Model Driven Mobile Care for Patients with Type 1 Diabetes

Stein Olav Skrøvseth
Eirik Årsand,
Fred Godtliebsen,
Ragnar M. Joakimsen
Diastat

- May – November 2011
- Adults with Type 1 Diabetes.
- Open-ended study
- 30 participants, no control group.
- All participants given mobile phone and diabetes application.
- Initial 3 months, expanded to 6 months for those who wanted.
The Few Touch Application

User-involved design.

Data recorded:
- Blood glucose
- Food
- Insulin
- Physical activity
- Symptoms
Data driven feedback

- Data
  - Compute
  - Result
    - Significant result
    - No result
Summary

Recruitment at the discretion of diabetes nurses at medical clinic, University Hospital of North Norway.

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Age (SD)</td>
<td>39.1 (11.2)</td>
</tr>
<tr>
<td>Female (%)</td>
<td>13 (43.3)</td>
</tr>
<tr>
<td>HbA1C before (SD)</td>
<td>8.3 (1.4)</td>
</tr>
<tr>
<td>HbA1C after (SD)</td>
<td>8.3 (1.3)</td>
</tr>
</tbody>
</table>

• Usage was correlated with age (older used more, p=.009), otherwise no significant associations.
• 6 (20%) withdrew / lost data.
• 18 (60%) patients provided consistent data.
• 19 (63%) intended to follow through for ~6 months.
Usage
Data analysis modalities

Three modes of pattern analysis were investigated:

• Period finding
• Trend identification
• Pattern of low/high BG
Period finding

• Uneven sampling: Lomb periodogram.
• Power is exponentially distributed, significant periods has adjusted $p < .05$.
• When period is found; display as a kernel regression smooth.
• Out of 18 qualified patients, periodicites were found for
  – all on 24 hours,
  – 8 on week,
  – 4 on month.
Example power spectrum

![Graph of power spectrum with period on the x-axis and spectral power density on the y-axis. The graph includes horizontal dashed lines at p = 0.1, p = 0.01, and p = 0.001.](image-url)
Example periods
Trend identification

Using scale-space methods to find trends in data at any scale.

All patients have trends – most at small scales.
Pattern recognition

• Identify pattern leading up to low/high BG.
• Split data into 20% – 80% quantiles to detect low/high BG.
• PPV among those with significant contingency tables:

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Mean</th>
<th>Max</th>
</tr>
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<tbody>
<tr>
<td>Low BG</td>
<td>11.1</td>
<td>31.2</td>
<td>71.0</td>
</tr>
<tr>
<td>High BG</td>
<td>16.7</td>
<td>40.2</td>
<td>62.1</td>
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</table>

• Rather coarse food registration is a likely factor.
Discussion

- Three methods for data-driven feedback to the user discussed, two of which are effective.
- Pattern recognition requires higher fidelity of food recording, metabolic models.
- The implementation of techniques is ongoing, and effect will be tested in an RCT late 2012.