Home Data

Supporting the Dialogue of Care

Dr Nick Hine
Role and importance of Telecare

Role of Technology in the promotion of Quality of Life

- 3rd Generation
- Smart Alarms
- No Technology

- Well Phase:
  (Informal Carers: Friends, Relatives;
  Formal Carers: Housing Associations)

- Chronic Phase Care:
  (Informal Carers: Friends, Relatives;
  Formal Carers: Housing Associations, GP)

- Recovery Phase Care:
  (Informal Carers: Friends, Relatives;
  Formal Carers: Nurse, Physiotherapist,
  Occupational Therapists, Housing Services, GP)

- Acute Phase Care:
  (Formal Carers: Social Services, Medics)
To understand the various steps involved in using lifestyle data to support a care dialogue between carers and older people living independently

- Find the questions that carers ask in order to fulfill their role
- Sensor to answer those questions
- Collect data into a database
- Organise/Segment the data
- Analyse the data
  - Look for change

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To understand the various steps involved in using lifestyle data to support a care dialogue between carers and older people living independently:

- Find the questions that carers ask in order to fulfill their role

<table>
<thead>
<tr>
<th>Service User</th>
<th>Bert</th>
<th>Stakeholder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Care Need</td>
<td>COPD with associated hypertensions and repeated lung infections. Is a smoker. Has cut down but is not convinced that he can stop.</td>
<td>GP &amp; Community Nurses</td>
</tr>
<tr>
<td>Interest</td>
<td>Health: Control of COPD</td>
<td>Jim</td>
</tr>
<tr>
<td>Question</td>
<td>Is there a change in COPD symptom?</td>
<td>Is Bert getting out for a walk and where is he going?</td>
</tr>
<tr>
<td>Measure</td>
<td>SPO2 levels, Breathing, Pulse, Blood Pressure.</td>
<td>Leaving and returning times, walking activity levels.</td>
</tr>
<tr>
<td>Sensor</td>
<td>SPO2 sensor, Peak Flow meter, Pulse/Blood Pressure instrument</td>
<td>GPS location</td>
</tr>
<tr>
<td>Data</td>
<td>SPO2 Levels, Peak Flow, Pulse, Blood Pressure</td>
<td>End point GPS data, data and time</td>
</tr>
<tr>
<td>Data Representation</td>
<td>Trend graphs at various levels of granularity</td>
<td>SMS giving time when Bert reached destination</td>
</tr>
</tbody>
</table>

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Stakeholders’ Interests are varied and complex

- Bert (yellow) cares about his well-being
- Jim (pink) cares that his friend gets to do what he wants to do
- Alice (orange) worries about her Dad living alone
- Professionals (blue) have a caring job to do
- Policy Makers (green) care about Bert as a member of society

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Sensor according to the questions that need to be answered

- The Dog Bowl Phenomenon!

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Sensor according to the questions that need to be answered

Low Risk Client

- Single sensor detecting person specific activity.
- Activity logged by service centre.
- Activity compared to expected profile
- Deviation from expected activity triggers an alert to preferred carer.

At Risk Client

- Generic sensor array detects activity in the home.
- Activity logged by lifestyle monitoring computer.
- Lifestyle model built up over time
- Deviation from expected activity is classified as an alarm or an alert and is passed to preferred carer.

Client with Specified Risk

- Generic sensor array supplemented with additional sensors specific to the identified risk.
- Activity logged by lifestyle monitoring computer.
- Lifestyle model built up over time
- Deviation from expected activity is classified as an alarm or an alert and is passed to preferred carer.

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To understand the need to segment data so that it can be explored in context

People behave in people time, not necessarily in formal time

<table>
<thead>
<tr>
<th>Zone</th>
<th>Hour</th>
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</thead>
<tbody>
<tr>
<td>Sleeping</td>
<td>00:00 – 7:00 a.m.</td>
</tr>
<tr>
<td>Early morning</td>
<td>7:00 – 9 a.m.</td>
</tr>
<tr>
<td>Late morning</td>
<td>9:00 – 12:00 p.m.</td>
</tr>
<tr>
<td>Lunch</td>
<td>12:00 -4:30 p.m.</td>
</tr>
<tr>
<td>Afternoon</td>
<td>4:30 – 7:00 p.m.</td>
</tr>
<tr>
<td>Evening</td>
<td>7:00 – 10:30 p.m.</td>
</tr>
<tr>
<td>Late evening</td>
<td>10:30 – 12:00 midnight</td>
</tr>
</tbody>
</table>

People operate in places, not necessarily in rooms

So, segment data

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To understand the principles underlying Online Analytical Processing (OLAP) as a data modelling technique and its use in exploring telecare data

Sensors generate potentially enormous volumes of data
So do supermarket store cards
So do transactional business systems

How can we possibly explore this huge volume of data in any meaningful way?

Ask questions: Business people do it all the time.

They use a technique known as Online Analytical Processing (OLAP)
To understand the principles underlying Online Analytical Processing (OLAP) as a data modelling technique and its use in exploring telecare data

Different stakeholders care about a person in different ways. The information that they need is different. Some is detailed, some is higher level.

For Example:

- **Service User**: Is my weight getting closer to my ideal weight or not?
- **Physiotherapist**: What is affecting the service user’s weight? Eating, exercise or therapy?

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Build an OLAP “Cube”

Pre-calculate all possible data values

<table>
<thead>
<tr>
<th>Year</th>
<th>Quarter</th>
<th>Month</th>
<th>Doctor</th>
<th>Community Nurse</th>
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<tbody>
<tr>
<td>2009</td>
<td>Q3</td>
<td>July</td>
<td>1</td>
<td>5</td>
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<td></td>
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<td>Aug</td>
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<td>Sept</td>
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<td>5</td>
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<tr>
<td></td>
<td>Q3 Total</td>
<td></td>
<td>5</td>
<td>13</td>
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<td>2009</td>
<td>Q4</td>
<td>Oct</td>
<td>2</td>
<td>5</td>
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<td>Nov</td>
<td>8</td>
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<td>Dec</td>
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<td>12</td>
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<td>Q4 Total</td>
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<td>15</td>
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<td>2009 Total</td>
<td></td>
<td></td>
<td>50</td>
<td>85</td>
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Add more Dimensions:
To explore diet and the physiological effects of different foods on an individual

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After Visualisation, THEN we can try Data Mining

- Data mining reveals things we didn’t know
- Data mining allows us to recognise whether current behaviour is normal or unusual
- Data mining might allow us to predict when change is about to happen
To understand the role of data mining in exploring telecare data

- Rules
- Clusters
- Probabalistic Models

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**Graphical Representation**

<table>
<thead>
<tr>
<th>Time</th>
<th>Temp (Lounge)</th>
<th>PIR (Bedroom)</th>
<th>PIR (Lounge)</th>
<th>PIR (Kitchen)</th>
<th>PIR (Hall)</th>
<th>PIR (Bathroom)</th>
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</thead>
<tbody>
<tr>
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<td>257</td>
<td>231</td>
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</table>

- **Activity Counts**
- **Temp (Lounge)**
- **PIR (Bedroom)**
- **PIR (Lounge)**
- **PIR (Kitchen)**
- **PIR (Hall)**
- **PIR (Bathroom)**

---

**Annotations**

- **Temp (Lounge)**: 22.0
- **PIR (Bedroom)**: 257
- **PIR (Lounge)**: 231
- **PIR (Kitchen)**: 324
- **PIR (Hall)**: 21
- **PIR (Bathroom)**: 10

---

**Time Calculations**

- < Minute
- < Hour
- < Day

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**Date Reference**

- 4 April 1998

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**Source**

- N. Hine, University of Dundee
Alternative data visualisations are required for different stakeholders in order for them to comprehend features of interest in telecare data.
Alternative data visualisations are required for different stakeholders in order for them to comprehend features of interest in telecare data.

**Time out for a walk: Service User**

**Time out for a walk: Carer**

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But!!

- Home data is messy and unpredictable!
- However regular a person wants their life to be, they get disturbed.
  - Sensors fail
  - Lives get interrupted
  - Lives get modulated
  - Jim Rowan’s butterflies
What does the Data MEAN?

Time out for a walk

Activity Level


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So ....

- This is Data ... not Information
- It becomes information when interpreted/contextualised by people
- This data contributes to a more informed “Dialogue of Care”