An Interpetive Approach in the Evaluation of Homecare Telematics Interventions

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ABSTRACT
Homecare telematics can be regarded as one of the fastest growing healthcare delivery sectors in the developed world and it is further reinforced as healthcare delivery paradigm is shifting from doctor and hospital-centered towards a new model where the citizen becomes responsible for the personalized management of healthcare, delivered at the point of living whenever possible. An important issue in the advancement and deployment of home telehealth services is their assessment. This paper reviews various approaches in health information systems evaluation and argues that home telehealth interventions more than any other such information systems applications require a holistic, interpretive approach in their evaluation, emphasizing the overall assessment of the telehealth service seen as an information system embedded in a clinical and a social context, rather than seen merely as a technical innovation or a drug. The paper proposes an adopted framework for evaluating home telehealth interventions and presents its application for the evaluation of a novel telehealth service for the monitoring and support of peritoneal dialysis at home.

Categories and Subject Descriptors
J.3 [**Life and Medical Sciences**]: Health, Medical information systems.

General Terms
Management, Design, Human Factors.

Keywords
Home care telematics, telehealth, peritoneal dialysis, web services, evaluation, interpretivism.

1. INTRODUCTION
Homecare telematics involves the use of information, communication, measurement and monitoring technologies to evaluate health status and deliver healthcare and support personalized healthcare management. The more modern term *home telehealth* includes in general any use of telecommunications by a home care provider to link patients or customers to one or more out-of-home sources of care information, education, or service by means of telephones, computers, interactive television, or some combination of each.

Generally, homecare telematic services, i.e. home telehealth can be used to support preventive healthcare through information dissemination and education for self-management, enhance health maintenance in special high risk groups with pre-existing chronic medical problems, assist rehabilitation after disease and major therapeutic interventions, and support health in both acute and chronic health problems. Such services fall broadly into the following categories [1],[2], and [3]:

(a) addressing patient and citizen anxiety;

(b) providing patient information and consultation for quality of life;

(c) supporting telemetry of vital signs and related patient data; and

(d) combining some or all of the above to set the basis towards integrated personalized care.

However, a recent literature review [4] suggests that most of the work on homecare telematics is towards two dominant services: audio-video teleconsultation and vital sign telemetry, while other added-value services such as decision support for medical staff and advanced information access and communication are rather sparse.

An important issue in the advancement and deployment of home care telematic services is their assessment, especially with the goal to improve such services and constitute them easier to integrate into the social and clinical setting. The meaning that researchers apply to assistive environments and telehealth in general is critical to the method they select for evaluation.

The debate of whether assistive technology and telehealth is a medical innovation, a drug that can be prescribed to patients or an information system coming to serve information transmission and processing needs is presented in this paper together with its effect on the selection of the right evaluation approach. Furthermore, the paper presents an evaluation framework for homecare telematics interventions that draws on the interpretive approach to information systems evaluation. Finally, a case report is presented where the framework is applied for the evaluation of a novel homecare telematic service for the support of patients with end stage renal disease that perform peritoneal dialysis at home.

2. BACKGROUND
Telemedicine or telehealth refers to a set of added value services provided over and advanced telecommunication infrastructure and supported by a variety of information and communication technologies. Their main goal is to support remote patient

management, including disease prevention, diagnosis and treatment, thus creating a virtual distributed health care provision environment.

The term 'telemedicine' is often being substituted by the wider term 'telehealth', to emphasize broader goals that include education, prevention and advancement of well being. Another related term is eHealth which is defined by Eysenbach [5] as: *"…an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology"*, a definition that comprehensively includes both technology and the environment.

In the specific case of caring for patients and/or health individuals at their place of living, the terms 'telecare' and 'telehealth' are also commonly used. Telecare is defined by Barlow, Bayer et al. [6] as the "*use of information and communication technology to facilitate health and social care delivery to individuals in their own homes*". The term 'telehealth' is used along 'telecare' with the emphasis that the recipients of telecare are usually patients while in the case of telehealth can even be healthy people who wish to remain well [7],[8]. Finally, the concept of home based eHealth is sometimes used to include both telehomecare and smart homes [9].

2.1 Health Information Systems Evaluation

Drawing on information systems evaluation literature we come across an interesting classification of the evaluation approaches in three zones [10]: the 'efficiency', the 'effectiveness' and the 'understanding' zone. The first two zones include the most widespread evaluation techniques that aim to assess whether an information system is either efficient or effective. The approaches included in the understanding zone however aim to understand the nature of the evaluation, its functions, problems and limitations. A well known example that produces such an understanding is the content, context and process framework developed by Pettigrew [11] and adapted to information systems evaluation by Symons [12]. According to this framework there is a link between what is to be evaluated (content), how it is evaluated (process) and who does it and why (context). The content is seen as determinant of the evaluation criteria and is presented in the centre ring of the evaluation 'onion'. Based on this, one can deduce that there is not 'one best method' suitable for the evaluation of all information systems [10].

The link between the type of the system and the evaluation approach used is seen also in the work of Farbey, Land and Target [13]. They argue that different information system applications require different approaches to be used for evaluating their impact. They present the 'benefits evaluation ladder', taxonomy of information system's application with eight rungs. The first rung represents mandatory changes and moving up the ladder we come across automation, direct value added systems, management information and decision support systems, infrastructure, inter-organizational systems, strategic systems and finally at the top business transformation. Each rung has a different degree of risk, uncertainty, and returns on investment estimation, and therefore evaluation complexity. Evaluating simply the cost of alternative solutions and the technical characteristics is enough for a system that an organisation is forced to introduce but not for a strategic system that will alter the way of managing and organising business.

Supporters of this link are also Smithson and Tsiavos [14]. In their work they demonstrate the complexity of evaluation by using the 'W-word' framework. Questions of what is the system being evaluated, why carry out the evaluation, when are the evaluations to be undertaken, and where is the evaluation to be performed are considered as subjective decisions that influence not only the way the evaluation is conducted but also the outcome of it. Whether the 'object' of the evaluation is seen as software and hardware, as network, as data or as a system that includes both technology and people operating in a given context gives an insight in the evaluation method followed. The boundary that is drawn on the artefact of evaluation depends not only on the evaluators' intentions but also on intentions of different groups of stakeholders. Actor network theory [15] is used in this approach to argue that evaluation is an act of representation (substitution) of the complex reality of an information system to a more manageable form (series of numbers and tables) that can be easily handled by decision makers.

The selection of the 'what is to be evaluated' is dominated by the meaning that is attached to the information system and it varies among different groups of stakeholders. In the case of assistive environments and telehealth this notion can explain the debate between the various evaluation approaches used. We can group telehealth evaluation approaches in three different categories according to the meaning that evaluators and stakeholders attach to such applications: (1) drug or therapeutic agent; (2) technical managerial innovation (technoeconomic logic); and (3) information system embedded in a clinical and social context.

A similar classification of evaluation approaches is presented by Cornford and Klecun [7] based on ethical perspectives. They argue that telehealth (a more encompassing term) draws on three different disciplines: medicine, information systems and information society. The ethics of each discipline vary and impose different evaluation frameworks to be followed. Medicine with its strong moral rule about patient's right and doctor's duty is translated into evaluation schemas based on a gold standard of proof testified by randomized control trials. The information systems discipline although presenting less explicit ethical concerns produces evaluation frameworks that examine technical, organizational, professional and societal aspects of telehealth and assistive environments as well as user satisfaction. Finally, ethics of information society impose evaluation approaches that emphasize on utilitarian principles like social inclusion, deskilling, loss of jobs etc.

2.2 Different Perceptions of Telehealth

Reviewing the literature on home telehealth evaluation approaches we came across three different perceptions of teleheath. Each perception leads to the adoption of a different view on the meaning and the aim of the evaluation activity and therefore of a different evaluation technique. We use here the term home telehealth as a more encompassing term that includes home telecare, home telemedicine, homecare telematics etc.

2.2.1 Telehealth as a 'Drug'

The most dominant perception of home telehealth is that of a 'drug' that can be prescribed to patients. Patients are thought to obey to this prescription and use technology in their homes according to the instructions given and in the end an immediate effect in their health condition is expected to be observed. Randomized control trials (RCT) are therefore presented as the most legitimate and credible evaluation technique. Indeed, most of the reviews exclude from their sample studies that do no use RCT [16]. There is big debate on the appropriateness of such a technique to evaluate telehealth applications. Here we present another deficit of the notion that telehealth and new medicines are equivalent interventions in patients lives. In the case of drugs, patients have two options: to obey to the prescription or ignore it. However, in the case of ICT while patients interact with it they '*enact structures which shape their emerged and situated use of it*' as Orlikowski argues in the structuration theory [17]. Information and communication technology is not a black box that closes after development An interpretation of this view in our context would suggest that each patient will draw on their skills, power, knowledge, assumptions, and expectations about the technology when using it at home and therefore enact a distinctive 'technology-in-practice'[17]. RCT focuses only on certain predefined outcomes ignoring this aspect of patients interaction with ICT which could answer the why of RCT's outcomes.

2.2.2 Home Telehealth as a Technical Innovation

A slightly more expanded view of telehealth is that of a technical/managerial innovation that will reduce cost of healthcare delivery, will raise physicians' productivity and patients' (seen as 'customers') satisfaction. Following this view, evaluators draw on economic theory to check cost effectiveness and productivity issues of each new innovation. On this category we can place another slightly different view of telehealth that still fits to the notion of telehealth as an innovation. Most telehealth applications today are funded by governmental bodies in order to establish a new modern way of healthcare delivery and bring ICT benefits in the health care sector. This means that telehealth applications are seen as short term projects that have a predetermined end and should be evaluated till the end of the funding. Evaluation is done quickly and by using methods that allow comparison and often serve publication purposes. Whetton points out that although evaluation is conducted on pilot short term telemedicine projects there is a widespread expectation that it assesses the long-term value of telemedicine [18].

2.2.3 Home Telehealth as an Information System Embedded in a Clinical and Social Context

Literature reveals that recently several researchers abandon partial views on home telehealth and perceive telehealth as an information system that is embedded in a clinical/social context. All three components of telehealth: technology, people and context are included in the evaluation and the interplay between them is examined in depth. Pragmatic approaches that consider the organizational context are proposed and qualitative evaluation using semi-structured interviews are carried out [6],[19],[20]. However, most of this work does not usually employ any theoretical framework to guide research and draw conclusions [21]. They do not present detailed descriptions of their method of gathering data and therefore their researches are strongly criticised as incredible.

Indeed, interpretive research requires adopting a theoretical model in order to present which aspects the evaluator wishes to study. This framework serves not only to structure the report of stakeholders' experiences but also to interpret them in a way that general patterns of interaction can be derived [17]. Thus, research would lead to a conclusion that may be meaningful beyond the limits of the specific study and bring a scientific contribution to telehealth evaluation area.

To overcome such shortcomings, researchers should familiarize themselves with information systems theories and make use of them while conducting telemedicine research [21]. Such attempts have already led researchers to construct their own evaluation frameworks of telemedicine and telehealth, For example, Taylor suggests that evaluation should consider whether telemedicine is first safe, second practical and last worthwhile [22]. Skiadas and Argoyiannis also present a three stages evaluation framework that includes: evaluability assessment which provides the specification of the evaluation criteria of the different stakeholders, then formative evaluation that focuses on the description of system's short term effects on the process and its influence upon stakeholders, and third summative evaluation that determines the impact of the system on health outcomes [23].

3. HOME TELEHEALTH EVALUATION FRAMEWORK

There is an agreement between authors of home telehealth that the evaluation process is much more complicated than that of the rest telehealth applications [6]. The most common reason mentioned is the diverse group of stakeholders. Stakeholders come from different parts of the healthcare system with different value systems, different perceptions of risk and different expectations of the home telecare application. Costs and benefits may fall unequally between the various groups of stakeholders. The second reason that is seen often in literature is the diffused context that home telehealth is applied to. The surrounding context varies (each patients' home) and given the fact that home telehealth applications are few and short (in terms of pilot applications duration) makes it difficult to generate data of sufficient scope and scale for conducting a careful analysis. These obstacles require careful consideration of the evaluation approach to be used. Another difficulty that should be pointed out is that home telehealth applications are usually designed without the participation of the most important group of stakeholders, the patients. Whole systems are developed without patients to be asked about their needs and preferences. Just like the production of new pharmaceuticals and therapeutic procedures, patients are more or less forced for obligatory usage of the home telehealth application after development, while during development their position is expressed mainly by their doctors and nurses. This tactic may preserve physicians' status and power over patients but may cause the development of home telehealth systems that ignore patients' abilities or needs.

Literature review reveals the need to base evaluation on a theoretical model that will guide our research and serve to the interpretation of the data in a way that general patterns of interaction can be derived. In order to construct such a model for home telehealth evaluation, we selected the context, process and

content framework created by Cornford and Doukidis [24] which derives from information systems literature and precisely from interpretative thinking, but also encompasses medical evaluation literature. The reason for the selection of this evaluation framework is that it serves our view of the evaluation as an attempt to understand the context, and the interplay between technology-people-context and as a *'continuous learning process rather than a search for judgement'* [25].

Cornford, Doukidis and Forster [24] have proposed an evaluation framework for telemedicine and telehealth interventions that views telehealth effects from three different angles: the structure, the process and the outcome. These three angles are applied at three levels: the level of the systems functions, the human perspectives and the organizational context.

In the level of systems functions the evaluation of structure involves the assessment of the technical details of the telemedicine application, the examination of the process focuses on the information processing and that of the outcome on whether the system as a technological innovation has relevant, applicable and reliable results. In the human perspective level, all stakeholders and participants in the telemedicine application are included and their acceptability searched. Actors may vary from owners, providers, and consumers of the system. In each case, the changes in their work conditions, or their behavior should be assessed in the structure layer, their view on the changes in the mode of operation and health care experience is to be addressed in the process layer while systems effectiveness through the eyes of the different actors is judged in the outcome layer. The aim is to view the system applying different lenses according to actors' role in it. Finally, at the organizational context which in the case of telemedicine is the health care system in the layer of structure the attention is drawn on systems sustainability assessment, while impact on the delivered quality of health provision and on the health status of the patients is examined in the process and outcome layer respectively.

In this paper we propose an adaptation of this model to evaluate home telehealth services. In our proposed adaptation, we further analyze the framework in order to account for the special requirements of the home care environment and its actors (see Figure 1). The emphasis is given to the human perspective, as in home telecare and telehealth applications we encounter the unique setting with the patient/citizen at home (or at their own environment), secluded from direct contact with the healthcare personnel and/or technical support. The chart in Figure 1 gives the basic questions that have to be tackled for every evaluation angle and every different level. It should be noted that depending on the goal of its evaluation, some or all of the cells in the proposed framework may be tackled.

4. A CASE STUDY: HOME TELEHEALTH FOR PERITONEAL DIALYSIS

The proposed framework was implemented for the evaluation of PERKA a novel telehealth service that supports peritoneal dialysis at home [26].

4.1 The PERKA Service: Home Telehealth for Patients in Peritoneal Dialysis

End stage renal disease with chronic renal failure is treated with either dialysis or kidney transplant. Dialysis involves substituting renal function by removing waste products from the blood via a specialized interface, either using an artificial membrane outside the patient's body (hemodialysis in Artificial Kidney Units) or using peritoneum as a physical membrane inside the patient's body (peritoneal dialysis). The number of end-stage renal patients with chronic renal failure tends to increase nowadays, mostly due to the increased incidents of diabetes.

In peritoneal dialysis (PD), a special fluid (solute) is inserted into the peritoneal cavity, remains there for a certain period of time and then exits the body. The process is implemented via a permanent catheter and a special mobile unit, and is repeated a few times a day (depending on the specific dialysis scheme). Peritoneal dialysis is performed at the home of the patient, who visits the hospital or PD clinic once a month for a routine check-up. The percentage of patients on peritoneal dialysis differs across countries and is about 10-50 % of patients on dialysis, while the effectiveness and success of the method depends on the dialysis scheme which is designed by the doctor for each patient and is determined among else by physiological parameters such as: patient weight, blood pressure and heart rate (and in specific cases ECG and blood glucose), as well as the type and amount of the solute that is inserted and excreted during the dialysis. There are a number of PD techniques; the most common include the Continuous Ambulatory Peritoneal Dialysis (CAPD), where the patient handles the process of fluid exchanges manually throughout the day, and the Automated Peritoneal Dialysis (APD), where the process is performed automatically by a cycler device during the night.

Being performed solely at home, peritoneal dialysis is a unique candidate for support via telematic services. Thus, teleconferencing has been used by various groups for psychological support, patient retraining, evaluation of catheter exit site and oedema presence [27],[28]. More recent studies and pilot implementations involve vital sign telemetry. Thus mobile telephony and web-based systems have been proposed to monitor CAPD sessions [29] as well as APD [30]. Automated telemetry between the patient's cycler and a computer in the PD clinic is currently supported by the most prominent manufacturers of APD equipment, such as Fresenious Medical Care (Germany, http://www.fmc-ag.com/) and Baxter International Inc. (IL, USA, http://www.baxter.com/), allowing data transmission and storage, doctor interventions to alter cycler prescription, as well as live patient-physician interaction [31].

Although telematic support has been incorporated into widely used APD cyclers, this service is provided only with a limited range of models and most importantly it is not provided as an open component system, so the APD telemetry data can only be monitored, archived and managed via proprietary software. Thus a PD center would have to either use APD equipment exclusively from a single ventor, or have to cope with different sets of monitoring and archiving software. In either case, monitoring would have to be restricted on APD patients using only the certain advanced cyclers, excluding users of other devices and/or patients on CAPD.

To overcome these limitations, in 2006 the School of Medicine in Democritus University of Thrace formed the PERKA consortium and were granted a competitive R&D fund in order to develop a new telemedicine service to support peritoneal dialysis at home,

using standard-based integration between individual units developed independently by various vendors. The PERKA service supports the collection and transmission of data from the patient's home via cellular or conventional phone or data networks to the PD clinic for monitoring and archiving. Transmitted data include: (a) peritoneal dialysis data: PD method, PD prescription, and PD daily treatment schema actually conducted including number of fluid exchanges, exchange duration, solute type and volume, and ultrafiltration volume; (b) general biometric data and biosignals: body weight, blood pressure, heart rate, oxygen saturation, temperature, and, on occasion, electrocardiogram and blood glucose levels; and (c) free text or sound report and/or response to a structured questionnaire. Data are transmitted to the PD Clinic, where they are archived as a patient record segment and processed to create intelligent alarms. Medical personnel can monitor transmitted data either on schedule or as a result of an alarm, and remotely supervise PD procedure, patient adherence to prescription, reaction to PD and the overall wellness of the patient, and can intervene to change the therapy or communicate with the patient. The service can be applied in any PD technique, including CAPD and APD.

The PERKA system builds on open internet standards for communication between well defined and self-described functional units, thus supporting solutions based on integration of components from various vendors. The basic functional units include:

- A patient unit, a PDA-based mobile application that undertakes local data collection, either automatically from various medical devices with digital output or as manual patient entry.
- A data collection unit, which is implemented as a web service, with standard self-describing interface methods that among else describe the type and details of telemetry data required. This web service collects, manages and processes telemetry data.
- A web-based portal application that provides different views of the telemetry data, according to the user (patient, doctor, nurse, administration, etc) via secure internet protocols.
- A database for patient telemetry data that corresponds to a patient record segment.
- A database for administrative data (user definitions, roles, permissions and other information) as well as content for general information of the medical personnel, patients and the public (which is organized by a content management system).

Communication between the patient unit and the data center is based on XML/SOAP. The published interface methods of the data collection web service allow for third party vendors (including vendors of peritoneal dialysis cyclers and other supportive medical equipment) to develop their own proprietary units for local collection from the patient and thus provide a generic standard interface for integration with special purpose mobile units and medical devices alike.

4.2 Evaluating the PERKA Service

Evaluation of the PERKA telehealth service was based on the proposed adapted evaluation framework with the aim to understand how various users involved in the service interact with it in the particular setting of a pilot implementation. The process of evaluation was viewed as a learning process used as an input for the advancement of the service and the study of the interaction of such a service with its human and organizational environment.

The evaluation was designed in two phases. In the first phase, evaluation of the service was performed in a limited number of users (medical personnel and patients) in the controlled environment of the hospital. The goal of this evaluation was to provide a basic service assessment using a prototype, so that to drive the finalization of the functionality and user interface of the server component and the patient unit. This part of evaluation was in fact part of the system development. Although medical personnel had participated extensively in the design and functional specification of the system, as well as in laboratory tests of the software, patients were not involved in this design and testing phase. Patients were excluded from these phases of system development in order to spare them extra confusion and the respective stress of getting involved in learning and trying to use a premature prototype, especially considering their already compromised health condition. However, once a first prototype reached maturity, it was used in a controlled environment for a first evaluation by a number of medical personnel and representative patients. This also helped the patients to get introduced and easily grasp the idea of the telehealth service and the system, a task rather difficult to achieve in the abstract phase of system functional requirements investigation and design.

The techniques employed were observation of the different stakeholders groups, unstructured and semi-structured interviews, documentation review and researchers' interaction with the technology used. In this preliminary evaluation, 5 doctors, 4 technicians and 4 patients were involved. Quotations from stakeholders are presented in their own words letting readers to interpret them. Following the proposed framework the findings of the preliminary evaluation are summarized as follows.

4.2.1 Evaluation of System Functions

Structure: Main problems where underlined in the patient unit. The device initially chosen was a PDA, and users indicated that this device was rather small in size and as a result not easily used by elder and health compromised users. The server component was easily accepted by the medical and technical personnel, mainly due to the fact that it had been designed and customized with continuous interaction with these user groups, and thus depicted their views and expectations. However, four out of five doctors reported problems with the terminology used in the user interface.

Process: Pilot data transfer, processing and display proved correct and satisfactory, although implementation in a real environment is required for a complete evaluation.

Outcome: The service was perceived as relevant and reliable by the doctors, although one questioned the relative validity of the biometric data inserted by the patient and transmitted: "*The reliability of the system depends on the reliability of the patient, as the patient inserts the data on their own – a direct interface with respective devices (e.g. scale, digital thermometer, dialysis equipment, etc) would alleviate this problem*", he quoted.

4.2.2 Human Perspective - Physicians

Structure: All physicians involved quoted that they use routinely information systems in their everyday work, so the introduction of the service did not seem to induce changes in their working environment, nor requiring new skills. They reported satisfaction of getting involved in the design process, and found the training adequate.

Process: All physicians expressed the belief that the service will alter the process of peritoneal dialysis patients' monitoring and will have a measurable effect on their health, by contributing in preventing peritoneal dialysis side effects, such as acute dehydration and pulmonary edema. However, first evaluation in a pilot implementation is not adequate to properly access process issues, as this requires a longer evaluation period in a real environment.

Outcome: Although various opinions were expressed about possible improvements of the system, all physicians agreed that the service will enhance their productivity in terms of patient monitoring and thus providing better healthcare. However, they pointed out that at this premature phase of introducing telehealth to their working environment and to their patients, it would be advisable to use telehealth for monitoring only and not for intervening to alter dialysis prescriptions.

	Home telehealth functions	**Human perspectives**			**Renal disease clinic context-Patients' home context**
		Physicians- Medical personnel	**Patients**	**Administrators**	
Structure	Are the hardware and software technical requirements met; does the system work; does it present technical problems?	What are the changes to physicians' and medical personnel's working conditions and practices; do they need to obtain new skills, and abilities?	Are patients required to obtain new skills, and abilities?	Is the system cost-effective?	Could this home telehealth system be sustained and supported within the renal disease clinic context? Could it be accepted within the home context?
Process	Is telehealth service operation correct & valid ? (collection & transfer of biometric data, communication between different units, presentation of telemetry data)	How was the physicians' and medical personnel's mode of operation changed? Are these changes seen as desirable to them?	How is the renal patients' behaviour altered; what are the changes in their everyday practices at home; which are the effects to their families?	Does it imply changes to administrator's working practices?	Could such a system be institutionalised?
Outcome	Are the functions of the telehealth application usable and reliable?	Was their effectiveness within the health care system affected?	Does the use of the system result in changes in the perceived quality of care/life?	Does the system improve specific clinical parameters?	Could such a system improve the health status and quality of life for renal patients?

Figure 1. The proposed evaluation framework, as a detailed adaptation of the Cornford, Doukidis and Forster framework for the specific case of home telehealth.

4.2.3 Human Perspective – Patients

Structure: All patients proved eager to use the service and seemed to be able to grasp its potential usefulness. Their only setback was reported to be caused by the relative difficulty to use the patient unit due to its small size. It is remarkable to note the persistence of one elder patient who quoted: "*I will do it! When it comes to our health, we can do anything*".

Process: The pilot evaluation in a controlled environment could not address process issues that require a more extensive evaluation in a real world environment.

Outcome: All patients seemed to understand the advantages and potential of the specific telehealth service and expressed their interest in taking up this service in their everyday routine. However, they also expressed their concern that such a service may be rather demanding for technologically illiterate patients. Therefore, they stressed the fact that the patient unit should be improved to be as user-friendly as possible, with emphasis on help messages, so that less technologically oriented patients will not be secluded from using the service.

4.2.4 Human Perspective – Administration

Assessment of the effects of the telehealth application in the administration was not a subject of this preliminary evaluation.

4.2.5 Organizational Context

Once again, the pilot implementation of the service is not

sufficient to assess organizational context issues. We could only comment on some effects for the immediate organizational context, i.e. the Peritoneal Dialysis (PD) Unit at DUTH. For the PD Unit the PERKA telehealth service proved to be an opportunity to investigate the potential of telehealth and especially an opportunity to improve their status by introducing state-of-the-art technologies in their working environment. The support of the PD Unit staff indicates that the service has the potential to be smoothly integrated in their routine clinical practice.

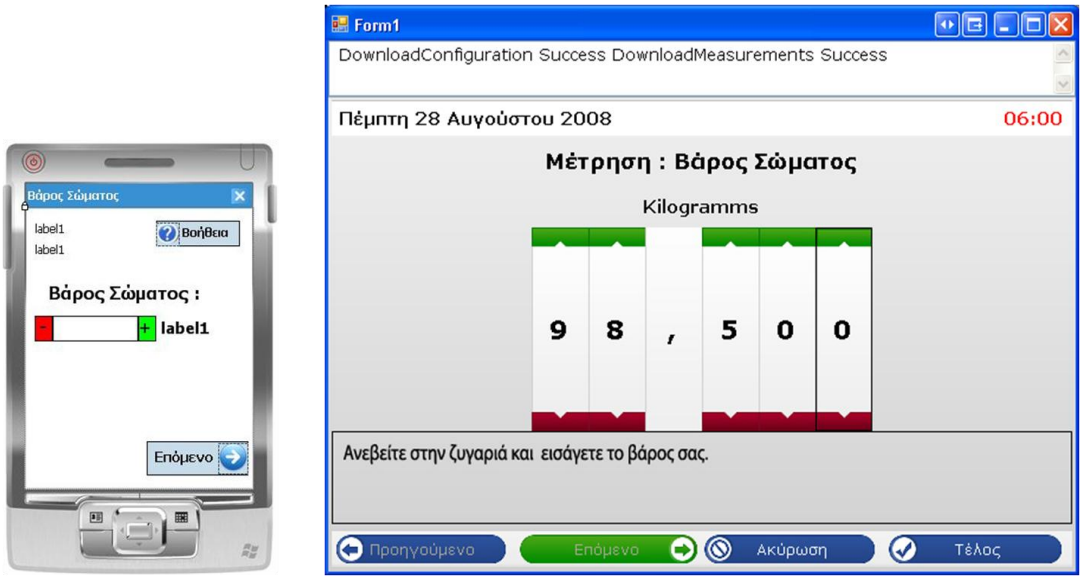

Figure 2. The initial PDA-based patient unit (left) and the subsequent netPC-based patient unit (right) that emerged after concluding first evaluation in a controlled environment.

5. DISCUSSION

The outcome of the first evaluation in a pilot controlled setting of the hospital indicated a positive attitude of physicians and patients against the PERKA telehealth service. The most direct result was the redesign of the patient unit, and its new implementation on a 9 inches touchscreen netPC, instead of a PDA. Figure 3 shows the initial PDA interface and the subsequent netPC interface. Minor modifications were also performed for the server component, which was deemed adequate in general. Currently the PERKA telehealth service is in the third month of its second stage evaluation (following the same framework) while in full deployment with 10 patients routinely using it (https://portal.perka.gr). This evaluation is expected to have a duration of several months, mainly targeting to assess outcome issues (especially from the human perspective and particularly the patient) and organizational context.

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