TELEREHABILITATION

GOOD PRACTICE - PROJECT

HoCare project (PGI01388) is carried out under the Interreg Europe programme financed by the European Regional Development
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Contents

Introduction to the Good Practice:

The platform is developed under the framework of the TeleRehabilitation project funded by the Cross Border Cooperation Programme Greece Cyprus 2007 -2013 in order to successfully meet the main technological and clinical objectives of the project. The TeleRehabilitation programme is an innovative home-based rehabilitation service for patients suffering from cardio-respiratory problems provided by the Nicosia General Hospital. It aims to support patients discharged from the intensive care unit (ICU) during their rehabilitation by using telemedicine tools and tailoring activity according to their morbidity profile.

Problem:

Many of the patients hospitalized in Intensive Care Units (ICU) return home suffering from reduced functional capacity, exercise tolerance, health related quality of life and social function. Although the evidence demonstrates a clear need for rehabilitation for those patients, it seems that is not often possible for them to join rehabilitation multidisciplinary supported programs. The main reasons are the absence of such programs provided by the public or private health sector, the high cost of participation and mobility problems due to the medical condition of the patient, the community location or the traveling overheads.

Solution:

Build a service that will improve accessibility to health care services, increase adherence to the rehabilitation programme, reduce costs and enable a more efficient provision of high quality telemedicine services. TeleRehabilitation is an advanced telemedicine tool that enables home-based rehabilitation sessions, which has a positive impact on patients and health care providers in terms of avoiding further hospitalisations because of missed rehabilitation session.

Impact:

The tele-rehabilitation system is completely developed and established in the premises of Nicosia General Hospital. The system is used for further studies and development of new innovative technologies from the Academia. The use of video-communication and remote monitoring systems have a positive impact on quality of life. Especially patients living in remote areas can benefit from this service. This way, the service enables patients to return home sooner and helps avoiding stressful situations of travelling while still in a precarious health condition. Family members and other carers are also relieved in this respect, since the patient does not need help with transportation from and to the hospital. Health professionals working in the TeleRehabilitation programme state that it can contribute to avoiding re-hospitalisation of patients.

1. Relevancy of the GP project

The “Relevancy of the GP project” section provides quick check and definition of its relevancy in regards to HoCare project objectives.

Good practice of quadruple-helix cooperation in R&I?	Yes, this GP project includes good practices of quadruple-helix cooperation in R&I
Good practice of delivery of Home Care R&I?	Yes, this GP project includes good practices of delivery of Home Care R&I.
If not in Home Care R&I, describtion and proof of its potential for transferability to delivery of Home Care R&I	
Generation of innovation in home care through answering unmet needs identified by formal or informal healthcare providers?	Yes, this GP project includes good practices of innovation through answering unmet needs.
Generation of innovation in home care through public driven innovation?	Yes, this GP project includes good practices of public driven innovation.
Generation of innovation in home care via quadruple-helix cooperation for quicker delivery to the market?	Yes, this GP project includes good practices of innovation via cooperation for quicker delivery to the market.

2. Quick overview of the GP project

The “Quick overview of the GP project” section provides initial overview of the good practice project (GP project) and enables readers to see if this GP project idea is relevant for possible transfer to their organization potential innovation activities.

Name of the GP project	TeleRehabilitation
Region of origin of GP project	Cyprus
5 keywords that best describe the content of the GP project	Cardiovascular Rehabilitation Group Exercise Patient Assessment Patient Monitoring & Alert at home Holistic approach (Exercise, Nutrition, Psychological)

Relevant **Operational Programme name through which the GP project has been funded** (+ also in local language in brackets)	Cross-Border Cooperation Programme Greece – Cyprus 2007-2013
Relevant **support programme / intervention area name** of the GP project **through which it was funded** (+ also in local language in brackets)	Accessibility and Area Security
Single or multiple recipients of the GP project?	multiple recipients
Type of lead recipient (SME, LME, research centre, innovation centre, network/association, university/school, municipality, other public body, other (specify)	Ministry of Health
Types of participating partners (list all participating partner types. E.g.: hospital, social house, senior house, patient association, networks, SMEs, LMEs, research actors, business supporting organizations, public institutions/regulators, other (specify)	NGOs, Hospitals, Research Actors, Universities
Summary of the good practice	Currently, an estimated 50 million people in the European Union live with multiple chronic diseases (multimorbidity) and this number is expected to further increase in the near future. As multimorbidity deeply impacts on people's quality of life -physically, but also mentally and socially-, there is a growing demand for multidisciplinary care that is tailored to the specific health and social needs of

	these people. Integrated care programmes have the potential to adequately respond to the comprehensive needs of people with multimorbidity by taking a holistic approach while making efficient use of resources. Such programmes are characterized by providing patient centred, proactive and coordinated multidisciplinary care, using new technologies to support patients' selfmanagement and improve collaboration between caregivers. The TeleRehabilitation programme is an innovative home-based rehabilitation service for patients suffering from cardio-respiratory problems provided by the Nicosia General Hospital. It aims to support patients discharged from the intensive care unit (ICU) during their rehabilitation by using telemedicine tools and tailoring activity according to their morbidity profile. This service improves accessibility to health care services, increases adherence to the rehabilitation programme, reduces costs and it enables a more efficient provision of high quality telemedicine services. The advanced telemedicine tool enables home-based rehabilitation sessions, which has a positive impact on patients and health care providers in terms of avoiding further hospitalisations because of missed rehabilitation sessions.

3. Transferability

The "Transferability" section provides more detailed review of strengths and weaknesses of this GP project including description of necessary basic conditions for region and leading organization to potentially transfer it. At the end of the section, the key threats in the successful transfer open up possibility to focus on specific relevant issues important for the successful transfer.

Strengths and weaknesses of the project

What are the GP project strengths? Why it was funded?	Innovation: It fills a gap in the provision and continuity of out-of-hospital services. Technology Excellence: The introduction of a telemedicine service in a country with limited experience in e-health is a challenge, but it has been successful according to both professionals and users. Transferability: The programme would be interesting for other areas/countries where rehabilitation services are underdeveloped or not easily accessible as in remote areas.
What are the **key weaknesses of the GP project**?	- Technology innovation with high complexity integration. - Sustainability would be an issue (too expensive equipment for individual patients) if the Ministry of Health or Insurance Companies do not support the service.

	- High maintenance cost

Basic conditions for successful transfer

Why is this GP project transferable? – innovation, impact, financial, legal, and timeframe aspects	The programme would be interesting for other areas/countries where rehabilitation services are underdeveloped or not easily accessible as in remote areas. The potential of the programme for expansion to other fields of medicine lies in its flexible design. The telemedicine service could easily be transferred and adapted for rehabilitation, monitoring and training that are required for other (chronic) health problems and diseases. The technical equipment allows the connection of other sensors to monitor vital signs. The video-communication system can also be applied for medical consultations from a distance. However, it is important to realize that the initial investment of the home-stations is high and the cost-effectiveness that is realized in this case is mainly due to the high cost of admittance to the ICU. Other units at the hospital have already shown interest in the system for their own home-based or community service provision. The possibilities for community services should be explored as stations could also be installed at community centres for the provision of all kinds of health-related care or prevention.
What are the **basic conditions the region needs to have** to be successful in transferring this good practise?	No specific conditions since the project addresses EU countries. Public, private, research and civil society organizations are important to cooperate for the implementation of such project and the production of its deliverables. A specific Call for proposals targeting National/Regional/Community Social Services provision/innovation could easily host such a project at any member state's national or regional level.
What are the **basic conditions the leading recipient from the region needs to have** to be successful in transferring this good practice?	To deploy this kind of service the following conditions must be met: 1. Technological: a. Broadband national networks. b. Medical equipment (Central monitoring station, wearable monitoring devices). c. Video conference solutions for multiparty sessions 2. People a. Ergophysiologists, Cardiologists, Pneumologists b. Trained Physiotherapists, Nurses c. Trained IT 3. Management:

	a. Coordinating team b. Established communication mechanisms with patients, patient organizations, public sector 4. Strategic: a. National Health Programme

Key threats in GP project transfer

What are the **key potential threats for the GP project transfer?**	- Medical devices must meet the standards. Public procurements due to strict laws introduce long timelines during this phase. - Personnel training - Patient familiarization with technology - Sufficient funding should be secured.

4. Description of the GP project

The “Description of the GP project” section provides more detailed information on the Good Practice project (GP project) and enables readers to get further detailed inspiration and easy ready-to-use information for possible innovation transfer to other project applications. This includes: tackled problem, time length of the GP project, objectives, phases, activities and deliverables of the GP project, its main innovation and target group.

Description of the tackled problem

What was the **problem / challenge tackled** by the project?	It aims to support patients discharged from the intensive care unit (ICU) during their rehabilitation by using telemedicine tools and tailoring activity according to their morbidity profile. This service improves accessibility to health care services, increases adherence to the rehabilitation programme, reduces costs and it enables a more efficient provision of high quality telemedicine services. The advanced telemedicine tool enables home-based rehabilitation sessions, which has a positive impact on patients and health care providers in terms of avoiding further hospitalisations because of missed rehabilitation session.
What were the **reasons for the problem?**	- Lack of specialized personnel in each Major Cyprus Hospitals. - Long distances to reach Nicosia’s General Hospital

Time length of the GP project

What was the **time length** of the GP project in months?	24 Months

Objectives of the GP project

Describe the **overall and specific objectives** of the GP project	The Intensive Care Unit of Nicosia General Hospital, as the principal partner of the project, in cooperation with the University General Hospital of Heraklion and the Department of Computer Science of the University of Cyprus have defined as a primary purpose the development of a novel pilot application of cardiorespiratory rehabilitation services in the community based on telemedicine, for patients after ICU discharge. Secondary objectives: The creation of a supportive technological infrastructure, of high quality and low cost for update and expansion. Publication of the scientific results regarding aerobic capacity, evaluation methodology as well as the structure and effectiveness of the individualized rehabilitation program. Setting the underpinnings for the evolution of the pilot project into viable and sustainable service. Further development of the inter-border cooperation between Cyprus and Crete in terms of medical services accessibility, secure social re-integration and novel research, and development of medical services.

Phases, activities and deliverables

List all **main phases** of the GP project including their time length	- User Requirement / Specifications: 8 months - Service Development: 12 Months - Pilot Testing / Evaluation: 4 Months
List and describe all **main activities** that were implemented by the GP project	- Project Management - Dissemination in National and International level - User Needs - Service/Platform Design - Development - Testing and Evaluation - Sustainability plan
List all **main deliverables** of the GP project	- Presentations in Scientific Conferences - Publications in Scientific Journals - User requirements (patients, practitioners, operators)

	- Platform specifications - Service specifications - Patients' health records web application - Technological Solutions integration - Rehabilitation programme methodology based on personalized training - Training (patients, practitioners, technologists) through online platform with interactive courses and videos. - Standard Operating Procedures (technological, health) - Pilot Testing and Evaluation - Cost Benefit analysis and sustainability plan

Main innovation of the GP project

What was the **main innovation** of the GP project?	- Personalized distanced rehabilitation - At home multiparty rehabilitation sessions - Holistic treatment - User Needs step referred in page 11 above, at the list of main activities included a quadruple helix model cooperation, since organizations representing all helixes were invited to work together in round table discussions in order to provide their experience and opinion for the definition of a more realistic view of the real needs to be tackled.

Target group of the project

Who was the main **target group** of the GP project? (SME, LME, research organization, university, public institution, healthcare provider, business supporting organization, other (specify)	- Patients - Ministry of Health - Patient Organizations - NGOs - Universities
Describe the main target group	The patients discharged by ICUs usually have a complex health status and often patients suffer from multiple chronic conditions. The TeleRehabilitation programme is not explicitly addressing multimorbidity in general, since it focuses on patients with cardiorespiratory problems discharged from ICUs. These patients suffer from multiple health problems, both acute and chronic in nature which are taken into account by comprehensive assessment based on which the

	individual the rehabilitation plan is designed. The programme applies a multimorbidity approach by tailoring the intervention to the specific health needs of patients. At the Nicosia General Hospital ICU an estimated 1,200 critically ill patients are hospitalised every year, of which around 1,000 survive. Approximately 25-35% of them are not able to resume their regular life and to participate in their daily activities immediately after being discharged. They often require specialised, tailored cardiorespiratory rehabilitation, as well as multidisciplinary support, in order to improve their health condition. However, there are major barriers in the Cypriot context that negatively influence the access of patients to such rehabilitation services. There is limited availability of formal services provided by hospitals and rehabilitation centres. A significant share of the Cypriot population lives in rural areas with less health infrastructure. Moreover the direct and indirect costs of travelling to the hospital are considered a substantial barrier for many people. In addition, patients might also suffer from mobility problems which make travelling very difficult. This situation may result in nonattendance and non-adherence to the rehabilitation plan. Dependence on relatives or carers is perceived as a significant burden. The programme was initiated to fill this gap. The target group of the programme are adults (aged 18 and over) discharged by the ICU after a stay of more than 48 hours, where they needed mechanical ventilation and had symptoms of the systemic inflammatory response syndrome and/or multi-organ failure. The patients eligible for participation in the programme are those with moderate mobility problems (Rivermead Mobility Index, (RMI), ≤10/15) (7). Patients diagnosed with quadriplegia or paraplegia and those suffering from cognitive impairments (failing the Mini-Mental State questionnaire, evaluated by a physician) are excluded from the programme. So far, the majority of users were adults between 35 and 50 years old, with only a few cases of older people accepted to participate in the programme.

5. Impact

The “Impact” section provides more detailed information on the effect of the GP project implementation and dissemination of major outputs.

Impact

What was the level of **geographical impact** of the GP project? (village,	- National and Cross-border level - countries (Cyprus, Greece)

city, county, country, international, other (specify)	
What were the final **impact indicators including their quantification**?	In the initial phase of the programme (2012-2014), the service was developed and tested through co-funding from the European Commission, which provided 1,200,000 Euros overall for research and development activities in the two sites of Nicosia (Cyprus) and Heraklion (Greece). The costs for technical equipment (including video-communication system, wearable sensors, IT infrastructure, central and patient stations, web applications, exercise equipment) amounted to 600,000 Euros. The expenditure for human resources involved (clinical, IT and home care staff) was approximately 150,000 Euros. Considering that the programme can support around 75-96 patients annually and, with a worst case scenario, lifetime of the technical equipment being 5 years, it was estimated that the cost per patient was around 2,100 Euros, the same amount of the daily costs for one ICU patient (6). Furthermore, a detailed financial analysis was conducted by an external company in order to evaluate the programme's sustainability in Nicosia over the years (9). The evaluation was based on a discounted cash flow (DCF) analysis, which estimates the return of investment adjusted for the time value of money using two measures of success: the net present value (NPV) and the internal rate of return (IRR). The financial prediction assumed an increasing number of users of the TeleRehabilitation (including both rehabilitation sessions and successive follow-ups) over a 5-year period (in the fifth year, 122 full users and 200 follow-ups). The initial investment for technical equipment (including devices, systems, software etc.) amounted to 382,000 Euros. In this respect, the analysis found out that both measures were positive. The NPV estimation calculated the sum of cash flows (both costs and benefits) of every year in a five-year period with an annual discount rate of 10%, assuming that any positive result of NPV means that the investment is worth and would add value: the NPV for Telerehabilitation is 30,000 Euros. IRR estimation calculated the rate of return which makes the NPV equal to zero, with the consequence that if the IRR is higher than discount rate the investment is acceptable by the organisation: in this study, the IRR was 11.8%. Thus higher and more convenient compared to a standard discount rate of assumed 10%. These results indicate that the TeleRehabilitation programme is worth the initial investment and leads to better financial outputs compared to re-hospitalisation of patients in the ICU because of failing recovery.
Describe the **changes**	1. One major hospital in Cyprus was equipped with Rehabilitation central

resulted from the project activities	monitoring facilities. 2. A second major hospital in Cyprus was equipped with Rehabilitation in groups devices 3. One major hospital in Cyprus was equipped with Rehabilitation at home devices 4. A multidisciplinary team of healthcare experts were trained for Cardiovascular Rehabilitation in vivo and at home 5. The development of a new protocol for Rehabilitation at home

Dissemination of outputs

Describe **dissemination activities** of the project outputs carried out during the GP project	- Website - Social Media - 3 National workshops and press conferences - Participation in International Conferences (Greece, European Society of Intensive Care Medicine,) - Presentations in Patient Organization events - National TV and Radio interviews - Publications in Scientific Journals - Leaflets and posters in all Main Hospitals. - Presentations to Insurance Companies, Universities and Private Hospital - Presentation to Medical Device Vendors and Technology providers

6. Risks

The “Risks” section provides more detailed review of potential risks of this GP project implementation including their defined mitigation strategies to eliminate them.

Describe **risks involved** in implementing this GP project including their **mitigation strategies**	- Technology acceptance rate by patients and practitioners - Initial investment - Sustainability

7. Budget

The “Budget” section provides more detailed review of costs regarding the project implementation as well as operational sustainability after its end. In addition, if relevant, public tenders within the project and additional generated incomes by the project are showed and explained.

Budget

What was the **overall budget** of the project **in EUR**?	1,2 Million Euros
List relevant **budget lines of the project including their % share** from total budget	staff cost: 38295 administration: 130000 travel & accommodation:39000 equipment: 452200 external expertise and services: 190000

Additional income generated by the project

Did the project create any **additional income**?	no, the GP project did not generate additional income
If yes, specify **which type of income and what amount in EUR?**	

Public tender

Did the project include any **public tender**?	yes, the project included a public tender
If yes, specify **what kind of contract** (specific contract, general contract, other)	- Specific contracts
If yes, specify in **what amount** in EUR	- 700000 Euros
Describe the **public tender subject**	- Equipment procurement - Rehabilitation methodology research and development (university – medical school) - System integration - Project Management and Coordination (NGO which acted as a mediator for patients)

Financial sustainability after GP project end

Was there an **operational financial sustainability plan** in the project **after its**	yes, the GP project included an operational financial sustainability plan

end?	
If yes, specify **where the operational funds** after project end **came from?**	Ministry of Health
If yes, specify the **amount of operational funds** in EUR	250000 Euros Annually

8. Other information

In this section, specific additional information about the GP project could be revealed.

Please describe **any other relevant information about this GP project** (if relevant)	N/A

9. Information gathered by …

The information about this good practise (GP) project has been gathered for the purpose of the HoCare project (Interreg Europe Programme) by the following organization:

Region	Cyprus
Organization name(s) (+ in local language in brackets)	Nicosia Development Agency (ANEL) Αναπτυξιακή Εταιρεία Λευκωσίας (ΑΝΕΛ)
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