From Lab to Living Room: Technologies for Long Term Conditions

The SMART Consortium
www.thesmartconsortium.org

Our Mission
To be the first point of reference for researchers, for policy makers and for end users of services who are interested in the benefits that new technologies might deliver in the areas of rehabilitation, enablement and self management.

SMART: Challenges for researchers
Importance of:-
• Design issues
• Meaningful involvement of the health and social care workforce
• End user involvement throughout
Need for:-
• Partnership working across different academic groups/ disciplines
• Industrial involvement

Our EPSRC Portfolio
• SMART1: technology for upper limb rehabilitation of people with stroke
• SMART2: technology for self management of people with long term conditions (stroke, chronic pain and chronic heart failure)
• KT-EQUAL: transferring the results of our work into industry and into practice

From Lab to Living Room
• SMART1: Prototype developed and tested in the homes of people with stroke
  Ready for further robust testing

• SMART2: Using off the shelf or near to market devices; clinical testing to commence January 2011

SMART1: more details at www.thesmartconsortium.org
This morning: a taster of SMART2 through presentations from several consortium members

Project aim;
To deepen understanding of how commonly encountered technologies might be configured together to enable people with stroke, chronic heart failure or chronic pain to self manage

How this might work is illustrated through the following scenario

Mastering the impact of a long-term condition: can technology help?

Nasrin Nasr
n.nasr@shu.ac.uk

The illness journey; stroke as a case example

Discontinuity

“I was decorating my dining room and suddenly it went funny. It wasn’t like a heart attack, because I didn’t have any pain in the chest.” (SMART2: Helen)

“I woke up in the middle of the night and everything went blank completely” (SMART2: David)

The illness journey

Facing transition/suffering

“You’re scared. ... I bring a friend who usually comes along as a precaution, for you can collapse any time ...” (Bendz, 2003)

The illness journey

Adaptation/mastering

“I went back to work for a year (after stroke) and they offered me early retirement, a different life you have to live with.” (SMART2: Michael)

“I want to get back to my usual self, ... the one I used to be” (Bendz 2003)
"The medical merry-go-round" (Robinson 1988)

Discharge from rehabilitation (Wiles, et al. 2004)
- The plateau phase
- The natural course of recovery
- The prescribed exercises
- High expectations

Coping resources (Kendall, et al. 2007)
- Social support
- Community services

Technologies

Discharge from rehabilitation; patients' reasoning

• Shortage of staff
• Long waiting lists
• Comparative reasoning

“I think they're (rehabilitation services) a bit short-handed now … Mary said that she’d come out and see me to give me some exercises but she didn’t do it so. I think they’re a bit busy at the moment, there’s more people worse off than I am, so I cope” (Wiles, et al., 2004: P8)

Natural recovery as a source of hope

“Oh you feel disappointed (to be discharged) but at the same time you know you realise that there’s just no way forward except time … I’m just hoping that the body and the mind can overcome some of the minor things I can’t do at the moment” (Wiles, et al., 2004: P12)

Who are people with long term conditions?

How can we meet their many and varied needs?

Technology for Long Term Health Conditions:

Who are people with long term conditions?

Sylvia Torsi
different attitudes towards information communication technologies

self-challenging and communication with others

The ideal solution that could help me to maintain my optimism would be...[Norman] to continue to make progress with my art skills and enter more exhibitions

The ideal solution that would help me to reach my life goals would be...[Norman] to improve my computer skills (very poor at present) / to use my mobile phone skills properly

practical values-facilitating tools

The ideal solution that could really support the self-management of my condition would be...[Laura] ...ability to manage on my own. / this would enable me to do household chores efficiently and fast

The ideal solution that could help me to maintain my optimism would be...[Laura]...something to help me garden and walk. Equipment which would overcome dizziness and eyesight problems.

existential and affective functions

The ideal solution that would help me to reach my life goals would be...[Lisa] to get back to what I was before the stroke and enjoy grandchildren.

The ideal solution that would make me feel not alone with my condition would be [Jeff] to be in contact with others who have the same condition - realizing that you are not unique.

creative opportunities/able in novel ways

The ideal solution that could really support the self-management of my condition would be...[Ross] been able to use the kinetic energy of my wheelchair to charge my mobile.

The ideal solution that could really support the self-management of my condition would be...[Laura] a bra which can be fastened with one hand.

What are the design implications of all these varied requests?
Why behaviour change?

- Specific behaviours can instigate and exacerbate long term health conditions, e.g.
  - Physical inactivity
  - Diet
  - Alcohol and smoking

- Changing these behaviours can improve self-management of conditions

- The benefits of technology:
  - Accessibility
  - Cost
  - Independence

Overview and purpose

What is the current status of behaviour change technology?

- Type of technologies employed
- Type of behaviours targeted
- Therapeutic content
- Issues with research and interventions

Review findings

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<th>Behaviour Change Focus</th>
<th>Technology/Platform</th>
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Intervention complexity

Technology
- Online manuals to virtual reality

Therapy content
- Information provision to interactive therapy

Balance
- Simplicity or overcomplicated

Standalone
- Therapist involvement common
Patient engagement and investment

Discussion and implications for SMART2

Positive conclusions
- The benefits of technology
- The range of technology
- Personal goals identification

The challenges
- Engagement - the human component
- Deconstructing therapy
- Reliable evaluation

Can technology help?
Matching identified needs with available technology

Huiru (Jane) Zheng
h.zheng@ulster.ac.uk

Personalised Self Management System (PSMS) Infrastructure

Technology Mapping

- Pain
  - Activities of daily living
    - Self reporting
    - Sleep patterns
  - Stroke
    - Gross motor activity
    - Upper limb activity
    - Weight distribution
  - CHF
    - Gross motor activity
    - Activities of daily living
    - Sleep patterns
    - Vital signs –
      - Blood pressure,
      - Heart rate
- GPS tracking
Tynetec Sensors (Receiver)
- Connects to the PC in one of two ways
  - RS-232 serial connection
  - USB port via RS-232 converter
- Receives sensor data only
  - Wireless RF protocol

Tynetec Sensors (Door)
- Can detect both open and close states.
- Uses a small CPU to monitor a set of magnetic contacts.
- Low Power - Coin cell battery.
- Low Range - approx. 20 metres
- Mechanical open/close
  - Doors
  - Windows
  - Cupboards
  - Appliances

Tynetec Sensors (Bed)
- Can detect both ‘In Bed’ and ‘Out Bed’ states.
- Low Range - approx. 20 metres
- Chair also available

Tynetec Sensors (PIR)
- Monitors in home movement
- Uses only one event type
- Range – approx. 20 metres

Home Hub (EEETop)
- Windows XP Home
- 19” Touch Screen
- Intel ATOM
- 1GB RAM
- Built in Webcam
- Built in WiFi
- SD Card Reader
- 6x USB Ports

Mobile Device (HTC Touch)
- 3.8” Touch Screen
- Windows Mobile 6 Pro
- Accelerometer
- GPS
- Bluetooth
- WiFi Connectivity
SMART Shoes/Insole

MIT shoe-integrated gait sensors

Smart Environment

Motion Sensing

Data collection and analysis
Message delivery
Bluetooth
Clus Master with Bluetooth
MTx Sensor
Illustration of Motion Sensing System

Balance and Weight Measurement

Mobile Device Interface

PSMS Interface