

ICT WP 2011-12
Challenge 5
-
Objective 5.1:
“Personal Health Systems”

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European Commission



**Challenges for
European Health Systems**

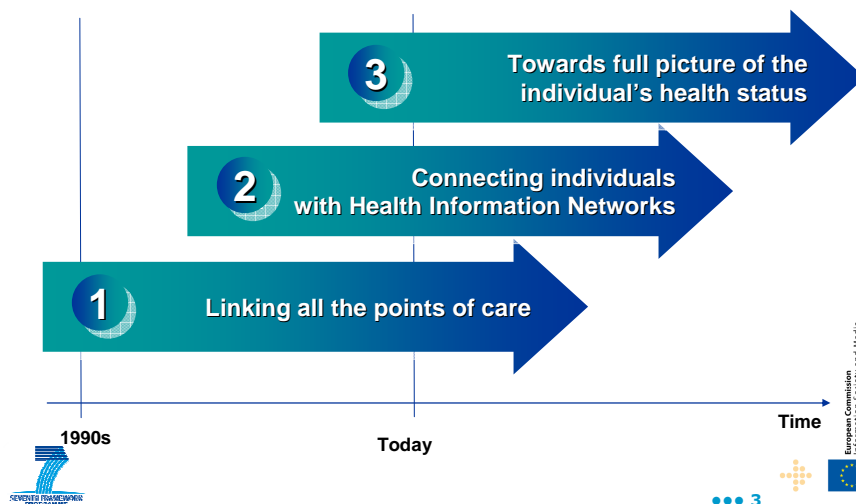
• ***Pressure on healthcare systems:***

- *Citizens' expectations for high-quality care*
- *Demographic changes*
- *Increased prevalence of chronic diseases*
- *Increased mobility of citizens and patients*
- *Staff shortages, unequal territorial distribution*
- *Reactive model of healthcare delivery*
- *Rising healthcare costs*

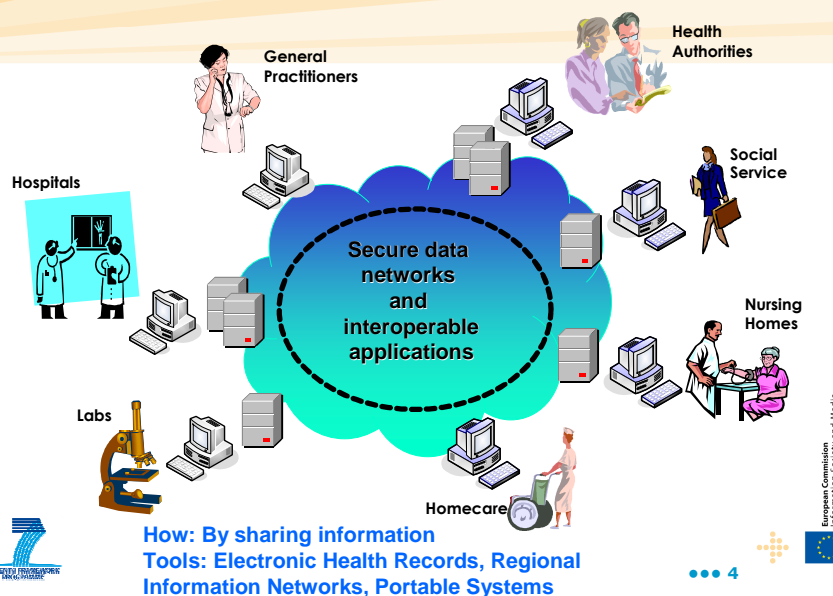
**How to offer
high-quality &
affordable care?**



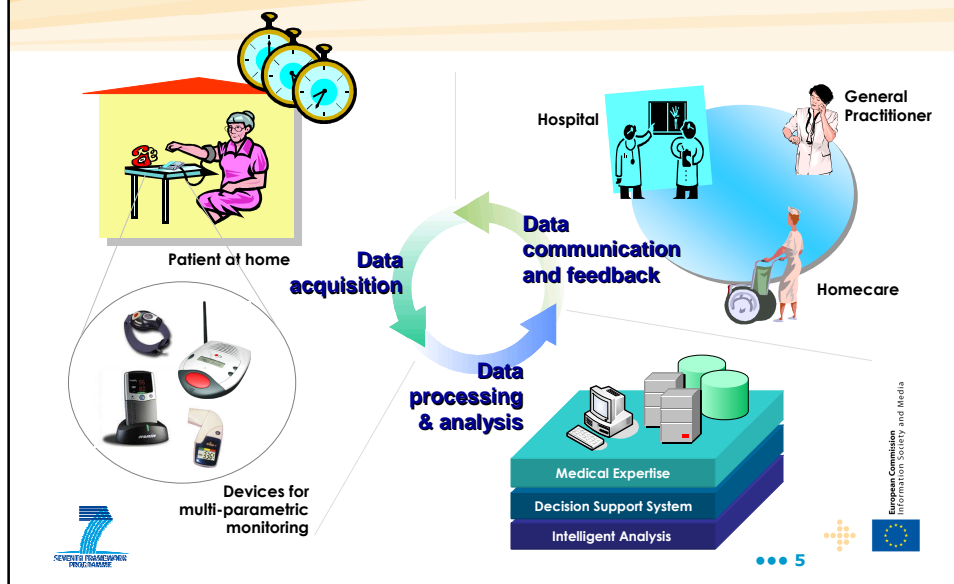
The EU roadmap for eHealth



Step 1 – Linking all the points of care



Step 2 – Connecting individuals with Health Information Networks



Personal Health Systems - PHS

- **A new generation of disruptive eHealth tools**

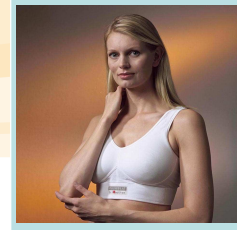
- Place the individual person in the centre of the healthcare delivery process
 - ✓ **Person-centric care**
- Aim for high quality, personalised care at the point of need
- Better use of the available healthcare resources

- **Key facilitators for:**

- Ubiquitous personalised care
- Continuity of care (in time and space)
- Supporting the shift to preventive care



PHS characteristics



Realised as:

- **Wearable, implantable, portable** systems
- Integration of various components and technologies
 - *e.g., sensors, implants, signal processing algorithms, user interfaces, mobile and wireless communications*
- Used by the patient or healthy individual
- Coupled with telemedicine platforms to provide personalised services

Non-/minimally-invasive monitoring and management

- Remote & continuous health status monitoring and disease management
- Personalised medical advice, recommendations & treatment
- Available at anytime and location beyond hospitals



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Patient Empowerment

- Patients to be managers of their illness/health status
- Effective communication between health professionals and patients
- **Need tools for Self-Management support** → **ICT**
- Look after psychosocial and emotional aspects
- Healthcare organisation to the service of patients

Chronic diseases model (Wagner, del McCall Institute for Health Care Innovation (www.improvingchroniccare.org))



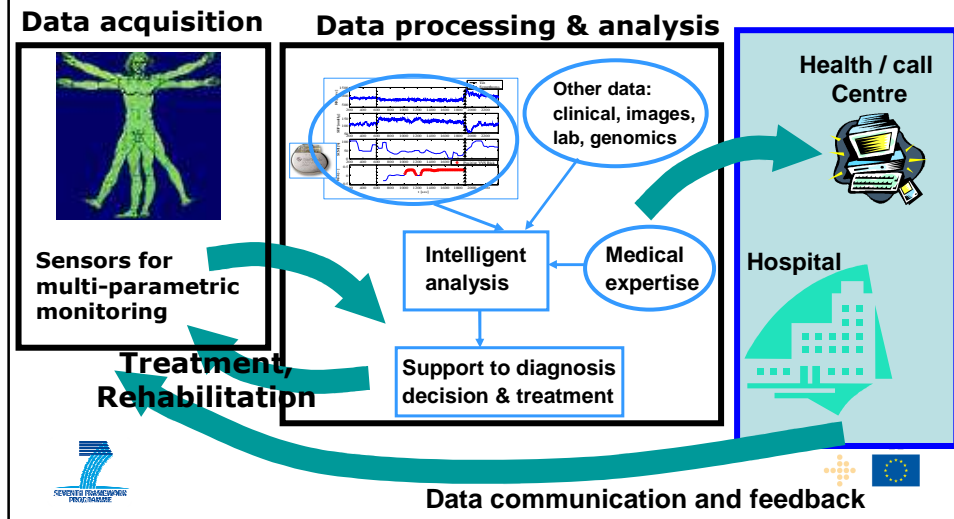
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Personal Health Systems: the big picture



The First Approaches in PHS: "Telehealth"

• Telehealth solutions for home care employing:

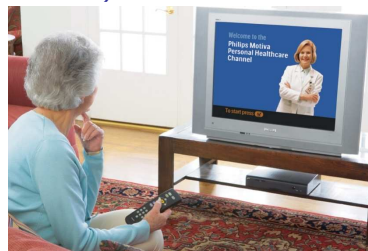
- Sensing and monitoring equipment
 - ECG (event) recorders, blood glucose monitors, etc...
- Communication networks
 - Via telephone lines
- Services provided by call centres
 - 24 hours a day, all year round
 - Linked with networks of health professionals
 - Medical response and guidance
- Example: Telecardiology - Boario Home Care Project, IT



Telehealth becomes “interactive”

- **Interactive TV:**

- Remote care at home
- Easy to use interface
- Patient education (through personalised videos)
- Feedback and motivational messages
- Supporting doctor-patient interaction
- Example: MOTIVA by PHILIPS



Source: Philips

<http://www.medical.philips.com/main/products/telemonitoring/products/motiva/>



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Introducing mobile technology: the move to “mHealth”

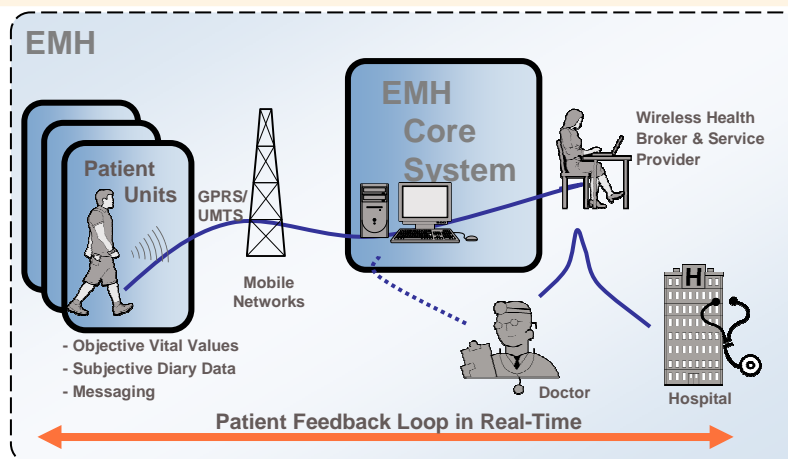
- **Mobile monitoring of health status**
 - Body sensors (wearable, wireless)
 - Measurement of vital signs (ECG, heart rate, blood pressure, blood glucose, ...)
- **Mobile/Wireless communication networks**
 - Wirelessly from sensor network to PDA or mobile phone
 - GPRS / UMTS mobile networks to servers in medical centres
- **Services**
 - Access to online health portals, health records and databases
 - Linked with health professionals
 - Remote disease management
 - Real-time/non-real time feedback to patient
 - Messages, reminders, guidance for lifestyle management



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Introducing mobile technology: the move to "mHealth"



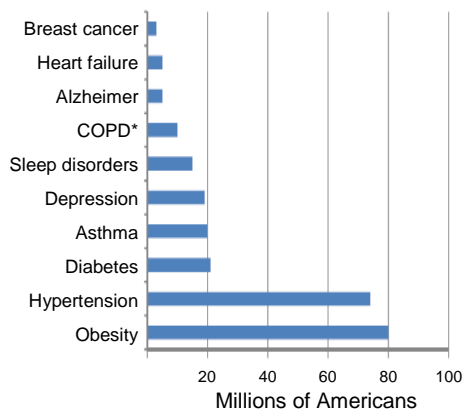
Source: Rainer Herzog, Ericsson,
presented at the Personal Health Systems conference, Brussels, 12-13 February 2007

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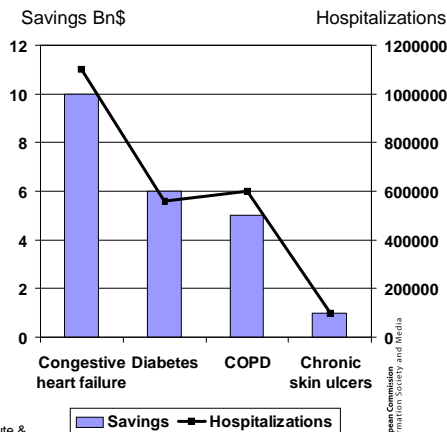


Drivers and Demand

Top ten conditions and diseases benefiting from wireless health



Potential annual savings from adoption of remote health monitoring



Source: Eric J. Topol, M.D. Scripps Translational Science Institute &
West Wireless Health Institute

Data provided by Manfred Kube - January 2010, Mobile
Healthcare, Cinterion Wireless Modules

* Chronic Obstructive Pulmonary Disease

Source: Betterhealthcaretogogether.org

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PHS and Physiological Health Stationary Telemonitoring Solutions



© FP5 project TOPCARE



Viterion Link
© Viterion TeleHealthcare



Patient Telemonitoring Set
© Philips



Wireless Telehealth Gateway
RTX3351, © RTX Healthcare



Multiparameter Monitoring System
WristClinic + MedicGate, ©
Telcomed



Source: Stephan Kiefer & Safdar Ali, Fraunhofer Institute for Biomedical Engineering, presented at the ICT 2008, Lyon, 25-27 November 2008



PHS and Physiological Health Mobile Telemonitoring Systems



vitaphone 2300, © Vitaphone



CoreBELT
© Corescience



eWatch
© Carnegie Mellon University, Pittsburgh
TU München



STATPATCH™ Wireless Holter Monitor,
© Telzuit Medical Technologies



© Fraunhofer Sensave



Source: Stephan Kiefer & Safdar Ali, Fraunhofer Institute for Biomedical Engineering, presented at the ICT 2008, Lyon, 25-27 November 2008



Prototype PHS in the hands of the users (from FP5 and FP6 research projects)

Examples for monitoring vital signs

- Wrist-worn devices
- Body Sensor Networks
- Biomedical clothes

AMON



MOBIHEALTH



MYHEART



WEALTHY

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SEVENTH FRAMEWORK PROGRAMME

Prototype PHS in the hands of the users (from FP5 and FP6 research projects)

The MyHeart system for closed-loop management of Heart Failure

- Patient self management: taking measurements at home, morning and night
- Detect trends in measurements prior to medical events
- Early prediction of patient "decompensation"

T-shirt



Respiration
ECG
Activity

Smart Bed



ECG
Pressure
•Heart Rate
•Respiration Rate
•Activity

Reference



Weight
Blood Pressure
Implant
•ECG
•Activity



SEVENTH FRAMEWORK PROGRAMME

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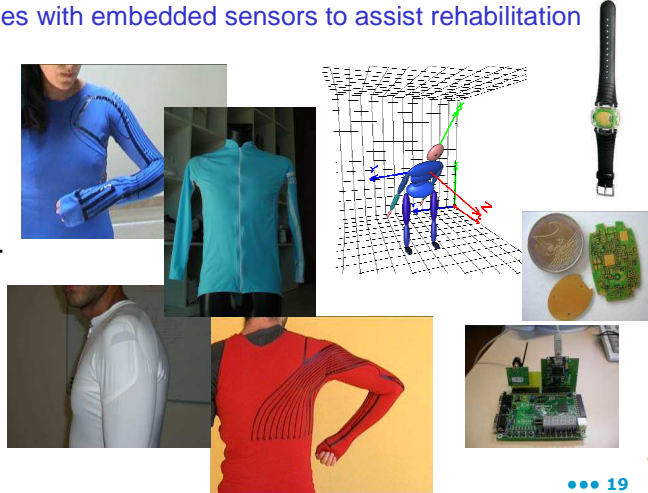


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Prototype PHS for stroke rehabilitation

In neurological applications

- Textiles with embedded sensors to assist rehabilitation



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Upper Limb Robotic Rehabilitation: State of the Art

Pts. with lower functional levels

Passive

1-2 DOF

Active

Interactive.

Multi DOF

Pts. with higher functional levels

- a) End-effector (operator holds manipulandum)
- b) Exoskeletons (worn by the operator)

- Systems are expensive & difficult to transfer to patient's home



Source: Fabrizio Pisano, Fondazione Salvatore Maugeri, presented at the PHS 2010 consultation workshop, Brussels, 14 January 2010



Measuring arm movements

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- Portable systems in laboratory settings; typical for assessing the quality of arm movements
- **Not yet applied** in home settings to register amount of functional movements (object manipulation, reaching movements, etc)
- Useful as tools for:
 - Monitoring performance
 - Monitor training programs at home and provide motivational feedback
 - Personalised treatment programs
- Telerehabilitation

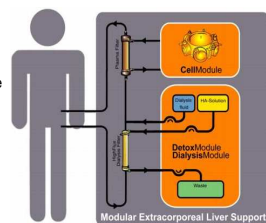
Source: Peter Feys, PHL/University of Hasselt ,
presented at the PHS 2010 consultation workshop, Brussels, 14 January 2010



Artificial Liver Support Systems

- Application: Acute liver failure, acute-on-chronic liver failure to bridge the time to liver transplantation or until regeneration;
- Liver dialysis methods:
 - Molecular Adsorbents Recirculation System (MARS), Teraklin AG
 - Single pass albumin dialysis (SPAD), Prometheus, Fresenius AG
 - Selective Plasma Exchange Therapy (SEPET™)
 - Bio reactors on the base of hepatocytes

Source: Charite



Source: Teraklin AG



Source: Arbios Systems Inc.



Source: Fresenius AG



Source: Stephan Kiefer & Safdar Ali, Fraunhofer Institute for Biomedical Engineering,
presented at the ICT 2008, Lyon, 25-27 November 2008



Future Artificial Liver Support Systems

- Improved detoxification, higher efficiency
- Immune modulation: removal of cytokine inducing substances
- Synthesis
- Bridging longer time intervals
- Less intensive care environments
- ICT support: remote monitoring of the patient and remote control of the device



Source: Charite



Source: Stephan Kiefer & Safdar Ali, Fraunhofer Institute for Biomedical Engineering, presented at the ICT 2008, Lyon, 25-27 November 2008



Considering personalised context & characteristics: the complete move to “pHealth”

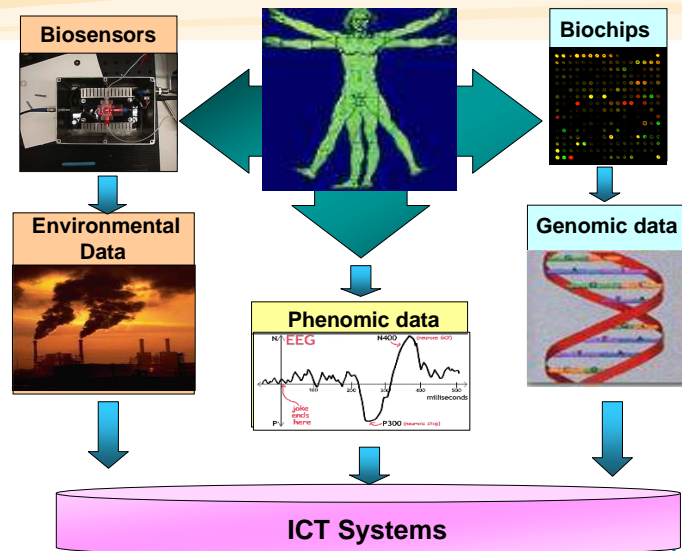
- **Enrich information**
 - *from surrounding environment, activities, emotions, genetic ...*
- **Account for measurements in non-clinically controlled environments**
 - *give “context” to a value, i.e. under which conditions it was measured*
- **Adapt to specific characteristics of the individual**
 - *we are all different from each other*
 - *a blood pressure level may be high for person X but normal for person Y*
- **Consider all the above in:**
 - *reducing false alarms*
 - *medical decision making*
 - *providing services*
- **PHS research moves in this direction**
 - *... but we are not quite there yet*



HEARTCYCLE



Step 3 – Towards full picture of individual's health status



PHS calls in FP7 so far (>€130M)

- **Aspects and areas covered:**

- 1) **Mainly *chronic disease management*, some on *prevention***

- (a) Cardiovascular diseases
- (b) Diabetes
- (c) Respiratory diseases
- (d) Renal failure
- (e) ICT-enabled Artificial Organs
- (f) Mental disorders (depression, bipolar, stress)
- (g) Point-of-Care diagnostics

- portable or handheld systems for multi-analyte screening at primary care (e.g., celiac disease, autoimmune diseases)

- 2) **Support Actions on:**

- RTD roadmap on Personal Health Systems
- Roadmap on ICT for disease prevention
- Interoperability of Personal Health Systems



PHS research in ICT WP 2011-12

- **Topics not adequately addressed in previous calls, e.g.:**
 - Management of neurodegenerative diseases
 - Rehabilitation of cerebrovascular/neurological conditions
 - Analysis of multi-parametric data
- **Input to PHS in Work Programme 2011-2012:**
 - From the PHS2020 road mapping project (www.phs2020.com)
 - From the study "Robotics for Healthcare" (final report: http://ec.europa.eu/information_society/activities/health/docs/studies/robotics_healthcare/robotics-final-report.pdf)
 - From PHS 2010 consultation exercise, January 2010 (report: http://ec.europa.eu/information_society/activities/health/docs/vents/phs2010wkshp/phs2010consult_workshop_report.pdf)



FP7 ICT Objective 5.1 – Personal Health Systems (PHS)

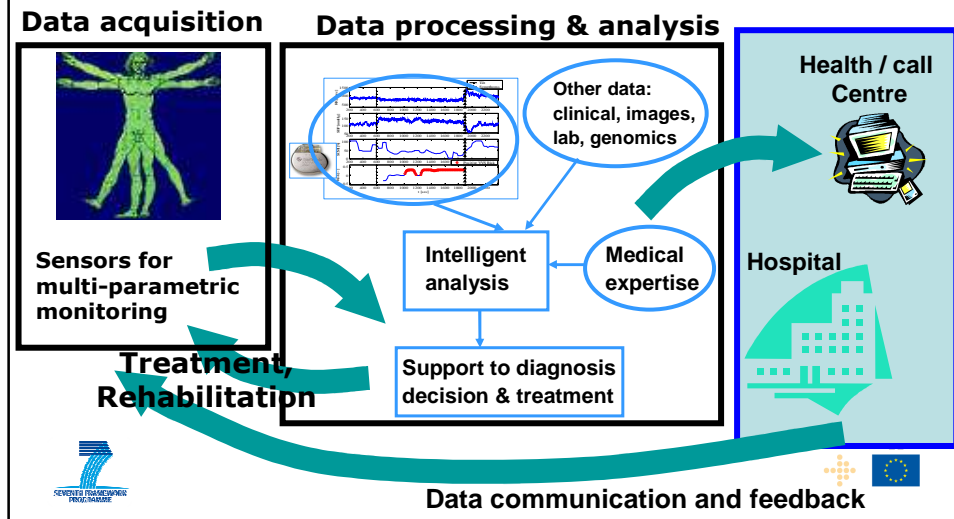
Target Outcome:

(a) PHS for remote management of diseases, treatment and rehabilitation

- **outside** hospitals and care centres
- **Closed-loop** approaches
- Integrate components into **wearable, portable or implantable devices**
- Coupled with appropriate platforms and **services**
- Innovations at **system** level and at **component** level



Personal Health Systems: the picture for 5.1(a)



FP7 ICT Objective 5.1 – Personal Health Systems

Target Outcome:

(a) PHS for remote management of diseases, treatment and rehabilitation

- Emphasis on **6 points**:
- i. **Auto-adaptive**, self-calibrating, energy-efficient modules with multi-sensing, advanced on-board processing, communication and actuation capabilities
- ii. **Accuracy** of measurements & **remote control** and **reliable** operation of the devices/systems
- iii. Context-aware, **multi-parametric monitoring** (health parameters, activity, lifestyle, environment and operational parameters of the devices)
- iv. **Analysis, interpretation** and **use** of multi-parametric data for **shared** patient-doctor decision support systems
- v. Clinical **workflows, guidelines** and patient **pathways** to support **remote** applications
- vi. **Education** and **motivation** of users



FP7 ICT Objective 5.1 – Personal Health Systems

Target Outcome:

(a) PHS for remote management of diseases, treatment and rehabilitation

- 3 application domains
- Proposals to undertake **high risk** research addressing only one of these domains
- a1) Neurodegenerative diseases
 - **remote** management and treatment of patients at point of need
 - addressing also the needs of their **carers**
 - **heterogeneous** data to assess patients' health status
 - depending on the disease addressed: may use neural recording, neurostimulation and/or drug delivery system



FP7 ICT Objective 5.1 – Personal Health Systems

Target Outcome:

(a) PHS for remote management of diseases, treatment and rehabilitation

- a2) Rehabilitation of stroke and neurological conditions
 - patient services at **home**
 - **telesupervision** by health professionals as and when required
 - facilitate continuity of personalised **cognitive** and **functional** rehabilitation
 - robotic and haptic technologies, wearable systems, implants, HCI, web services or virtual reality environments
 - **heterogeneous** data and **predictive** models to **assess** patient status and progress, monitor **risk** factors and **predict** new episodes
- a3) Liver failure
 - **ICT-enabled artificial liver:** detoxification as **remote** transient therapy at the point of need
 - continuous care from hospital to home settings



FP7 ICT Objective 5.1 – Personal Health Systems

Additional requirements for Target Outcome (a):

- Scenario-based design
- Service models to support transferability of healthcare outside hospitals and care centres
- Strong involvement of clinical users; experts in regulatory approval
- Target group is **only patients** (*not healthy individuals*)
- Proposals will address:
 - user acceptance
 - patient compliance
 - security and confidentiality of patient data
 - interoperability related to heterogeneous data sources, devices and links with electronic health records
 - recommended use of standards and suitable open software platforms



FP7 ICT Objective 5.1 – Personal Health Systems

Additional requirements for Target Outcome (a):

- Validation to demonstrate:
 - proof of concept
 - efficiency gains
 - if possible, cost effectiveness
 - include comparison versus currently accepted gold standards
 - include **quantitative** indicators of the added value and potential impact of the proposed solutions

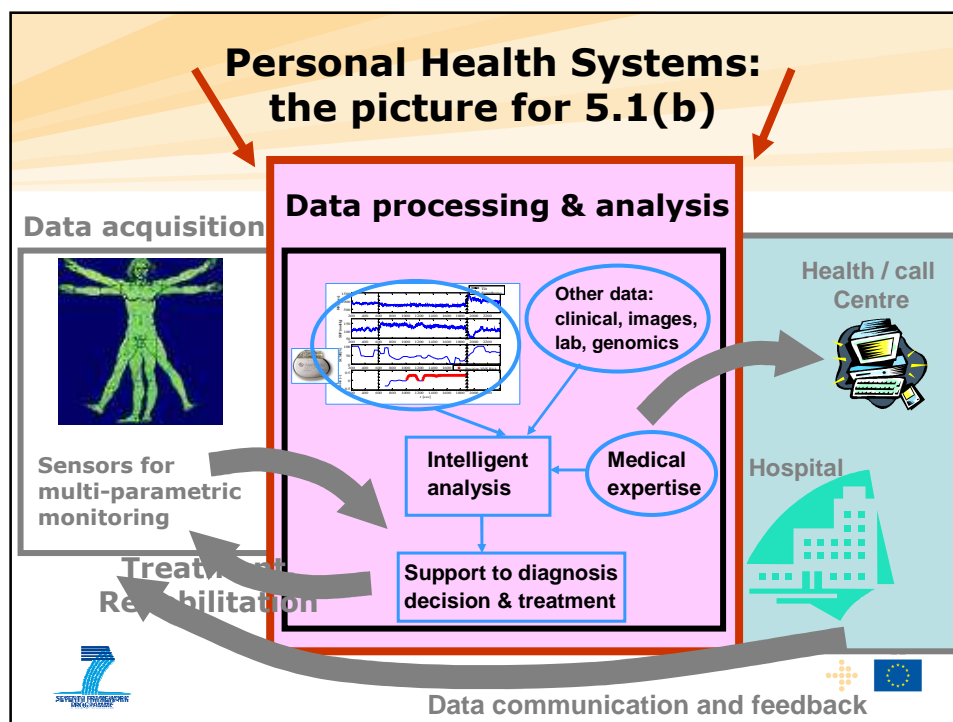


FP7 ICT Objective 5.1 – Personal Health Systems

Target Outcome:

(b) Intelligent systems for the analysis of multi-parametric data

- Focus **exclusively** on **analysing** multi-parametric data
 - **related to PHS** for prevention or remote management of clearly targeted diseases or co-morbidities
- **Multi-parametric data**: physiological measurements, genetic data, medical images, laboratory examinations, activity, lifestyle and data on surrounding environment
- **Process and interpret** multi-parametric data for: accurate **alerting, signalling** of risks, supporting healthcare professionals in **decision making**
 - correlating the multi-parametric data with established biomedical knowledge to derive clinically relevant indicators
 - creating new medical knowledge for diagnosing worsening of conditions and prompting early intervention



FP7 ICT Objective 5.1 – Personal Health Systems

Target Outcome:

(b) Intelligent systems for the analysis of multi-parametric data

- Use patient data **already available** in databases or from other research projects or pilots
- Creation of **new** patient data with the use of **previously developed** and **tested** monitoring systems
- Adaptation of existing monitoring systems is **eligible**
- The development of **new monitoring systems is not in scope**
- Attention to security and protection of patient data
- Validation to demonstrate with **quantitative** indicators:
 - **effectiveness**
 - **medical** and **economic** benefits



FP7 ICT Objective 5.1 – Personal Health Systems

(c) Coordination and Support Action:

Roadmaps for research and support to wide use of:

- mobile eHealth (**mHealth**) for **lifestyle** and **disease management**
- **Address elements such as:**
 - technology options for applications and services
 - any need for dedicated radio frequency bands
 - any need for update of medical guidelines, including methodology to deliver new knowledge to medical professionals and patients
 - user acceptance, security and privacy
 - business cases and reimbursement
 - mapping of future mHealth applications to the regulatory framework of medical devices
- **Consider relevant experiences in developing countries**



FP7 ICT Objective 5.1 – Personal Health Systems

Expected Impact

For target outcomes a) and b):

- Reduced hospitalisation rate and improved disease management, treatment or rehabilitation at the point of need
- Strengthened evidence base on medical outcomes, economic benefits and effectiveness of the use of Personal Health Systems
- Reinforced medical knowledge w.r.t. efficient management of diseases
- Contribution to more sustainable European healthcare system
 - through provision of high quality, personalised care, with better use of the available healthcare resources
- Reinforced leadership and innovation capability of the industry in PHS, medical devices and services
 - through introduction of new business models, creation of spin-offs and better exploitation of IP for products, standards and regulation



FP7 ICT Objective 5.1 – Personal Health Systems

Expected Impact

For target outcomes a) and c):

- Accelerated establishment of interoperability standards and of secure, seamless communication of health data between all involved partners, including patients

For target outcomes a) only:

- Participation of essential stakeholders in production of end-to-end solutions for personalised care. Reinforced national or regional commitment in deployment of innovative services following R&D projects
- Improved links and interaction between patients and doctors facilitating more active participation of patients in care processes

For target outcomes c) only:

- Improved understanding of technology options, business and regulatory aspects for both privately-driven and publicly-funded mobile solutions for healthcare services



FP7 ICT Objective 5.1 – Personal Health Systems

- **When :** Call 7
- **Budget :** 60 M€
- **Instruments and Selection:**
 - (a) : IPs and STREPs
 - (b) : STREPs only
 - €59.5 M for (a) + (b)
 - In (a): area coverage is top priority
 - First selection made from the top ranked proposals in the 3 domains: a1, a2 and a3
 - At least 2 IPs for (a)
 - Up to 2 STREPs for (b)
 - (c) CSAs – €500k:
 - Up to 1 CSA, 24 months maximum duration



Contact persons

- **DG INFSO Unit H1 – “ICT for Health”**
- **Personal Health Systems group**
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 - Jaakko Aarnio
 - Griet van Caenegem

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ICT Proposers' Day 2011
19 - 20 May, Budapest
Networking for European ICT R&D



- Aim of the event:
to prepare for Calls 8 and 9 (together >1 billion €)
 - by networking and partnerships building
 - by first-hand information from >100 EC officials
- Structure:
 - thematic sessions with presentations of proposal ideas
 - information stands & meeting points
- Registration:
free of charge, open from January 2011



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<http://ec.europa.eu/ictproposersday>