Holistic Monitoring to Support Integrated Care Provision

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BT
From Telecare…

- Activity monitoring
- Social care
- Home setting
- Fixed deployment
- Technology led
From Telecare…to holistic care

- Activity monitoring
- Social care
- Home setting
- Fixed deployment
- Technology led

- Activity & physiological monitoring
- Social care & healthcare
- Holistic data analysis and intelligence
- Home & mobile settings
- Flexible deployment
- Technology & business drivers
3 Generations of Telecare Monitoring

• 1st generation
  – Social alarms - dispersed panic alarm with pendant and pull cords
  – Addition of passive sensors for auto alerts
  – An existing care intervention package

• 2nd generation
  – Telecare systems - adaptive, personalised but event driven
  – Exhibits aspects of reasoning
  – An emerging care intervention package

• 3rd generation
  – Well-being analysis - pre-emptive, long term trend analysis
  – Migrates telecare from a crisis safety net to an assessment tool
  – Will enable intervention outcome measures and optimisation
Non-invasive home monitoring

2nd Generation

Data capture and intelligent analysis

Automated alerting to client

Automated alarm escalation to carer

Call Centre

Carer
Activity monitoring

24.0
Temp (Lounge)
22.0

PIR (Bedroom) 257

PIR (Lounge) 231

PIR (Kitchen) 324

PIR (Hall) 21

PIR (Bathroom) 10

Closedoor (Entrance Door) 8

Closedoor (Fridge Door) 15

Activity (CDEFGI) 865

Activity monitoring
User trials in Liverpool
- Example showing typical activity
- Client in bed between 11pm and 8:30am
• Example showing cause for concern
• Client leaves dwelling at 10pm and does not return till 3am
OT Comments:

“The community teams in the Older Persons Mental Health Service in Liverpool, and Occupational Therapists in particular, are committed to maintaining people in their own homes as independently as possible for as long as possible… Anything that helps to reduce these risks is of immense value to the people the community teams work with and their carers, especially a system that requires no direct action on the part of the Service User.”
Daily profiles identify changes in patterns of behaviour:

• Evidence for risk assessments
  Allowing community teams to predict when changes in treatment or care packages are required.

• Early detection of medical problems
  Example: When people with dementia develop an infection it will temporarily increase their level of confusion, for example a sudden increase in visits to the toilet may indicate a urine infection.
3rd Generation Telecare

• 3rd generation Telecare is a tool for providing the carer with activity information enabling them to identify significant changes in the general well-being of their client.

• Its aim is to enable carers to prevent incidents from occurring in the home.

  – Shift from response (r-mode) to prevention (p-mode)
Health care benefits of activity monitoring (1/2)

• Continuous evidence for risk assessment
  – the use of Telecare data to better tailor care plans to match genuine needs

• Timely response to emergency situations
  – timely response to emergency situations can improve outcomes such as reducing further complications

• Reduction in anxiety and fear of falling
  – increased sense of security leading to reduced emergency situations

• Reduced acute care stays
  – through either avoiding admission, fewer complications or early release

• Sleep Patterns
  – sleep can provide a good indication of well-being and highlight the onset of a variety of problems
Health care benefits of activity monitoring (2/2)

• **Identification of a reduction in level of activity**
  – *changes in activity levels may indicate developing problems such as mobility issues*

• **Indication of infection**
  – *identification and early treatment of infections through highlighting changing behaviours such as increased toilet usage*

• **Identification of toilet related problems**
  – *toilet usage patterns can indicate physical or mental problems*

• **Evidence of effects of medication changes**
  – *adverse effects of medication changes may be detected through changes in activity patterns*

• **Reduced risk of hypothermia**
  – *reduced risk of hypothermia through avoiding low in-home temperatures*
Understanding Wellbeing

• Individual’s general wellbeing is what we are interested in

• Wellbeing is composed of physical, mental and social aspects and is a personal state

• How do you define wellbeing?

• How do you monitor it?
Well-being concept model
Well-being concept model

Person Factors:
- Physical attributes
- Psychological attributes

Context Factors:
- Home
- Social network
- Locale
- Social support

Activities:
- Social interaction
- Personal goals
- *ADLs

Experience

Well-being:
- Mental
- Social
- Physical

*Activities of Daily Living
## Activities monitored

<table>
<thead>
<tr>
<th>Well-being element</th>
<th>Activity type</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical</td>
<td>ADL’s</td>
<td>Preparing food &amp; eating</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sleeping</td>
</tr>
<tr>
<td>Social</td>
<td>Social Interaction</td>
<td>Leaving &amp; returning home</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Visitors</td>
</tr>
<tr>
<td>Mental</td>
<td>Personal goals</td>
<td>Personal appearance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Leisure activities</td>
</tr>
</tbody>
</table>

*Activities of Daily Living*
Sample ‘Wellbeing’ interface

<table>
<thead>
<tr>
<th>Tell me about Joe’s…</th>
<th>History</th>
<th>3 Month Trend</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1. Social life outside the home</td>
<td><img src="image1" alt="History" /></td>
<td><img src="image2" alt="3 Month Trend" /></td>
<td><img src="image3" alt="Current" /></td>
</tr>
<tr>
<td>Q2. Social life inside the home</td>
<td><img src="image4" alt="History" /></td>
<td><img src="image5" alt="3 Month Trend" /></td>
<td><img src="image6" alt="Current" /></td>
</tr>
<tr>
<td>Q3. Sleeping Habits</td>
<td><img src="image7" alt="History" /></td>
<td><img src="image8" alt="3 Month Trend" /></td>
<td><img src="image9" alt="Current" /></td>
</tr>
<tr>
<td>Q4. Eating Habits</td>
<td><img src="image10" alt="History" /></td>
<td><img src="image11" alt="3 Month Trend" /></td>
<td><img src="image12" alt="Current" /></td>
</tr>
<tr>
<td>Q5. Personal Hygiene</td>
<td><img src="image13" alt="History" /></td>
<td><img src="image14" alt="3 Month Trend" /></td>
<td><img src="image15" alt="Current" /></td>
</tr>
<tr>
<td>Q6. Leisure Activities</td>
<td><img src="image16" alt="History" /></td>
<td><img src="image17" alt="3 Month Trend" /></td>
<td><img src="image18" alt="Current" /></td>
</tr>
</tbody>
</table>

Average Well-Being Index

![Graph](image19)
Sensors “tool box”

- Water flow
- Gas flow
- Power usage
- Vibration
- Pressure
- PIR
- Active IR
- Telephone usage
- Gait analysis
- others ….

- Wireless connectivity
- Self powered, battery and scavenged
- Jiffy-bag deployment
Sensor locations

- Kitchen
- Lounge
- Back door
- Sink
- Fridge/freezer
- RMU
- Coffee table
- ‘Radio’ chair
- ‘TV’ chair
- Window sill
- Fireplace
- Cupboard
- Gas oven/hob
- Sofa & armchairs

24 sensors installed
Sensor locations

- Master bedroom
  - Double bed
  - Wardrobes
  - Bath
  - Basin
  - Bathroom
  - Landing
  - Pile of various objects
  - Draws

- Spare bedroom
  - Wardrobes
  - Pile of various objects
  - Draws
Information delivery

PC web-based
- Sensor data
- Trend analysis
- Pattern learning
- Significant event identification

Email
- Sensor data
- Snapshot

PDA
- Summary information
SAPHE - Smart and Aware Pervasive Healthcare Environment
High Intensity Users (HIUs). Those requiring repeated admission to acute care. 5%

‘Unwell’ patients. Worsening symptoms, those requiring greater care. 5-10%

‘Nearly well’. Managed through contact with GPs, community matrons, etc. 70-80%

‘Well’. Self-management. 10%

Service users
• Non invasive monitoring of activity and physiology
• Continuous monitoring – home and away
• Reassurance
• Independence
• Self management
• Medication / regime reminders
• Education

...and better support this group to prevent them moving up.

Informal carers
• Reassurance
• Support
• Access to wellbeing summaries
• Alerted to problems

Professionals
• Continuous evidence based risk assessment
• flagging of early changes in disease state
• Reduce acute admissions
• Support earlier release
  • Monitoring in context
  • Trend analysis
  • Improve compliance

Call Centre
• Manage alerts
• Access to monitoring data
• Access to records
• Escalation to professionals
To increase efficiencies within the PCT
“To be able to do more with what we have.”
- Liverpool PCT

Supporting Community Matrons
- Closer management of conditions
- Prioritising of ‘amber’ patients
- Reduce anxiety of patients
- Early detection of exacerbation onset
- Allow earlier discharge

Chronic condition management
- Continuous risk assessment: preventative care and early change detection
- Monitoring in context: Correlation of physiology and daily activities
- Information dissemination: Appropriate and timely to carers

Wellbeing and Independence
- Combined health and social monitoring
- Contextual understanding
  – New intelligence that adds value to care processes
- Trend analysis
- Prediction
- Support
- Reassurance

Ubiquitous non-invasive monitoring infrastructure
End to End System
Home Environment
Continuous Service User Monitoring
Bringing it all together