DAPHNE

Data-as-a-service platform for healthy lifestyle and preventive medicine

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610440

D7.3 Report on second cycle of validation

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Abstract

The current deliverable will discuss the experiments performed from month 25 to month 30 for the second cycle of tests "Testing the first software prototypes, sensors and system integration".
The aim of the deliverable is to describe in depth the tests performed for the integration of the whole system, the results obtained and the feedback recorded from different voluntary end-users. In particular specific sections ("Changes required in the tests"/"Final design") will be proposed, were necessary, in order to explain the main differences from the original design, illustrated in the deliverable D7.1.

Executive summary

In order to test the first software prototypes, sensors and system integration, several actions have been carried out by the different partners from month 25 to month 30.
The main aim of Cycle 2 was to assure that no problems appear in Cycle 3 tests, which will be performed in hospital setting, with patients.

In particular the different steps planned for Cycle 2 has been carried out as follows:

- **Action 1**

  1) UPM tested the viability of including ActiGraph Link sensor in the DAPHNE platform, investigating three different areas: (i) Data collection, (ii) Battery life and (iii) Health Tracker Library tuning. They concluded that the ActiGraph sensor is a good fit for the project and will provide adequate to good performance in all required tasks.

  2) UPM and Evalan tested the integration between the sensors (WP3), the algorithms (WP4) and the Services (WP5). These tests were very useful for the detection and correction of problems which improved the general functioning of the system.

  3) The different software developers (TREELOGIC, NEVET, SILVERCLOUD) tested the integration of the different modules in the PHS (WP5), and the connection with the Data Cloud (WP6) and security modules (WP2), as planned. Results showed different technical problems in the platform in different modules, connection problems and sensors data upload difficulties. The testing activities were necessary to fix many of these problems and provide a system able to be tested by volunteers in Action 2.

- **Action 2**

  UPM and UNIVLDS enrolled adult volunteers in order to test the system functionality in actual scenarios. These tests were extremely important to detect any possible technical issues in order to have the possibility to fix them before Cycle 3. Feedback was given from UNILDS and UPM in order to allow technical partners to diagnose the problem and try to solve it. Feedback from users (evaluation questionnaire), highlighted, as expected, the many problems that were encountered. The huge majority of these have now been solved therefore going forward to Cycle 3. Nevertheless, despite the results so far and the technical problems, all users could see the benefit of the DAPHNE system and were positive about the concept and aims of the project.

- **Action 3**

  The DAPHNE system was shown to external physicians, in order to collect feedbacks from real users. Physicians´ interest in Daphne platform as a support tool for their patients was manifest, as well as overall interest in participating in future pilot testing. Questionnaires' showed that information provided by DAPHNE is useful for physicians, although further work in the design of the patient portal should be carried out for a wider acceptance among patients.

In conclusion, all the tests planned for cycle 2 have been carried out as planned, using both the ActiGraph and the DAPHNE sensors.

Moreover, since an important objective of cycle 1 was to test the Energy Expenditure and the Activity Recognition Systems using both the ActiGraph and the DAPHNE sensors, these experimental tests has been performed in Cycle 2 by UPM. Results will be shown in the resubmission of the deliverable D7.2.

The current state of the DAPHNE sensors has been fully explained in the deliverable D3.4.

Finally, the integration between the entire DAPHNE system and the OPBG/Maccabi's servers is being tested in order to assure their operability for the beginning of Cycle 3. Results of the entire deployment will be shown in the deliverable D7.4.

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Abstract (for dissemination)	The current deliverable will discuss the experiments performed from month 25 to month 30 for the second cycle of tests "Testing the first software prototypes, sensors and system integration". The aim of the deliverable is to describe in depth the tests performed for the integration of the whole system, the results obtained and the feedbacks recorded from different voluntary end-users. In particular specific sections ("Changes required in the tests"/"Final design") will be proposed, were necessary, in order to explain the main differences from the original design, illustrated in the deliverable D7.1.
Keywords	Testing cycles, cycle 2, results, 1st prototypes, system integration

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Abbreviations

DAPHNE: Data-as-a-service platform for healthy lifestyle and preventive medicine

DNS: Domain Name System

GUI: Graphical User Interface

HOTP: HMAC-based one-time password

HTL: Health Tracker Library

IAM: Identity and Access Manager

IP: Internet Protocol

OPBG: Ospedale Pediatrico Bambino Gesù

OTP: One Time Password

PHR: Personal Health Recorder

PHS: Personal Health Service

SDK: Software Development Kit

UNIVLDS: University of Leeds

UPM: Universidad Politécnica de Madrid

WP: Work Package

1 Cycle 2 – Testing the first software prototypes, sensors and system integration

Cycle 2 was designed as the second step of the Testing Cycles with the following objectives:

1. Evaluation of the integration between the DAPHNE sensors (WP3), the ActiGraph sensors, the algorithms (WP4), the Services (WP5) and the Data Cloud (WP6).

2. Evaluation of the entire DAPHNE system functionality in actual scenarios (healthy volunteers). Focus on the functionality and efficiency of the:

    - Services developed in WP4 and WP5 (back-end servers, PHS, mobile applications, Physician Application, Big Data Consumer Portal) in collecting data inserted by the end-user and giving to him/her feedbacks and recommendations. (see deliverables D4.7, D4.9, D5.2 and D5.3.) [1-4]

    - Data Cloud first prototype (WP6) in collecting, processing and storing data in the cloud, with the necessary security requirements.

3. Collection of information from voluntary end-users about functionality, comfort and possible adverse events of the sensors, collected with feedback questionnaires.

4. Problem review and solution to improve the entire system and provide the final developments.

5. Collection of feedback from real end-users, physicians out of the consortium.

The final goal for this cycle was to assure that no problems appear in Cycle 3, which will be carried out in hospital setting, with patients.

Different actions were foreseen to be carried out by the partners from month 25 to month 30.

Action 1

Different tests were performed in the first months of Cycle 2:

1) UPM tested the viability of including ActiGraph Link sensors in the DAPHNE platform for Activity Recognition and Energy Expenditure estimation.

2) UPM and Evalan tested the integration between the sensors (WP3), the algorithms (WP4) and the Services (WP5).

3) The different software developers (TREELOGIC, NEVET, SILVERCLOUD) tested the integration of the different modules in the PHS (WP5), and the connection with the Data Cloud (WP6) and security modules (WP2).

Action 2

UPM and UNIVLDS enrolled adult volunteers in order to test the system functionality in actual scenarios.

Action 3

The DAPHNE system was shown to external physicians, in order to collect feedbacks from real users. In particular for this purpose:

Due to technical issues it was not possible to measure the Heart Rate (HR) and Galvanic Skin Response (GSR) properly with the DAPHNE sensors. For this reason it was not possible to measure the stress level and validate the Stress Detection System during Cycle 2. These measurements has not been included in Cycle 2 and will not been included in Cycle 3, but experiments on HR and GSR will be undertaken in parallel on

DAPHNE sensors. The current state of the DAPHNE sensors has been fully explained in the deliverable D3.4 [5].

The deployment of the DAPHNE system in OPBG/Maccabi's servers is being tested in order to assure its operability in Cycle 3. Results of the entire deployment will be shown in the deliverable D7.4.

2 Action 1

2.1 Testing the viability of including ActiGraph Link sensors in the DAPHNE platform for Activity Recognition and Energy Expenditure estimation

2.1.1 Changes required in the test

The inclusion of the ActiGraph sensor in the platform implied developing a wide range of tests to assess the suitability of the sensor's characteristics for this project. These tests included:

- Data collection: aimed to check signal quality and stability while recording for several hours.
- Battery life: aimed to check the device's battery performance when continuously recording data.
- Health Tracker Library tuning: focused on optimizing the HTL for operation with the Actigraph sensor.

2.1.2 Final design

Using a Windows computer, the ActiGraph sensor must be enabled and assigned to a user in the ActiLife web page in order to collect data for the desired time frame. Then, the sensor can be connected via Bluetooth to a mobile phone equipped with a simple data recording application, which will be used for all of these tests.

2.1.3 Objectives

Determining the suitability of the sensor's characteristics for its use with the Daphne Application.

2.1.4 Experimental methods

- Data collection: by developing an Android application based on the sensor's SDK, real-time data collection on the device via Bluetooth was enabled. Data was recorded up to 5 different times for several hours.
- Battery life: the test consisted of collecting data from 9 am until the device shut down, and was performed with both ActiGraph sensors available at that time at UPM.
- Health Tracker Library tuning: accuracy tests were ran with the recorded data in different scenarios for activity detection and pedometer operation. After this, algorithms were tuned to maximize accuracy.

2.1.5 Results

2.1.5.1 General issues

We will first present the issues we found during the testing (Table 1).

Table 1. General issues detected during the tests on ActiGraph link sensors

Issue:	Signal availability during Bluetooth access
Findings:	The ActiGraph SDK only allows accelerometer data collection
Solution/discussion:	Since the algorithms have been proven to obtain good detection rates using only one accelerometer at the hip, we expected good detection rates despite the lack of a gyroscope signal. This was confirmed in the HTL tuning phase.

Issue:	Time/date loss
Findings:	The sensor sometimes loses its time and date values after being completely discharged, which causes the SDK access and therefore Bluetooth recordings to be disabled.
Solution/discussion:	The time and date can be recovered connecting the device to a Windows computer equipped with the ActiSync software. The issue can be easily prevented by never letting the sensor discharge its battery completely.

Issue:	Idle mode
Findings:	The sensor enters idle mode after some time when it stops detecting movement. In Idle mode, the data received and timestamp remain unchanged, which causes problems with activity detection and synchronization.
Solution/discussion:	Idle mode can be completely disabled from the ActiLife mobile application. As long as the battery is not discharged, this setting will remain unchanged. In case of battery discharge, the setting should be disabled again within the ActiLife app.

2.1.5.2 Conclusions

4) Data collection: The device is more than capable of accurate activity detection, along with the energy expenditure estimation and pedometer functions.
5) Battery life: In our testing, the sensor kept collecting data until the following day, so we consider the battery life more than adequate for the project. The device should not be let discharging completely.
6) Health Tracker Library tuning: activity detection and pedometer accuracy were improved, along with general functioning with the ActiGraph sensor.

2.1.6 Discussion

Since the issues we found are either non-important, easily prevented or fixed, we have concluded that the ActiGraph sensor is a good fit for the project and will provide adequate to good performance in all required tasks.

2.2 Testing the integration between the sensors (WP3), the algorithms (WP4) and the Services (WP5).

These tests were carried out using both ActiGraph and DAPHNE sensors. The aim was to check the connection between the sensors and the DAPHNE mobile application, as well as between the application and the servers.

2.2.1 Final design

Volunteers were recruited to use the platform for a 1 week period. At the start of the week the volunteers filled in the anthropometrics and health marker information, while nutrition and behaviour data was introduced every day. Feedback was received by the researcher and adjustments to the applications were made to solve the most urgent problems. At the end of the week, the volunteers filled in a questionnaire to assess their experience with the system.

The test users were divided into two groups, one group wore DAPHNE/ActiGraph sensors while the other did not.
Precise instructions were given to all the participants at the start of the testing period, emphasizing the instructions and general guidelines for sensor connection, charging and general use. The researchers supervised the initial registration, information filling, and sensor connection where it may apply.
Information about nutrition was filled in every day for all user groups, while behavioural data was introduced manually for users without a sensor and automatically for users equipped with a sensor.
At the end of the test period, a questionnaire was given to each user so they could rate their satisfaction with all aspects of the system.

2.2.2 Objectives

The main objectives were the following:

- Testing sensor connectivity and ease of use.
- Checking the accuracy of activity, energy expenditure and pedometer estimations.
- Checking the Daphne platform's usability

2.2.3 Experimental methods

2.2.3.1 Participants

Volunteers (23-36 year-old) were recruited by researchers of UPM. The study was approved by the Comité de Ética de la Universidad Politécnica de Madrid (see Annex D in D7.1) [6].

2.2.3.2 Anthropometrics

Height was measured using measuring tape, while weight was measured with a regular, home-use scale. According to the WHO classification for adults overweight and obesity were defined as a BMI $\geq$25 kg/m^2 and 30 kg/m^2, respectively (see D1.2, section 3.1) [7].

2.2.3.3 Evaluation questionnaires

User feedback and evaluation was assessed using a questionnaire developed by the DAPHNE consortium (see Annex N in D7.1) [6].

2.2.4 Results

2.2.4.1 Sample description

Nine subjects were recruited for the experiment and divided in two different groups. The first group consisted of 4 people equipped with Daphne or ActiGraph sensors, integrated by 3 males and 1 female with an age ranging from 24 to 36 years old. The second group consisted of 5 people without a sensor, a total of 3 males and 2 females with age ranging from 23 to 32 years old.

2.2.4.2 General issues

Some important issues were found by the users during this testing (Table 2).

Table 2. General issues detected during the tests on the integration between the sensors (WP3), the algorithms (WP4) and the Services (WP5)

Issue:	Activity detection is inaccurate with the ActiGraph sensor
Findings:	Disconnections and similar problems with the ActiGraph sensor causes problems with its calibration, which makes activity detection quite inaccurate.
Solution/discussion:	When the activity detection becomes inaccurate with the ActiGraph sensor, it can be connected to the charging station and then disconnected and laid in a flat table for 10 seconds, which leads to automatic calibration and a correct functioning.

Issue:	The platform is unable to detect activities that span through midnight
Findings:	The platform divides everything into days so problems appear if the sensor tries to send and activity that starts at one day and ends at another day.
Solution/discussion:	The HTL library was modified so activities are automatically split at midnight.

Issue:	User anthropometric data is hardcoded into the DAPHNE App
Findings:	The user anthropometrics that are used to make estimations in the HTL are fixed in the application and not user specific.
Solution/discussion:	Due to the challenges in the development there has not been time yet to implement user specific anthropometric data in the application. At the moment the outcomes are based on the anthropometrics data that are hardcoded in the HTL.

Issue:	When linking the DAPHNE app to the platform, the PIN number has to be 12345
Findings:	When setting up an user account for the application the PIN number had to be 12345 otherwise the data was not uploaded to the cloud.
Solution/discussion:	The application is adjusted and it is now possible to use any PIN number.

Issue:	Energy Estimation is inaccurate when walking and running
Findings:	Since the latest versions of the HTL, Energy Estimation while walking and running uses a interpolator to modify the estimation based on the user's number of steps (and therefore speed), which was producing incorrect results when the speed exceeded

	certain values.
Solution/discussion:	The interpolator code was fixed in the HTL and Energy Estimation was accurate again.

Issue:	The DAPHNE App must remain open for data collection
Findings:	The sensors are disconnected from the application when the phone goes into sleep mode or when the application runs on the background.
Solution/discussion:	The application is adjusted and now runs as a service on the mobile phone. Running the application as a service makes it possible to collect data when the phone is in sleep mode and when the application runs in the background.

2.2.4.3 User Feedback Evaluation Questionnaire

The evaluation questionnaire was completed by volunteers. Table 3 shows their results ranging from 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree.

Table 3. Evaulation questionnaire's results (volunteers at UPM)

	Average Score (sensor)	**Average Score (no sensor)**
1) It was easy to provide all the data the DAPHNE system requires in the web portal	3	2,8
2) It was easy to provide all the data the DAPHNE system requires in the mobile application	3,5	3,4
3) It was easy to check recommendations on the mobile application	3,5	3,4
4) It was easy to check the recommendations on the web portal (PHS)	4	3,8
5) It was easy to choose foods from the database for the food diary	1	1,6
6) I preferred to record my food intake using the DAPHNE tools rather than on paper	2	2
7) The wrist sensor was comfortable to wear	4	
8) The hip sensor was comfortable to wear	4,5	
9) I felt comfortable to wear the sensors during the day (Eg. School, sport, free time etc?)	3,5	
10) I would be happy to wear the sensors for long periods of time (e.g. over a number of months)	3,25	
11) I would be happy to use the DAPHNE system for long periods of time (e.g over a number of months)	2,75	2,6
12) Please provide any additional comments that might be useful in future developments of the sensor	• In DAPHNE Aggregator App, the	

and system	screen cannot be locked so you cannot wear it in a pocket or a bag. • In order to link the DAPHNE sensor to the Aggregator App, it is necessary to use the dock station.	
13) The instructions for use of the sensors were adequate	3,75	3,8
14) The instructions for downloading and using the DAPHNE web portal and apps were adequate	3,75	3,8
15) Please provide any addition comments that might be useful in improving the instructions and set up of the DAPHNE system (from the point of view of the user who wouldn't be involved in a study)		
16) I was satisfied with the type of data the system required to insert	4	3,8
17) I was satisfied with the type of information the system gives	4,25	4,2
18) I was satisfied with the help given by the system during the treatment	3,5	3,2
19) Please provide any additional comments on data inputted and outputted from the system and how these could improve satisfaction	**Anthropometrics** • The slider of the risk Waist-T-Height is not working properly, All values between 0.5 and 0.9, correspond to 0.9. **Nutrition** • The nutrition information is difficult to introduce in the platform. Perhaps clustering foods could be useful. • For some products, the calories calculated by the system are not coherent. • Is it possible to use a search engine for foods in order to facilitate the task of introduction of food? • In the nutrition App. When you delete an item in the nutrition list, all the items disappear however when you try add to add a new one they appear again. **Behaviour Data Analyzer.** • When DAPHNE platform is used without sensor, the introduction of spent calories is really difficult. Could they be calculated automatically	

	based on the type of activity and the duration?	
20) I felt comfortable with the type of data the system required to insert in the:		
a) ”Anthropometric” section	4,25	4,2
b) “Health markers” section	4	4
c) ”Nutrition” section	3	3,2
d) ”Physical activity” section	4	4
e) ”Psychological wellbeing” section	3	2,8
21) I felt comfortable with the type of output given by the system in the:		
a) ”Anthropometric” section	4,25	4,2
b) “Health markers” section	4	4
c)”Nutrition” section	3	2,8
d)”Physical activity” section	4	4
e)”Psychological wellbeing” section	3	2,8
22) I felt comfortable wearing the sensors during the day	4,5	4,4
23) I did not have any allergy problems, blushes or itches	4,75	4,6
24) I did not have any sweat problems wearing the sensors	4,75	4,6
25) I felt secure about how the data have been stored and used	3,5	3,6
26) I felt secure about the management of the data inside and outside the Hospital	3,75	3,8
27) Please provide any additional comments about data security that might be of use in further developing the system	• The use of OTP passwords is a bit tedious • For psychological wellbeing it is necessary to install a certificate in the web browser and this is not an easy task.	

2.2.5 Discussion

These tests were very useful for the detection and correction of problems which improved the general functioning of the system. After these corrections, user experience was mostly positive.

2.3 Testing the integration of the different modules in the PHS (WP5), and the connection with the Data Cloud (WP6) and security modules (WP2).

2.3.1 Final design

Different integration environments were implemented and used for testing the DAPHNE platform in Cycle 2: the "Test environment" and the "Uni environment".

Test environment: This environment was used by partners to technically test DAPHNE components and add new functionalities in a controlled environment. Each partner hosted its own server as it is shown on **Errore. L'origine riferimento non è stata trovata.**4 and infrastructure was connected to Internet, which allowed integration tests among the different components developed by the different partners.

Table 4. Location information dor each componetn of the DAPHNE system in the Test Environment

Component	DNS	IP	Facilities
PHS Portal	phs.test.daphne-fp7.eu	195.55.126.7	Treelogic
PHS Portal (Physical Activity module)	phs-pa.test.daphne-fp7.eu	40.115.51.219	Nevet
	operator-pa.test.daphne-fp7.eu	40.115.51.219	Nevet
	patient-pa.test.daphne-fp7.eu	40.115.51.219	Nevet
	doctors-pa.test.daphne-fp7.eu	40.115.51.219	Nevet
	mobile-pa.test.daphne-fp7.eu	40.115.51.219	Nevet
PHS Portal (Psychological Wellbeing Module)	phs-pw.test.daphne-fp7.eu	89.101.107.82	Silvercloud
Physician Application	pha.test.daphne-fp7.eu	195.55.126.7	Treelogic
Data Consumer Portal	dcp.test.daphne-fp7.eu	195.55.126.7	Treelogic
Self-tracking health data	sthdr.test.daphne-fp7.eu	159.8.49.46	IBM
PHR	phr.test.daphne-fp7.eu	159.8.49.46	IBM
IAM	iam.test.daphne-fp7.eu	212.34.151.208	ATOS
Sensor	-	-	Worn by the user
Aggregator App	-	-	Installed on mobile
Mobile GUI	-	-	Installed on mobile
Energy Expenditure Measurement Module	-	-	Installed on mobile
Activity Recognition Module	-	-	Installed on mobile
Stress Detection Module	-	-	Installed on mobile
Behaviour Analyzer	-	-	Treelogic
Psychological Wellbeing Module	-	-	SilverCloud
Physical Activity Module	-	-	Nevet
Nutrition Module	-	-	Treelogic
Health Risk Detector	-	-	Treelogic

In this environment all the components were installed outside the Hospitals and there was no direct relationship with them. The **Figure 1** shows the architecture diagram for the test environment indicating the location of each component by means of flags.

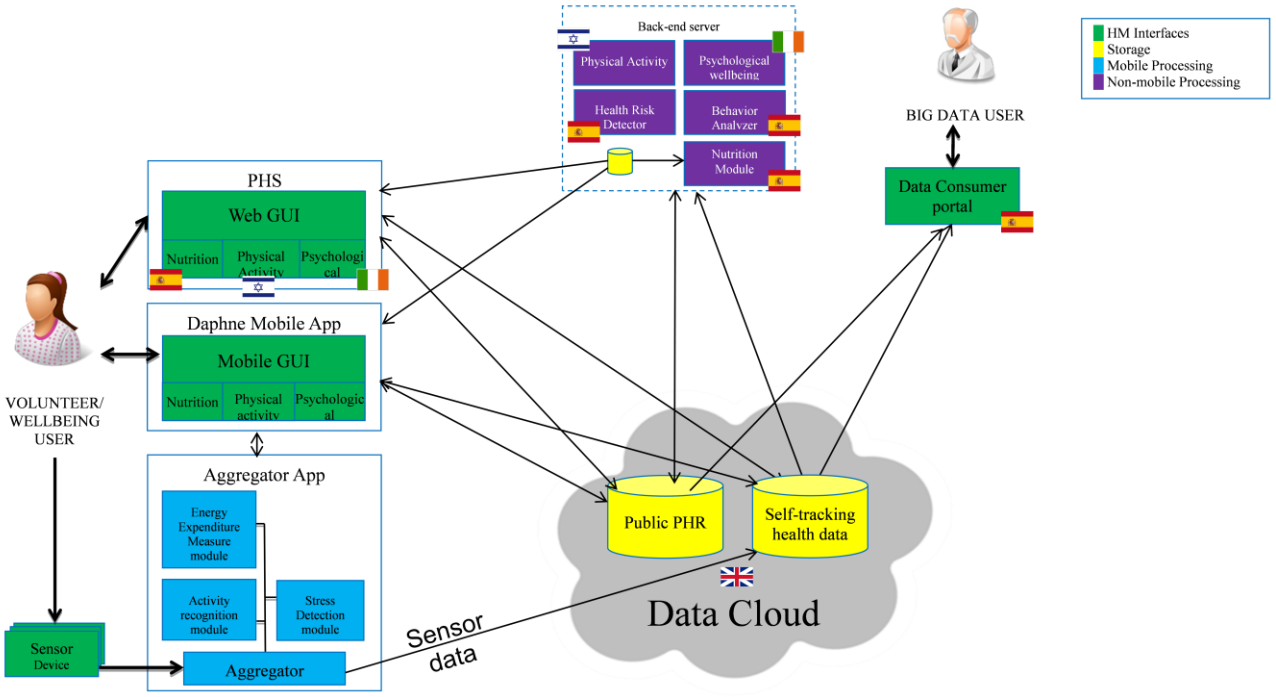

Figure 1: Architecture Test environment

Uni environment: This environment hosted the first version of the Daphne system. It was deployed for the use of UPM and UNIVLDS during the pilot Cycle 2. This environment is similar to the test environment in terms of architecture: the components were installed outside the hospitals and each partner hosted its own server (see **Errore. L'origine riferimento non è stata trovata.**). It required a complete testing process by technical partners in order to fix different technical issues found.

The main difference between this environment and the Test environment is that this was a stable version of the DAPHNE system corresponding to the Month 22 and it was not modified unless an error influencing the correct functionality of the system was found. In this case, the error was fixed.

The aim of this environment was to support the pilot Cycle 2. The goal of Cycle 2 was testing the first prototype of the whole DAPHNE system in a real scenario collecting data from sensors, processing them and giving feedbacks to the users from the back-end services, recording and storing data.

During the pilot Cycle 2 the sets of algorithms analysing data, the feedback provided by the system and the integration of the whole components were tested with real data. Moreover, issues reported by the participant volunteers has been adjusted and the recommendations provided by the system were refined, in order to minimize the errors and deliver a final prototype sufficiently accurate to face the pilot Cycle 3.

Table 5. Location information dor each componetn of the DAPHNE system in the UNI Environment

Component	DNS	IP	Facilities
PHS Portal	phs.uni.daphne-fp7.eu	195.55.126.7	Treelogic
PHS Portal (Physical Activity module)	phs-pa.uni.daphne-fp7.eu	40.115.51.219	Nevet
	operator-pa.uni.daphne-fp7.eu	40.115.51.219	Nevet
	patient-pa.uni.daphne-fp7.eu	40.115.51.219	Nevet
	doctors-pa.uni.daphne-fp7.eu	40.115.51.219	Nevet
	mobile-pa.uni.daphne-fp7.eu	40.115.51.219	Nevet
PHS Portal (Psychological	phs-pw.uni.daphne-fp7.eu	134.0.77.6	Silvercloud

Wellbeing Module)			
Physician Application	pha.uni.daphne-fp7.eu	195.55.126.7	Treelogic
Data Consumer Portal	dcp.uni.daphne-fp7.eu	195.55.126.7	Treelogic
Self-tracking health data	sthdr.uni.daphne-fp7.eu	159.8.49.46	IBM
PHR	phr.uni.daphne-fp7.eu	159.8.49.46	IBM
IAM	iam.uni.daphne-fp7.eu	212.34.151.208	ATOS
Sensor	-	-	Worn by the user
Aggregator App	-	-	Installed on mobile
Mobile GUI	-	-	Installed on mobile
Energy Expenditure Measurement Module	-	-	Installed on mobile
Activity Recognition Module	-	-	Installed on mobile
Stress Detection Module	-	-	Installed on mobile
Behaviour Analyzer	-	-	Treelogic
Psychological Wellbeing Module	-	-	SilverCloud
Physical Activity Module	-	-	Nevet
Nutrition Module	-	-	Treelogic
Health Risk Detector	-	-	Treelogic

Further details on these environments are provided in D6.7 System Integration [8].

2.3.2 Objectives

The objectives of this technical testing were the following:

- Test the "Test environment" by technical partners, in order to fix the different technical problems found in the development and integration processes. Also test new developments for the final version of the DAPHNE platform in a controlled environment
- Test the "Uni environment" by technical partners, in order to ensure that a robust system was deployed for its use with volunteers in Action 2.

2.3.3 Experimental methods

- Test environment: continuous testing was carried out by technical partners (ATOS, IBM, TREELOGIC, Evalan and Silvercloud) during months 24 to 30.
    - Initial testing activities (months 24 to 26) provided continuous feedback to developers to fix the numerous problems found and in order to deploy the Uni environment.
    - Final testing activities of the test environment (months 28 to 30) are focused on testing the new and final functionalities of the DAPHNE platform.
- Uni environment: Continuous testing was carried out by technical partners (ATOS, IBM, TREELOGIC, Evalan and Silvercloud, with the help of technical staff at UPM and UNIVLDS) to set the final Uni environment to be used in pilot with volunteers (Action 2).

2.3.4 Results

Test environment: The final version of the test environment, despite different technical problems (visibility of some modules, difficulties with the login and access to the system, difficulties in the connection of sensors) was useful for deploying the Uni version to be tested by volunteers.

Uni environment: The final version of the Uni environment also had several technical problems (visibility of some modules, difficulties in the connection of sensors and data upload), but succeed in providing a platform for testing by volunteers in Cycle 2.

2.3.5 Discussion

Testing activities of the different environments of DAPHNE were carried out as planned. Results showed different technical problems in the platform in different modules, connection problems and sensors data upload difficulties, but these testing activities were necessary to fix many of these problems and provide a system able to be tested by volunteers in Action 2.

3 Action 2 - Testing the system functionality in actual scenarios (adult volunteers)

3.1 Changes required in the tests

Due to delays with the DAPHNE and ActiGraph sensor, testing at UNIVLDS and UPM started without the sensors. It was decided by the consortium to begin testing the nutrition application, Psychological Wellbeing application (was not ready for initial testing) and the user portal. In addition, the lead researcher at UNIVLDS acted as physician so could provide feedback on the physician portal. The number of volunteers was reduced due to a delayed start and some technical problems during the testing; it was deemed more important to be able to fix some of the problems encountered than it was having more volunteers reporting the same problems without having time to address them. The researchers were in constant dialogue with the volunteers and provided (often daily) feedback to the technical partners so they could work on the problems as we went along rather than just at the end of the testing.

3.2 Final design

The final design for stage 1 was to recruit volunteers to use the working parts of the DAPHNE system for a period of 7 days. On the first day, the study was explained to the volunteer by the lead researcher and informed consent was given. The volunteer was registered as a new patient within the DAPHNE system according to instructions provided by technical partners. There were several steps to setting the user up. Once set up, the researcher led the volunteer through the different aspects to be tested. The volunteer was aware that the primary endpoint for this testing was an evaluation questionnaire that they would be asked to complete when they returned after 7 days of using the system and mobile applications.

For stage 2 the plan was to repeat the stage one testing with the addition of either the DAPHNE or ActGgraph sensor for a duration of 7 days. Unfortunately at UNIVLDS, we encountered some technical problems with the sensors, the main limiting one being that the data collected through the sensor and mobile app did not upload to the cloud on the university WiFi. No solution was found for this in the time frame before having to send the sensors to the clinical partners to start cycle 3. However, the initial steps of testing the sensors at UNIVLDS provided informative feedbacks and many issues were solved in collaboration with technical partners during this time.

For the tests performed at UPM see section 2.2.

3.3 Objectives

The aim of the study was to investigate the integration, the effectiveness and the usability of the DAPHNE physical activity sensor and online data system as assessed by an end-user questionnaire. This study allowed receiving the first feedback from the end-user and was used to make final adjustments to the system before it was deployed in pilot study in Italian and Israeli hospitals. This system is the most comprehensive health system available since it incorporates input data about physical activity, psychological wellbeing, food intake and health markers rather than assessing behaviour from one domain. In addition, the study investigated the ‘added value’ of the DAPHNE physical activity sensors. Collection of feedbacks from voluntary end-users about functionality, comfort and possible adverse events of the sensors through questionnaires was the primary results for Cycle 2.

3.4 Experimental methods

3.4.1 Participants

Volunteers (18-55 year-old) were recruited from around the university campus by researchers of UNIVLDS. The study was approved by the School of Psychology Ethics Reference (ref no: 15-0338; date approved: 23-Nov-2015) (see Annex H in D7.1) [6].

3.4.2 Anthropometrics

Height was measured using a stadiometer (Leicester height measure, SECA) and weight was measured using a platform scale (Adam Equipment, Model MSP200P, USA). According to the WHO classification for adults overweight and obesity were defined as a BMI ≥25 kg/m^2 and 30 kg/m^2, respectively (see D1.2, section 3.1) [7].

3.4.3 Evaluation questionnaires

User feedback and evaluation was assessed using a questionnaire developed by the DAPHNE consortium (see Annex N in D7.1) [6].

3.4.4 Statistical analysis

Data from the evaluation questionnaire in stage 1 is available for 6 volunteers. Statistical analysis is not applicable since their data cannot be compared to anything, but results will be shown in the form of issues presented from UNIVLDS back to technical partners and then results from the volunteers on the evaluation questionnaire.

3.5 Results

3.5.1 Sample description

Due to delays and technical issues, the sample size for stage 1 was n=6. Results will be shown in terms of:

1) Feedback given from volunteers during their measurement period to technical partners and the partners responses
2) The results of the user feedback questionnaire – please note that not all sections were completed since not all sensors/applications were ready to be tested

3.5.2 Feedback to technical partners

UNIVLDS, UPM and OPBG collaboratively logged the issues that were encountered during the download of the system components, during the registration of users/patients, that volunteers encountered during their testing and any issues encountered by the person acting as the physician. The data will be presented as a table to concisely show each issue, and the response of the technical partner involved (Table 6). Some problems were expected, some were easy to diagnose and fix, whereas others were more complex to be fixed.

Table 6. General issues detected during the test on the system functionality in actual scenarios

Issue:	System crashes regularly.
Findings:	All users enrolled have reported getting error message ‘DAPHNE nutrition has stopped’ and you can click ‘ok’ – sometimes it works again straight away, sometimes it takes a while.
Solution/discussion:	The error was fixed.

Issue:	The ‘notes’ section is great – would be good if the person could add the calories of something like sushi they would know from the packet but not be able to enter?
Findings:	-
Solution/discussion:	The food information is extracted from the EuroFir Database as you can see in the deliverables. There is no functionality to add food information because users do not have to enter just the calories but the micronutrient and macronutrient information. We do not have time and resources to implement this functionality, but it can be classified as “possible improvement of the system”.

Issue:	Volunteer asked to input username, pin, password and the HOTP but never receives an email.
Findings:	From the way I am doing things, for both the nutrition app and the PHS a different HOTP password is sent, sometimes even when one works the first time, when the second thing is done it doesn't send an email so I request another one, enter it, it is declined and so on – it can take a long time to get a volunteer set up – but sometimes it works first time – I don't know why it is inconsistent.
Solution/discussion:	The consortium worked hard to solve this issue – the solution decided upon, and which now works perfectly is for the user to have to 'request' an OTP password rather than it being automatic. Since this change was implemented no further problems were encountered.

Issue:	Have had to get HOTP password on more than one occasion (seems like once per day).
Findings:	This is happening less often than at the start but it is more than once. For further registrations this seems to be working better.
Solution/discussion:	Same solution as above, once the 'request OTP' was implemented no further problems were encountered.

Issue:	It would be helpful to be able to search food rather than having to select the category of food first – most people would struggle to know what category some of the foods are in and might be put off entering real data.
Findings:	The nutrition app was based on another EU project therefore functionality and changes are not within our control at this stage.
Solution/discussion:	It is impossible now. There are thousands of food items and such quantity of data in the mobile phone / tablet would be unmanageable. The way the services are implemented does not allow to do fast searches of food items.

Issue:	Some entries are wrong in the app - several things seem to give a huge calorie number that are not plausible.
Findings:	Information extracted from the EuroFir database and there is not the opportunity to change this now.
Solution/discussion:	We do not have the ability to change the nutrition app at this stage but can be seen as an area for improvement going forward.

Issue:	Initial problems being able to assign questionnaires to volunteers was solved by SilverCloud. Filled in answers then went to 'next, 2 left to complete' it said 'you don't have access to this' and then it had lost the answers I'd put up.
Findings:	This only happened with the first few users**.**
Solution/discussion:	New users are being able to complete all questionnaires assigned to them.

- Psychological Wellbeing Application

Issue:	Seems to be working well from start of April, but volunteer data is not visible in the physician portal.
Findings:	Completed questionnaires were not visible to physician / researcher users due to a configuration issue. The physician / research user group did not have the necessary permission attributes to view the questionnaires.
Solution/discussion:	Silvercloud have now fixed this functionality and data is visible to the physician. This was resolved by granting the necessary permissions to the physician / research user group.

Issue:	The 'back' button often causes the 'sorry the nutrition app has stopped working' message as does entering the highest amount of grams – these seem to be systematic ways of making the app crash.
Findings:	-
Solution/discussion:	The error was fixed.

- User Portal

Issue:	HTTP 500 status error regularly when signing in.
Findings:	No, this happens a lot in PHS – I have to reload the page and sometimes it still gives the error and I have to reload a few times before it works.
Solution/discussion:	The stability of the platform is less than expected, but refreshing the page usually fixes this error.

Issue:	Having to enter One Time Password too often – like every time of going into user portal – then often get the HTTP 500 error message.
Findings:	The system asks the One Time Password each time you try to enter the Daphne system from different devices. Once you enter the OTP for the device, the system should not ask for it again.
Solution/discussion:	Even though we should not have been asked for more than one password we were being asked regularly – the consortium then took the decision to change the consents and the user has to 'request OTP' – this solved the problems.

Issue:	We had several problems with entering data on health markers and anthropometrics and then the data not being saved.
Findings:	-
Solution/discussion:	This is now solved. It was due to the consents.

Issue:	Be able to enter HR and BP in intervals of 1, not 10.
Findings:	Data would be quite inaccurate if we could only enter set values 10 beats apart.
Solution/discussion:	This was changed very quickly by technical partners.

Issue:	Be able to enter glucose levels at intervals of 0.1.
Findings:	Again, data would be inaccurate if the intervals were not lowered.
Solution/discussion:	This was changed very quickly by technical partners.

- Behaviour Analyser

Issue:	Since we did not have the sensors there should be a function to 'add activity' – there should be a place to do this – sometimes the button appeared but did not work and sometimes it was not there at all.
Findings:	-
Solution/discussion:	The error was fixed.

- Physician Portal

Issue:	Takes a long time to move between sections – may be limiting for doctors who are very busy if they have to wait for pages to load.
Findings:	-
Solution/discussion:	The application was optimized in order to reduce the time responses.

Issue:	The recommendations available were only for physical activity.
Findings:	The drop down menu showed all options but the recommendations were not there.
Solution/discussion:	This was solved and all recommendations were available.

- Testing with Sensors

Issue:	Data not uploading to the cloud.
Findings:	Having ensured the sensor was connected and streaming data to the mobile aggregator we found that no data was uploaded to the cloud when on the university wifi.
Solution/discussion:	The issue was not tested adequately to state that the issue has to do with the wifi connection. Having tested multiple types of wifi the problem could not be replicated. At the moment it is unsure what the issue is.

Issue:	Sleep mode of mobile
Findings:	When the mobile goes into sleep/idle mode the connection to the sensor is lost and the data stops streaming and to reconnect (in the case of the daphne sensor) it needs to be loaded onto the charging dock and plugged in
Solution/discussion:	The application now runs as a service and the connection with the sensor will not get lost when the mobile goes into sleep mode.

3.5.3 User Feedback Evaluation Questionnaire

The evaluation questionnaire was completed by all volunteers. Unfortunately due to delays and technical issues, some parts of the system were not available for testing during stage one therefore volunteers were asked to complete only the sections that they had experience of using. Table 7 shows their results ranging from 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree.

Table 7. Evaluation questionnaire's results (volunteers at UNIVLDS)

	Average Score
1) It was easy to provide all the data the DAPHNE system requires in the web portal	2.6
2) It was easy to provide all the data the DAPHNE system requires in the mobile application	1.4
3) It was easy to check recommendations on the mobile application	0.8
4) It was easy to check the recommendations on the web portal (PHS)	1.2
5) It was easy to choose foods from the database for the food diary	1.4
6) I preferred to record my food intake using the DAPHNE tools rather than on paper	2
11) I would be happy to use the DAPHNE system for long periods of time (e.g over a number of months)	1
12) Please provide any additional comments that might be useful in future developments of the sensor and system	• There were several technical and reliability problems. • It is too difficult to set up the system and apps - I would not have been able to do this on my own if I did not have help from the researcher who understood the system. It was disappointing not to be able to fully use all components and sensors as this is what I signed up for. The system and apps continuously had problems, which would put me off using it very quickly if I did not know this was a testing phase. • The nutrition system is difficult to navigate. It is hard to know which 'group' food items would come under. The system was not convenient to use - foods should be searchable, you should be able to add foods and adjust the amounts (rather than multiples of 10g). Nutrition information for a lot of items seems wrong (porridge). Lack of commercial vegetarian products - e.g. quorn - and there was no alterntive. App crashed frequently and took a long time to process commands. Row spacing on app too narrow, I frequently selected the wrong item which caused the app to crash when I tried to go back and correct the error. • App kept crashing (was only able to record one

	full day of intake). Disliked the food categories component and layout/usage was offputting. Psychological wellbeing questionnaires formatting was wrong so not able to complete them.
16) I was satisfied with the type of data the system required to insert	2.8
17) I was satisfied with the type of information the system gives	1.6
18) I was satisfied with the help given by the system during the treatment	1
19) Please provide any additional comments on data inputted and outputted from the system and how these could improve satisfaction	• The system didn't seem to provide any information even though I entered the nutrition data. It was a shame not to be able to wear the sensors. • I was only able to input anthropometrics and health markers. The energy intake seemed inaccurate - 20g almonds = 490kcal. The behaviour analyser wasn't fully operational; could not enter physical activity and the recommendations to increase physical activity seemed to be specific but not to me. Nutrient intake figures were not clear. • Be able to enter the grams rather than in 10's, other units would be good cups, tbsp, mls etc.
20) I felt comfortable with the type of data the system required to insert in the:	
a) Anthropometric section	4.2
b) Health markers section	4
c) Nutrition section	2.6
If disagree/strongly disagree, please explain what you would like to change	• Nutrition app was difficult to navigate and crashed a lot; it would put me off using it. Some entries did not seem accurate. • No nutrition summary in user portal; a lot of the nutrition entries were inaccurate; foods are too difficult to find it puts the user off. • Enter number of grams to nutrition app; option for a recipe builder with number of servings.

	Difficult to estimate how many grams in a group based meal • health section crashed so difficult to save data, some outputs from nutrition app were very inaccurate.
21) I felt comfortable with the type of output given by the system in the:	
a) Anthropometric section	3.8
b) Health markers section	2.8
c) Nutrition section	2.2
If disagree/strongly disagree, please explain what you would like to change	• Very little output seemed to be given.
25) I felt secure about how the data have been stored and used	2.8
26) I felt secure about the management of the data inside and outside the hospital	2
27) Please provide any additional comments about data security that might be of use in further developing the system	

3.6 Discussion

For stage 1, we encountered a number of problems. It must be remembered that these were expected and the purpose of Cycle 2 was to experience these problems and try to fix them before Cycle 3. The results shown for stage 1 testing in the present document, detail the problems we encountered and the technical partners' response/ideas to solve this. Feedback was given from UNILDS in order to the technical partners to diagnose the problem and try to solve it. The second part of the results show the user feedback using the evaluation questionnaire. As expected the results from this highlight the many problems that were encountered – but the huge majority of these have now been solved therefore going forward to Cycle 3, the evaluation feedback from users should be improved. Nevertheless, despite the results so far and the technical problems, all users could see the benefit of the DAPHNE system and were positive about the concept and aims of the project.

It was unfortunate that we were not able to fully test the sensors in volunteers, however a number of fundamental technical problems were identified during the short period of testing which are being dealt with by technical partners. A new version of the aggregator was developed and seemed to solve some problems.

4 Action 3

4.1 Collection of feedbacks from external physicians

4.1.1 Final design

External physicians were also involved in the testing of the platform. The final "test environment" with the final developments were shown to the external physicians in order to collect their feedback for future developments and plan possible testing pilots.

In particular, the physicians had a complete presentation of the whole DAPHNE system (services and sensors). The system's services (PHS, Physician Applications and Big Data portal) were opened to the physicians and they were able to access them, see the different sections, see the different types of data the different services allow to insert, as well as the feedbacks they give. In particular the physicians tested the Physician Application on their own by inserting some fictional data of a hypothetical patient to see the Application, the way it works and the recommendations/feedbacks it gives the physicians will receive a practical demonstration of the DAPHNE sensor and ActiGraph sensors functionality and interaction with the DAPHNE services. The sensors were not left to the Physicians.

4.1.2 Objectives

The objectives of showing the DAPHNE platform to external physicians were the following:

- check whether the functional design and implemented functionalities meet their needs and could be used in their treatment of obese patients;
- collect feedback for improving the DAPHNE system in the future;
- check their interest to participate in future validations of the DAPHNE platform with their patients;
- check additional technical details, such as standardization of the information and interoperability with their systems;
- check exploitation possibilities in the different hospitals/clinics.

4.1.3 Experimental methods

Personal interviews were carried out by TREELOGIC staff with the following external physicians and potential users:

- **Hospital Universitario La Paz** (Madrid). Dr. Luis Beltrán (Unidad Metabólico-Vascular).
- **Hospital Universitario 12 de Octubre** (Madrid). Dr. Miguel León (Sección Endocrinología y Nutrición)
- **Centro Médico Quirón (Sevilla).** Dr. Alberto Aliaga and Executive Board in Grupo Quirón.

During the interview, the following points were followed:

- DAPHNE platform was shown, with the different developed modules. User feedback and evaluation was assessed using a questionnaire developed by the DAPHNE consortium (see Annex O in D7.1) [6];
- interest to participate in future validations of the platform was evaluated;
- possibilities for the adoption of the solution were discussed.

4.1.4 Results

Table 8 shows evaluation questionnaire's results ranging from 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree.

Table 8. Evaluation questionnaire's results (Physicians from Sapnish clinics)

Question	Average score
1) I think it is could be helpful to integrate the classical obesity treatment with the DAPHNE system	4.2
2) I think it could be useful for the obesity treatment to have an interactive and continuous monitoring of patients	3,8
3) I think it would be useful to provide recommendations to the patients through the Physician Application	3,8
4) I think it could be an improvement to adopt the DAPHNE system in the obesity treatment	4,2
5) The health data generated by the DAPHNE solution enables a holistic and personalised approach to the obesity prevention and treatment (psychological, physical activity and nutrition data)	4,2
6) The physical activity data generated is reliable and can be used for the assessment of the patient's daily physical activity levels, patterns and make evidence based recommendations	1,8
7) Nutrition data generated is reliable and can be used to assess the patient's diet, eating patterns, evaluate risks and release evidence based recommendations or interventions	1,6
8) Psychological wellbeing data generated is reliable and can be used to evaluate the patient's mental states and release evidence based recommendations or interventions	2,6
9) The DAPHNE solution enables multidisciplinary treatment approach and collaboration amongst the medical practitioners involved in the treatment	4,2
10) Real -time access to the health data enables continuous monitoring of the patient's compliance with the treatment plan and making timely and evidence -based corrections to the plan	2,4
11) DAPHNE alerting and reporting functionality enables timely prioritisation of patients at risk and making timely evidence -based corrections to the treatment plan	3
12) The DAPHNE solution including automatic personalised recommendations promotes health literacy, responsibility and self-management of healthy lifestyle amongst patients.	3,2
13) I am satisfied with the type of data Daphne system requires in the Physician Application	2,2
14) I am satisfied with the type of information the	2,8

system gives	
15) I am satisfied with the type of information about the patient I could see in the Physician Application	2,8
16) I agree that the DAPHNE solution can be used for the prevention, monitoring and treatment of conditions comorbid with obesity such as: diabetes type 2, cardiovascular diseases, arthritis, other.	2,4
17) There is a need for patients' education about the benefits of integrating the DAPHNE technology as a part of the obesity prevention and treatment care path.	3,4
18) There is a need for medical practitioners' education about the benefits of integrating the DAPHNE technology as a part of the obesity prevention and treatment care path	3,2
19) Health data made available by the DAPHNE solution enables evidence -based clinical decisions, diagnosis and treatment design.	3,2
20) Access to health data made available by the DAPHNE solution will contribute greatly to clinical research and improving clinical outcomes	3
21) Data Consumer Portal enables structured and targeted manipulation of the health data for the research purposes	3,2
22) Based on the interaction with the mechanisms in place to access the DAPHNE system (secure login), I perceive that health data are adequately protected against unauthorised disclosure	4,2
23) A comprehensive set of security measures, such as secure storage of personal and sensitive data which can't leave the hospital PHR and strong encryption of other stored and transmitted data, are in place to ensure the confidentiality and continuous protection of personal and sensitive data in compliance with applicable legislation. Knowing this, my trust in the DAPHNE system is significantly improved	4,3
24) DAPHNE system follows a user - centric approach to empower patients to learn details about who has accessed their health information and when. I believe this is a very positive approach which allows our patients to have a real control over their health data, to become more aware of their privacy and to improve their trust in cloud -based eHealth systems like DAPHNE	3,8
25) What other added value features you can suggest for the DAPHNE	• Connection to other sensors would be very interesting (glucometers, blood pressure sensors) • Connection to other physical activity sensors widely commercialized would be interesting.

	• Improvement in the motivational aspect for patients should be carried out
26) Can you see any risks with using the DAPHNE solution in clinical practice?	No major risks were seen

More specific information from each potential end user is summarized in the following tables (Table 9, 10 and 11).

Table 9. Physician additional feedbacks (Hospital Universitario 12 de Octubre – Madrid)

Functional / Technical comments	
Overall evaluation	There was interest in the nutritional / physical activity sections
Anthropometrics section	Not very interested, as they are specialised physicians and they thought the information is already known by them. However, showing the information for the patient was considered as a good idea.
Health markers section	Not very interested, as they are specialised physicians and they thought the information is already known by them. However, showing the information for the patient was considered as a good idea.
Nutrition section	Very interested to have reliable nutritional information. They knew about other software that could be used for this purpose. Interested to participate in a future validation of the module.
Physical activity section	They would be interested in the sensor if there is some clinical evidence that the sensor is acquiring data in a correct way.
Psychological section	Interested in covering psychological aspects also. They commented the lack of time and resources in the treatment of patients.
Validation interests	
They are interested in taking part in future validations of the platform.	
Exploitation possibilities	
Integration of new solutions in Public Health institutions in Spain is not easy. Political interest is necessary. They have good contacts with HP, official provider of the Healthcare community of Madrid, so including them in future validations of the platform may be a good idea.	

Table 10. Physician additional feedbacks (Hospital Universitario La Paz - Madrid)

Functional / Technical comments	
Overall evaluation	They think this can be a very interesting tool for physicians, mainly primary care physicians.
Anthropometrics section	They think this information is useful for primary care physicians, as well as for patients.
Health markers section	They think this information is useful for primary care physicians, as well as for patients.
Nutrition section	They doubt about the commitment of patients to fill in the information.
Physical activity section	They are interested to know the performance of the sensor and acceptability
Psychological section	Not usually included in their treatment of patients.
Validation interests	
They are interested in taking part in future validations of the platform.	
Exploitation possibilities	
Integration of new solutions in Public Health institutions in Spain is not easy. Political interest is necessary. Connection to other sensors would be very interesting (glucometers, blood pressure sensors). They are interested in taking part in future validations of the platform.	

Table 11. Physician additional feedbacks (Centro Médico Quirón – Sevilla)

Functional / Technical comments	
Overall evaluation	Highly interested in making use of Daphne for the treatment of their patients. In line with their holistic approach to the treatment of obesity.
Anthropometrics section	They think this is useful information for patients. More importance to the motivation of patients should be followed.
Health markers section	They think this is useful information for patients
Nutrition section	They doubt about the commitment of patients to fill in the information.
Physical activity section	They are interested to know the performance of the sensor and acceptability
Psychological section	Very interested in covering also psychological aspects. Not really in line with their approach used with patients. More importance to the motivation of patients should be given.
Validation interests	
They are interested in taking part in future validations of the platform.	
Exploitation possibilities	
Interested to take part in future validations of the platform. Can be a potential user of the system in the future. Motivational aspect in patients should be taken into account.	

4.1.5 Discussion

Physicians´ interest in DAPHNE platform as a support tool for their patients was manifest. Overall interest in participating in future pilot testing was expressed. Interest on specific modules of DAPHNE depended on the type of specialist consulted.

Average score of their evaluation is higher than the score obtained by volunteers in testing activities, showing that the information that DAPHNE provides is useful for physicians, although further work in the design of the patient portal should be carried out for a wider acceptance among patients.

Private clinics are the best potential end users for the platform, while the use in public hospitals is conditioned by a number of political decisions, usually taking a long period of time. These results will be further described in the following exploitation deliverables.

5 Conclusions

The current report described in depth the experiments performed from month 25 to month 30 for the first cycle of tests “Testing the initial sensors prototypes”.
All the partners cooperated in order to be able to carry on the experiments planned for Cycle 2 and get the final integration of the whole system. In conclusion:

1) the ActiGraph sensor is a good fit for the project and will provide adequate to good performance in all required tasks;

2) the integration between the sensors (WP3), the algorithms (WP4) and the Services (WP5) was carried out successfully, and the tests were very useful for the detection and correction of problems which improved the general functioning of the system;

3) the integration of the different modules in the PHS (WP5), and the connection with the Data Cloud (WP6) and security modules (WP2), was conducted as planned. Tests were very useful for the detection and correction of different technical problems in the platform in different modules, connection problems and sensors data upload difficulties;

4) the system functionality in actual scenarios was tested. Tests were extremely important to detect any possible technical issues in order to have the possibility to fix them before Cycle 3;

5) feedback from users (evaluation questionnaire), highlighted, as expected, the many problems that were encountered. The huge majority of these have now been solved therefore going forward to Cycle 3. Nevertheless, despite the results so far and the technical problems, all users could see the benefit of the DAPHNE system and were positive about the concept and aims of the project;

6) feedback from external physicians was collected. Physicians´ interest in Daphne platform as a support tool for their patients was manifest, as well as overall interest in participating in future pilot testing. Questionnaires’ showed that information provided by DAPHNE is useful for physicians, although further work in the design of the patient portal should be carried out for a wider acceptance among patients.

In conclusion, all the tests planned for cycle 2 have been carried out as planned, using both the ActiGraph and the DAPHNE sensors.

Moreover, since an important objective of Cycle 1 was to test the Activity Recognition and the Stress Detection systems using DAPHNE sensors, these experimental tests has been performed in Cycle 2 by UPM. Results will be shown in the resubmission of the deliverable D7.2.

The current state of the DAPHNE sensors has been fully explained in the deliverable D3.4.

Finally, the deployment between the DAPHNE system and the OPBG/Maccabi’s servers is being tested in order to assure their operability in cycle 3. Results of the entire deployment will be shown in the deliverable D7.4.

References

[1] *Deliverable D4.7 Behaviour Analyser System Final Prototype.* UNIVLDS. DAPHNE.

[2] *Deliverable D4.9 Health risk detector final prototype.* UNIVLDS. DAPHNE

[3] *Deliverable D5.2 Personal Health Services (PHS) Design.* TREELOGIC. DAPHNE

[4] *Deliverable D5.3 Big Data Services design.* TREELOGIC. DAPHNE

[5] *Deliverable D3.4 Report describing the technical specifications of Sensor Devices.* Evalan. DAPHNE

[6] *Deliverable D7.1 Selection of target prototypes and evaluation methodology. Resubmission (April* 2016) OPBG. DAPHNE.

[7] *Deliverable D1.2 Clinical and functional requirements report. Resubmission.* OPBG. DAPHNE.

[8] *Deliverable 6.7 System integration.* TREELOGIC. DAPHNE