



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)

Workpackage: WP 1
Task: T 1.4
Due Date: 31st May 2017 (M16)
Actual Submission Date: 20th July 2017 (M18)
Last Amendment: 20th July 2017
Project Dates: Project Start Date: February 01, 2016
Project End Date: July 31, 2019
Project Duration: 42 months
Deliverable Leader: Prime Data

Project co-funded by the European Commission within H2020 Programme (20015-2016)		
Dissemination Level		
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://365mo.sharepoint.com/teams/pdm/EU%20project%20reviews/D1.5%20\(D1.4.2.a\)%20Demo%20movies%20for%20Prototype%20and%20Integrated%20POWER2DM%20System%20Releases%20I](https://365mo.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

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1 INTRODUCTION

1.1 Purpose and Scope

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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

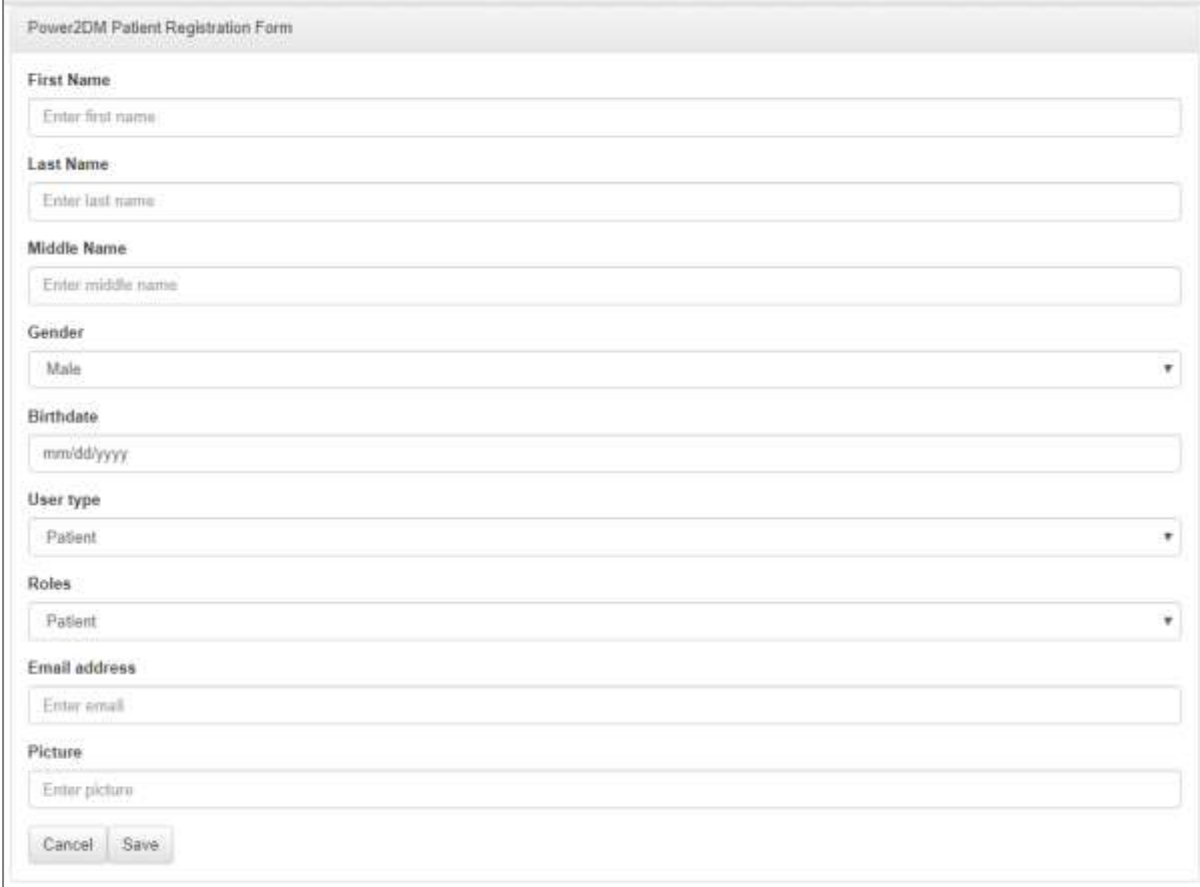
Figure 1 shows the Patient Registration Form where a new patient can be registered into the system. A nurse enters the user data into the registration form and saves it to the system.

The screenshot shows a web form titled "Power2DM Patient Registration Form". The form is organized into several sections, each with a label and a corresponding input field or dropdown menu. The fields are: "User name" (text input), "Password" (text input), "First Name" (text input), "Last Name" (text input), "Middle Name" (text input), "Gender" (dropdown menu with "Male" selected), "Birthdate" (text input with placeholder "mm/dd/yyyy"), "User type" (dropdown menu with "Patient" selected), "Roles" (dropdown menu with "Patient" selected), "Email address" (text input), and "Picture" (text input). At the bottom of the form, there are two buttons: "Cancel" and "Save".

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.



The screenshot shows a web form titled "Power2DM Patient Registration Form". The form contains the following fields and controls:

- First Name:** A text input field with the placeholder text "Enter first name".
- Last Name:** A text input field with the placeholder text "Enter last name".
- Middle Name:** A text input field with the placeholder text "Enter middle name".
- Gender:** A dropdown menu with "Male" selected.
- Birthdate:** A text input field with the placeholder text "mm/dd/yyyy".
- User type:** A dropdown menu with "Patient" selected.
- Roles:** A dropdown menu with "Patient" selected.
- Email address:** A text input field with the placeholder text "Enter email".
- Picture:** A text input field with the placeholder text "Enter picture".
- Buttons:** "Cancel" and "Save" buttons located at the bottom left of the form.

Figure 2, Update patient registration

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

2.2.1 Patient Information Page

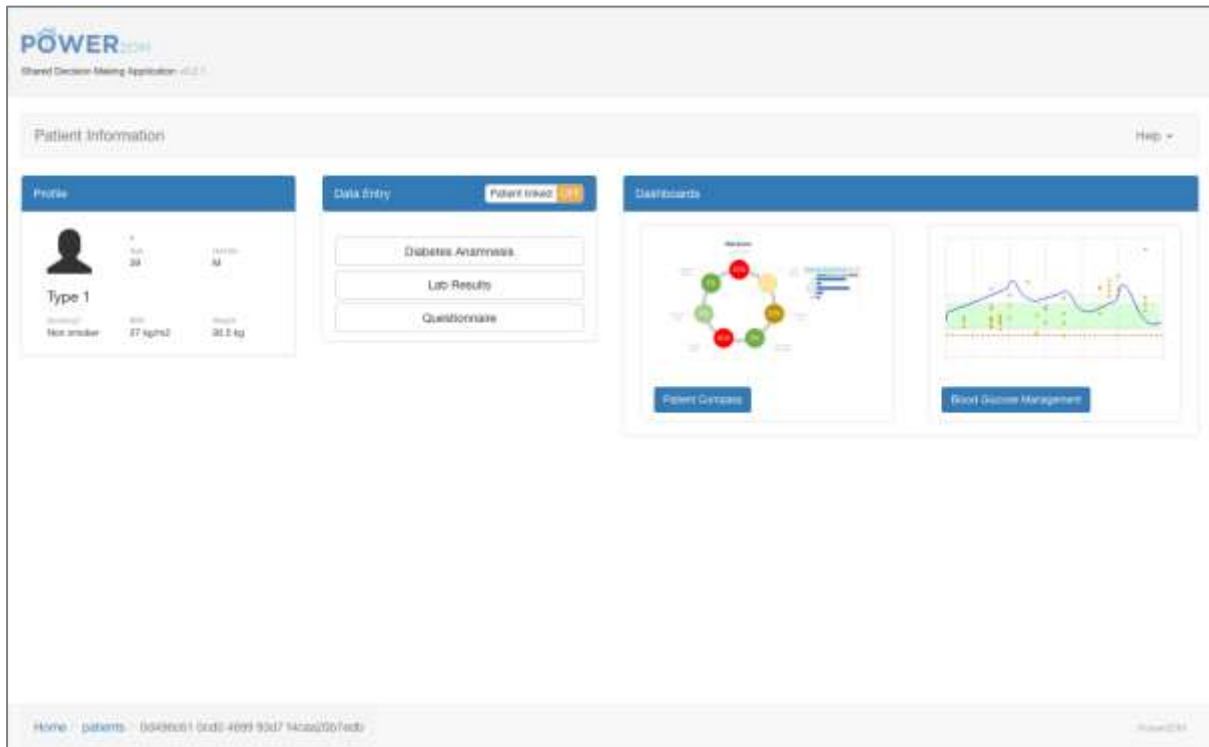


Figure 3, Patient Information page SDMA

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.

Diabetes Anamnesis

Age: 39

Gender: Male Female

Height: 180 cm

Type Diabetes: T1DM T2DM

Weight: 75 kg
Weight and BMI calculated from Weight will be reassessed at the end of Phase 1 and Phase 2.

Waist: 80 cm

BMI: 23 kg/m²
Weight and BMI calculated from Weight will be reassessed at the end of Phase 1 and Phase 2.

Waist-Hip Ratio: 1

Systolic Blood Pressure: 125 mm Hg (Blood pressure will be reassessed at the end of Phase 1 and Phase 2)

Diastolic Blood Pressure: 80 mm Hg (Blood pressure will be reassessed at the end of Phase 1 and Phase 2)

Reason to start POWER2DM

Illness History

Figure 4, Diabetes Anamnesis data entry form

2.2.2 Patient Compasses Page

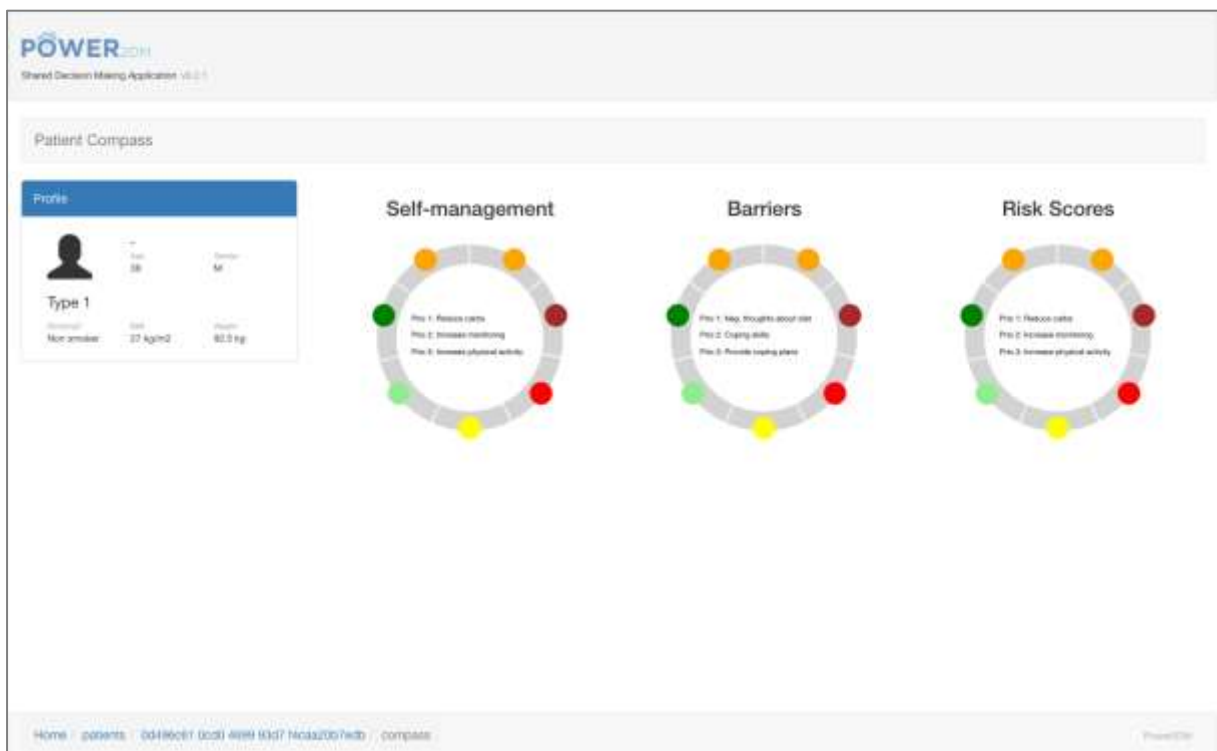


Figure 5, Patient Compasses page SDMA

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).

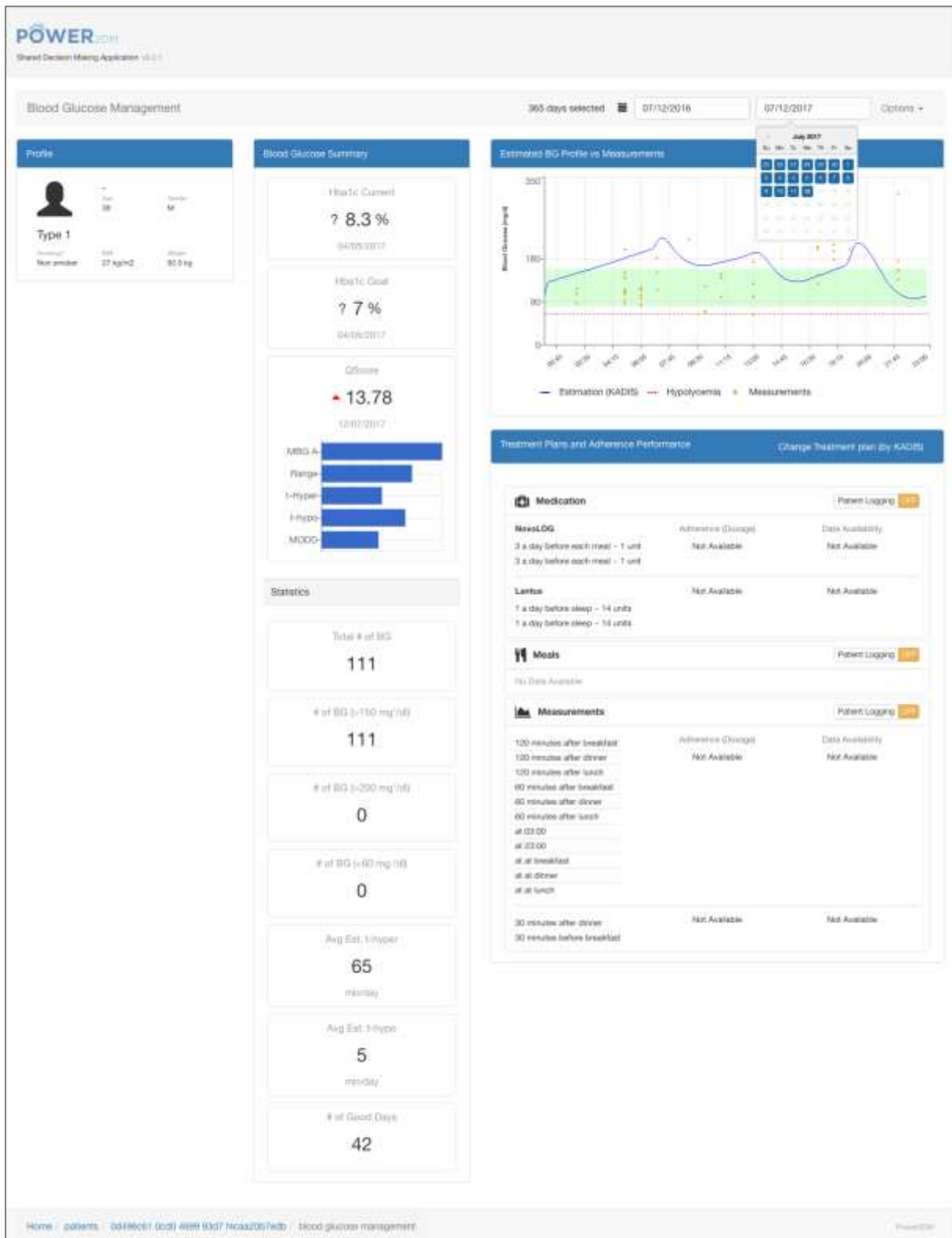


Figure 6, Blood Glucose Management page SDMA

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.

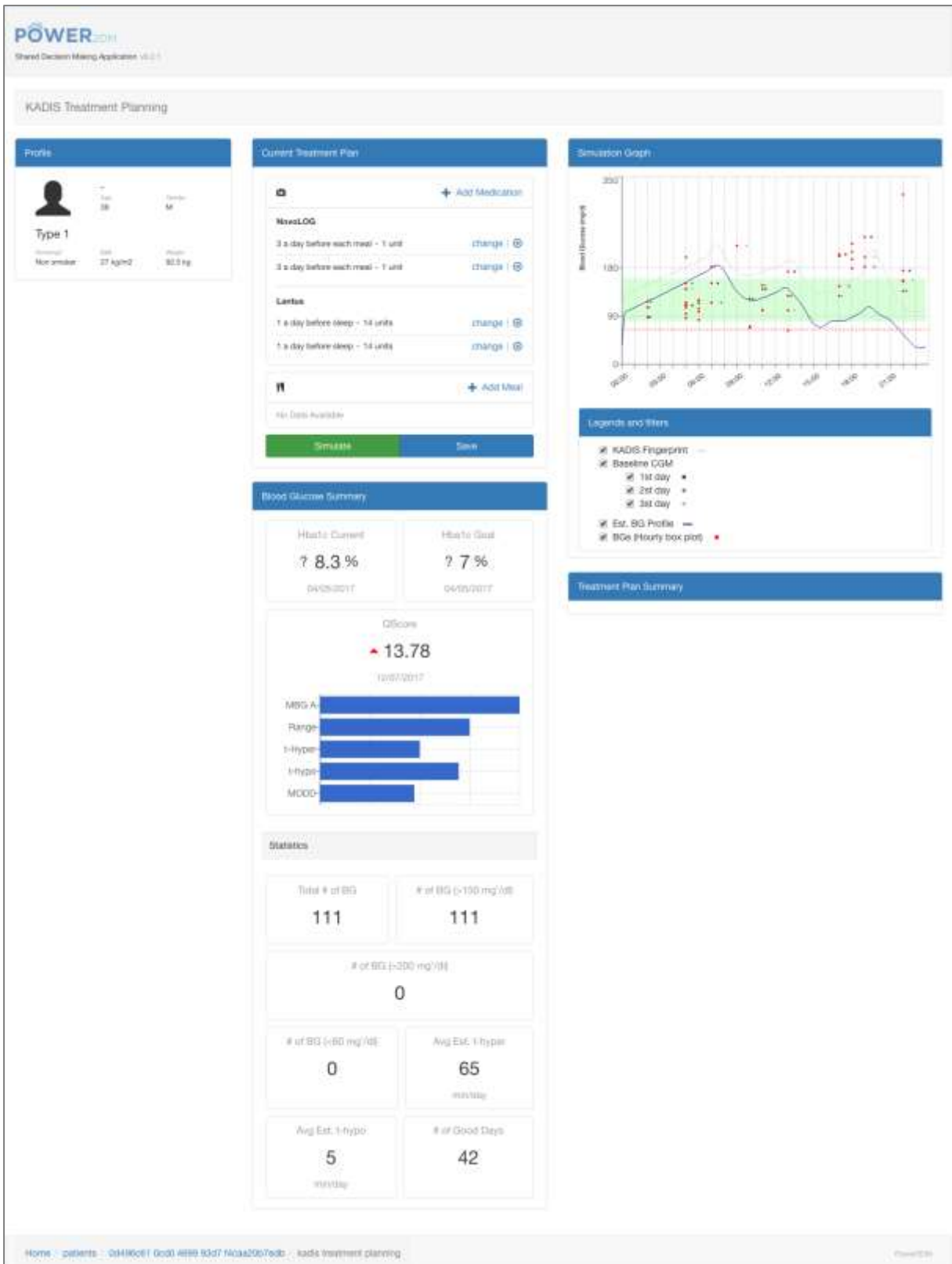


Figure 7, KADIS Treatment Planning page SDMA

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.

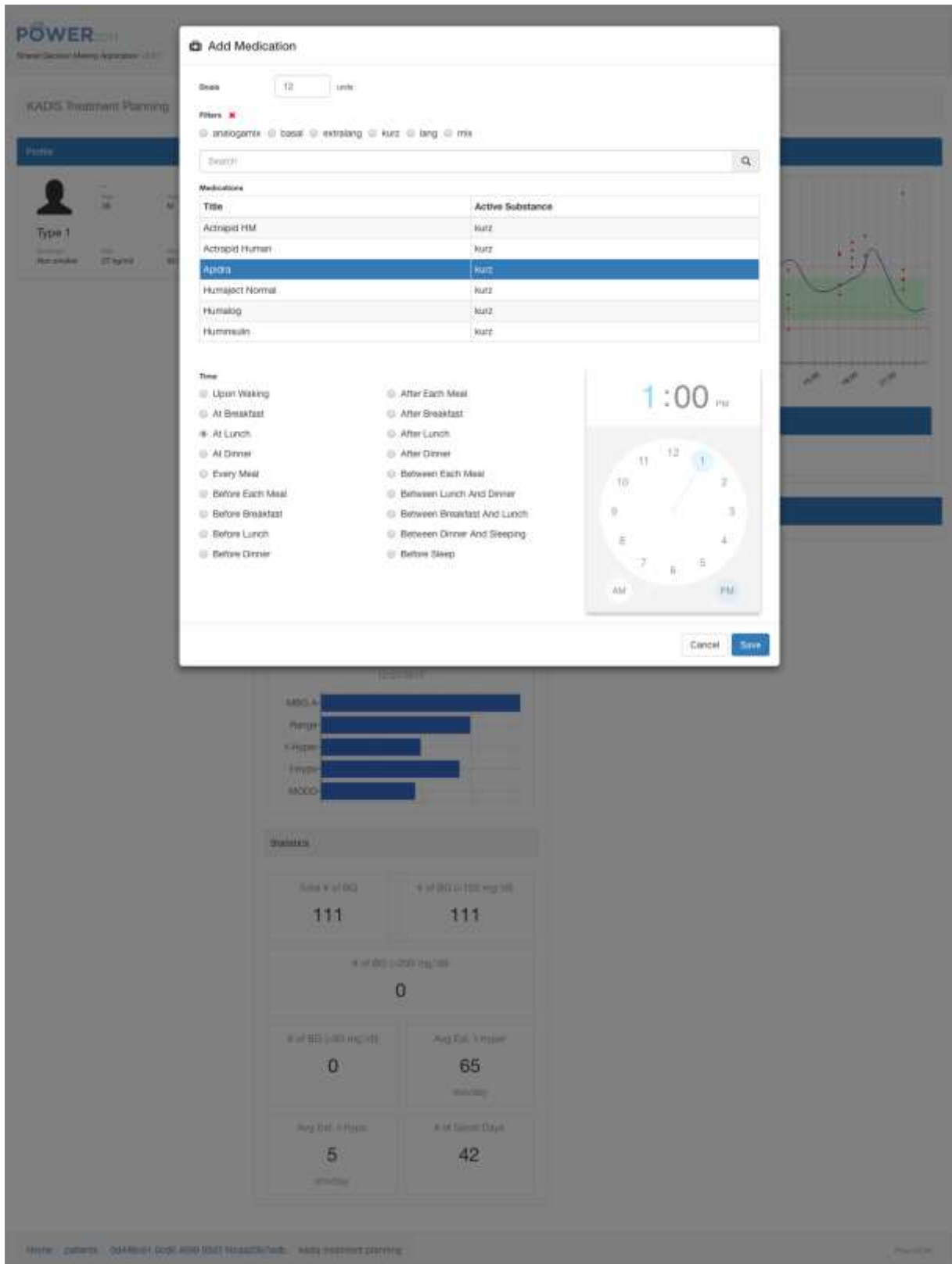
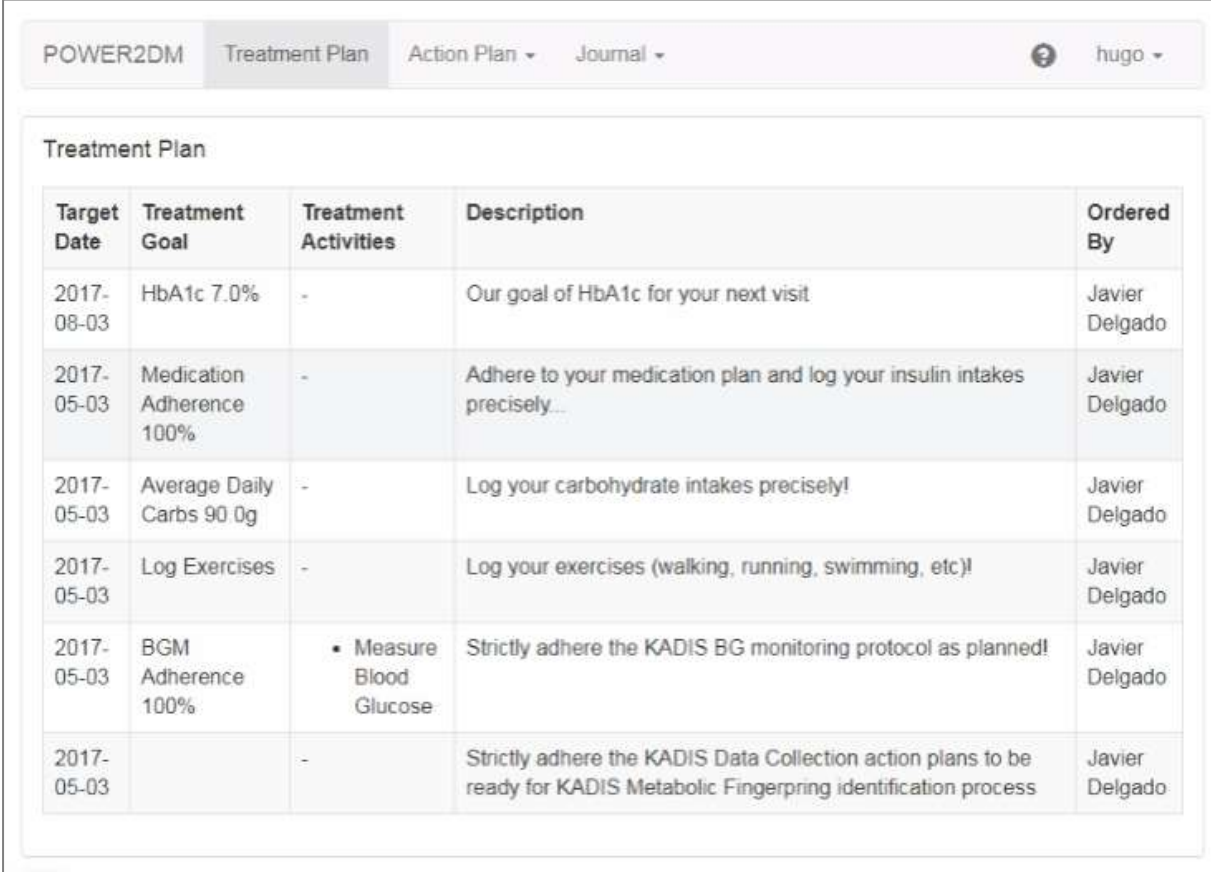


Figure 8, KADIS Treatment Planning modal

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

2.3.1 Treatment Plan



The screenshot shows the POWER2DM web interface with a navigation bar at the top containing 'POWER2DM', 'Treatment Plan', 'Action Plan', and 'Journal'. A user profile 'hugo' is visible in the top right. Below the navigation bar, the 'Treatment Plan' section is displayed as a table with the following data:

Target Date	Treatment Goal	Treatment Activities	Description	Ordered By
2017-08-03	HbA1c 7.0%	-	Our goal of HbA1c for your next visit	Javier Delgado
2017-05-03	Medication Adherence 100%	-	Adhere to your medication plan and log your insulin intakes precisely...	Javier Delgado
2017-05-03	Average Daily Carbs 90.0g	-	Log your carbohydrate intakes precisely!	Javier Delgado
2017-05-03	Log Exercises	-	Log your exercises (walking, running, swimming, etc)!	Javier Delgado
2017-05-03	BGM Adherence 100%	<ul style="list-style-type: none">• Measure Blood Glucose	Strictly adhere the KADIS BG monitoring protocol as planned!	Javier Delgado
2017-05-03		-	Strictly adhere the KADIS Data Collection action plans to be ready for KADIS Metabolic Fingerprinting identification process	Javier Delgado

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

The screenshot shows a 'Goal' planning window with the following fields and content:

- Target Date ***: 2017-07-12
- Goal ***: exercise
- Related Treatment Goals**:
 - HbA1c 7.0% (ordered by Javier Delgado)
 - Medication Adherence 100% (ordered by Javier Delgado)
 - Average Daily Carbs 90.0g (ordered by Javier Delgado)
 - Log Exercises (ordered by Javier Delgado)
 - BGM Adherence 100% (ordered by Javier Delgado)
 - (ordered by Javier Delgado)
- Description**: log exercises: walking, gardening, swimming
- Motivation**: (empty)

At the bottom right, there are 'Cancel' and 'Save' buttons. A note at the bottom left states '* Required field'.

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.

Activity

Activity * walking

Description

Category * Exercise

Subcategory * Walking

Related Goals

- HbA1c 7.0%
- exercise
- take Aspart
- take Glargine
- BGM Adherence 100%

Schedule * 17:00 - 18:00 We, Fr (From: 2017-07-09, To: 2017-07-15)

+ Add schedule

* Required field

Cancel Save

Figure 11, Planning activities

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

POWER2DM Treatment Plan Action Plan Journal Hugo

Calendar

+ Add

Completed In Progress Incomplete In Future Observable

Weekly Activities

- take Glargine (100%)
- take Aspart (91%)
- measure Blood glucose (0%)
- dancing with Elena (In Future)
- walking (In Future)

Su, 2017-07-09	Mo, 2017-07-10	Tu, 2017-07-11	We, 2017-07-12	Th, 2017-07-13	Fr, 2017-07-14	Sa, 2017-07-15
06:00 take Aspart	06:00 take Aspart	06:00 take Aspart	06:00 take Aspart	06:00 take Aspart	06:00 take Aspart	06:00 take Aspart
06:30 measure B	06:30 measure B	06:30 measure B	06:30 measure B	06:30 measure B	06:30 measure B	06:30 measure B
12:00 measure B	12:00 measure B	12:00 measure B	12:00 measure B	12:00 measure B	12:00 measure B	12:00 measure B
12:00 take Aspart	12:00 take Aspart	12:00 take Aspart	12:00 take Aspart	12:00 take Aspart	12:00 take Aspart	12:00 take Aspart
18:30 take Aspart	18:30 take Aspart	18:30 take Aspart	17:00 walking	18:30 take Aspart	17:00 walking	18:30 take Aspart
19:00 measure B	19:00 measure B	19:00 measure B	18:30 take Aspart	19:00 measure B	19:00 take Aspart	19:00 measure B
23:00 take Glargi	23:00 take Glargi	23:00 take Glargi	19:00 measure B	23:00 take Glargi	19:00 measure B	20:00 dancing with Elena
			23:00 take Glargi		23:00 take Glargi	23:00 take Glargi

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.

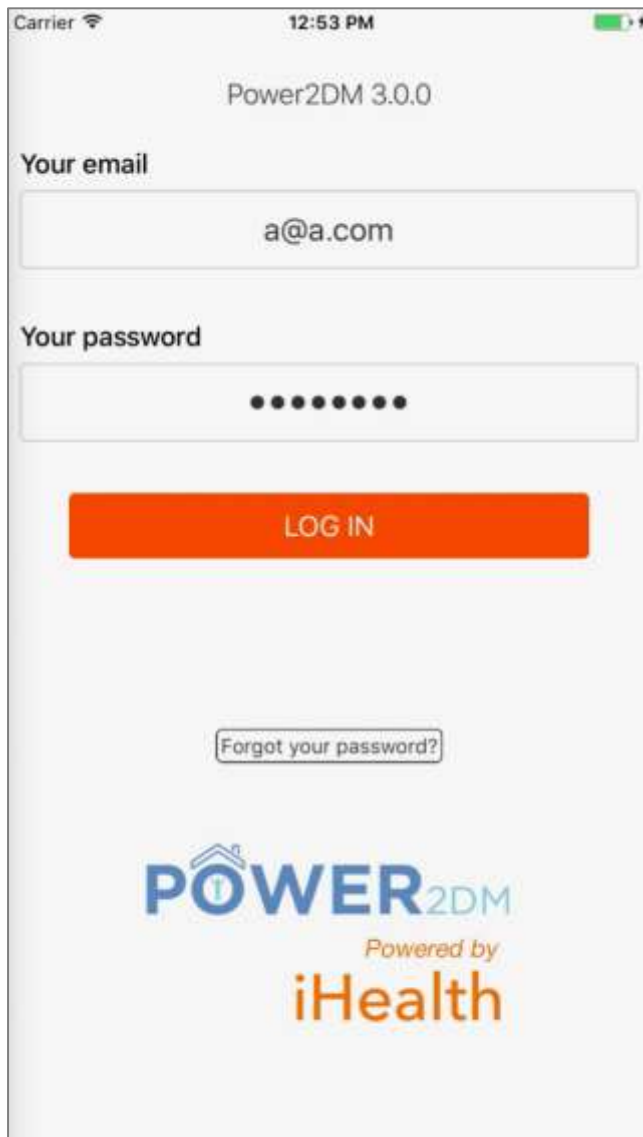


Figure 13, SMSS mobile application – login screen

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

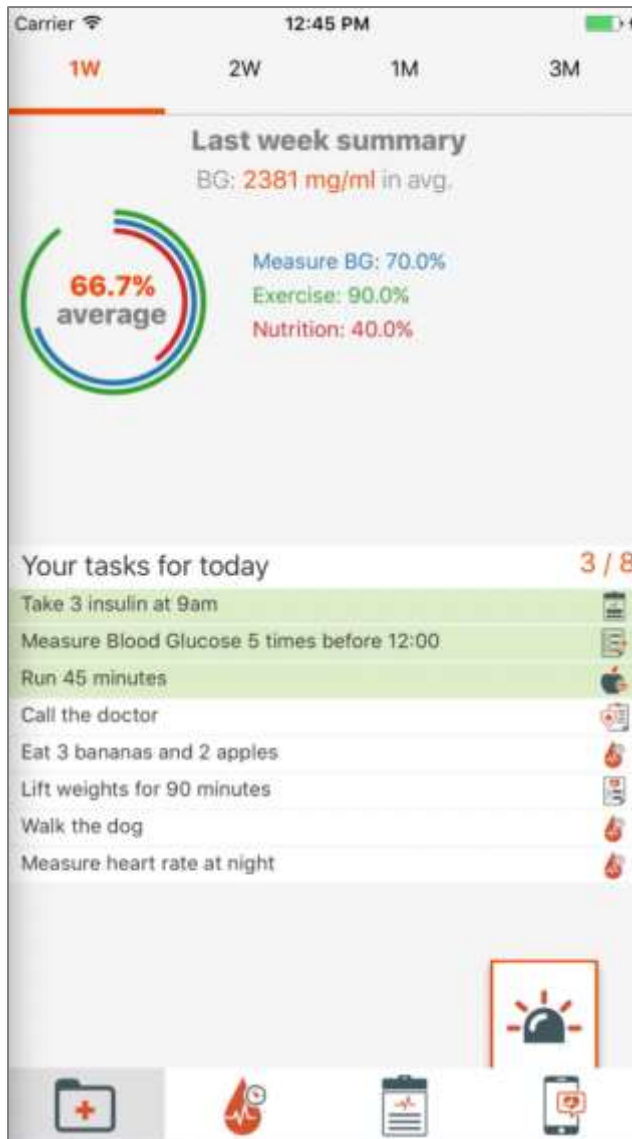


Figure 14, SMSS mobile application – dashboard

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.

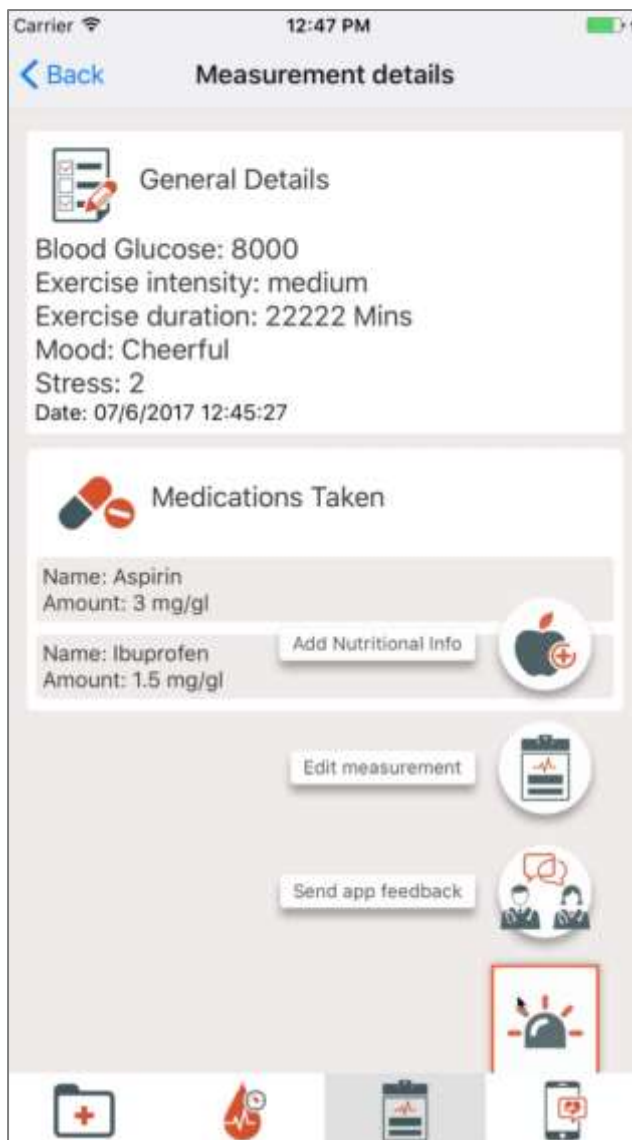


Figure 16, SMSS mobile application – measurement details

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.

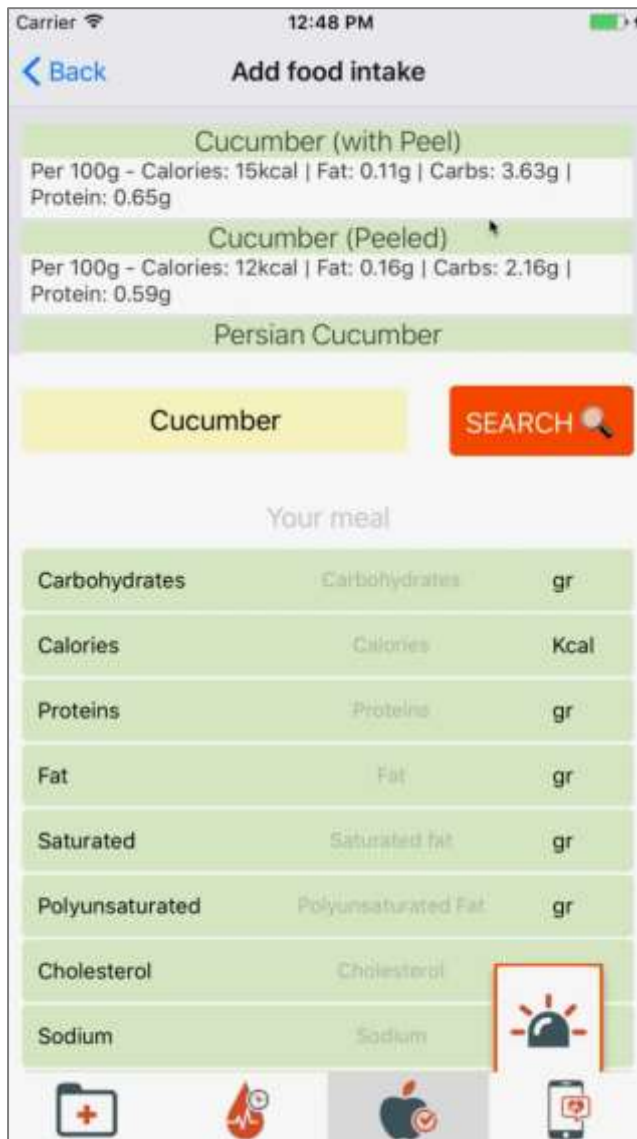


Figure 17, SMSS mobile application – add food intake

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.

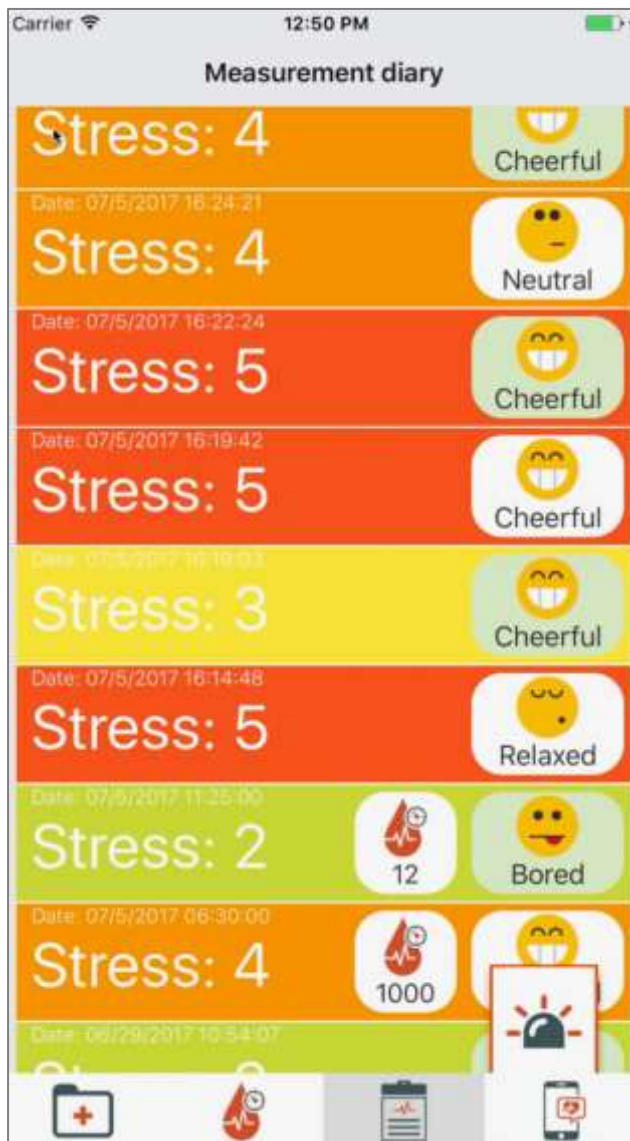


Figure 18, SMSS mobile application – measurement diary

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.

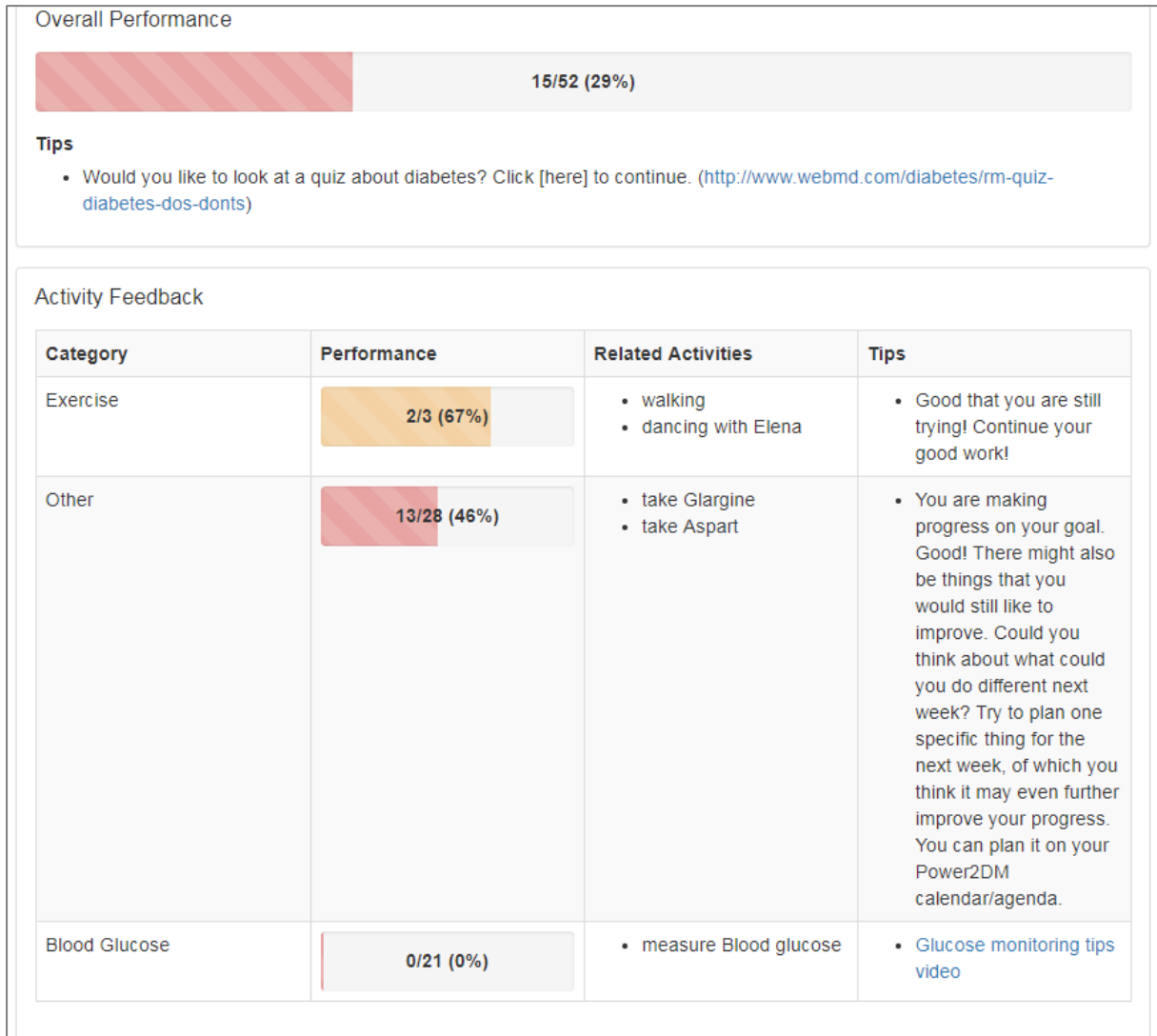
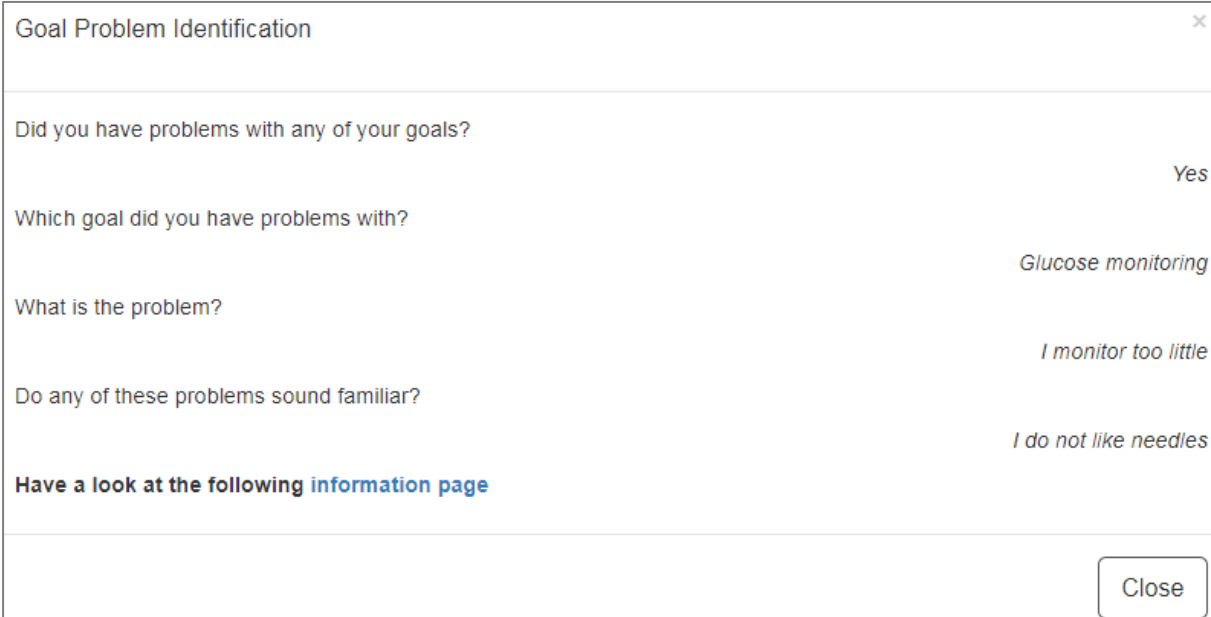


Figure 20, Periodic Review

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.



Goal Problem Identification ×

Did you have problems with any of your goals? Yes

Which goal did you have problems with? Glucose monitoring

What is the problem? I monitor too little

Do any of these problems sound familiar? I do not like needles

Have a look at the following [information page](#)

Close

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 published to Simplifier.net¹ 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>

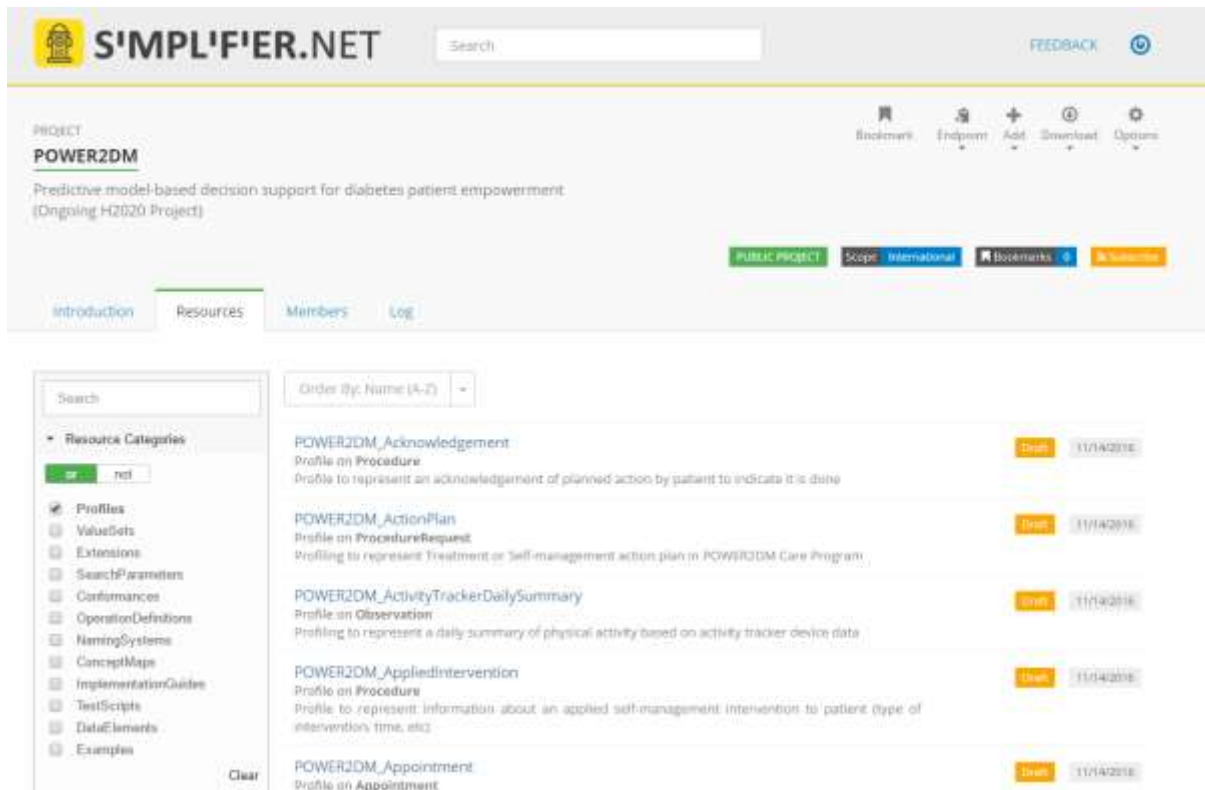


Figure 22, Snapshot from Simplifier.net POWER2DM model publications page

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-0b3fbd06b8f) http://app.srdc.com.tr/power2dm/pds/Patient/09bcb899-4520-4701-afab-0b3fbd06b8f/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-0b3fbd06b8f/RiskAssessment>

```

← → C app.srdc.com.tr/power2dm/pds/Patient/d92c7b61-b564-44a5-af1-75b6aa831c9/Observation?code=http://loinc.org|41653-7&_count=2
This XML file does not appear to have any style information associated with it. The document tree is shown below:
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  <type value="searchset" />
  <total value="24" />
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  <link
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  </link>
  <link
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    <url value="http://app.srdc.com.tr/power2dm/pds/Patient/d92c7b61-b564-44a5-af1-75b6aa831c9/Observation?code=http://loinc.org|41653-7&_count=2&_page=2" />
  </link>
  <link
    <relation value="last" />
    <url value="http://app.srdc.com.tr/power2dm/pds/Patient/d92c7b61-b564-44a5-af1-75b6aa831c9/Observation?code=http://loinc.org|41653-7&_count=2&_page=12" />
  </link>
  <entry>
    <fullurl value="http://app.srdc.com.tr/power2dm/pds/Observation/88b7283f-6b7a-4bf1-8c29-df5512702791" />
    <resource>
      <Observation xmlns="http://hl7.org/fhir">
        <id value="88b7283f-6b7a-4bf1-8c29-df5512702791" />
        <meta>
          <versionId value="1" />
          <lastUpdated value="2017-03-14T18:59:45Z" />
          <profile value="http://www.power2dm.eu/pds/StructureDefinition/POWER2DM-SimpleQuantityObservation" />
        </meta>
        <status value="final" />
        <code>
          <coding>
            <system value="http://loinc.org" />
            <code value="41653-7" />
          </coding>
        </code>
        <subject>
          <reference value="Patient/d92c7b61-b564-44a5-af1-75b6aa831c9" />
        </subject>
        <effectiveDateTime value="2017-01-02T09:00:00Z" />
        <valueQuantity>
          <value value="3.9" />
          <unit value="mg/dL" />
          <system value="http://unitsofmeasure.org" />
          <code value="mg/dL" />
        </valueQuantity>
        <device>
          <reference value="Device/4c978588-0c93-479b-b5cc-25a165038f8b" />
        </device>
      </Observation>
    </resource>
  </entry>
  <entry>
    <fullurl value="http://app.srdc.com.tr/power2dm/pds/Observation/1cd32e9c-84d9-4576-98a2-9044da8efdd" />
    <resource>
      <Observation xmlns="http://hl7.org/fhir">
        <id value="1cd32e9c-84d9-4576-98a2-9044da8efdd" />
        <meta>

```

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/>).

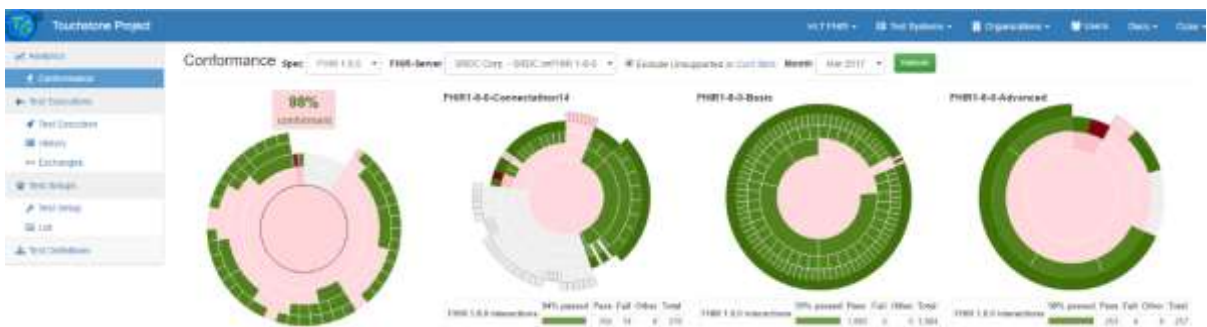


Figure 24, FHIR compliance test results on Touchstone testing environment