



COCIR **TELEMEDICINE TOOLKIT**
SUPPORTING EFFECTIVE DEPLOYMENT
OF TELEHEALTH AND MOBILE HEALTH **MAY 2011**

COCIR
SUSTAINABLE COMPETENCE IN ADVANCING **HEALTHCARE**

European Coordination Committee of the Radiological, Electromedical and Healthcare IT Industry



TABLE OF CONTENTS

PART 1 COCIR POSITION PAPER	3
PART 2 COCIR GLOSSARY OF TERMS	13
PART 3 COMPILATION OF REFERENCED STUDIES	19
PART 4 SUCCESS STORIES.	31



TELEMEDICINE: WHAT'S NEW?

Building on the success of its telemedicine toolkit, published in March 2010, COCIR decided to enrich it with new updates every year.

Feedback we received from different stakeholders gave us the confirmation that we had filled an information gap and created a valuable resource by sharing our expertise and our concrete recommendations on how to accelerate the deployment of telemedicine in Europe. Given this need for credible information, we felt it was timely to update the toolkit with the latest on this technology which has so much potential to improve patients' lives.

One year since that first edition, the main barriers to the deployment of telemedicine remain but the political context has changed for the better.

The European Commission has taken significant steps to address ageing and the rise of chronic diseases through the Active and Healthy Ageing Innovation Partnership and the Digital Agenda projects full deployment of telemedicine by 2020. COCIR warmly welcomes these policy developments and has developed this updated toolkit to guide the authorities and other stakeholders on the different steps needed to accelerate the deployment of telemedicine across Europe. Things have also changed at country level, notably in France where a legal framework has been developed to regulate the use of telemedicine¹. Other countries are experimenting the integration of telemedicine in routine clinical practice through ambitious and promising pilot projects, such as the Whole System Demonstrator² in the UK or the Belgium Heart Failure project³ in Belgium.

The COCIR telemedicine toolkit 2011 provides:

- › Additional information on mobile health (mHealth) as one new subset of telemedicine
- › Updated recommendations
- › An enriched glossary of terms
- › Stronger evidence base on the benefits of telemedicine for chronic patients
- › Personal success stories based on recent case studies

We encourage the reader to also discover the new COCIR eHealth toolkit which provides an overarching view of eHealth.

Nicole Denjoy

COCIR Secretary General

¹ SNITEM website, <http://snitem.fr/fr>

² Newham WSD website, <http://www.newhamwsdtrial.org/>

³ Belgian Heart Failure Project, <http://www.belgium-hf.be/>



COCIR POSITION PAPER

1



PART 1 COCIR POSITION PAPER

1

COCIR'S RECOMMENDATIONS	4
DETAILED BRIEFING	
COCIR's definition of eHealth	5
COCIR's definition of telemedicine	5
What is telehealth?	6
What is mHealth?	7
Benefits of telehealth	7
Benefits of mHealth	8
Barriers hindering the development of telehealth and mHealth	8
Building evidence on the effectiveness of telehealth	9
DETAILED BRIEFING ON COCIR'S RECOMMENDATIONS	11

COCIR advocates the deployment of telemedicine as being crucial for improving healthcare and ensuring the continuum of care as stated in COCIR's White Paper⁴ towards a sustainable healthcare model.

To support this mission, COCIR established in 2009 an expert group on telemedicine to build expertise on the field. It gathers industry experts and key opinion leaders. These experts meet regularly to exchange knowledge, expertise, best practice and build a vision for the future.

COCIR is happy to share this expertise with the broader health community:

The vision is detailed in the following position paper and the knowledge-based expertise is condensed in the accompanying glossary of terms, compilation of reference studies and success stories.

The first pages of this position paper describe telemedicine and its different components. We have chosen to focus on two of them in particular: telehealth and mHealth.

COCIR PROPOSES SIX RECOMMENDATIONS FOR A BETTER DEPLOYMENT OF TELEMEDICINE IN EUROPE:

- 1 Establish a sustainable economic model for telehealth and mHealth by starting dialogue between healthcare stakeholders
- 2 Integrate telehealth and mHealth into existing care delivery structures
- 3 Support interoperability of telehealth and mHealth solutions
- 4 European Commission and Member States to establish an appropriate legal framework with effective transposition at country level
- 5 Strengthen cooperation between healthcare stakeholders to 'best practice health strategies' supporting telehealth and mHealth adoption in routine clinical practice
- 6 Finance more and sustainable large scale projects with health economic evaluation to assess the impact of telehealth and mHealth solutions

⁴ COCIR White Paper – 'Towards a sustainable healthcare model' (November 2008)
http://cocir.org/uploads/documents/-34-cocir_wp_on_sustainable_hc_-_released_on_19_nov_2008.pdf

DETAILED BRIEFING

COCIR'S DEFINITION OF eHEALTH

Telemedicine is one component of a broad range of eHealth activities.

eHealth describes the application of information and communication technologies (ICTs) across the whole range of functions that affect the health sector.

eHealth includes tools for health authorities and professionals as well as personalized health systems for patients and citizens. eHealth can thus be said to cover the interaction between patients and health-service providers, institution-to-institution transmission of data, or peer-to-peer communication between patients and/or health professionals; it can also include health information networks, electronic health records, telemedicine services, and personal wearable and portable communicable systems for assisting prevention, diagnosis, treatment, health monitoring and lifestyle management.

eHEALTH COMPRISES THE FIVE FOLLOWING TYPES OF SYSTEMS:

- › Hospital information systems
- › Clinical information systems
- › Telemedicine solutions and services
- › Secondary-usage non-clinical systems
- › Integrated health information networks

COCIR'S DEFINITION OF TELEMEDICINE⁵

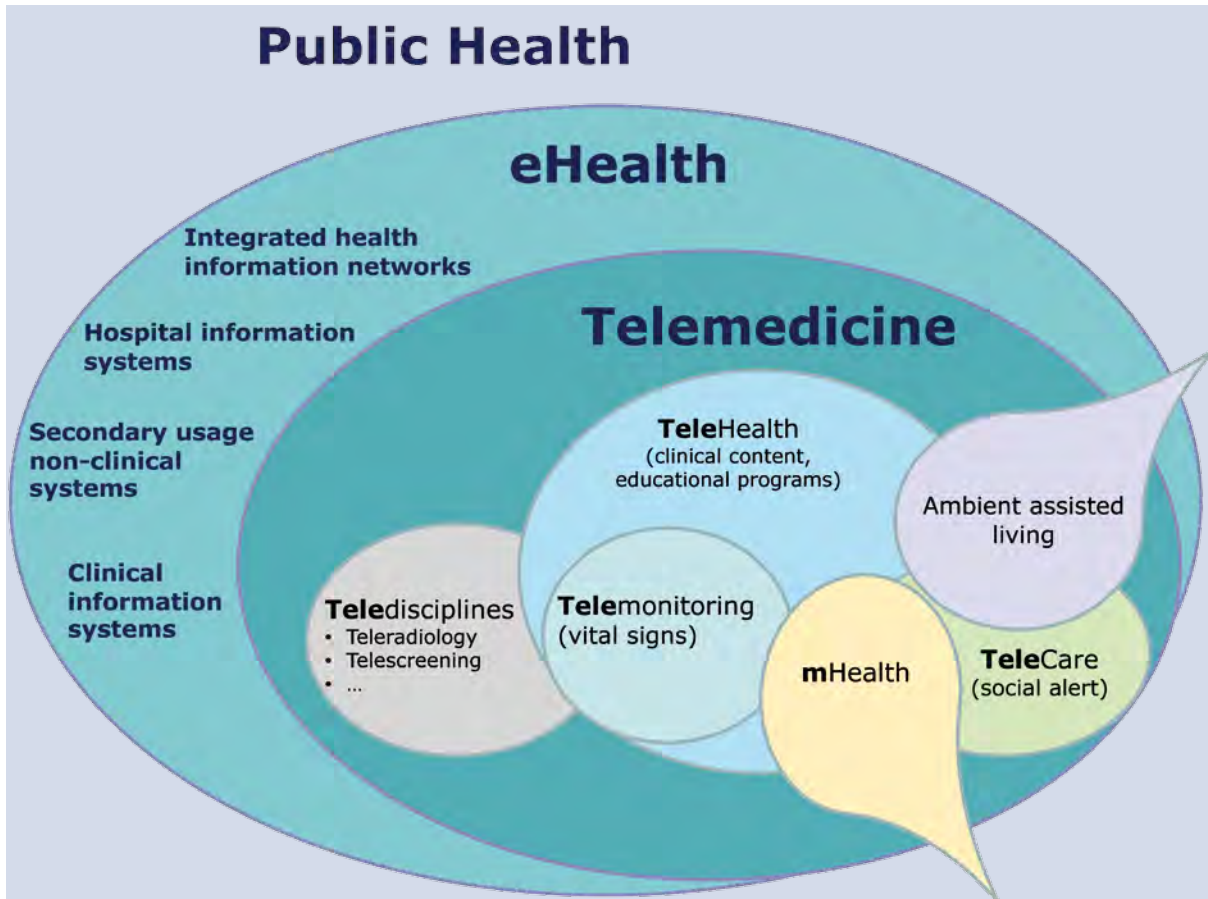
Telemedicine can be defined as the delivery of healthcare services through the use of Information and Communication Technologies (ICT) in a situation where the actors are not at the same location. The actors can either be two healthcare professionals (e.g. teleradiology, telesurgery) or a healthcare professional and a patient (e.g. telemonitoring of the chronically ill such as those with diabetes and heart conditions, telepsychiatry etc).

Telemedicine includes all areas where medical or social data is being sent/exchanged between at least two remote locations, including both Caregiver-Patient/Citizen as well as Doctor to Doctor communication.

IT INCLUDES:

- › Telehealth/Remote Patient Management
- › Telecare
- › Teledisciplines (including teleradiology, teledermatology, telescreening, etc)
- › mHealth

⁵ See COCIR Glossary of terms



WHAT IS TELEHEALTH?

The term telehealth covers systems and services linking patients with care providers to assist in diagnosing, monitoring, management and empowerment of patients with long-term conditions (chronic patients).

Telehealth solutions use devices (interactive audio, visual and data communication) to remotely collect and send data to a monitoring station for interpretation, to support therapy management programs and to improve patients' knowledge and behaviour.

Telehealth solutions comprise systems and components (patient interfaces in hardware and software; sensors/peripherals; operating software and applications intended for care provider usage; clinical content and intelligence; data transmission, storage and intelligent routing) as well as supporting services (system operation; logistics; financial services etc). Input data sources are typically patients' self-assessments ('subjective data') as well as dedicated peripherals to measure vital parameters ('objective data').

Telehealth solutions address healthcare delivery, diagnosis, consultation and treatment as well as education/behavioural modifications and transfer of medical data.

WHAT IS mHEALTH?

mHealth is a new area emerging within the field of TeleCare and TeleHealth.

mHealth (also written as m-health or mobile health) is the use of mobile communications – such as personal digital assistants and mobile phones – for health services and information. The mHealth field has emerged as a subset of telemedicine. mHealth applications range from SMS medication reminders - based on existing mobile capabilities - to collecting community and clinical health data, delivery of healthcare information to practitioners, researchers, citizens and patients, real-time monitoring of patient vital signs and direct provision of care.

BENEFITS OF TELEHEALTH

Telehealth with an interactive health support platform will fill a crucial gap in the continuum of care. Flexible telehealth solutions are designed to support a multi-dimensional model of care for individuals with chronic conditions, particularly those with multiple complex needs who are often either elderly, frail and/or disabled.

For this purpose telehealth provides a clinical management model with clinical-intelligence capabilities based on underlying algorithms: a telehealth program based on a timely and evidence-based knowledge for physicians and supporting care providers to make appropriate interventions.

The benefits of telehealth listed below are of immediate, tangible and significant benefit to clinical staff, patients and society.

- › **Reduced mortality:** telehealth patients live 15 to 55% longer, compared to people receiving usual care.
- › **Reduced hospitalisations:** the use of telehealth results in a more stable population in which enrolled members in programmes utilise less acute healthcare resources: reduced hospitalisations (30-50%), and reduced hospital length of stay (24-48%).
- › **Increased quality of life of patients:** patients in telehealth programmes have a better quality of life. This is due to improved and stabilised health as well as peace of mind, better connection to their care team and involvement in the healthcare process.
- › **Early detection of exacerbations, impairment of health:** the system regularly gathers information from various sources on vital signs, symptoms, behaviour and the patient's knowledge about their condition, as well as environmental status and psychosocial context. This information is analysed and risk-tagged, allowing care coordinators to triage and facilitate targeted, expedited, interventions that can prevent acute-care-related emergency room visits and hospitalisations (up to 35% reduction of exacerbations).
- › **Individualised interventions:** because of the regular assessment of the patient's vital signs and symptoms, and disease specific knowledge and behaviour, clinicians can target interventions to the exact situation and aspect of the patient's illness, behaviour, understanding of symptoms and psychosocial/home situation. Interventions can be individualised both in terms of content and timing to maximize the impact of the intervention to immediately improve the member's health status and stabilise their condition/avoid future degradation.
- › **Patient empowerment, education, behavioural reinforcement and motivation:** information delivered via the telehealth system is targeted to specific knowledge deficits or areas of recommended behavioural modification. This information is tailored to the individual patient's need and directly delivered to the home of the patient, therefore reducing the amount of time clinicians must spend on the phone or road delivering content and reinforcing necessary behavioural change. Patients understand their medical condition and treatment better and become empowered to manage their chronic conditions. Positive feedback and a personalised approach are important for the patient's motivation in relation to their treatment.

-
- › **Efficient, exception-based interventions:** telehealth systems enable clinical staff to be in regular contact with larger member caseloads compared to standard telephonic models for individuals with complex chronic conditions. On the patient side, each member is connected to the telehealth system, is assessed, given feedback and positive reinforcement when needed – a model that is not feasible by traditional models of telephonic clinical management (because of personnel capacities necessary and related costs), even for individuals at high acuity levels.

BENEFITS OF mHEALTH

mHealth presents additional benefits:

- › **Increased access to healthcare:** with 80% of the world's population within range of a mobile network, mHealth does not require access to broadband and internet. This allows access to primary healthcare, health information and health education, in particular in regions with scarce medical resources, poor health infrastructures and no connectivity.
- › **Societal acceptance of mobile communications:** in our society, mobile has a strong societal acceptance and use which will facilitate the adoption by patients and medical professionals.
- › **Real time communication:** mHealth offers the possibility for almost real-time communication and two-way information between the patient/citizen and the medical professional/service provider.

BARRIERS HINDERING THE DEVELOPMENT OF TELEHEALTH AND mHEALTH

While the potential benefits of telehealth and mHealth are enormous, a number of barriers continue to hinder their introduction, or prevent them from achieving optimal benefits.

- › **Lack of reimbursement and sustainable funding:** many programmes are stopped after a successful testing period due to a lack of reimbursement for services.
- › **Lack of efficient business model:** providers have not yet established successful business models enabling them to maintain telehealth and/or mHealth programmes after the initial trial phase. This is also due to the current infrastructure of care in existing healthcare systems.
- › **Lack of recognised IT standards:** telehealth applications and infrastructure have been developed and tested throughout Europe for at least a decade in isolation. The result is an innovative field, however only with isolated applications that have interoperability challenges. Such systems, when in place, must have the capability of exchanging data with other systems, at least country wide, and ideally across borders. Resolving interoperability is no longer a technical issue as the technical standards are emerging e.g. IHE⁶ or Continua⁷. The remaining challenge is a political, behavioural and acceptance issue which requires promotion to overcome.
- › **Insufficient awareness and confidence:** many patients as well as medical experts are not convinced yet by the benefits of telehealth or mHealth. To ensure a high level of acceptance from physicians and patients, the content has to be developed with medical experts following and supporting medical guidelines. Also the intuitive use of the telehealth solution ('usability') for both patient and medical personnel is a key requirement.
- › **Need for integrated solutions:** industry needs to develop end-to-end solutions in cooperation with the medical community to cover all the needs for a full home care service.

⁶ IHE is an initiative by healthcare professionals and industry to improve the way computer systems in healthcare share information.

⁷ The Continua Health Alliance is an open industry coalition on personal telehealth. Continua's mission is to establish a system of interoperable personal telehealth solutions that fosters independence and empowers people and organizations to better manage health and wellness.

-
- › **Need to integrate telehealth and mHealth services into care delivery structure:** one of the primary challenges confronting telehealth today is the lack of effective workflow integration into existing care delivery structures. In order to enable payers, providers and patients to fully benefit from telehealth and mHealth, it needs to be seamlessly woven into existing delivery structures. Best practice concepts still need to be identified.
 - › **Uncertain legal framework for data protection and providers' responsibility:** the lack of legal clarity in the area of telehealth and mHealth is an obstacle to its wider use. This is a major challenge in particular with regards to data protection but also with regards to liability, jurisdiction and to licensing, accreditation and registration of telehealth services and professionals. In addition, cross-border provision of telehealth services also require legal clarification with regard to privacy. These issues are primarily the responsibility of the Member States, but need to be coordinated at European level through the revision of the data protection directive planned in 2011.

BUILDING EVIDENCE ON THE EFFECTIVENESS OF TELEHEALTH⁸

The situation today: a limited but growing evidence base on telehealth

Although an increasing number of studies and clinical trials demonstrate the effectiveness of telehealth solutions (see figures below), the lack of reliable scientific evidence remains a barrier to the wider deployment of telehealth. Indeed many clinicians, patients and payers, partially question the evidence available and do not trust telehealth applications to support and improve the delivery of good quality healthcare.

This lack of trust is based on the fact that the results of existing studies are only partly known and many of the results are not directly comparable, because of the size, duration or overall design of the respective studies.

COCIR has started to collect and summarise the peer reviewed evidence from telehealth projects and studies to support consistent communication on the quality of care and cost-effectiveness of telehealth solutions⁹.

Summary of relevant studies

There are a growing number of good large-scale scientific telehealth evaluations reaching completion and publication in peer reviewed journals. These studies will, over time, help establish telehealth within routine care. In general, most of these studies indicate that telehealth has a positive effect on reducing hospital admissions, length of stay, mortality, and improving patients' quality of life. The actual economic benefits differ, depending on the respective care delivery systems, and thus needs to be evaluated in reference to the associated care delivery structure.

Given today's sources of information for patients with **heart failure** (e.g. meta-analysis of telemonitoring and structured telephone support)¹⁰, the indications are that telehealth will:

- › Reduce mortality (in the range of 15–55%)¹¹
- › Reduce hospital admissions (for cardiovascular reasons 50%)¹²
- › Reduce hospital length of stay (broad range of values taken from various studies -26%-48%)

⁸ This chapter provides evidence on telehealth solutions only.

⁹ See COCIR's database of reference studies on telemedicine

¹⁰ Clark et al. 2007

¹¹ Clark et al. 2007

Three recent studies^{13, 14, 15} for telehealth systems (two with medical content) in the field of **Chronic Obstructory Pulmonary Disease (COPD)** show the following results:

- › 35% reduction of exacerbations
- › Between 15% to 43% reduction of hospitalisation
- › Detection of exacerbations
- › Reduction of costs (up to 52%)
- › Improvement of quality of life

Results of a systematic review (17 studies with different telehealth systems) for patients with **diabetes**¹⁶ prove to be positive, too:

- › Reduction of HbA1c
- › Reduction of complications
- › Good receptiveness by patients and patient empowerment

12 Giordano et al. 2009

13 Trappenburg et al. 2008

14 Koff et al. 2009

15 Vitacca et al. 2009

16 Jaana Pare 2007

DETAILED BRIEFING ON COCIR'S RECOMMENDATIONS

1 ESTABLISH SUSTAINABLE ECONOMIC MODEL FOR TELEHEALTH AND mHEALTH BY STARTING DIALOGUE BETWEEN HEALTHCARE STAKEHOLDERS

Telehealth and mHealth solutions cannot and will not become part of the existing healthcare delivery structure if there is no clear understanding on 'who invests and who pays'. A dialogue on how to finance/reimburse telehealth has been initiated, but this dialogue is still in the starting blocks and needs to be taken to another level.

This dialogue should include all stakeholders: healthcare professionals, patients, insurers, governments, national/regional health authorities. This dialogue should establish who benefits from telehealth and who should pay for it, with a view to establishing a fair and sustainable funding/reimbursement system.

Over the last years, the healthcare technology industry has been investing heavily to develop adequate telehealth solutions without any return on investment. Although the healthcare technology industry is keen to innovate and propose technological solutions that can improve healthcare, it cannot continue to invest in innovation without the promise of a sustainable business model.

2 INTEGRATE TELEHEALTH AND mHEALTH INTO EXISTING CARE DELIVERY STRUCTURES

While the emergence of new technologies and the development of telehealth and mHealth solutions allow for considerable improvements in healthcare for the benefits of both patients and healthcare professionals, there is a very low level of integration of these solutions in existing clinical practice and care delivery structures. Telehealth solutions remain in the domain of pilot projects and are not integrated in clinical practice. This is partly due to the fact that healthcare stakeholders (healthcare professionals, patients, insurers etc.) need to adapt their usual working method to include all stakeholders (e.g. the empowered patients, the monitoring centre).

A better recognition of the role of each stakeholder in the new healthcare cycle, and better cooperation between them, is a must to move telehealth from the pilot project scheme into everyday clinical practice scheme.

3 SUPPORT INTEROPERABILITY OF TELEHEALTH AND mHEALTH SOLUTIONS

Interoperability allows the different technological solutions to communicate with each other, allowing patients and doctors to exchange medical information across healthcare settings, and across borders, even if they use different devices (medical software, computer, phone, medical equipment) or ICT providers (broadband provider etc).

It is therefore crucial that telehealth and mHealth solutions are interoperable:

- › For the patient's safety and mobility
- › To facilitate the work of healthcare professionals
- › To remove barriers (e.g. borders) for the deployment of telehealth

COCIR welcomes the work of IHE and the Continua Health Alliance on interoperability and calls on the authorities to support interoperability-driven initiatives.

4 EUROPEAN COMMISSION AND MEMBER STATES TO ESTABLISH AN APPROPRIATE LEGAL FRAMEWORK ALLOWING EFFECTIVE TRANSPOSITION AT COUNTRY LEVEL

The lack of an appropriate legal framework at both the EU and national level is a barrier to the adoption of telemedicine by healthcare professionals. It is essential to bring legal clarity on some crucial aspects such as licensing/authorisation, health data protection, liability of healthcare professionals, reimbursement, conflicts of jurisdiction (in case of cross-border care).

COCIR believes that:

- › The European Commission should support the Member States in the development of a single legal framework for telemedicine and mHealth in Europe
- › Member States should work together on current and future legislative frameworks relevant to telemedicine and mHealth
- › Member States should adapt the existing legal framework to allow telemedicine and mHealth to be used locally

5 STRENGTHEN COOPERATION BETWEEN HEALTHCARE STAKEHOLDERS TO ‘BEST PRACTICE HEALTH STRATEGIES’ SUPPORTING TELEHEALTH AND MHEALTH ADOPTION IN ROUTINE CLINICAL PRACTICE

Successful implementation of sustainable telehealth solutions requires close cooperation between all healthcare stakeholders. Patients, medical professionals, payers and solution providers can reach higher mutual benefits when building integrated systems rather than continuing to work separately.

COCIR will support ‘best practice health strategies’ introducing telehealth into routine clinical practice by sharing information, encouraging dissemination of successful projects, bringing partners together and motivating stakeholders to cooperate as close as possible.

6 FINANCE MORE SUSTAINABLE LARGE-SCALE PROJECTS WITH HEALTH ECONOMIC EVALUATION TO ASSESS THE IMPACT OF TELEHEALTH AND mHEALTH SOLUTIONS

The lack of sustained incentives is a recurrent problem. Existing funding schemes finance small-scale and short-term projects with no or little connection between each other. This results in a duplication of efforts, where the outcomes of the projects are not well-disseminated, not comparable and not significant enough to be considered real evidence on the effectiveness of telehealth. COCIR therefore calls for more and sustained funds with a view to finance large-scale cross-border long-term initiatives, including an economic evaluation to measure the impact of telehealth.

This will avoid the current fragmentation of efforts and allow for better exploitation of results.

COCIR GLOSSARY OF TERMS

2



PART 2 GLOSSARY OF TERMS

INTRODUCTION	14
PART I: TELEMEDICINE DEFINITIONS	14
TABLE: ACTORS INVOLVED IN TELEMEDICINE	16
PART II: TELEDISCIPLINES DEFINITIONS	17

INTRODUCTION

Telemedicine is an emerging field in healthcare with many unknowns. The COCIR Telemedicine Focus Group considers of utmost importance to develop a centralized glossary of terms to provide clear definitions and bring coherence to the various interpretations of the terms used in the field of telemedicine.

The COCIR glossary is the foundation to clearly articulate strategic directions throughout the care cycle. It includes a table outlining the level of involvement of the various actors in the telehealth care cycle¹⁷.

This glossary is a living document and will be updated on a regular basis.

PART I: TELEMEDICINE DEFINITIONS

Telemedicine¹⁸ is the overarching definition covering Telehealth, Telecare, mHealth and Teledisciplines.

Telemedicine can be defined as the delivery of healthcare services through the use of Information and Communications Technologies (ICT) in a situation where the actors are not at the same location. The actors can either be two healthcare professionals (e.g. teleradiology, telesurgery) or a health care professional and a patient (e.g. telemonitoring of the chronically ill such as those with diabetes and heart conditions, telepsychiatry etc). Telemedicine includes all areas where medical or social data is being sent/exchanged between at least two remote locations, including both caregiver to patient/citizen as well as doctor to doctor communication.

AMBIENT ASSISTED LIVING

Systems, services and devices providing unobtrusive support for daily life based on the context and the situation of the assisted persons.

¹⁷ See Annex 1 page 4

¹⁸ This COCIR definition of telemedicine is in line with the World Health Organisation and European Commission terminologies

mHEALTH

mHealth (also written as m-health) is the use of mobile communications – such as personal digital assistants and mobile phones – for health services and information.

The mHealth field has emerged as a subset of telemedicine. mHealth applications range from SMS medication reminders - based on existing mobile capabilities - to collecting community and clinical health data, delivery of healthcare information to practitioners, researchers, citizens and patients, real-time monitoring of patient vital signs and direct provision of care.

PERSONAL HEALTH SYSTEMS (PHS)¹⁹

Personal Health Systems (PHS) assist in the provision of continuous, quality controlled, and personalised health services, including diagnosis, treatment, rehabilitation, disease prevention and lifestyle management, to empowered individuals regardless of location. PHS consist of: intelligent ambient and/or body devices (wearable, portable or implantable); intelligent processing of the acquired information; and active feedback from health professionals or directly from the devices to the individuals.

TELE-ASSISTANCE

Tele-assistance can be a medical act when a doctor remotely assists another doctor carrying out a medical or surgical act. The doctor can also assist another healthcare professional providing care or imaging services, even within the framework of an emergency, to remotely assist a first-aid worker or any person providing medical assistance to someone in danger while waiting for the arrival of trained medical professionals.

TELECARE

Telecare designs systems and services capable of social alert and social services. Telecare is used mainly to monitor the situation of people dependent on external help, e.g. elderly or disabled people in the home setting.

TELECONSULTATION

Teleconsultation is a medical act which is carried out in the presence of the patient who dialogues with the physician and/or the physicians consulting at distance as necessary.

TELE-EXPERTISE

Tele-expertise is a remote medical act between at least two healthcare professionals without the presence of the patient for decision purpose.

TELEHEALTH (INCLUDES REMOTE PATIENT MANAGEMENT OR 'RPMT')

The term telehealth covers systems and services linking patients with care providers to assist in diagnosing and monitoring, as well as the management and empowerment of patients with long-term conditions (chronic patients).

Telehealth solutions use devices (interactive audio, visual and data communication) to remotely collect and send data to a monitoring station for interpretation and to support therapy management programmes and improve patients' knowledge and behaviour.

Telehealth solutions comprise systems and components (patient interfaces in hardware and software; sensors/peripherals; operating software and applications intended for care provider usage; clinical content and intelligence; data transmission, storage and intelligent routing) as well as supporting services (system operation; logistics; financial services; etc).

¹⁹ European Commission definition: http://ec.europa.eu/information_society/activities/health/glossary_of_terms/

Input data sources are typically patients' self-assessments ('subjective data') as well as dedicated peripherals to measure vital parameters ('objective data').

Telehealth solutions address healthcare delivery, diagnosis, consultation and treatment as well as education/behavioural modifications and transfer of medical data.

TELE-INTERVENTION

Tele-intervention is a therapeutic medical act which is performed remotely by a physician on a patient, without or with the local presence of other healthcare professional(s) (e.g. telesurgery).

TELEMONITORING

Telemonitoring designs systems and services using devices to remotely collect/send vital signs to a monitoring station for interpretation.

Telemonitoring is the remote exchange of physiological data between a patient at home and medical staff at a hospital to assist in diagnosis and monitoring. This could include support for people with lung function problems, diabetes etc. It includes amongst other things a home unit to measure and monitor temperature, blood pressure and other vital signs for clinical review at a remote location (for example, a hospital site) using phone lines or wireless technology.

TABLE: ACTORS INVOLVED IN TELEMEDICINE									
ACTORS INVOLVED					ACT				
R: Required O: Optional									
REMOTE HCP	ACTIVE PATIENT	PASSIVE PATIENT	HCP NEAR PATIENT	EXPERT	PREVENTION	MONITORING	DIAGNOSTIC	THERAPY	
R		R			Telehealth				
		R			Telecare				
R		R				Telemonitoring (e.g. telecardiology)			
R	R		O				Teleconsultation (e.g. telepsychiatry)		
R		R	R	O				Tele-assistance	
R				R			Tele-expertise (e.g. teleradiology)		
R		R		O				Tele-intervention (e.g. telesurgery)	
		R			Assisted Ambient Living				

PART II: TELEDISCIPLINES DEFINITIONS

The term 'teledisciplines' is being introduced as an umbrella to describe various approaches to provide medical services over a distance with the help of ICT. It covers various medical disciplines performed at a distance between two healthcare professionals using ICT. A 'telediscipline' typically is restricted to a specific medical discipline. In contrast to a 'telediscipline' the terms 'telemedicine' or 'telehealth' have a more general meaning.

The following is a non-exhaustive list of 'teledisciplines'.

TELECARDIOLOGY

Telecardiology covers the remote collection of cardiology data, mostly ECG data, and its transmission to a service centre. In the centre, the data is evaluated by qualified staff who give advice to a patient or another healthcare provider. In emergencies, the service centre may also trigger rescue measures. Data transmission can either take place continuously or at clearly defined points in time. Data collection can take place either at the patient's home or in a mobile way.

TELEDERMATOLOGY

Teledermatology describes the transmission of visible light images (photos or videos) of disorders of the human skin for classification and diagnosis. It can take the form of primary as well as secondary diagnosis. Detection and classification of skin cancers is a typical example. Since dermatology is a highly specialised discipline and many patients will first see a general practitioner, the use of teledermatology offers great potential to shorten the diagnostic process and speed up the start of appropriate treatment.

TELEOPHTHALMOLOGY

Teleophthalmology describes the remote diagnosis of medical conditions of the human eye. Similar to teledermatology, patients may not have immediate access to an ophthalmologist. Ophthalmology not only diagnoses typical diseases of the eye but can also generate useful information on other diseases, e.g. diabetes and cardiac conditions and related secondary symptoms. Data typically takes the form of photos or videos.

TELEPATHOLOGY

Telepathology enables remote staff pathologists, and third-party providers, to securely share images of anatomical pathology specimens to complete primary and non-primary diagnostic evaluation, and to also seek expert second opinions, and primary interpretation of urgent cases, from operating rooms.

TELEPSYCHIATRY

Telepsychiatry is a form of teleconsultation by a psychiatrist of a patient suffering from mental disorder.

TELERADIOLOGY

Teleradiology Information Systems (IS) enable secure remote evaluation of digital diagnostic studies (CT scans, MRIs and X-Rays). This technology enables both remote staff radiologists and third-party providers to complete primary and non-primary diagnostic studies from any location. It encompasses hospital-to-home teleradiology for off-hours health care coverage e.g. remote working for radiologists being part of the hospital radiology department. It also covers outsourcing to other imaging centers or commercial teleradiology companies that provide outsourcing services for image interpretation (night and/or day reads).

TELESCREENING

Telescreening describes the use of a first or second opinion through a remote connection in screening programmes. Either medical data is transferred to a remote specialist for primary evaluation, e.g. in the case that a specific medical qualification is required. Another scenario involves a second opinion in order to increase the quality of the screening process. An example in the form of teleradiology would be the use of screening centres in mammography screening. The data transmitted during telescreening can take any form from digital X-Ray images to video files or ECG or laboratory data.

TELESURGERY

Telesurgery describes the remote controlling of surgical apparatus, e.g. a surgical robot, by an experienced surgeon or the remote advice provided by an experienced surgeon to the surgeon on duty in the operating theatre. In the latter case, a live video connection and an audio connection between the two surgeons is sufficient. In the former case, a data link between the surgical apparatus on site and the remote manipulation tool is required.

COMPILATION OF REFERENCED STUDIES

3



PART 3 COMPILATION OF REFERENCED STUDIES

INTRODUCTION	20
PURPOSE	20
SELECTION CRITERIA	20
PERIODICITY	20
ABBREVIATIONS	21
TABLE 1: CONGESTIVE HEART FAILURE	22
TABLE 2: CHRONIC OBSTRUCTIVE PULMONARY DISEASE	26
TABLE 3: DIABETES	28
TABLE 4: MULTIPLE CHRONIC DISEASES	29

INTRODUCTION

COCIR has established a dedicated Focus Group on telemedicine to respond to the many questions and doubts remaining about telemedicine.

COCIR defines telemedicine as the delivery of healthcare services through the use of Information and Communication Technologies (ICT) in a situation where the actors are not at the same location. The actors can either be two healthcare professionals (e.g. teleradiology, telesurgery) or a health care professional and a patient (e.g. telemonitoring of chronically ill such as those with diabetes and heart conditions, telepsychiatry etc).

Telemedicine includes all areas where medical or social data is being sent/exchanged between at least two remote locations, including both caregiver-patient/citizen as well as doc-to-doc communication.

PURPOSES

Although an increasing number of studies and clinical trials demonstrate the effectiveness of telemedicine solutions, many clinicians, patients and payers, partially question the evidence available and do not trust telemedicine applications to support and improve the delivery of good quality healthcare. This lack of confidence is also a barrier to the integration of telemedicine in healthcare infrastructure and to the reimbursement of telemedicine services by health insurance companies.

This lack of trust is based on the fact that the results of existing studies are only partly known and many of the results are not directly comparable, because of the size, duration or overall design of the respective studies.

To address this situation, COCIR has started to collect and summarise the peer reviewed evidence of telemedicine projects and studies to support consistent communication on the quality of care and cost-effectiveness of Telemedicine solutions.

CRITERIA

The references that are listed below are all completed and published relevant studies in well-known scientific publications.

PERIODICITY

This database is a living document. It will be updated with new studies on a regular basis.

ABBREVIATIONS

BDOC	... Bed Days Of Care
CCQ	... Clinical COPD Questionnaire (measure of HRQoL)
CHF	... Congestive Heart Failure
COPD	... Chronic Obstructive Pulmonary Disease
ECG	... Electrocardiogram
ECOPD	... Exacerbations of chronic obstructive pulmonary disease
ER	... Emergency Room
GP	... General Physician
HF	... Heart Failure
HHA	... Home Health Agencies
HRQoL	... Health Related Quality of Life
HTM	... Home Telemonitoring
LVEF	... Left Ventricular Ejection Fraction
NYHA	... New York Heart Association (NYHA) functional classification (extent of heart failure)
RCT	... Randomised Controlled Trial
SGRQ	... St George's Respiratory Questionnaire
TM	... Telemonitoring
TVC	... Telemedicine Video Control
UC	... Usual Care

TABLE 1 CONGESTIVE HEART FAILURE

REFERENCE OF STUDY	STUDY TYPE	PATIENTS POPULATION	STUDY DURATION	STUDY OUTCOME	TYPE OF INTERVENTION	LINK
Domingo M, et al., Evaluation of a telemedicine system for heart failure patients: feasibility, acceptance rate, satisfaction and changes in behaviour. Results from the CARME study. Eur J Cardiovasc Nurs (2011), doi: 10.1016/j.ejcnurse.2011.02.003	Prospective intervention study	97 patients (out of 211 screened)	1 year follow up	<ul style="list-style-type: none"> • Telemonitoring resulted in positive changes in patients behaviour: • High compliance in responding to the questionnaire (88%) • Good compliance with self-monitoring of weight (76%) and blood pressure (72%) • High satisfaction of patients and nurses with the system: after the study 65% of patients wished to continue the telemonitoring, especially group B patients. 	<ul style="list-style-type: none"> • All patients used the Motiva systems: an interactive telemedicine platform in a multidisciplinary heart failure unit at a university hospital which uses educational videos, motivational messages, questionnaires. • All patients were sent 20 educational videos and 25 different questionnaires on physical activity, nutrition, symptoms, etc. • Group A used only Motiva system and group B used Motiva system and self-monitoring tools. 	
Inglis et al., Structured telephone support or telemonitoring programmes for patients with chronic heart failure. Cochrane Database of Systematic Reviews 2010, Issue 8. Art. No.: CD007228	<ul style="list-style-type: none"> • Systematic review of 25 peer reviewed published RCTs and five published abstracts. 	Various	Various	<ul style="list-style-type: none"> • Telemonitoring reduced all-cause mortality (RR 0.66, 95% CI 0.54 to 0.81, P < 0.0001) effect (RR 0.88, 95% CI 0.76 to 1.01, P = 0.08). • Both structured telephone support (RR 0.77, 95% CI 0.68 to 0.87, P < 0.0001) and telemonitoring (RR 0.79, 95% CI 0.67 to 0.94, P = 0.008) reduced CHF-related hospitalisations. • For both interventions, several studies improved quality of life, reduced healthcare costs and were acceptable to patients. • Improvements in prescribing, patient knowledge and self-care, and New York Heart Association (NYHA) functional class were observed 	Comparison of telephone support or telemonitoring with usual care.	
Polisena et al., Home telemonitoring for congestive heart failure: a systematic review and meta-analysis J Telemed Telecare 2010, 1-8	<ul style="list-style-type: none"> • Systematic review and meta-analysis of 21 RCTs and observational studies. • These studies compared telemonitoring, telephone support and usual care. 	<ul style="list-style-type: none"> • median age>55 	Between 30 days to one year - depending on the study	<ul style="list-style-type: none"> • Lower risk of death in telemedicine group (risk ratio=0,64; 95% CI:0,48-0,85). • Increased primary care visits, specialist visits and homecare visits for the telemedicine group. • Studies suggested that telemedicine helped to lower the number of hospitalisations and the use of other health services. • Studies suggested patient quality of life and satisfaction with telemonitoring were similar or better than with usual care. 	Comparison of telephone support or telemonitoring with usual care.	
Polisena et al., Home telemonitoring for congestive heart failure: a systematic review and meta-analysis J Telemed Telecare 2010, 1-8	<ul style="list-style-type: none"> • Systematic review and meta-analysis of 21 RCTs and observational studies. 	<ul style="list-style-type: none"> • median age>55 	Between 30 days to one year - depending on the study	<ul style="list-style-type: none"> • Lower risk of death in telemedicine group (risk ratio=0,64; 95% CI:0,48-0,85). • Increased primary care visits, specialist visits and homecare visits for the telemedicine group. • Studies suggested that telemedicine helped to lower the number of hospitalisations and the use of other health services. • Studies suggested patient quality of life and satisfaction with telemonitoring were similar or better than with usual care. 	Comparison of telephone support or telemonitoring with usual care.	

TABLE 1 CONGESTIVE HEART FAILURE FOLLOWING

REFERENCE OF STUDY	STUDY TYPE	PATIENTS POPULATION	STUDY DURATION	STUDY OUTCOME	TYPE OF INTERVENTION	LINK
Chaudhry et al. , Telemonitoring in Patients with Heart Failure. The New England Journal of Medicine, 2010, 363;24.	Multicenter RCT	<ul style="list-style-type: none"> • 1653 patients who had recently been hospitalised for heart failure. • 826 patients assigned to telemedicine; 827 patients assigned to usual care. • Median age of patients: 61 years old: 42% female and 39% black. 	2006-2009	<ul style="list-style-type: none"> • The outcomes for telemonitoring group and the usual care group did not differ significantly. • Readmission for any reason occurred in 49.3% of the telemonitoring group and 47.4% of the usual care group. • Death occurred in 11.1% of the telemonitoring group and 11.4% of the usual care group. • Low adherence to the programme probably due to the method used (answering machine): • 14% of patients assigned to the telemonitoring group never used the system. • By the end of the study period, only 55% of patients were still using the system • 21% of patients did not complete the final telephone interview at 6 months. 	<ul style="list-style-type: none"> • Telemonitoring was accomplished by means of a telephone-based interactive voice-response system that collected information about symptoms and weight that was reviewed by the patients' clinicians. • Primary end point: readmission for any reason or death within 180 days after enrollment. • Secondary end point: readmission for heart failure, number of days in hospitals, and number of hospitalisations. 	
D. Owais et al. , A randomized trial of home telemonitoring in a typical elderly heart failure population in North West London: results of the Home-HF study. European Journal of Heart Failure 11 (2009): 319-325.	Multicenter RCT	<ul style="list-style-type: none"> • 182 typical heart failure patients discharged from three acute hospitals. • 50% of patients assigned to telemedicine and 50% patients assigned to usual follow up care. • Mean age of patients: 70 yr 	<ul style="list-style-type: none"> • July 2006-August 2007 • 6 months follow up. 	<ul style="list-style-type: none"> • Excellent compliance with daily monitoring (95% of telemonitoring patients used the monitoring equipment for at least 90% of the study duration). • No difference in the median number of days alive or out of hospital between the two groups. • For those hospitalised, no difference between number of days spent in hospital between the two groups. • More emergency heart failure admissions in the usual care group (81 % of patients) compared to the telemedicine group (36% of patients). • Reduction in the number of secondary care outpatient visits and reduction in emergency room visits in the telemonitoring group. 	<ul style="list-style-type: none"> • All patients received an initial home visit by a nurse and received advice on self-monitoring of heart failure. • Telemedicine group received in addition a monitoring device, and were taught how to use it. Transmitted data (weight, blood pressure, heart rate and oxygen saturation) was reviewed daily by a heart failure nurse. If any deviation of vital signs, Telemedicine patients received advice. 	http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2645059/
Giordano et al. (2009) Multicenter randomised trial on home-based telemanagement to prevent hospital readmission of patients with chronic heart failure. Int J Cardiol;131:192-9	multicenter (n=5) RCT	460 patients randomized 1:1 to UC (n=230) or TM (n=230) Diagnosis of CHF, left ventricular ejection fraction (LVEF) <40%, at least one hospitalization for acute HF in the previous year, clinically stable: symptomatically improved, without intravenous therapy for at least 7 days, stable oral therapy (maximally tolerated doses of angiotensinrenin inhibitor and beta-blocker, no dose change for 5 days) and stable weight(no change >1Kg).	one year follow up	<ul style="list-style-type: none"> • Primary Outcome: significantly lower risk of heart failure related readmission - 50% (TM:n=43, UC:n= 73, p=0,0001), • Secondary Outcome:- 55% reduction in cardiovascular mortality (p= 0,06), 31 % decrease in episodes of hemodynamic instability (TM: 101 episodes, UC: 147 episodes, p< 0,001), mean cost of hospital readmission 35% lower in TM-group (TM: €843+/-1733, UC: €1298+/-2322, p=0,01) 	All patients: education about HF, advice on daily weight, self-measurement of blood pressure, rate of carrying out blood examinations, dietary restrictions, signs and symptoms of a heart failure decompensation. UC: referral to their primary care physician TM: portable advice (Card-Guard 2206) transferring from a fixed or mobile phone, one-lead-trace to a receiving station with a doctor or nurse available 24 h, 7 days/week. scheduled appointments every week or every 15 days Nerve Center: 4 Hewlett Packard server, WEB server, firewall , computerized call center 15 IAN workstations. Technological and organizational support. 5 Centers: Terminals linked with the call center, configured to share the application programme interface of the Central Station with On line license. Management of clinical activity. Cardiologist and nurse: meeting once a week to sum up the course of the patients	
Mortara et al. (2009) Home telemonitoring in heart failure patients: the HHH study (Home or Hospital in Heart Failure). Eur J Heart Fail; 11(3):312-8	Multinational, multicentre, randomized controlled clinical trial, additional post hoc test Setting: UK, Poland, Italy	416 patients, randomized (1:2) to usual care (n=160) or TM(n=301); 18<age<85; NYHA II-IV aetiology:ischaemic, idiopathic, hypertensive, or valvular <40%; abnormal diastolic echocardiographic pattern from E/A<1;hospital admission in the previous 12 month;optimized medical therapy	12 month follow up	<ul style="list-style-type: none"> • Feasibility: 92 % practical recordings (of 1630/2078), compliance unrelated to NYHA (p = 0.1) or older age (p = 0,25) • Efficacy: (p= 0,5) no significant effect in reducing bed days occupancy, cardiac death plus hospitalization or number of re- hospitalizations • Post hoc: heterogenous effect in the countries in the number of hospitalizations and cardiac death + hospitalization. Italy has a 52% reduction of the combined endpoint death and CHF related hospital admission. Only about 10% cardiac mortality rate in both intervention and control group. 	3 strategies in the TM group; strategie 1 (n = 106): answering machine + nurse telephone contact, strategie 2 (n = 94) : answering machine + nurse telephone contact + weekly vital signs, strategie 3 (n= 101): answering machine + nurse telephone contact + weekly vital + NICRAM ;TM-groups : portable device to report ECG, respiration and physical activity over 24 h, additional reported symptoms, weight, heart rate, systolic blood pressure and unspecified blood test	

TABLE 1 CONGESTIVE HEART FAILURE FOLLOWING

REFERENCE OF STUDY	STUDY TYPE	PATIENTS POPULATION	STUDY DURATION	STUDY OUTCOME	TYPE OF INTERVENTION	LINK
Ramaekers et al. (2009): Adherence among telemonitored patients with heart failure to pharmacological and nonpharmacological recommendations. <i>Telemedicine & e-Health</i> ;15: 517-24	RCT; multicentric Setting: Telemonitoring via University of Maastricht (NL); Patients recruited from 3 Dutch hospitals and provided with usual care	101 patients	3 months follow-up	<ul style="list-style-type: none"> • Disease specific knowledge improved significantly in two of the three hospitals ($p < 0.001$ and $p = 0.040$). • Adherence in terms of fluid restrictions ($p = 0.012$), daily weighing ($p < 0.001$), physical exercising ($p = 0.034$), and alcohol restrictions ($p = 0.040$) improved significantly in the telemonitoring group; • Substantial but statistically not significant decrease in depression. 	Health Buddy CHF programme w/o additional peripherals	http://www.liebertonline.com/doi/abs/10.1089/tmj.2008.0160
Goernig et al. (2009) Ambulatory Disease Management in Cardiac Patients: 12 month follow-up of Home Care Telemedicine in Thuringia by the Management Program Zertiva®. <i>Phys Rehab Kur Med</i> ; 19: 9-13	RCT	95 patients, 5 with suspected paroxysmale tachycardia, 90 with chronic heart failure; randomized to UC (n=90) and TM (n=90); at least one hospitalization for HF in the previous 6 month, members of one statutory health insurance	12 months	<ul style="list-style-type: none"> • No drop outs • Good compliance • Significant fewer hospitalizations -43% (UC: n=143, TM: n=62, $p = 0,001$) • 68% reduction of bed days of hospital care (UC:1328, TM:424, $p = 0,001$) • costs reduction -77% (UC:1371408€ TM: 317033€, $p = 0,001$) in the TM-group. 	TM: mobile 12 channel EC (Viapac TM from SHL)G, NYHA III patients additionally received a wage, pulse- and blood pressure measurement and transmitted vital parameters weight, blood pressure and pulse on daily base; Information material about pathophysiology, nutrition and animation; electronic patient record viewable for patients and physicians	
Soran et al. (2008) A Randomized Clinical Trial of the Clinical Effects of Enhanced Heart Failure Monitoring Using a Computer-Based Telephonic Monitoring System in Older Minorities and Women. <i>J Cardiac Fail</i> ;14:711-7	RCT	315 patients (1:1)	6 months follow up	<ul style="list-style-type: none"> • Reduction of combined endpoint cardiac mortality and CHF related hospital admission by 34% ($p = 0,083$) 		
Morguet et al. (2008) Impact of telemedical care and monitoring on morbidity in mild to moderate chronic heart failure. <i>Cardiology</i> ;111:134-9	RCT	128 patients (1:3), TM:n=32, UC: n=96, Ejection fraction > 60%, NYHA class II or III	300 days mean follow up	<ul style="list-style-type: none"> • All cause hospitalization duration (UC: 317, TM: 693 days/100 patients years, -54%, $p < 0,0001$) and rate (UC:38, TM:77 days/100 patients years, -51%, $p = 0,034$) as well as cardiac hospital • Admissions -69% and bed days of care -87%, (UC:379 TM :49 days/100 patients years, $p < 0,0001$) were significantly lower 	All patients: medical instruction about HF, pathophysiology basics, diet and physical exercise; biweekly scheduled telephone calls about symptoms, medication and quality of life TM: transmission of weight, blood pressure , pulse rate and when required a 12-lead ECG	
Kielblock et al. (2007) [Impact of telemetric management on overall treatment costs and mortality rate among patients with chronic heart failure] Einfluss einer telemedizinisch unterstützten Betreuung auf Behandlungskosten und Mortalität bei chronischer Herzinsuffizienz. <i>Dtsch Med Wochenschr</i> ;132:417-422	Non-randomized controlled comparison Setting: Disease Management Provider	2/05/2011	12 month mean follow up	<ul style="list-style-type: none"> • Primary outcome: Reduction of days in hospital: UC:49,1 - TM:25,3 (-48 %, $p = 0,01$) Reduction of hospital cases: UC: 3,4 - TM: 2 (-41%, $p = 0,01$) • Secondary outcome : Cost reduction of 39,5%: UC: 17446€ - TM:10563€ ($p = 0,05$), Return on investment: 3:1; Mortality in UC: 27,1%(n=69) - TM:14,7% (n=37) ($p = 0,001$); statistical significant difference between men and female in hospitalizations(F: 1,9 - M:N=2,1; $p = 0,03$)and costs(F: 9854€ - M:11090€; $p = 0,02$); medication in TM-Group increased: 10,2% total 	Heart failure service nurses and for special problems doctors, 20 learning lessons, construction of a medical 'data warehouse', TM-equipment: telemetric weight scale, weighing every day, automated transfer of these data to the medical datawarehouse. Reporting to patients and their physicians: every three month	

TABLE 1 CONGESTIVE HEART FAILURE FOLLOWING

REFERENCE OF STUDY	STUDY TYPE	PATIENTS POPULATION	STUDY DURATION	STUDY OUTCOME	TYPE OF INTERVENTION	LINK
Dansky et al. (2007) Impact of telehealth on clinical outcomes in patients with heart failure. Clinical Nursing Research; 17:182-99	Prospective randomized field experiment multicentre Setting: 10 home health agencies (HHA)	284 patients randomized (3:2) to UC or TM, primary or secondary diagnoses of heart failure, ability to communicate in English	Follow up 4 months	<ul style="list-style-type: none"> • Outcome measurement: Omaha System Problem rating Scale for Outcomes (PRSO) number of home care was significantly correlated with several outcomes • Hospitalization: statistically significant fewer hospitalizations at 60 days; No statistically significance within group comparisons; • Emergency visits: fewer ED visits (60 days, TM: 24%, TM+Video: 18%, UC:30%; 120days, TM:30%, TM+Video: 31%, UC:36%, p=0,09) 	All patients: information on heart failure, providing basis facts on the disease, guidelines on self-management UC: routine home visits nurses and supervisors: training TM: One-way telemonitoring system: own measurements of blood pressure, pulse and weight through peripheral devices, transmitting to the HHA , every day at a predetermined time Two-way telemonitoring system: additional videocamera and digital stethoscope for interaction between nurse and patient, sessions scheduled by the home care nurse (2-3 times a week)	
John G. F. Cleland et al. Noninvasive Home Telemonitoring for Patients with Heart Failure at High Risk of Recurrent Admission and Death. The Trans-European Network-Home-Care Management System (TEN-HMS) Study - Journal of American College of Cardiology 2005;45:1654-64	Randomized controlled trial. Setting: Patients were recruited from twelve main and four satellite hospitals that did not have a comprehensive heart failure management organisation in place in Germany, the Netherlands and UK.	Enrollment criteria: Intervention group: 462, control group: 168. 48% were aged > 70yrs old. History of at least 1 hospital admission due to worsening heart failure lasting > 48hrs within the last 6 weeks, persisting symptoms of heart failure, LV ejection fraction <40%, In addition history of at least 1 unplanned cardiovascular admission lasting >48h within previous 2 years, and LV ejection fraction < 25%, or treatment with furosemide at a dose >100mg/day or equivalent.	First patient enrolled: August 2000. Last patient enrolled: March 2002. Follow up 450 days.	<ul style="list-style-type: none"> • Significant mortality reduction - 30% • Reduction in hospital length of stay – 25%. 	Twice-daily patient measurement of weight, blood pressure, heart rate and rhythm with automated devices linked to a cardiology center. The objective was to identify whether home telemonitoring (HTM) improves outcomes compared with nurses telephone support and usual care.	
Schofield et al. (2005): Early Outcomes of a Care Coordination-Enhanced Telehome Care Program for Elderly Veterans with Chronic Heart Failure. Telemedicine and eHealth, 11(1), 20-27.	Non-randomized non-controlled pre-post evaluations Setting: primary care providers of the Veterans Health Administration (USA)	73 patients, veterans with new onset systolic CHF (NYHA II-IV), mean LVEF 23%, mean age 67ys	6 months	<ul style="list-style-type: none"> • Vital signs: significant improvements in blood pressure (129m to 119/69 mm Hg, p < 0.05), weight (196 to 192 pounds, p < 0.01), and shortness of breath rate (0-10 scale, 4.0 to 2.7, P = 0.02); • Resource utilization: significant reduction for bed days of care 1.65 (+/- 5.4) per patient during the program versus 8.63 (+/- 9.6) during prior year, p < 0.001 	Care-coordinated, nurse-directed home telehealth management program with disease-specific education via the nurse coordinator and/or the Health Buddy and monitoring of symptoms, weight, blood pressure, heart rate.	http://www.liebertonline.com/doi/10.1089%2Ftmj.2005.11.20
Vaccaro et al. (2001): Utilization Reduction Cost Savings, and Return on Investment for the PacifiCare Chronic Heart Failure Program, 'Taking Charge of Your Heart Health.' Disease Management, 4(3), 131-141.	Non-randomized, matched cohort controlled comparison Setting: Primary care providers of the Veterans Health Administration (USA)	52 patients with moderate or severe CHF in intervention group, 1 inpatient admission or 3 ER visits for CHF in the prior year, 56 % male, median age above 75 years; matched cohort control group with 638 patients	Enrollment period from 8/99 through 10/99, follow-up of 6 months	<ul style="list-style-type: none"> • Inpatient hospitalizations for all causes: reduction by 1.29 to 0.65 per patient per year (-49.6 %), p<0.001; • ER visits for all causes: reduction by 0.63 to 0.17 per patient per year (-73%), p<0.001; • Estimated costs savings for hospitalizations and ER visits: \$5,271 per patient per year (-50.6%) 	Monitoring of symptoms via Health Buddy plus written educational material and monthly phone calls for education	http://www.liebertonline.com/doi/abs/10.1089/1093507015259605

TABLE 2 CHRONIC OBSTRUCTIVE PULMONARY DISEASE

REFERENCE OF STUDY	STUDY TYPE	PATIENTS POPULATION	STUDY DURATION	STUDY OUTCOME	TYPE OF INTERVENTION	LINK
Sorknaes AD et al.(2010) Nurse tele-consultations with discharged COPD patients reduce early readmissions - an interventional study, the Clinical Respiratory Journal.	Interventional study, not randomised	<ul style="list-style-type: none"> Intervention group: 52 patients, control group: 50 patients. Inclusion criteria: People who have been admitted to hospital for ECOPD (COPD with dyspnoea, more cough and/or more sputum and a need for increased medication). Exclusion criteria: <40 yrs, systolic blood pressure, other serious diseases (cancer or severe heart failure), communication problems, not able to use a phone... 	<ul style="list-style-type: none"> From 4 June 2007 to 15 March 2008 and from 8th August 2008 to 6 January 2009. 28 days follow up. 	<ul style="list-style-type: none"> Within the 28 days period, The TVC group showed a readmission rate for ECOPD of 12% whereas the control group showed a readmission rate for ECOPD of 22%, hence a difference of 10% in readmissions. Patient satisfaction was high. Conclusion: in a hospitalised population with ECOPD, a nurse TVC assignment is protective against early readmission and reduces the days of readmission. 	<ul style="list-style-type: none"> Interventional study in which all ECOPD (exacerbations of chronic obstructive pulmonary disease) were allocated into two groups (telemedicine video control (TVC) or control) depending on their home municipality. The TVC patient received daily TVC at home with a nurse based in hospital for approximately one week. Thereafter the patient received at least one follow-up call and they could call the nurse for the rest of the study period of 28 days. The telemedicine equipment was composed of a computer with a web camera, a microphone and measurement equipment. 	
Koff P et al. (2009): Proactive Integrated Care Reduces Critical Care and Improves Quality of Life in COPD, European Respiratory Journal 34 (Suppl. 53):p. 75s	RCT; monocentric, Setting: COPD and General Pulmonary Clinic at the University of Colorado Hospital	<ul style="list-style-type: none"> Intervention group: 270 patients Control group: 130 patients Inclusion Criteria: GOLD Class III and IV or FEV1 > 50% predicted with a recent exacerbation Exclusion Criteria: Asthma, Significant co-morbidities including HIV infection, interstitial lung disease, end-stage liver or renal disease or dementia <p>Diseases likely to result in death within 2 years, Exclusion Criteria: Asthma,</p>	<ul style="list-style-type: none"> 9 months follow-up Study period: 2006-07; enrollment 2 pt. per day 	<ul style="list-style-type: none"> Significant reduction in critical care utilizations Reduction in gross costs depending on differing hospital reimbursement rates (High Reimbursement Rate: -450\$ p.p.p.m., Middle: -210\$ p.p.p.m., Low: -150\$ p.p.p.m.); Significant improvements in health-related quality of life (measured with SGRQ), 6 min walk distance, oxygene saturation and shortness of breath; Decreased mortality (4 % vs. 1%, p=0.046) 	Proactive Integrated Care with disease-specific education, teaching of self-management techniques, enhanced communication and remote home monitoring with Health Buddy; monitoring from Monday to Friday for changes in symptoms, SpO ₂ , FEV1 and steps in 6 min walk test	http://www.ersnet.org/learning_resources_player/abstract_print_09/files/66.pdf
Vitacca et al. (2009) Tele-assistance in chronic respiratory failure patients: a randomized clinical trial. European Respiratory Journal; 33: 411-418	RCT, monocentric Setting: Italy	101 patients (57:44)	12 months	43% reduction of hospital admissions (0,17 vs 0,3 per patient per month) ; reduction of costs 52% (UC: 24743 Euro/Year vs. TM: 9886 + 2000 Euro (service/ devices))	<ul style="list-style-type: none"> Thereafter the patient received at least one follow-up call and they could call the nurse for the rest of the study period of 28 days. 	
Koff P et al. (2009): Proactive Integrated Care Improves Quality of Life in Patients with COPD. European Respiratory Journal,	RCT; monocentric Setting: COPD and General Pulmonary Clinic at the University of Colorado Hospital	Intervention group: 19 (mean age 67y), control group: 19 (age 65y); GOLD stage III and IV; no statistical significant baseline characteristics	First patient enrolled: Nov 2004; last patient enrolled: June 2005; follow-up 12 weeks; outcomes compared to prior 12 weeks	<ul style="list-style-type: none"> Quality of life (SGRQ): intervention) 10.3 points improved (19%), control) 0.6 points improved (1%), p=0.018; Costs: no statistical significant differences; Exacerbations and hospital admissions not analyzed Detection of exacerbations (9 vs. 2 patients) 	Proactive Integrated Care with disease-specific education, teaching of self-management techniques, enhanced communication and remote home monitoring with Health Buddy; monitoring from Monday to Friday for changes in symptoms, SpO ₂ , FEV1 and steps in 6 min walk test	http://erj.ersjournals.com/cgi/content/short/09031936.00063108v1

TABLE 2 CHRONIC OBSTRUCTIVE PULMONARY DISEASE FOLLOWING

REFERENCE OF STUDY	STUDY TYPE	PATIENTS POPULATION	STUDY DURATION	STUDY OUTCOME	TYPE OF INTERVENTION	LINK
Trappenburg J.C.A. et al. (2008): Effects of Telemonitoring in Patients with Chronic Obstructive Pulmonary Disease. Telemedicine and e-Health, 14(2), p. 138-146.	<ul style="list-style-type: none"> • Non-randomized controlled comparison • Multicenter 	Intervention group: 68 (mean age 69y), control group: 56 (age 70y); GOLD stage III and IV; history of at least 1 COPD exacerbation in the preceding 6 months; more exacerbations, outpatient visits and hospital admissions in intervention than in control at baseline	First patient enrolled: May 2004; last patient enrolled: August 2005; follow-up 6 months; outcomes compared to previous 6 months	<ul style="list-style-type: none"> • Rate of exacerbation: intervention group 1.0 -> 0.65 (-35 %), control group 0.69 -> 1.01 (+46 %), p=0.004; • Rate of hospitalization: intervention 0.76 -> 0.65 (-15 %), control 0.48 -> 0.75 (+ 56 %), p=0.02; quality of life (CCQ): no statistical significant differences 	Health Buddy intervention with daily questions to patients that both monitor their disease symptoms, medication compliance, and knowledge; and provide education about their condition; answers reviewed from Monday to Friday by respiratory nurse; usual access to physician, GP or clinic; no additional case management or education	http://www.liebertonline.com/doi/abs/10.1089/tmj.2007.0037

TABLE 3 DIABETES

REFERENCE OF STUDY	STUDY TYPE	PATIENTS POPULATION	STUDY DURATION	STUDY OUTCOME	TYPE OF INTERVENTION	LINK
Chumbler et al. (2009): Mortality risk for diabetes patients in a care coordination, home-telehealth programme. Journal of Telemedicine and Telecare, 15(2), 98–101	Retrospectively matched controlled comparison using propensity scores	<ul style="list-style-type: none"> • 774 patients (387 for each group) • Mean age 68 yr 	4 years	<ul style="list-style-type: none"> • Reduction of 4-year all-cause mortality: hazard ratio 0.69, 95% CI 0.50–0.92, p=0.013 • Mean survival time: intervention 1348 days versus control 1278 days, p=0.015 • Slightly higher comorbidity score and pre-enrollment outpatient visits in intervention group 	Veterans Health Administration (VHA) care coordination/ home-telehealth (CC/HT) program using Health Buddy as communication device for education and monitoring of symptoms and health status; Care coordinators (registered nurses and nurse practitioners) monitored the answers from the devices daily so that early interventions could be made	http://jtt.rsmjournals.com/cgi/content/abstract/15/2/98
Chumbler et al. (2005): Evaluation of a care coordination/home-telehealth program for veterans with diabetes: health services utilization and health-related quality of life. Eval Health Prof, 28(4), 464-78.	<ul style="list-style-type: none"> • Uncontrolled, pre-post evaluation • Setting: VA sites in the Florida, Southern Georgia, and Portsmouth region (USA) 	445 patients, 2 or more hospitalizations or ED visits in the 12 months preceding enrollment,	12 months	<ul style="list-style-type: none"> • Hospitalizations: -50% • ER visits: -11% • BDOC: -3days, improvement of HrQoL 	Veterans Health Administration (VHA) care coordination/ home-telehealth (CC/HT) program using Health Buddy as communication device for education and monitoring of symptoms and health status	http://ehp.sagepub.com/cgi/content/abstract/28/4/464

TABLE 4 MULTIPLE CHRONIC DISEASES

REFERENCE OF STUDY	STUDY TYPE	PATIENTS POPULATION	STUDY DURATION	STUDY OUTCOME	TYPE OF INTERVENTION	LINK
Darkins et al. (2008): The Systematic Implementation of Health Informatics, Home Telehealth, and Disease Management to Support the Care of Veterans with Chronic Conditions. <i>Telemedicine & e-Health</i> , 14(10), 1118-1126.	<ul style="list-style-type: none"> • Non-controlled pre-post evaluation • Setting: Care Coordination/ Home Telehealth as a routine non institutional care services 	<ul style="list-style-type: none"> • 17025 patients, veterans, with diabetes, hypertension, CHF, COPD, depression, posttraumatic stress disorder or other mental health problems 	12 months	<ul style="list-style-type: none"> • 25% reduction in numbers of bed days of care • 19% reduction in numbers of hospital admissions • 86% mean satisfaction score rating 	Different telemonitoring systems	http://www.liebertonline.com/doi/abs/10.1089/tmj.2008.0021
Pare et al, Systematic Review of Home Telemonitoring for Chronic Diseases: The Evidence Base, <i>J Am Med Inform Assoc</i> . 2007;14:269 –277	<ul style="list-style-type: none"> • Systematic review of 65 empirical studies (18 pulmonary conditions, 17 diabetes, 16 cardiac diseases, 14 hypertension). • Studies published between 1991 and 2006. 	Various adult population.	Various	<ul style="list-style-type: none"> • The magnitude and significance of the telemonitoring effects on patients' conditions (e.g., early detection of symptoms, decrease in blood pressure, adequate medication, reduced mortality) still remain inconclusive for all four chronic illnesses. • High compliance with telemonitoring programs and the use of technologies. • Positive effect on health outcomes (decrease in the emergency visits, hospital admissions, average hospital length of stay). These effects are more consistent in pulmonary and cardiac studies than diabetes. • Economic viability of telemonitoring was observed in very few studies. 		
Darkins et al. (2008): The Systematic Implementation of Health Informatics, Home Telehealth, and Disease Management to Support the Care of Veterans with Chronic Conditions. <i>Telemedicine & e-Health</i> , 14(10), 1118-1126.	<ul style="list-style-type: none"> • Non-controlled pre-post evaluation • Setting: Care Coordination/ Home Telehealth as a routine non institutional care services 	17025 patients, veterans, with diabetes, hypertension, CHF, COPD, depression, posttraumatic stress disorder or other mental health problems	12 months	<ul style="list-style-type: none"> • 25% reduction in numbers of bed days of care • 19% reduction in numbers of hospital admissions • 86% mean satisfaction score rating 	Different telemonitoring systems	http://www.liebertonline.com/doi/abs/10.1089/tmj.2008.0021



SUCCESS STORIES

4



PART 4 SUCCESS STORIES

EMELIE A.

**Emelie, 67 years old,
lives alone and suffers from Congestive Heart Failure (CHF) since 1995.**
Newham Whole System Demonstrator case study (UK)

'I definitely know now that someone is looking out for me.'



EMELIE'S CONDITION

Emelie's heart has lost the ability to pump blood efficiently. The result is that her body doesn't get as much oxygen and nutrients as it needs, leading to problems like fatigue and shortness of breath. Although in the past few years her condition has improved somewhat, the concern for Emelie is that her blood pressure could go up very quickly without warning.

HOW DOES THE TELEHEALTH SERVICE WORK?

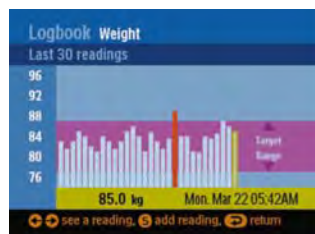
Since 2009, Emelie has been using a Telehealth system allowing her to manage her own health at home, with the supervision of health professionals. Emelie is now able to take her own blood pressure, weight, pulse and oxygen levels each day, with special equipment linked to a set-top box connected to her television. The results are automatically uploaded to a team of healthcare professionals who view them daily and can contact Emelie if anything is out of the ordinary.

THE OUTCOME FOR EMELIE

Emelie is enjoying the part she is now playing in managing her own health and she is more conscious of changes in her readings. *'I can see how my readings are related to my diet and how much physical activity I do... if they change, it makes you think 'What have I done? What did I eat?' and when you remember, you say to yourself 'no wonder my readings have gone up!'*



Body Weight Scales



Weight trends displayed to patients via their TV



Clinical Application

SUMMARY OF THE BENEFITS:

- 1 Disease education
- 2 Patient empowerment
- 3 Increased feeling of security

FRANK S.

Frank suffers from Chronic Obstructive Pulmonary Disease (COPD) and is followed by a telemonitoring service.

ATICO case study – Robert Bosch Healthcare GmbH

'I have gained about 30% more quality of life.'



FRANK'S CONDITION

COPD is a chronic and progressive disease that damages airways and causes breathing dysfunction because of the amount of mucus present in the lungs. It can lead to pneumonia, pulmonary hypertension and heart failure.

HOW DOES THE TELEHEALTH SERVICE WORK?

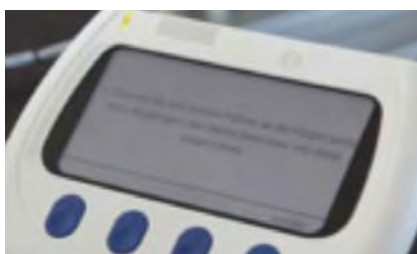
Every morning, Frank captures his vital signs, such as oxygen saturation and heart rate, through a simple electromedical device. He also answers a few questions on his symptoms – coughing, sputum and difficulties in breathing – and on how he is feeling. The information is then automatically sent to a data analysis center. The system issues a listing of all patients, with a color code: green if all goes well, red if there are reasons to worry. A nurse opens the red files to assess the seriousness of the situation and contacts the patients to ask them further questions on their condition. If she notes that Frank's condition has deteriorated, she will immediately put him in contact with Dr. Werner.

THE OUTCOME FOR FRANK

'If something is wrong, I'll be notified and taken to hospital or my doctor will be in touch. That gave me so much security and confidence, that I could do things again. It motivates you to get moving. I used to be pretty passive, but now I try to walk as much as possible.' Frank

'The idea is that routine visits are diminished and emergency visits, when necessary, can be made at exactly the right time. It is more important that patients come in such cases, rather than for routine examinations, when there is nothing wrong.'

Dr. Werner



'The system is so easy that you can't do anything wrong.'

'The base station is quite easy to operate with four large buttons, so that even elderly patients can get along with it very well.'

SUMMARY OF THE BENEFITS:

- 1 Increase of the quality of life and of the feeling of security
- 2 Reduction of emergency visits
- 3 Improved understanding of the symptoms by the patient

The data shown in this case study is used with the consent of the different parties involved.

CAROL H.

**Carol, 58 years old,
suffers from diabetes and from a heart condition.**
Newham Whole System Demonstrator case study (UK)

*'Telehealth helps me with my weight, too.
It keeps me on my toes to watch what I eat.'*



CAROL'S CONDITION

In addition to diabetes 58-year-old Carol also suffers from a heart condition which means she has an irregular heartbeat and palpitations. Her blood pressure often drops very low and, the concern for her and her husband is that it could happen quite rapidly with little time to recognise the symptoms.

HOW DOES THE TELEHEALTH SERVICE WORK?

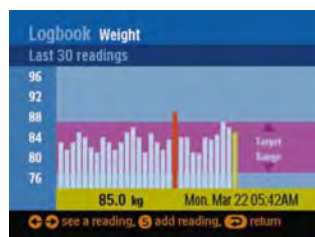
Since 2009, Carol has been using a TeleHealth system connected to her television, enabling her to take her own blood pressure, weight, pulse, blood sugar and oxygen levels every day. Data is automatically received and reviewed by healthcare professionals. Once, they noticed Carol's blood pressure was too low; an ambulance was sent to her house, and she was taken to the hospital early enough to avoid serious complications.

THE OUTCOME FOR CAROL

'Every morning I look forward to seeing how my readings are. Before I would just do it but not really understand or take the time to see a pattern,' said Carol. Carol is now playing a much more active role in the management of her own health and is more conscious of any changes in her readings.



Body Weight Scales



Weight trends displayed to patients via their TV



Clinical Application

SUMMARY OF THE BENEFITS:

- 1 Disease education
- 2 Patient empowerment

AHMED R.

Ahmed has lived with diabetes for the last 18 years

ATICO case study – Robert Bosch Healthcare GmbH

'My life was saved thanks to telehealth.'



AHMED'S CONDITION

Ahmed was diagnosed with diabetes 18 years ago and has been battling with his condition for the past ten. At the end of 2008, his health deteriorated so much that he lost all feeling in his body from the neck down and was hospitalised. Ahmed's health has since stabilised but he is concerned about his health deteriorating again. Ahmed realised diabetes is a serious disease when he suffered complications including an amputation.

HOW DOES THE TELEHEALTH SERVICE WORK?

Ahmed has been monitored by telehealth since November 2008. He is able to take his own blood pressure, weight, pulse and blood sugar readings each day. The readings are taken with special equipment which is linked to a set-top box connected to his television. The results, which Ahmed can view on his television, are automatically uploaded to a team of healthcare professionals who view them daily.

THE OUTCOME FOR AHMED:

In one instance, Ahmed noticed his blood pressure readings were not right and as he was feeling dizzy as well, he called his GP. He was told his symptoms sounded like he may have had a stroke and that he should call an ambulance. On arrival at the hospital he found out that he'd had a minor stroke. Getting the advanced warning may have saved him from something more major.

'TeleHealth is really great for a person with an illness. Someone is always looking out for me and that is a big support. I'm always aware what is happening about my health.' Ahmed

'The system helped him (Ahmed) to learn more about the disease in the first place, learn about the importance of good treatment and learn how to control his diabetes.' Doctor Kumar



Blood Pressure Monitor



Patient Education presented via
the TV



Clinical Application

SUMMARY OF THE BENEFITS:

- 1 Disease education
- 2 Patient empowerment
- 3 Increased feeling of security
- 4 Improved quality of life by staying at home

The data shown in this case study is used with the consent of the different parties involved.
Source: <http://www.newhamwdtrial.org/>

GENERAL INFORMATION ABOUT COCIR

Founded as a non-profit trade association in 1959, COCIR represents the radiological, electromedical and healthcare IT industry in Europe. As such, our members play a driving role in developing the future of healthcare both in Europe and worldwide.

COCIR is committed to supporting its members and communicating with its partners in Europe and beyond on issues which affect the medical technology sector and the health of EU citizens.

COCIR also works with various organisations promoting harmonised international standards and fair regulatory control that respects the quality and effectiveness of medical devices and healthcare IT systems without compromising the safety of patients and users.

We encourage the use of advanced technology to support healthcare delivery worldwide.

COCIR's key objectives include promoting free worldwide trade of medical devices and maintaining the competitiveness of the European health sector.

COCIR COMPANY MEMBERS:



NATIONAL TRADE ASSOCIATIONS MEMBERS:



COCIR HOW TO JOIN US

COCIR aisbl :: Diamant Building :: Boulevard A. Reyerslaan 80 :: 1030 Brussels :: Belgium
 Tel +32 (0)2 706 8960 :: Fax +32 (0)2 706 8969 :: Email info@cocir.org :: www.cocir.org