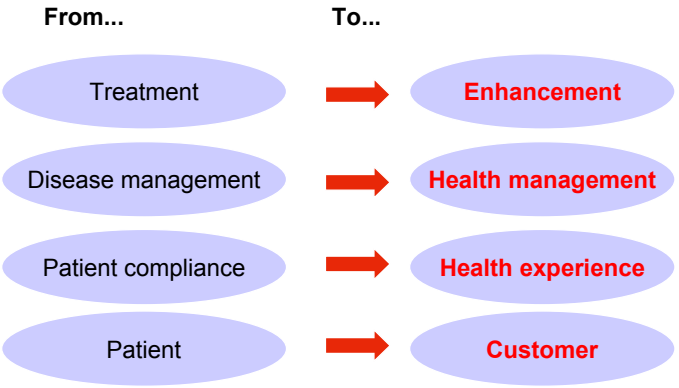
Healthcare Challenges in the 21st century

Healthcare payers	Care providers	Patients
Value for money **Reduce costs**	**Cost** **Effectiveness** **Efficiency** **Quality** **Resources**	**Quality of life** **Access to care**

Needs

- Citizen centric health services
- Continuous care across organizational boundaries between
  Public & Private & 3rd Sector Providers &
  Primary & Specialised care & Occupational health services
- **Expanding scope of medicine (supply) vs. Citizen expectations (demand) vs. Resources**
- Equity, Quality and Cost concerns

PARADIGM SHIFTS

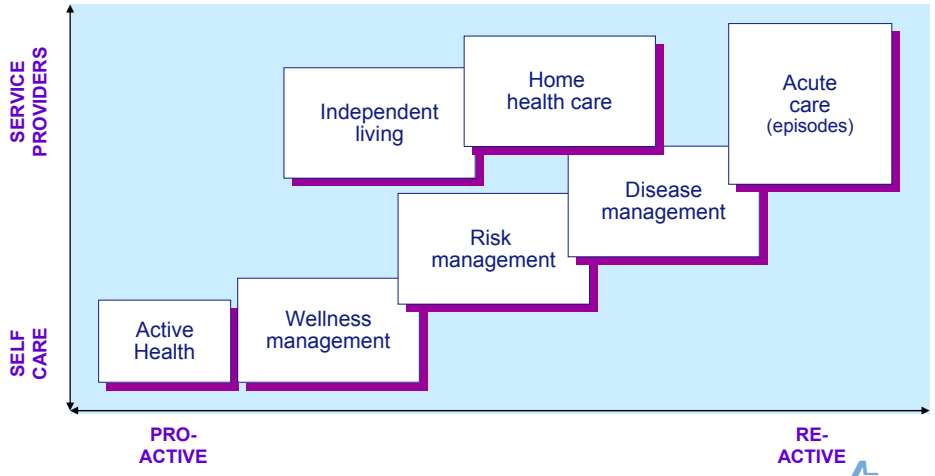


From Philips

Whose health?
Who cares?

Categories of applications (by Philips)

Application clusters

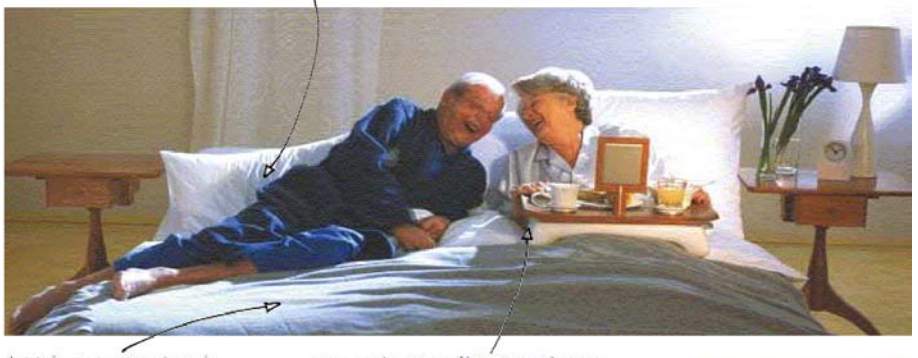


Lamminmäki E, Korhonen I, Saranummi N. Mobile and personal health and wellness management and monitoring systems – usage models and applications. In: Mihailovidis A, Bardram J, Wan D (Eds.): Pervasive Computing in Healthcare, CRC Press.

How?

Technology – visions and state-of-the-art

Philips Smart Environment Scenario



Philips HomeLab





Wearable systems for Healthcare: to enable….

- **Continuity of care**
- **Health conscious citizen**
- **Needs of patient for better care**
- **Managed care, limited healthcare budgets**
- **Healthcare quality control and improvement**
- **Societal changes e.g. lifestyle, ageing, chronic diseases**

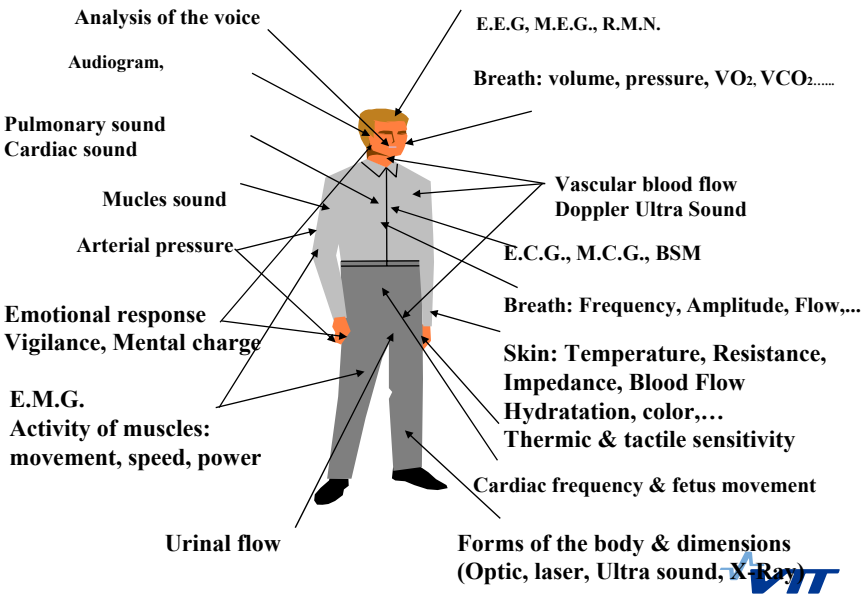
HealthWear by Bodymedia, Inc

LifeShirt by Vivometrics, Inc

- ***Current shift paradigms***
  - From portable to wearable
  - From monitoring and treating to preventing
  - From low-cost to ultra-low-cost

IEEE EMBS Technical Committee for Wearable Biomedical Sensors and Systems

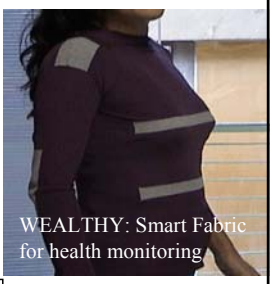
Non-invasive measurements: Plethora of possibilities



eHealth systems for Patients –EC Projects Results

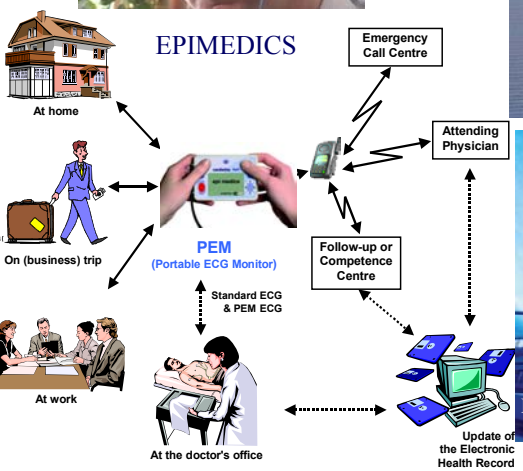
PARREHA

AMON



WEALTHY: Smart Fabric for health monitoring

MOBIHEALTH



IMP-ART: Oxygen delivery for wound healing

Future scenario: disposable unobtrusive health sensors

State-of-the-art

- Measurement devices
  - Technically advanced
  - Wireless transmission:
    - Most devices don't have
    - Different technologies (Bluetooth, IrDA, inductive link, ANT, ZigBee, WLAN, WiFi, …)
- Services
  - Web services
  - Web + mobile phone
  - Different service for each device

- Measurement devices are incompatible → Each device has its own transmission tecnology, services, user interface, etc.


www.omron.com


www.polar.fi


www.soenhle.com

www.nokia.com


www.bodymedia.com

Coming soon(?)

- Easy to use
- Unobtrusive measurement
  - Comfortable
  - Light-weight
  - Invisible
- Low/no-maintenance & installation
  - Long battery-life (months to years)
  - Easy calibration (if any)
- Wireless
  - Devices compatible
  - Automatic data transfer
- Services
  - Web service, web community
  - ”Life coach”


http://www.ethlife.ethz.ch


www.bodymedia.com


www.istsec.fi


www.omron.com

ON THE MOVE

www.nokia.com

Wireless connection


www.polar.fi

SERVICES


www.bodymedia.com


www.emfit.com


www.soenhle.com

www. omron.com

AT HOME

Blood Glucose Monitoring

Now...

Roche Accu-Chek Softclix
www.accu-chek.fi

Abbott Precision Xceed
www.abbott-diabetes-care.de

LifeScan OneTouch UltraSmart
www.lifescaneurope.com/fin/

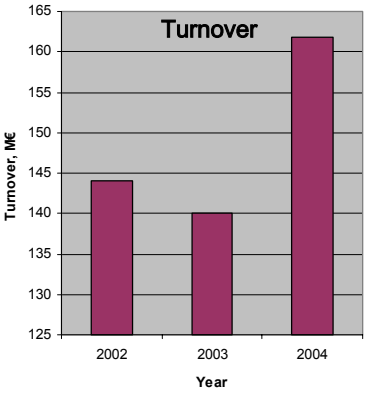
...and in the future

Glucowatch G2
www.medtronic.com

Medtronic MiniMed 2007 Implantable Insulin Pump System
www.minimed.com

Why?
And why not (yet)?

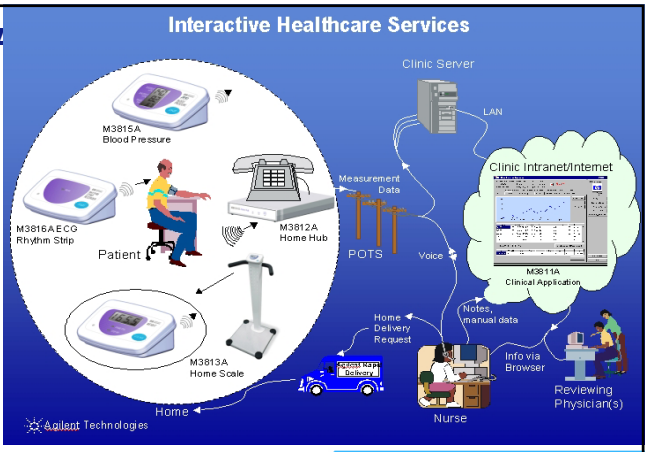
Polar Electro

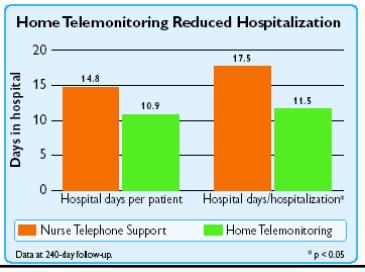


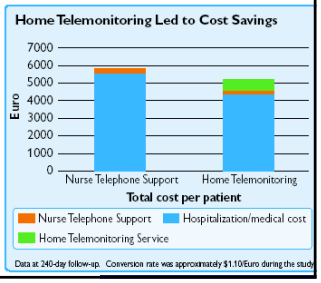
Example of existing proof (Philips Medical)

- Congestive heart failure
- Home telemonitoring (Philips Interactive Health Services)
- Randomised prospecive trial, 426 patients, 12 medical centers (NL, UK, Germany), >240d (mean 480d, total 205.000d)
  - Control
  - Nurse telephone support
  - Telemonitoring
- 26% reduction in hospital days
- 10% reduction in cost
- Improved survival rate

- However: main impact from re-organising care, monitoring (technology) contributed less than that



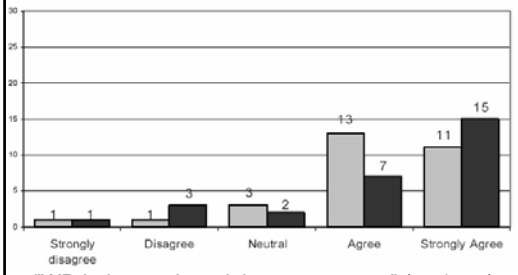




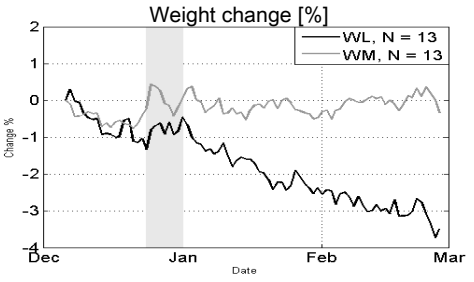
Personal weight management through Wellness Diary

(In collaboration with Nokia)

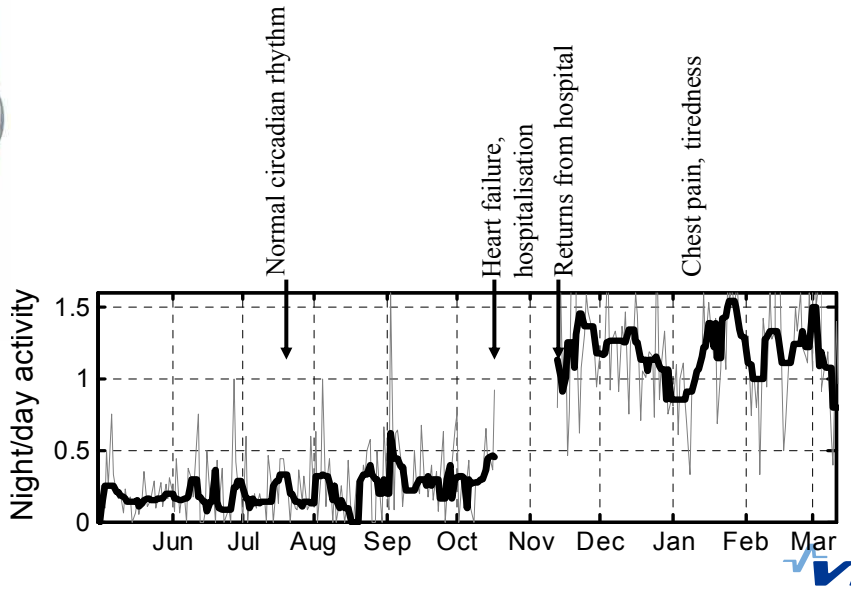
- **Idea:**
  - Based on CBT based psychological model of human behavior
  - Mobile phone centric *(S60 application)*
  - As simple as possible
  - Activates user to observe his/her behavior
- User pilot: 29 volunteers (3 drop outs), 3mths



"WD helps me in weight management" (pre/post)



Example: activity monitoring by IST Vivago WristCare



Proc of the 4th Annual IEEE Conf on Information Technology Applications in Biomedicine, UK

IST VIVAGO® - AN INTELLIGENT SOCIAL AND REMOTE WELLNESS MONITORING SYSTEM FOR THE ELDERLY

A. Särelä[1], I. Korhonen[2], J. Lötjönen[2], M. Sola[3], and M. Myllymäki[1]
[1]IST International Security Technologies Oy, Helsinki, Finland
[2]VTT Information Technology, Tampere, Finland
[3]Department of Public Health, University of Tampere, Finland

Automatic Sleep-Wake and Nap Analysis with a New Wrist Worn Online Activity Monitoring Device Vivago WristCare®

*Jyrki Lötjönen PhD, *Ilkka Korhonen PhD, †Kari Hirvonen MD, ‡Satu Eskelinen, ‡Marko Myllymäki MSc, †Markku Partinen MD

*VTT Information Technology, Tampere, Finland; †Haaga Neurological Research Center, Helsinki, Finland; ‡IST International Security Technology Oy, Helsinki, Finland

J. Sleep Res. (2005) 14, 61–68

Circadian activity rhythm in demented and non-demented nursing-home residents measured by telemetric actigraphy

PAULA PAAVILAINEN[1], ILKKA KORHONEN[2], JYRKI LÖTJÖNEN[2], LUC CLUITMANS[2], MARJA JYLHÄ[1], ANTTI SÄRELÄ[3] and MARKKU PARTINEN[4]
[1]Tampere School of Public Health, University of Tampere, Tampere, [2]VTT Information Technology, Tampere, [3]IST International Security Technology, Helsinki and [4]Rinnekoti Research Centre, Espoo, Finland

The 3rd European Medical and Biological Engineering Conference EMBEC'05
November 20 – 25, 2005 Prague, Czech Republic

DIFFERENCES IN LIGHT SLEEP AND DEEP SLEEP MEASURED WITH IST VIVAGO® WRISTCARE

E. Lamminmäki*, A. Saarinen**, J. Lötjönen*, M. Partinen*** and I. Korhonen*

* VTT Information Technology, Tampere, Finland
** Rokua and Kajaani Rehabilitation Centres, Finland
*** Skogby Sleep Clinic, Rinnekoti Research Center, and Department of Neurology, University of Helsinki, Finland

Original

Telemetric activity monitoring as an indicator of long-term changes in health and well-being of older people

Paula Paavilainen MSc
Tampere School of Public Health
FIN-33014 University of Tampere, Finland
E: paula.m.paavilainen@uta.fi

Ilkka Korhonen Dr Tech
VTT Information Technology
P.O. Box 1206, FIN-33101 Tampere, Finland

Markku Partinen MD PhD
Skogby Sleep Clinic, Rinnekoti Research Center, and Department of Neurology, University of Helsinki
Kumputie 3, FIN-02980 Espoo, Finland

October 2005, Vol 4, No 2

Telecare and telehealth for independent living

- Telecare: provision of care remotely by ICT
  - Emergency alarms (also called social alarms) for fire, burglary, flood, health disorders
  - Access control of demented subjects

This is provided typically by social care systems

- Telehealth: enabling a clinical process to be conducted remotely
  - Remote monitoring of vital signs

This is provided typically by health care systems

- Optimally, telecare and telehealth solutions should be integrated

Technical systems may be integrated but
• desicion making
• care provisioning
• payment models
are typically not (in many countries)!

MAKING HEALTH IT HAPPEN
Four Pillar Framework

1)An **actor network** that develops the solution and evolves over time;

2)A **health ICT application** that is developed by the actors together with the services and other changes needed in health service delivery;

3)Acquiring **proof** or evidence of the value of the health ICT application; and

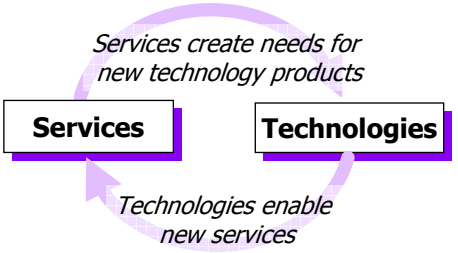
4) Positioning of the health ICT application in the **value production network** and integrating it with the other ICT applications according to need.

Saranummi N, Korhonen I, Kivisaari S, Ahjopalo H. A framework for developing distributed ICT applications for health. *In: Proceedings of the 1st Distributed Diagnosis and Home Healthcare (D2H2) Conference,* Arlington, Virginia, USA, April 2-4, 2006. pp. 137-143.

Making it Happen for pHealth - Challenges

SERVICES & BUSINESS PLAN

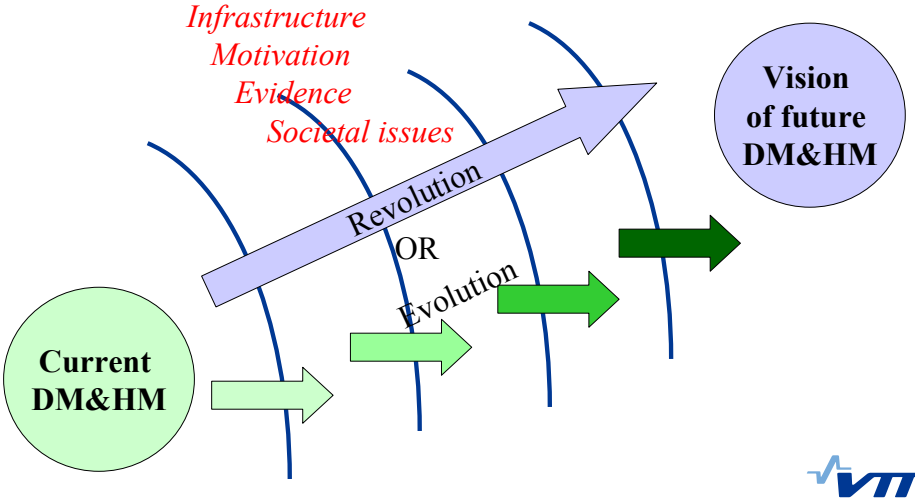
- Positioning of the product in solution provision chain of service and technology providers
- Producing evidence of value of the product to users and payers



TECHNOLOGY

- Sensors & Information appliances
- Making sense of the collected data in context
- Making patient data available ubiquitously (EHR)

Introduction of new ICT services for disease and health management



Conclusions

- Technology will increasingly be providing methods for monitoring and management of health and health risks – these methods may be used for promotion, prevention, ...
  - Examples: wearable health monitoring, smart homes...
- Citizen will be increasingly **interested** in their health (– their willingness to contribute truly is a matter of debate) + **needs** for new solutions are needed (cost crisis in health care)
  - This creates a rapidly increasing **market**
- There is a true potential in technology to have an effect – but
  - Services need to match – co-development
  - Proof – may be hard to catch (in terms of EBM)
  - Device-based approach will still dominate in near future – system-based (incl. services) innovations are penetrating slowly due to immature partnerships, incomplete value networks, and chicken-egg problem

Kaleva 31.1.2004

Kiitos!

Ilkka Korhonen, docent, DrTech
Customer Manager, ICT, Healthcare and Wellness
VTT, Tampere
+358-40-549 5949
ilkka.korhonen@vtt.fi