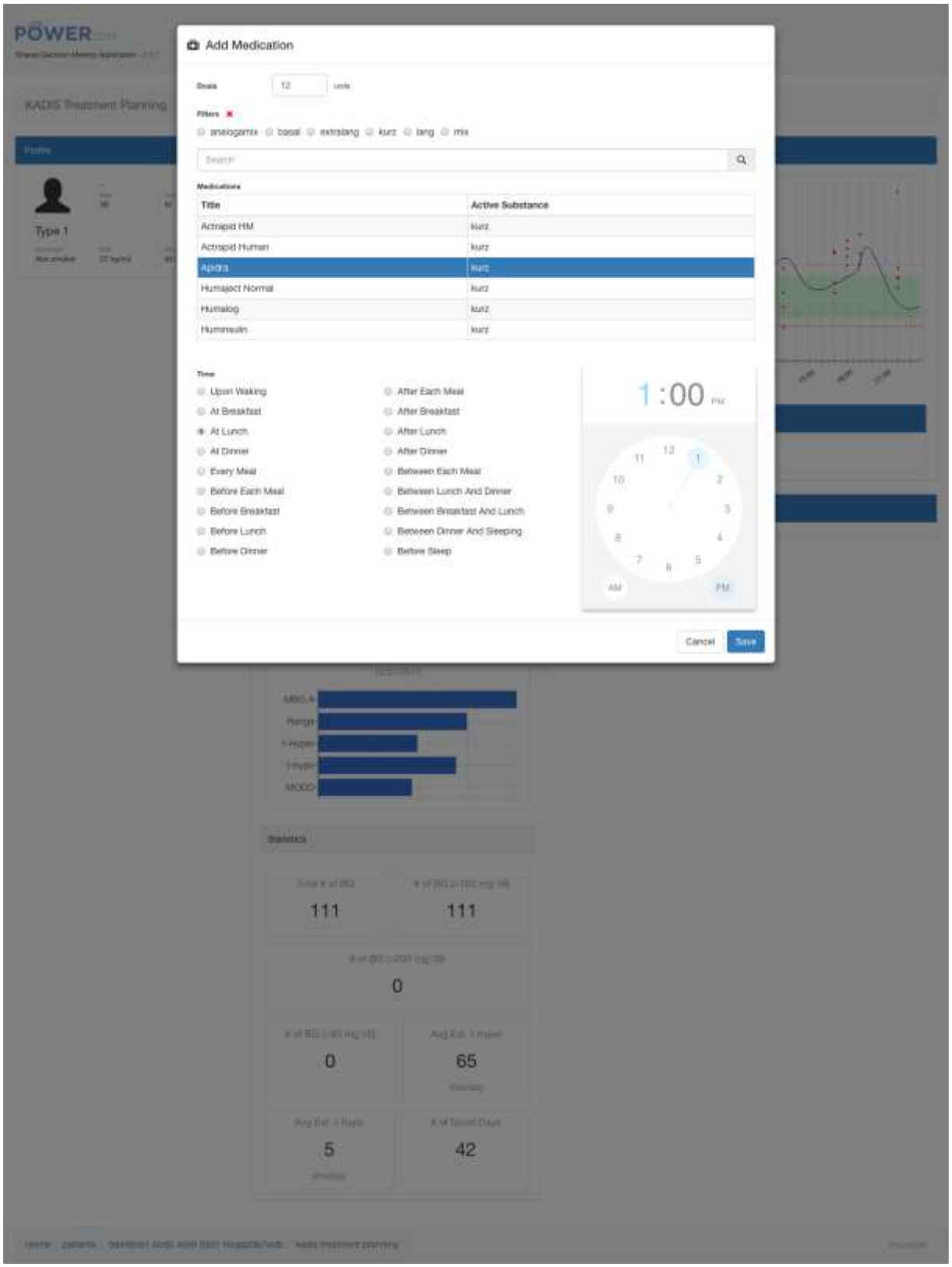

Figure 8, KADIS Treatment Planning modal

2.3 UC4 Look at treatment plan. Make patient goals and plans – SMSS web interface

2.3.1 Treatment Plan

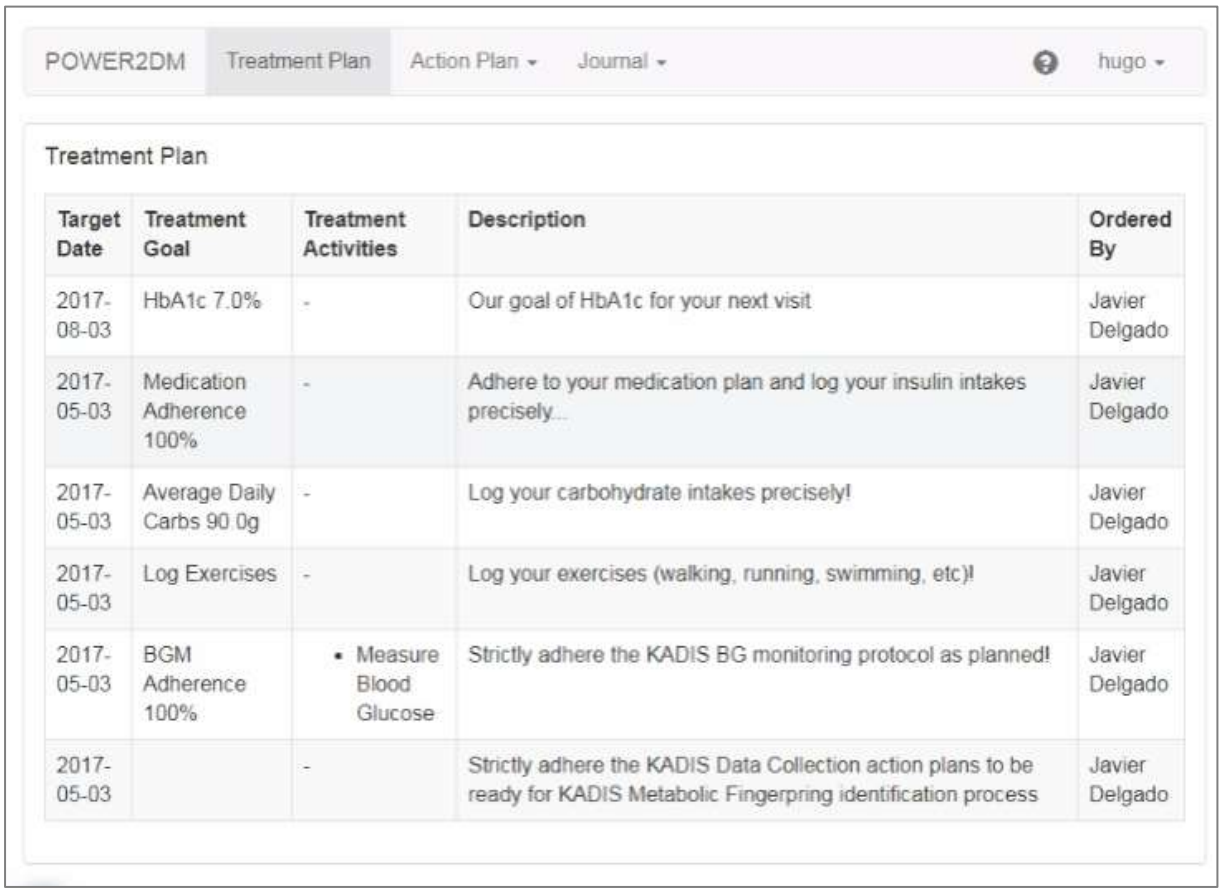

Figure 9, Treatment Plan in APE

Figure 9 presents the Treatment Plan imported into the Action Plan Engine. The patient can have a look at it and decide how to continue. He can either adopt treatment goals as self-management goals as there are specified by the doctor or he can specify the treatment goals in a more detailed way (e.g. specifying which type of exercise he actually will do). Additionally, the patient can also adopt treatment activities in his calendar (e.g. measure blood glucose).

2.3.2 Planning self-management goals

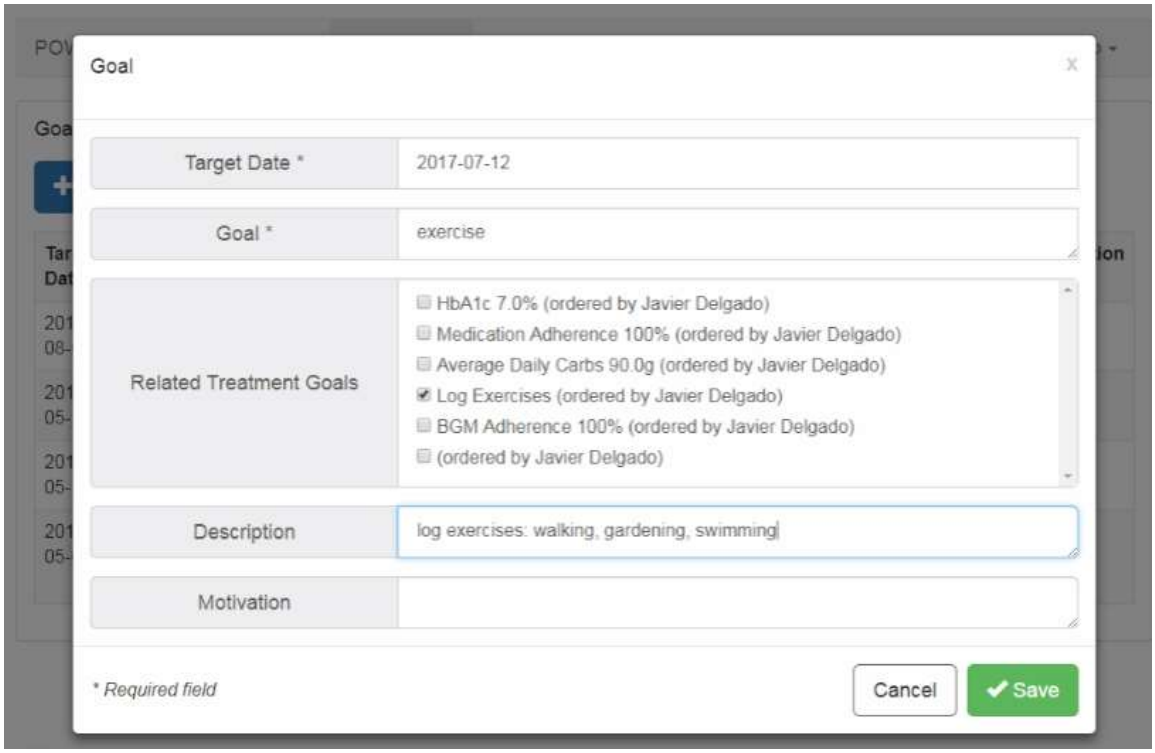

Figure 10, Planning self-management goals

The patient can also insert individual goals, so-called self-management goals as shown in Figure 10. He can relate such a self-management goal to a treatment goal if this applies. This is a reference why his individual goal is important and in the line with the treatment plan.

2.3.3 Planning activities

Next, the patient plans his activities for e.g. the upcoming week. Figure 11 demonstrates an example how to add an activity, namely scheduling a walking exercise on Wednesday and Friday.

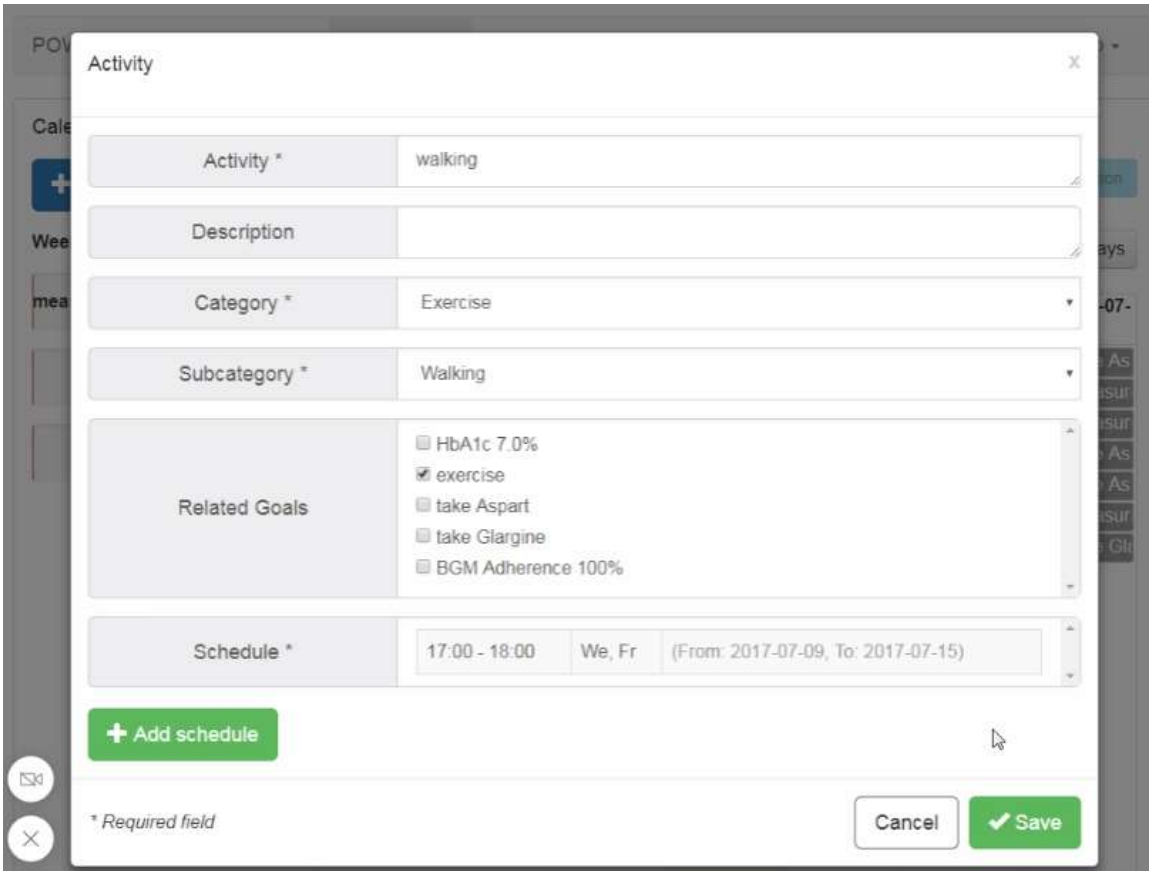

Figure 11, Planning activities

Figure 12 presents the calendar with scheduled activities. Actvities are marked “green” when they are completed, e.g. the user marked them as done. Actvities are marked “red” when they are not (yet) completed, e.g. the blood sugar values are not yet recorded. Actvities with a grey colour are upcoming activities.

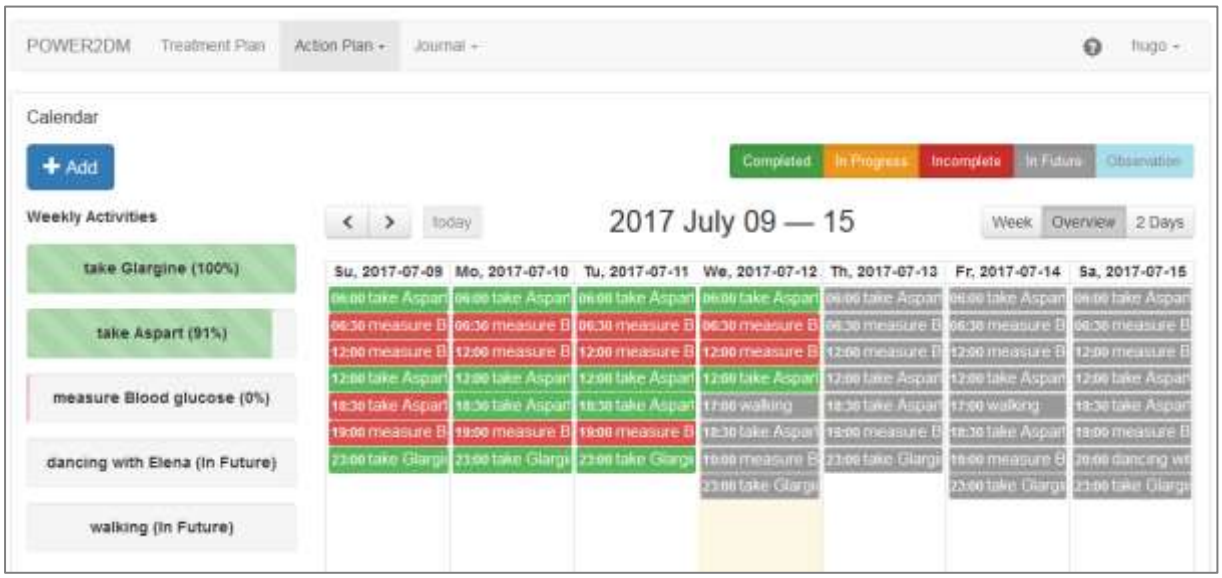

Figure 12, Calendar with planned activities

2.4 UC5 Look at glucose measurements (simulated) and demo the entire app – SMSS mobile application

The demo video of the SMSS mobile application shows a typical user logging into the app and using the main functionality.

2.4.1 Login and Dashboard

The login screen is shown in Figure 13.

Figure 13, SMSS mobile application – login screen

Once the user has been able to correctly log in, the app shows the main dashboard view. This is shown in Figure 14.

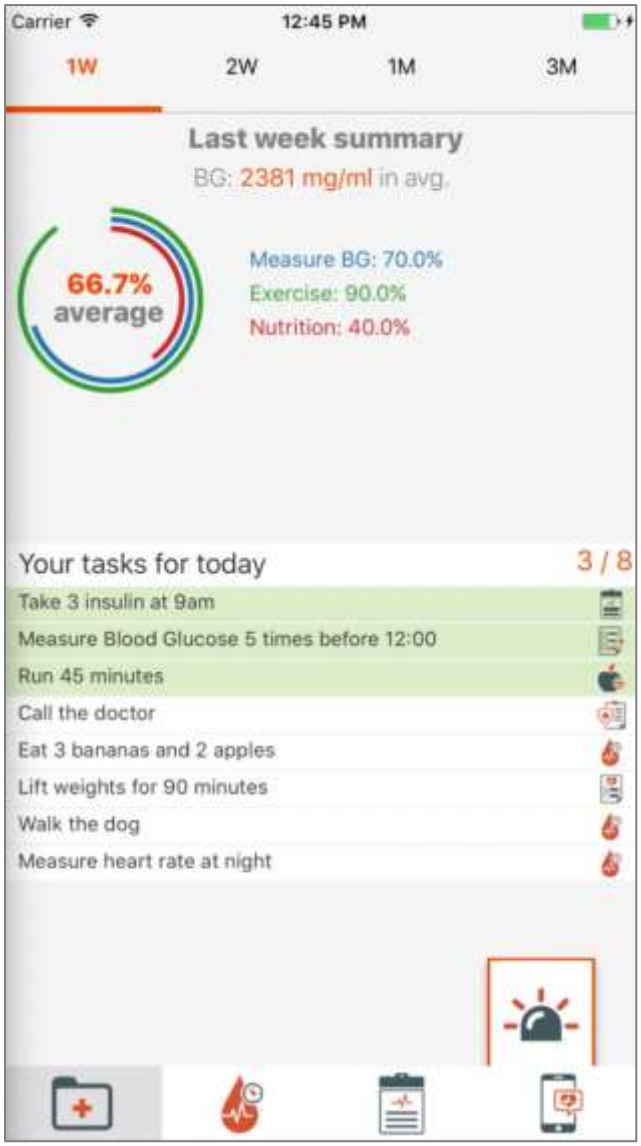

Figure 14, SMSS mobile application – dashboard

The dashboard shows week and month long time interval summaries, together with the main metrics of blood glucose, exercise and nutrition goals. Below the graph, today's tasks are being displayed.

2.4.2 Add measurement, view details and give feedback

The add measurement screen, shown in Figure 15, is where the user can log a measurement on a given date and time. The user can specify mood, stress level, blood glucose, exercise and other power2dm parameters.

Figure 15, SMSS mobile application – add measurement

In the demo video, the app for Android as well as the app for iOS are being demonstrated.

After saving the measurement the user is able to see the main summary of the saved measurement. This is shown in Figure 16.

Figure 16, SMSS mobile application – measurement details

In the main menu, which can be accessed through the button at the bottom right, the user can choose to send feedback about the application. The chat module shows up where the user can type or send images to the app support team.

2.4.3 Add food intake

The user can also add nutritional information to the measurement. This is shown in Figure 17.

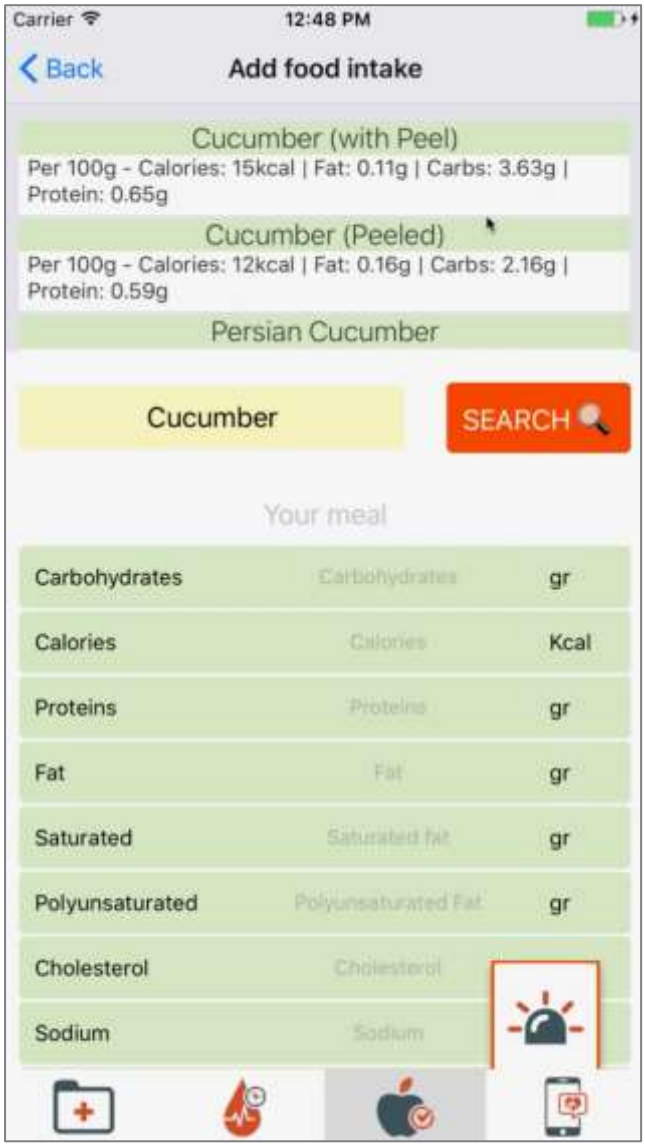

Figure 17, SMSS mobile application – add food intake

The user adds a specific food through a search interface and the nutritional summary is displayed. It is possible to create a meal by adding more than one food to a measurement.

2.4.4 Measurement diary

The diary screen, shown in Figure 18, displays all the saved measurements and it is possible to edit existing measurements in case the user made a mistake.

Figure 18, SMSS mobile application – measurement diary

2.4.5 Change password and logout

Through the settings screen (Figure 19) a user can modify their password and log out.

Figure 19, SMSS mobile application – settings screen

2.5 UC6 Look at weekly review and at barrier identification process – SMSS web interface

2.5.1 Periodic Review

The review is typically on a weekly basis but can also be biweekly or monthly or cover another time-period. The Review gives feedback based on the performance of planned versus completed activities. Depending on the degree of completion Interventions are suggested. That can be a motivational message, a specific tip how to improve a type of activity (in the screenshot for Blood Glucose) or e.g. a quiz as demonstrated in Figure 20 for the Overall Performance.

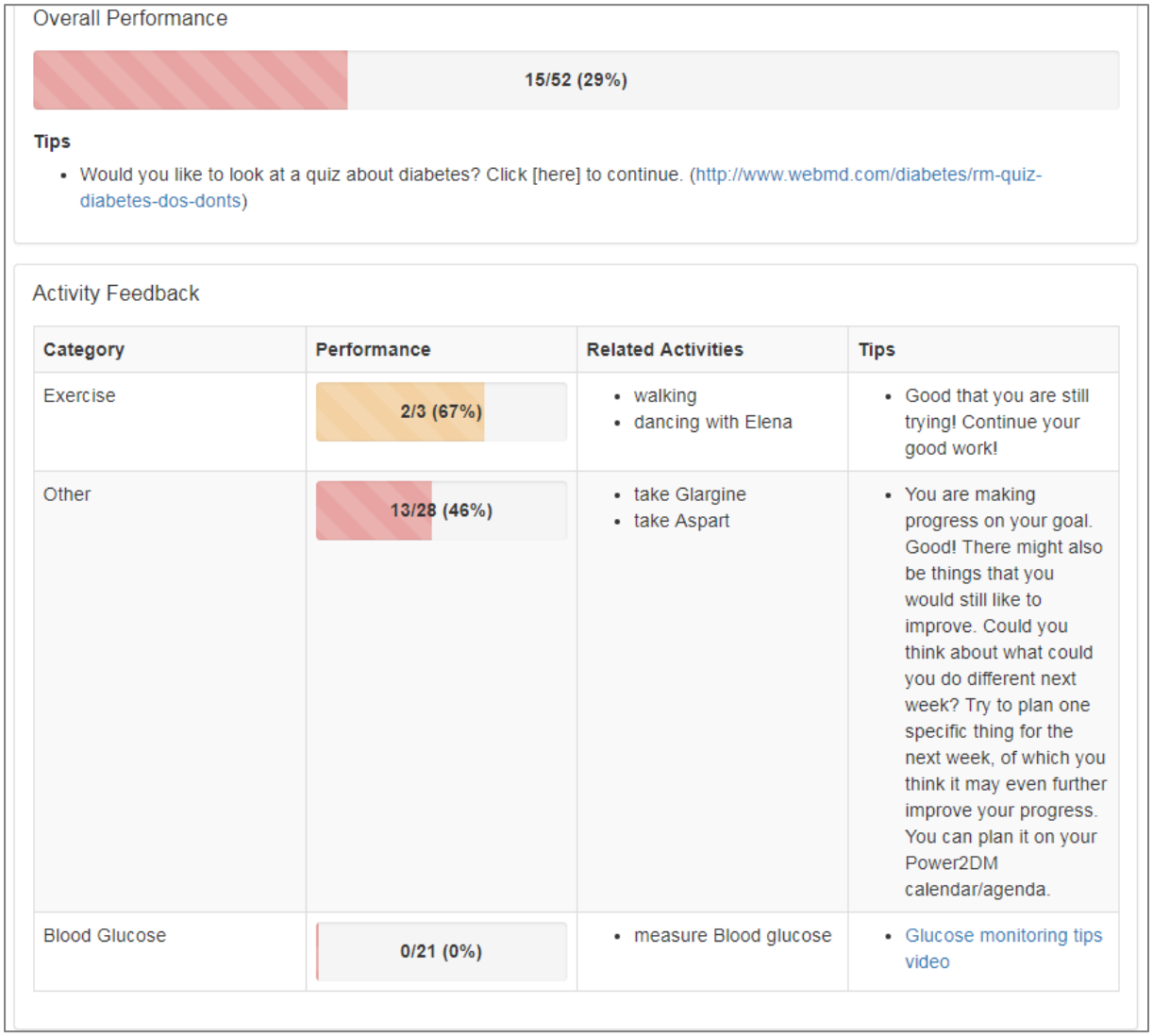

Figure 20, Periodic Review

2.5.2 Barrier Identification

Figure 21 presents the barrier decision tree for glucose monitoring. The patient selects that he monitors too little and that he doesn't like monitoring his glucose as his problem. POWER2DM suggest a website with information about "Diabetes Complications" as intervention.

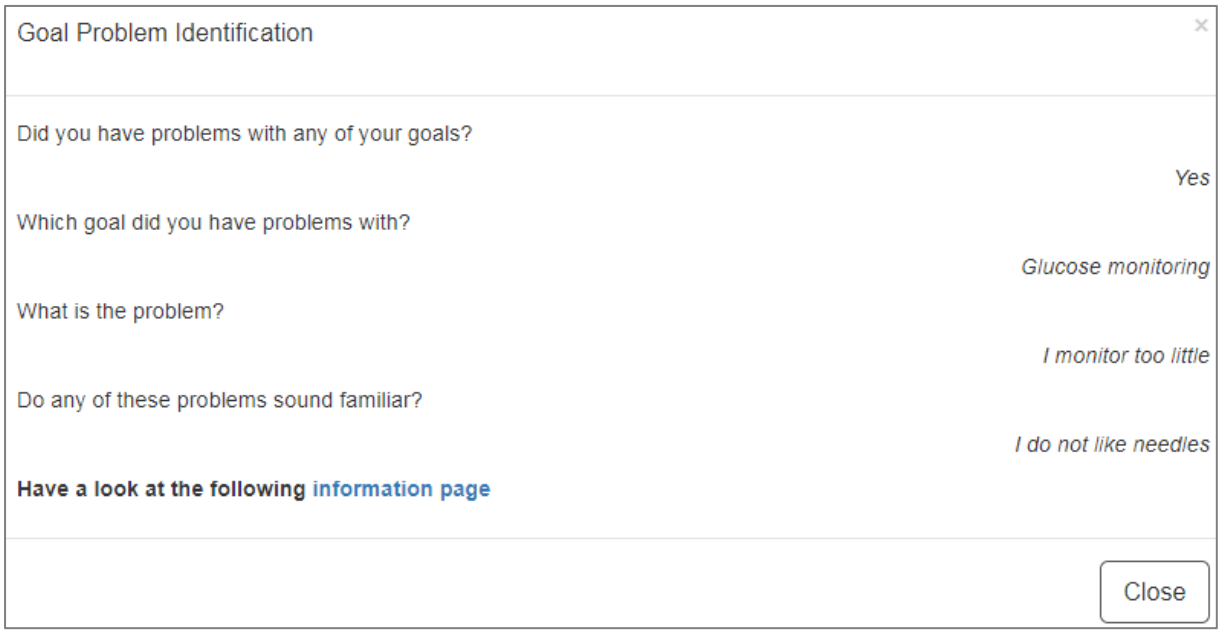

Figure 21, Barrier identification

2.6 POWER2DM Personal Data Model

This section contains information about the POWER2DM Personal Data Model (PDS) and links to online content to demonstrate this component. More information on the PDS and Service Implementation can be found in deliverable D4.2 Personal Data Store Service Implementation.

All POWER2DM resource and data type profile definitions and search parameter definitions are pulished to Simplifier.net[1] which is a public repository for FHIR resource definitions and related projects. You can access the profile definitions from https://simplifier.net/POWER2DM?category=StructureDefinition . Similarly you can access the search parameter definitions from https://simplifier.net/POWER2DM?category=SearchParameter.

[1] https://simplifier.net

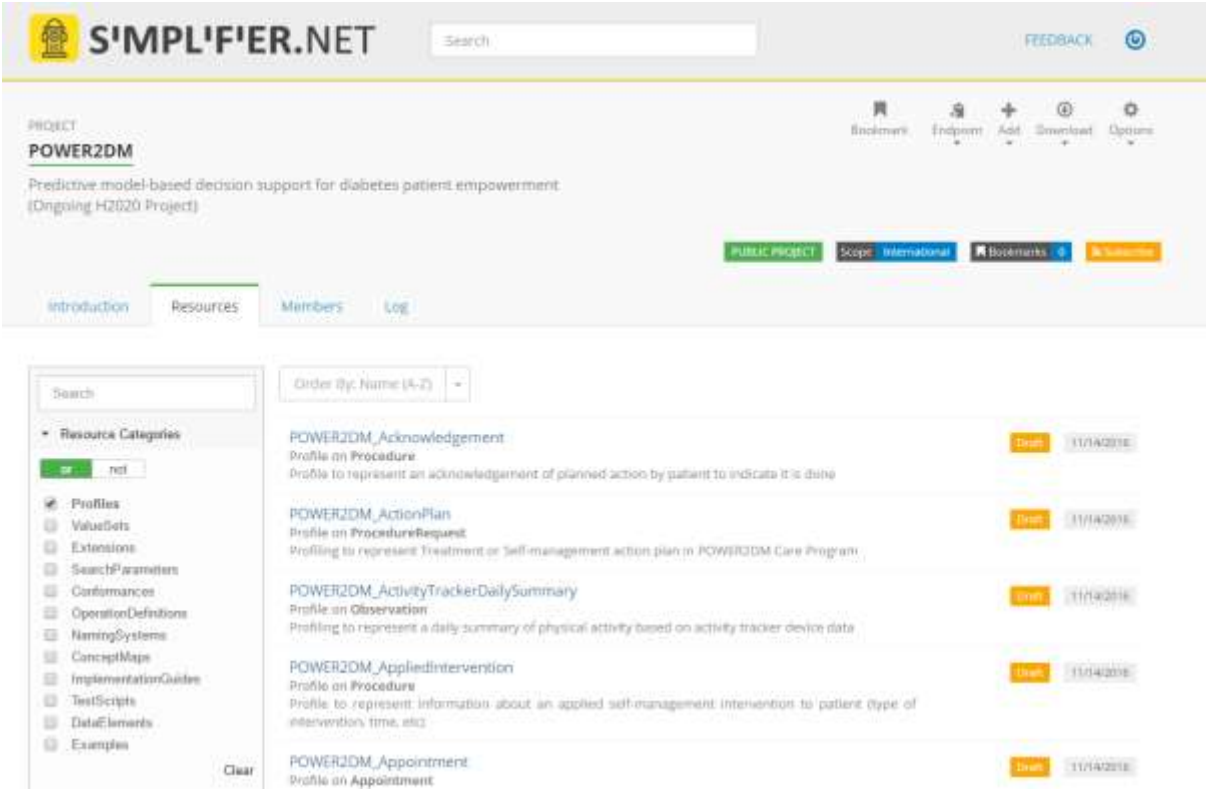

Figure 22, Snapshot from Simplifier.net POWER2DM model publications page

PDS configurations and the standalone application of onFHIR.io is packaged as a project and it is served from the Gitlab repositories; http://gitlab.srdc.com.tr/power2dm/pds, https://scm.primevisiononline.com/projects/horizon-2020_power2dm/repository/pds (please contact tuncay@srdc.com.tr for access to the PDS setup).

PDS is deployed on our cloud for demonstration and as testing environment for other partners. The main URL for the repository is http://app.srdc.com.tr/power2dm/pds. You can access the FHIR Conformance (Capability) statement from http://app.srdc.com.tr/power2dm/pds/metadata.
You can run the following example queries on PDS to access patient data (sample data). Use your browser or a Restfull client application (e.g. Postman)

- To list all patients -> http://app.srdc.com.tr/power2dm/pds/Patient
- Blood glucose measurements of a patient (with id 09bcb899-4520-4701-afab-0b3fbdc06b8f) http://app.srdc.com.tr/power2dm/pds/Patient/09bcb899-4520-4701-afab-0b3fbdc06b8f/Observation?code=http://loinc.org|41653-7&_count=2 (**Error! Reference source not found.**)
- Risk assessments (UKPDS) and KADIS and MARVEL predictions for a patient http://app.srdc.com.tr/power2dm/pds/Patient/09bcb899-4520-4701-afab-0b3fbdc06b8f/RiskAssessment

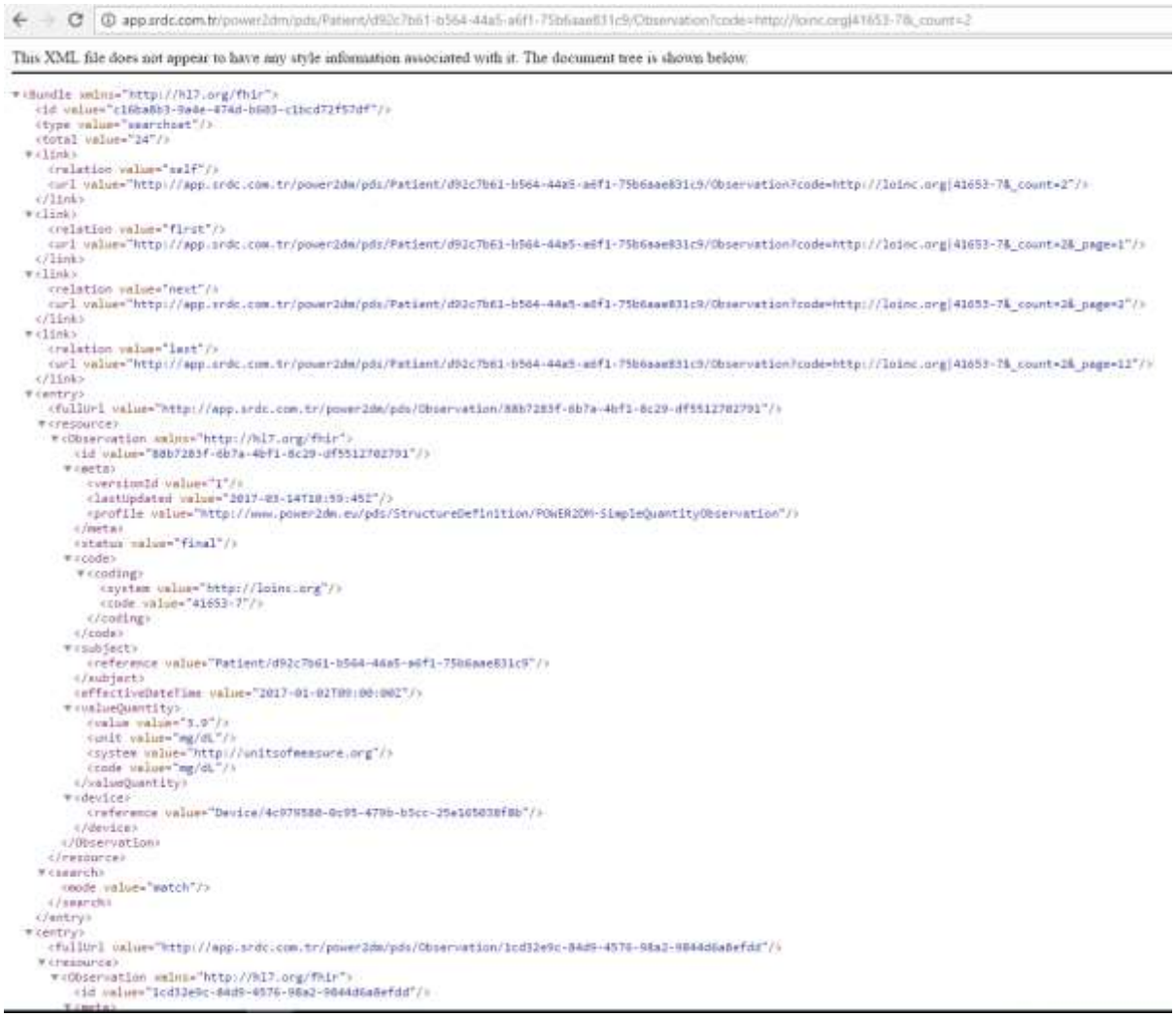

Figure 23, Sample query and result from browser for blood glucose measurements

We have tested the PDS repository for FHIR compliance with two different online testing environment designed to test FHIR conformance. From one of the environments, Crucible, which we have a continuous testing integration, you can see the results from https://projectcrucible.org/#homepageCarousel. **Error! Reference source not found.** illustrates onFHIR.io's compliance performance on the other testing environment called Touchstone (results are not publicly available for this one) (https://touchstone.aegis.net/touchstone/).

Figure 24, FHIR compliance test results on Touchstone testing environment