



D4.3.2 APPLICATION/SOFTWARE DEVELOPMENT

(Business analyst)

«Report on the Feasibility Study for the Healthcare
Monitoring System»

Reporting period: 20/09/2018 – 05/12/2018

WP 4 Joint Monitoring

Systemproject

IMPROVING HEALTHCARE ACCESS TROUGHPERSONALHEALTH MONITORING SYSTEM

Sotirios Serdenis

December 2018

*The project is implemented in the framework of INTERREG V-A “Greece-Bulgaria 2014-2020”
Cooperation Programme and is co-funded by the European Regional Development Fund
(ERDF) and by national funds of the countries participating in the Programme*

<http://www.ehealthmonitoring.eu/>

*The contents of this publication are sole responsibility of project partners
and can in no way be taken to reflect the views of the European Union, the
participating countries, the Managing Authority and the Joint Secretariat*



Summary

The deliverable «Report on the Feasibility Study for the Healthcare Monitoring System» is part of the project APPLICATION/ SOFTWARE DEVELOPMENT in the frame of WP 4 Joint Monitoring System of the overall project IMPROVING HEALTHCARE ACCESS THROUGH A PERSONAL HEALTH MONITORING SYSTEM, according to the contract (14/09/2018, Ref. No: 44957) that is being implemented under the INTERREG V-A Greece – Bulgaria 2014-2020 Programme.

The particular document is an extended summary of the Greek version of the deliverable and presents the results of the feasibility study for the Health Monitoring System that will be developed within the project. The study provided valuable information which was essential for designing the system and highlighted all necessary procedures for the effective implementation of the project.

Table of contents

Summary	2
Table of contents	3
List of figures	3
List of tables	4
1 Introduction.....	5
2 Market Analysis	8
2.1 Greek Market	9
2.2 External Market	12
2.3 Promotion Plan.....	16
2.4 SWOT Analysis	18
3 Technologies and Services.....	19
3.1 Introduction.....	19
3.2 Description of the Software	20
3.2.1 Functionalities.....	20
3.2.2 Innovation	21
4 Pricing.....	22

List of figures

Figure 2: Mobile Health & Homecare Services Market Segmentation (Berg Insight 2014)	8
Figure 3: Care Delivery Platforms Market (Berg Insight 2014)	9
Figure 4: Chronic Patient Groups in Greece	10
Figure 7: (%) Prevalence of diabetes in European countries	14
Figure 9: SWOT Analysis.....	18

List of tables

Table 1: Benefits of homecare & health monitoring services	7
Table 7: Target Groups	10
Table 11: Domestic competitive solutions	12
Table 12: Demographics, financial and epidemiological data of European countries	13
Table 15: Competitive solutions in the international market	16
Table 21: App Functionalities	20
Table 31: Service pricing	23



1 Introduction

The main objective of the project is to secure provision of healthcare services to individuals who do not currently have access to them, through the development and validation of an electronic remote health monitoring system. The system will address the need of chronic patients for continuous health monitoring and improve the living conditions of people in remote and secluded areas. Collaboration and validation of the system through piloting activities in the two involved countries will result in a state-of-the-art, reliable and extendable eHealth solution, immediately exploitable (in either country, as well as the EU, the Mediterranean region and countries of the Middle East) upon the completion of the project and bound to bring positive social-economical outcomes, both for citizens and the national healthcare system.

Strategic objectives

The project aims to offer a system which will consist of a sustainable eHealth solution, reducing the constantly rising national healthcare costs. Therefore, the following strategic objectives have been identified:

- 1. Technological excellence**
- 2. Increased awareness of the public regarding Mobile Health & Homecare**
- 3. Improvement of healthcare service provision to fulfil existing and future needs.**

Benefits

The envisioned system offers a plethora of benefits, both for end users and their families, but most importantly for society:

- Improved quality of life for seniors and people living in remote areas
- Improved quality of life for individuals with disabilities and mobility problems
- Remote care delivery to seniors with reduced income
- Prevention, early intervention and effective emergency management
- Reduced hospitalization rates
- Enhanced patient adherence
- Prolonged life expectancy and independent living
- Προσφορά αισθήματος ασφάλειας στους ηλικιωμένους και τους οικείους τους



- Peace of mind to patients and their families

Specifically, for the various stakeholders:

For the end user:

- Extended independent living
- Continuous health monitoring
- Timely response to acute episodes and emergencies
- Prevention of hospital admissions

For their families:

- Increased free time
- Easy communication
- Reduced care costs
- Prolonged independence for seniors

For providers:

- Continuous and effective patient monitoring
- Increased patient satisfaction and loyalty
- Provision of added-value services
- Competitive advantage
- Higher prestige
- Elimination of distance

Clearly, reduced hospitalization rates have a direct positive effect on the national health insurance system.

The following table lists the benefits of homecare & health monitoring services internationally.

	Diabetes	Heart failure	COPD	Hypertension
Hospital admissions	-20% (3 surveys)	-40% (19 surveys)	-57% (12 surveys)	-30% (1 surveys)
Visits to emergency department	-6% (2 surveys)	-69% (12 surveys)	-54% (4 surveys)	—



	Diabetes	Heart failure	COPD	Hypertension
Ambulance service calls	—	-44% (1 survey)	-58% (2 surveys)	—
Outpatient department visits	-49% (1 survey)	—	—	—
Homecare	—	+19% (5 surveys)	-26% (7 surveys)	—
GP visits	-9% (1 survey)	-41% (4 surveys)	-61% (4 surveys)	—

Table 1: Benefits of homecare & health monitoring services

2 Market Analysis

According to a report by Berg Insight (2014), the Mobile Health & Homecare services market can be segmented, based on the target audience, the scope and the requirements addressed, into 5 basic categories:

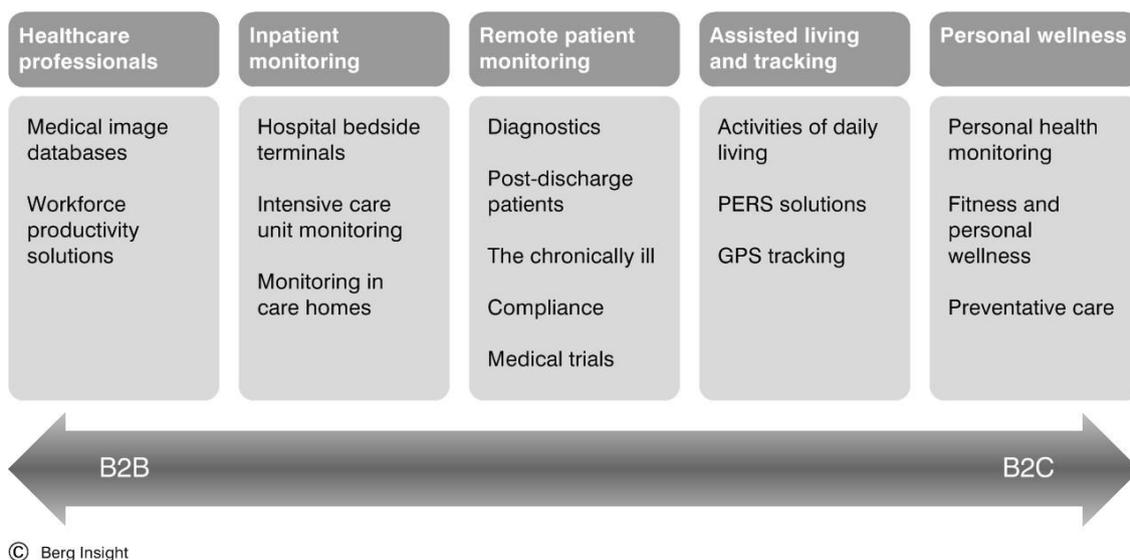


Figure 1: Mobile Health & Homecare Services Market Segmentation (Berg Insight 2014)

The report mentions that there are 3 million patients that use connected health monitoring devices worldwide. The study estimated that by 2018 the number of patients using connected monitoring devices would increase at a rate of 44.4%, reaching 19.1 million users. Η ίδια μελέτη εκτιμά ότι μέχρι το 2018 ο αριθμός των ασθενών που χρησιμοποιούν διασυνδεδεμένες συσκευές παρακολούθησης στο σπίτι θα αυξάνεται με έναν ρυθμό που αγγίζει το νούμερο του 44.4% φτάνοντας τα 19.1 εκατομμύρια. Therefore, the dynamic of the field, as well as the need for investments, is evident.

Connected health and care delivery allows for the provision of new services in the field of Homecare. Wireless technologies offer advanced capabilities for care delivery and health monitoring at home. The study by Berg Insight (2014) identifies 4 sectors in the connected care delivery chain: Suppliers of Sensors and medical devices, Suppliers of mHealth services, Suppliers of Care Delivery platforms and Suppliers of health monitoring services. The system under development falls under the Care Delivery platforms category.

Care Delivery platforms are software solutions capable of remote care provision, connecting patients with healthcare professionals and other involved stakeholders (e.g. family members). These platforms

are usually based on economies of scale. There are currently 6 categories of available Homecare platforms in the market:



Figure 2: Care Delivery Platforms Market (Berg Insight 2014)

Common and prevalent chronic conditions, such as hypertension, diabetes, asthma and COPD induce major costs and reduce life expectancy and quality of life. Such conditions require the use of monitoring equipment at home, for effective treatment. The report by Berg Insight (2014) estimates there are more than 200 million suffering from at least one chronic condition, in Europe and the USA, and who can benefit for such a platform

2.1 Greek Market

Barriers to Entry

Barrier to entry in the Greek market stem from:

- Issues with the nature of the market (e.g. low awareness of eHealth services)
- Issues with the nature of the services (e.g. privacy concerns).

The envisioned innovation lies in the provision of services which are not currently available in the Greek market, with respect to Homecare and Patient Monitoring.

Target Audience

The following table lists the target groups for each type of service.

Service	Target group
Assisted independent living	<ul style="list-style-type: none"> • Individuals with physical or cognitive impairment • Individuals that require post-hospitalization care
Vital signs monitoring	<ul style="list-style-type: none"> • Chronic patients
Assistance at Home	<ul style="list-style-type: none"> • Combinations of the above groups and individuals that can afford continuous health monitoring at home

Table 2: Target Groups

According to EU statistics, 54,8% of people aged 65 or older suffer from at least one chronic condition. Based on the Greek census, the corresponding target group size is 1.16 million people. Therefore, piloting activities will include seniors, without excluding younger participants.

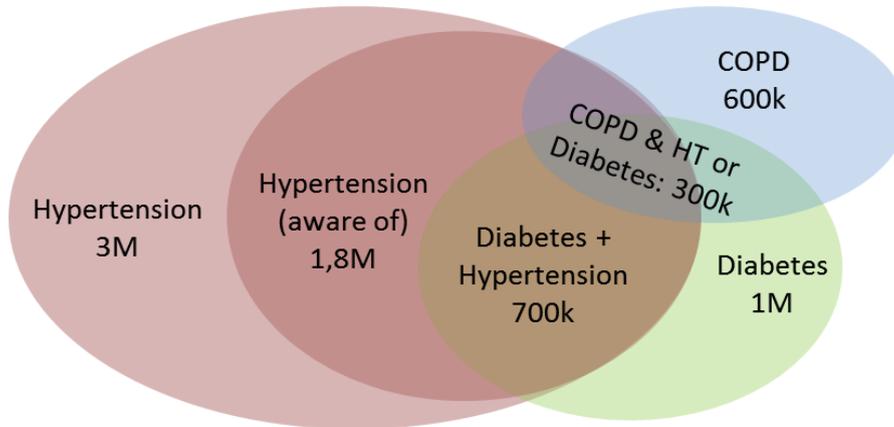


Figure 3: Chronic Patient Groups in Greece

Competitive Solutions

PERS – Remote Patient Monitoring Services	Provider type	Provided Services				
		Home hospitalization	PERS	GPS	Homecare	Telehealth
Vidavo	Private					 ¹
MedCare (Vida24)	Private					
MediCall	Private					
Lifeline	Non- profit					
Help at home «Βοήθεια στο σπίτι»	Public					
Care for life «Φροντίδα Ζωής»	Private					
Homed	Private					
Vidavo (in collaboration with Vodafone	Private					

¹ Low extent



PERS – Remote Patient Monitoring Services	Provided Services					
	Provider type	Home hospitalization	PERS	GPS	Homecare	Telehealth
Greece)						

Table 3: Domestic competitive solutions

2.2 External Market

Barriers to Entry

Barrier to entry in the international market stem from:

- Issues with the nature of the market (e.g. low awareness of eHealth services, with few exceptions)
- Issues with the nature of the services (e.g. privacy concerns).

Target Audience

A. Europe

With respect to the European market, both epidemiological and eHealth services market penetration data have been examined.

Country	Population (M)	% over 65 yo	% market penetration of PERS services (>65 yo)	PERS Services Subscriptions ²	% suffering from diabetes ³	% raised blood pressure ⁴
Bulgaria	7.6	17.50%	0.00%	0	9.7%	44.5%
France	65.4	16.60%	1.60%	173.702	5.7%	35.7%
Germany	81.8	20.70%	3.40%	575.708	8.0%	39.7%

² ICT & Ageing, European Study on Users, Markets and Technologies, Report prepared by empirica and WRC on behalf of the European Commission, Directorate General for Information Society and Media, 2010

³ Raised fasting blood glucose (≥ 7.0 mmol/L or on medication), age-adjusted

⁴ Raised blood pressure (SBP ≥ 140 OR DBP ≥ 90 OR on medication), age-adjusted

Country	Population (M)	% over 65 yo	% market penetration of PERS services (>65 yo)	PERS Services Subscriptions ²	% suffering from diabetes ³	% raised blood pressure ⁴
Denmark	5.6	16.30%	6.50%	59.332	7.3%	34.5%
Greece	10.8	19.10%	0.00%	0	8.7%	36.1%
UK	62	16.40%	16.20%	1.647.216	6.7%	37.5%
Ireland	4.4	11.30%	14.30%	71.100	7.0%	40.6%
Iceland	0.32	11.00%	N/A	N/A	8.9%	33.8%
Spain	47.2	16.80%	3.70%	293.395	9.9%	36.7%
Italy	60.4	20.20%	1.60%	195.213	7.1%	37.9%
Cyprus	0.8	12.50%	N/A	N/A	8.4%	37.0%
Malta	0.4	13.70%	N/A	N/A	10.4%	38.6%
Norway	5	15.00%	N/A	N/A	9.1%	40.9%
Netherlands	16.7	15.30%	3.20%	81.763	5.1%	36.6%
Hungary	10	16.60%	3.30%	54.780	9.5%	45.5%
Poland	38.2	13.50%	0.00%	0	7.6%	46.0%
Portugal	10.6	17.30%	N/A	N/A	6.6%	41.9%
Slovenia	2	16.50%	0.20%	660	9.7%	46.4%
Sweden	9.4	18.10%	10.40%	176.946	7.0%	37.9%
Turkey	73.7	6.80%	N/A	N/A	10.0%	36.1%
Finland	5.4	17.00%	9.00%	82.620	8.1%	41.9%

Table 4: Demographics, financial and epidemiological data of European countries

The following figure⁵ illustrates the prevalence of diabetes in European countries.

⁵ Diabetes Atlas, Fifth Edition – International Diabetes Federation, 2012



Figure 4: (%) Prevalence of diabetes in European countries

Therefore, countries such as Italy, Spain and Portugal, as well as Balkan countries, are excellent candidates for the promotion of the developed services.

Competitive Solutions

Company	Provided Services						
	Provider type	Platform for general care provision	Health monitoring platform	Platform for patient needs	Teleconsultation platform	Incentive platform	Platform tailored to specific treatment
Healthy Circles	Private						
Get Real Health	Private						
Exco InTouch	Private						
BePatient Solutions	Private						
BodyTel	Private						

Provided Services							
Company	Provider type	Platform for general care provision	Health monitoring platform	Platform for patient needs	Teleconsultation platform	Incentive platform	Platform tailored to specific treatment
Medixine	Private						
Verizon Mobile Health Solutions	Private						
Verklizan	Private						
BOSCH	Private						
HomMED	Private						
OpenTele	Private						
Numerasocial Solution	Private						
WellFX	Private						
Patients LikeME	Private						
MDLive	Private						
Polycom	Private						

Company	Provided Services						Platform tailored to specific treatment
	Provider type	Platform for general care provision	Health monitoring platform	Platform for patient needs	Teleconsultation platform	Incentive platform	
Vidyo Solutions	Private						
FuzeBox	Private						
BlueStar	Private						
U-Sleep	Private						
Diabeo	Private						
AchieveMint	Private						
Welltok	Private						
ayogo	Private						

Table 5: Competitive solutions in the international market

2.3 Promotion Plan

The promotion plan for the services is based on the following:

- Market and competition analysis
- Assessment of:
 - Strengths and weaknesses.
 - Opportunities and threats.
- Definition of key factors regarding the success of the promotion strategy



Attracting audiences

The developed high-tech services are targeted to individuals who may be not tech savvy. Therefore, communication will play an important role in future market penetration of the services. An aggressive promotion strategy is required and should include the following:

- Strategic partnerships
- Pilot trials (Hands-on experience)
- UX/UI design targeted to senior users
- Social media and online presence
- Demonstrations

Steps required to expand internationally

- Translation of UI
- Translation of manuals, portal
- Establishment of a tech support network
- Adaptation of the system to local requirements



2.4 SWOT Analysis

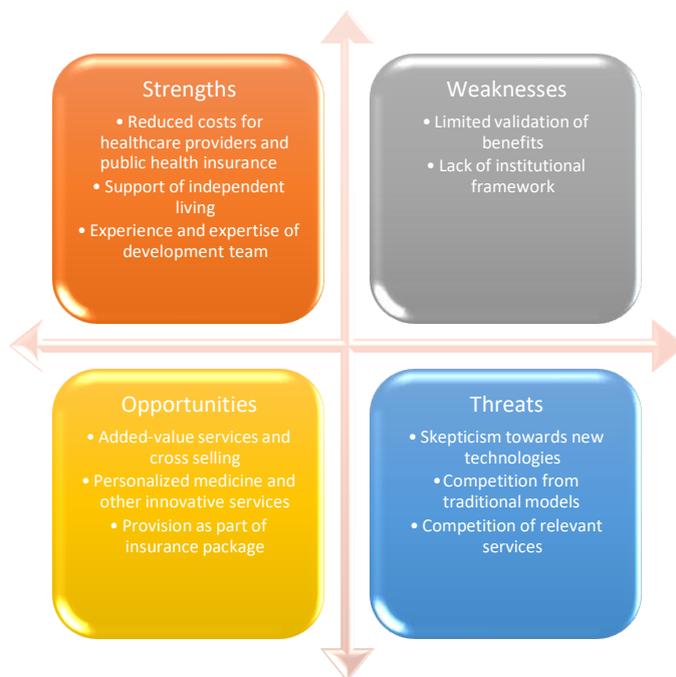


Figure 5: SWOT Analysis

3 Technologies and Services

3.1 Introduction

The developed platform will offer communication and health monitoring services, through accurate recording and transmission of vital signs and other critical information, serving the constantly changing needs of vulnerable user groups. The offered services will address the needs of seniors, improving their living conditions and offering peace of mind to their families.

The user can access the platform from a tablet or smartphone and use wireless medical devices (e.g. blood pressure meter) and wearables (e.g. activity tracker) to record their vital signs, while their attending doctor will be able to view recorded measurements, in order to monitor the patient more effectively, as well as set thresholds for each type of measurement. The system will automatically detect threshold violations. In addition, the system will include communication capabilities, allow the user to contact their loved ones.

The services include communication of the user with their family, as well as their attending doctor. Furthermore, monitoring the user's activity levels allow for detection of potentially dangerous situations.

More specifically, the system will be able to monitor the following parameters:

- Blood glucose levels
- Oxygen saturation (SpO₂)
- **Heart rate**
- **Blood pressure**
- **Physical activity** (steps and sleep)

and the recorded measurements will be saved in the user's personal health record, allowing doctors to form personalized care plans.

Overall, the services are first and foremost targeted to chronic patients, patients recovering post surgery or in rehabilitation, and in general people (mainly seniors) living alone and in need of communication and support.



3.2 Description of the Software

The aforementioned services require the development of a portal, as well as the following applications:

1. End-user application
2. Doctor application

These applications will be available for Android devices and also as Web apps accessible on any web browser, exploiting the benefits of cloud services.

3.2.1 Functionalities

The following is a list of functionalities covered by each app.

A	App	Functionality category	Individual functions
A			
1	Web-app	App accessible via the portal: <ul style="list-style-type: none"> • Registration of new user • User info management • Health information management • Videoconferencing 	<ul style="list-style-type: none"> Registration Account activation Account info management User info management Health information management Account management Video call (outgoing) Video call (incoming)
2	Mobile app	App for end users: <ul style="list-style-type: none"> • Videoconferencing • Biosignal collection and management • Reminders <p>The app can also be user by the doctor for:</p> <ul style="list-style-type: none"> • Videoconferencing • Viewing patient measurements 	<ul style="list-style-type: none"> Installation - Maintenance Reminders Recording of biosignals Video call (outgoing) Video call (incoming) View personal health record

Table 6: App Functionalities

3.2.2 Innovation

The developed system's innovative nature lies in both the technical implementation and the business perspective of the offered services. More specifically, technologies will be fused to deliver the following:

- Personalized medicine
- Detection of reduced mobility
- Patient adherence encouragement
- Algorithms for automated measurement evaluation
- Technologies for increased mobility
- Specially design GUI for seniors

4 Pricing

In order to price the system's services for potential commercial exploitation after the end of the project, a comprehensive analysis of the European market was conducted and the following costs were identified:

Country	Monthly subscription	Additional costs	Coverage
Germany	25 €	Unknown	Up to 17,90 €/per month, for citizens >65 yo
Denmark	Unknown	Unknown	100%
Spain	Unknown	Unknown	40 - 100%, depending on age and income
Finland	25 €	Unknown	100%
France	25 € - social alarm 38 € - telecare	50 € initial cost	Up to 50% under conditions
Hungary	Unknown	Unknown	Up to 160 € per year, if not more than 2% of user's yearly income
Ireland	6-12 €	300 € initial cost	- Installation costs - Non-profit organizations offer financial support
Italy	15-40 €	Unknown	Only for people without income
Netherlands	12-13 €, for attending doctor alerts 25 €/month for helpdesk support	Unknown	For a small percentage of the population, after evaluation
Poland	14 €	28 € - fall detector 43 € - gas or flood detector	-
Sweden	Unknown	320 € - initial cost for Videophone	Final price for citizens at 9-10 €
Slovenia	25 €	450 - 650 € equipment (care phone)	Cost of equipment by 80%

Country	Monthly subscription	Additional costs	Coverage
UK	10-25 €	Unknown	For those entitled to welfare
USA	15-50 USD	200 to >1500 USD initial cost	Only some states, based on income and health condition

Table 7: Service pricing

Considering that the aforementioned costs refer to telecare services, lacking biosignal recording and communication features, and in countries with higher living costs and GDP compared to Greece and Bulgaria, a pricing of 15 – 20 € for monthly subscription to the offered services is considered reasonable.