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Cost-effective Ambulatory Monitoring

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Abstract

The Mobinet service concept emerged, as points of care move closer to the patient and the citizen/patient undertakes a more active role in healthcare monitoring and prevention. Today's advances in monitoring devices and telecommunication networks have made possible a viable solution regarding the provision of continuous health monitoring services, seamlessly from the patients' point of view. The Mobinet concept has been tested under various clinical, technical and business pilots throughout Europe and is currently set for commercial launch in Greece.

Keywords:
Telemonitoring; Patient empowerment

1. Introduction

As healthcare infrastructure matures, the sector is able to support a wide range of advanced applications. The healthcare actors reform their healthcare provision models in order to remain competitive in a demanding landscape and in order to reach rising customer expectations for improved services, while maintaining economic efficiency.

Disease management and treatment plans consisted the core of the healthcare processes, prior to the evolution of new practices due to IT developments in the framework of the information era. The development of novel back-office applications or telemedicine solutions and other services addressing demanding patient needs triggered patient centric processes, mainly focusing on prevention rather than treatment. Additionally, it has been shown that better patient education and self-management on heart failure and other chronic diseases may increase the mean time to re-admission and decrease the number of days in hospital and the annual health care cost per patient [1].

Further to the new approaches in the provision of healthcare services in the frame of ehealth, wireless developments create new opportunities, for the healthcare professionals, individuals and organizations, patients and health authorities. Mobile health advances generate new capabilities in patient self-care. Cost effective solutions minimize effort in monetary and human input terms, whereas creating new communication modes, facilitating both the healthcare professionals and the patients.

The Mobinet service concept aims to explore the dynamics of interactive continuous chronic patient and citizen monitoring. The pilot application particularly focused on the telemonitoring impact on the patients' quality of life, the patients' active involvement in their own care and accordingly, the impact on the overall quality of healthcare provision, as well as the benefits for the healthcare providers (time management, patient management, savings, etc). Utilizing the ICT and medical industry advances, Mobinet will exploit a

modular telemedicine platform, in order to achieve remote vital signs' diagnosis. The Mobinet concept was piloted in Greece and developed a sound business case regarding the provision of innovative telemedicine services to citizens with chronic conditions, as well as those who want to monitor their health more closely for "wellness" purposes, since Mobinet is directed at the "chronically ill" as well as the "worried well" citizens.

2. Mobinet Ambulatory Monitoring

2.1 Mobinet concept

The Mobinet service concept emerged, as points of care move closer to the patient and the citizen/patient undertakes a more active role in healthcare monitoring and prevention. The need to provide cost-effective healthcare services for continuous telemonitoring of vital signs to remote or on the move patients has been early identified, to bridge the gap in healthcare provision. This gap is created by the inability of healthcare providers to offer continuous monitoring, seamlessly to chronic patients.

2.2 Mobinet service description

Mobinet allows the physician to design the personalized care protocol of each patient, to monitor the application of the protocol and the measurements already taken by the patient. Two major subsystems, the patient's module and the server, compose the overall Mobinet service concept.

The patient's module consists of one or more monitoring devices. The patient or a nurse/carer, following the care protocol created by the physician, takes the measurements. The data are then sent to the server (multiple routes were tested including PSTN, GPRS and TCP/IP), where it is examined by the physician. A number of pilots were set to test the concept from a clinical and a business point of view. Two of them were partially supported by the EC under the IST and eTEN programmes of DG INFSO between 2000 and 2004 [2] [3].

During the clinical tests the service was provided to patients with chronic cardiac and pulmonary diseases, such as arrhythmias, Coronary Heart Disease (CHD), asthma and Chronic Obstructive Pulmonary Disease (COPD). The patients were equipped with the appropriate monitoring devices and recorded their vital signs (ECG and/or lung function parameters as FVC) on a pre-defined basis. The physician at the medical center reviewed and processed the measurements, providing then feedback to the patient.

In a full-scale commercial operation, physicians and patients will have access to the service from PC, PDA's or mobile phones connected to the Internet.

2.3 Customer typology and benefits

The two main user groups of the telemonitoring services are the healthcare professionals and the citizens/patients. Each user group is divided into several sub-groups. More specifically, the Mobinet service concept targets:

- *Healthcare professionals*: including cardiologists, pulmonary specialists, GPs, and/or family doctors. Depending on the vital data to be measured by the patient and monitored remotely, this group of users can be easily expanded to address further specialties (i.e. *endocrinology)*. The healthcare professionals, either individuals in private practice or entities can expand via the Mobinet concept their customer base, address remote geographical markets, and manage more effectively resources.

- *Citizens / Chronically ill patients*: including patients with heart or pulmonary diseases as well as citizens wishing to maintain an optimal physical condition. Mobinet empowers citizens/patients to actively monitor their health status and enjoy autonomy and an elevated quality of life.

Besides the main user categories identified, other actors include diagnostic centers, private insurance companies, private clinics / hospitals, free-lance doctors, pharmaceutical companies, private clinics for the elderly or athletes that may utilize ambulatory monitoring services in order to expand their service portfolio, while reducing costs.

3. Results

3.1 Service evaluation

The service was tested in various settings (i.e. diagnostics centers, hospitals, residential homes, doctors' offices in private practice, and individual patients) throughout Europe, by a total of ninety-four users, enabling continuous health monitoring and patient-physician interaction. Healthcare professionals and chronic patients comprised the core of the group that validated the service.

The health status of the patients was closely monitored, when they were at home, work, vacation, etc. The majority of the patients responded positively to the service and highly valued the enhanced feeling of safety they experienced via Mobinet. The latter was even more intense in the case for the female population participating in the service concept evaluation. Additionally, all patients (both with cardiac and pulmonary diseases) reported that the Mobinet process of ambulatory monitoring is particularly easy for the inexperienced users.

Patients located in remote areas in particular and utilizing the service, such as monks at the Holy Mountain Athos, appraised the time and money savings deriving from the remote monitoring, instead of visiting the closest urban center, in order to contact specialized healthcare professionals.

The healthcare professionals acknowledged the Mobinet contribution in facilitating their everyday tasks. A larger base of patients is handled in a straightforward manner. The cardiologists viewed the service as a valuable tool for monitoring heart diseases and depicting a change in the patient's condition. In the case of arrhythmias in particular, Mobinet contributes to the evaluation of the patients' description of symptoms that cannot be diagnosed for example at the doctor's office, but only at the time they occur.

The pulmonologists pointed out that in the case of asthma patients, Mobinet has diagnostic value, which is to be furthered explored and tested. Via Mobinet, the basic measurement reflecting the narrowing of the airways, is monitored and provides input for differentiating between obstructive and restrictive patterns, for asthma diagnosis (via the vital signs' variability), for assessing the severity of the condition and monitoring the patient's response to a pre-specified treatment plan, for monitoring the severity of COPD and also assessing the suitability of patients for oxygen therapy. As the major problem with asthma and COPD patients is that may be asymptomatic, when they visit their doctor and have exacerbations when they are at home, via Mobinet the doctor ensures that the complete image of the patient condition is considered.

Following the healthcare professionals feedback on the use of the service, the following application areas were identified for the Mobinet concept deployment: a) diagnosis, b) monitoring, c) treatment, and d) follow-up.

It should be noted at this point, that only the healthcare professionals familiar to new technologies were initially positive towards the Mobinet service implementation. Techno phobia can comprise a remarkable constraining factor to the Mobinet concept success. Healthcare professionals unaware of the information society capabilities and their impact on the practice of medicine view the Mobinet concept as a potentially competing service that will compel them to reduce their patient base. On the other hand, the only way to appeal to the majority of the patients is to reach them via their attendant physician.

3.2 Financial Feasibility

The successful completion of the clinical trials and the service attributes highly valued by the users, contributed to the preliminary business considerations and the development of a complete implementation plan for commercial operation in Greece. The business plan was technically based on the Cardguard PMP® solution, the only currently world-wide commercially available solution matching the Mobinet concept requirements. Based on the business planning elements, the service has a significant potential in the local Greek market, but also, on a pan-European basis as well. It is crucial to address with novel healthcare services the cardiology and pulmonary fields of medicine, as they comprise diseases that affect a great amount of the population on local and European levels. CHD and COPD for example, constitute in cases not only life-threatening health conditions, but additionally entail a series of associated socio-economic costs (e.g. negative impact on the patient's overall quality of life, hospitalisation expenses, insurance expenses, etc) [4].

The business plan focuses on the peculiarities of the local health market, explores the potential of telemonitoring services and draws the business, financial and marketing strategies for the successful penetration to the Greek market.

Based on the Mobinet business planning considerations, telemonitoring services can prove to be cost-effective either in the public or the private healthcare provision domain. On the one-hand public healthcare providers are able to reach remote isolated areas and possibly reduce hospitalisation expenditures in the long run. On the other hand, individual citizens may benefit from the service. Undertaking the cost of telemonitoring can save them the time and money previously allocated to visits at private medical establishments for the conduction of routine diagnostic tests. Additionally, when the service is provided by a private healthcare provider, it is considered as an added-value service to its existing portfolio of services, meaning that it can attract a wider customer base.

Although the market is still immature, the financial benefits generated for all parties involved create the potential for appealing to the general public. Nevertheless, there is still uncertainty about the impact telemonitoring will have when used in routine practice. The wider economic implications have not been comprehensively quantified and valued. In addition, long-term sustainable telemedicine programs must be consistent with business objectives and strategic plans, which is not always evident in the area of current applications [5].

4. Discussion

The Mobinet concept generates significant social benefits, including improvement in the provision of healthcare services and elevation of the patient quality of life. Mobinet enables healthcare professionals to allocate their time in an efficient and effective manner, as they are able to manage more patients, since telemonitoring allows the simultaneous monitoring of the health status of multiple patients. Patient management and also, data management for each patient is improved, facilitating medication management and the completion of administrative tasks for the healthcare professionals.

Mobinet is a novel service concept within the Greek market and it is expected that part of the costs previously allocated to home visits and/or visits to the hospital will be allocated to Mobinet. Therefore, it is anticipated that the full market deployment of Mobinet will positively impact hospitalization duration and according expenses and that it will improve patient's morale since s/he will have an active role in monitoring his/her health condition.

The service feasibility in Greece has been validated and the outcome so far creates expectations for the full market deployment. The Mobinet concept in Greece directly targets citizens that reimburse the primary healthcare services they receive, via out-of-pocket payments. Whereas virtually all Greek citizens have coverage for healthcare services through statutory insurance or the National Healthcare System, there is a large private sector consisting of consultations with physicians in private practice, visits to private diagnostic centers, as well as private hospitals for in-patient care. This is due to dissatisfaction with publicly provided services. Nevertheless, public insurance funds, sooner or later, are expected to notice the advantages of (the Mobinet concept and other) telematic services and, overcoming their reluctance towards innovative technological systems, employ them. This allows a perspective of a much wider user base in the future.

5. Conclusion

Services like the Mobinet concept enable patient-doctor continuous interaction, regardless of location and any other geographical limitation. Following the trend for healthcare service provision away of the traditional nursing areas (i.e. at the patient's homecare setting, work environment, or event at vacation, etc), ambulatory telemonitoring services have a direct impact on the patient's overall quality of life.

The enhanced monitoring capabilities of the Mobinet service concept are expected to have a positive impact on the time saving and the cost efficiency of the healthcare professionals, as the service enables the simultaneous monitoring of the health status of multiple patients. Patient management and also, data management for each patient will be improved, facilitating medication management and the completion of administrative tasks for the healthcare professionals. Additionally, Mobinet is anticipated to positively impact hospitalisation duration and costs, and also, to minimize transportation costs allocated by patients / citizens in remote areas to doctor visits for routine examination.

The Mobinet service when deployed is expected to promote the wellness concept at the chronically ill and worried well market segments.

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