Diabetes Management
Mobile Applications

Behavior Change Theory and Evidence-Based Medicine

World Social Marketing Conference 2013
Kitty Harding
1. Background & Objectives
2. Methods
3. Results
4. Discussion
5. Conclusions & Recommendation

Agenda
Background & Objectives
Background – Diabetes in the United States

- Affects 25.8 million people in the US – 8.3% of the population
- 7th leading cause of death in the US
- Major cause of stroke and heart disease\textsuperscript{1,2,3}
- Often controlled by diet, exercise, and medication
- Self-management education and self-care are vital \textsuperscript{4,5}
Objectives

**Project Objective:** Rate iTunes mobile applications for diabetes self-management against criteria to assess the use of behavior change theory and evidence-based guidelines
Methods
Literature Review – Diabetes Self-Management & Theory

• **Diabetes Self-Management Behaviors** 6,7
  – Physical activity
  – Healthy eating
  – Medication taking
  – Monitoring blood glucose
  – Problem-solving
  – Reducing risk of diabetes complication
  – Psychosocial adaptation

• **Behavioral Theories** 8,9,10
  – Theory of Planned Behavior
  – Health Belief Model
  – Social Cognitive Theory
Literature Review – Mobile Usage & the State of the Science

• Cell phones and mobile app usage
  – 46% of US adults own a smartphone\textsuperscript{11}
  – 19% of smartphone owners have at least one health app on their phone

• State of the science
  – Texting interventions successful\textsuperscript{12,13}
  – Apps only studied for self-monitoring blood glucose\textsuperscript{14,15}
Codebook Development

• Codebook criteria developed based on literature review findings to rate inclusion of diabetes self-management behaviors and behavioral theory

• Final Codebook: 44 criteria – 31 self-management and 13 theory-based
Application Identification

- Identified diabetes self-management apps
  - 50 unique apps identified
- Eliminated 23 non-relevant apps
  - 9 not primarily meant for diabetes self-management
  - 3 diagnostic tools for healthcare providers
  - 3 insulin calculators
  - 2 iPad and iPhone versions identical
  - 1 failure to load content
  - 1 exclusively for gestational diabetes
  - 1 members only
  - 1 not in English
  - 1 outdated; directs users to a different app
  - 1 paid version same as free version
- 27 apps deemed relevant
# Relevant Applications

<table>
<thead>
<tr>
<th>Name</th>
<th>Platform</th>
<th>Type</th>
<th>Rating</th>
<th>Users</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolus Bridge</td>
<td>iPhone &amp; iPad</td>
<td>tracker</td>
<td>n/a</td>
<td>n/a</td>
<td>free</td>
</tr>
<tr>
<td>Daily Carb Premium</td>
<td>iPhone</td>
<td>tracker</td>
<td>2.5</td>
<td>11</td>
<td>2.99</td>
</tr>
<tr>
<td>Diabetes Management</td>
<td>iPhone</td>
<td>tracker</td>
<td>n/a</td>
<td>n/a</td>
<td>4.99</td>
</tr>
<tr>
<td>Diabetes Pal by Telcare</td>
<td>iPhone</td>
<td>tracker</td>
<td>4.5</td>
<td>23</td>
<td>free</td>
</tr>
<tr>
<td>Diabetes Self-Management Magazine</td>
<td>iPhone &amp; iPad</td>
<td>education</td>
<td>3</td>
<td>15</td>
<td>free</td>
</tr>
<tr>
<td>Diabetes Management Database</td>
<td>iPhone</td>
<td>tracker</td>
<td>n/a</td>
<td>n/a</td>
<td>0.99</td>
</tr>
<tr>
<td>Diabetes Management Database Lite</td>
<td>iPhone &amp; iPad</td>
<td>tracker</td>
<td>n/a</td>
<td>n/a</td>
<td>free</td>
</tr>
<tr>
<td>DiabetesTeam Lite</td>
<td>iPhone</td>
<td>tracker</td>
<td>n/a</td>
<td>n/a</td>
<td>free</td>
</tr>
<tr>
<td>dLife Diabetes Companion</td>
<td>iPhone</td>
<td>both</td>
<td>3</td>
<td>205</td>
<td>free</td>
</tr>
<tr>
<td>Glooko Logbook</td>
<td>iPhone</td>
<td>tracker</td>
<td>4.5</td>
<td>63</td>
<td>free</td>
</tr>
<tr>
<td>Glucose</td>
<td>iPhone</td>
<td>tracker</td>
<td>2.5</td>
<td>36</td>
<td>0.99</td>
</tr>
<tr>
<td>Glucose Buddy</td>
<td>iPhone</td>
<td>tracker</td>
<td>4.5</td>
<td>166</td>
<td>free</td>
</tr>
<tr>
<td>Glucose Companion iPad</td>
<td>iPad</td>
<td>tracker</td>
<td>4</td>
<td>8</td>
<td>1.99</td>
</tr>
<tr>
<td>Glucose Companion iPad free</td>
<td>iPad</td>
<td>tracker</td>
<td>4</td>
<td>10</td>
<td>free</td>
</tr>
<tr>
<td>Glucose Manager Patient</td>
<td>iPhone</td>
<td>tracker</td>
<td>n/a</td>
<td>n/a</td>
<td>3.99</td>
</tr>
<tr>
<td>iBGStar Diabetes Manager</td>
<td>iPhone</td>
<td>tracker</td>
<td>4</td>
<td>79</td>
<td>free</td>
</tr>
<tr>
<td>iFORA Diabetes Manager</td>
<td>iPhone</td>
<td>tracker</td>
<td>n/a</td>
<td>n/a</td>
<td>free</td>
</tr>
<tr>
<td>LogFrog DB</td>
<td>iPhone</td>
<td>tracker</td>
<td>4</td>
<td>5</td>
<td>2.99</td>
</tr>
<tr>
<td>Low GI Diet Tracker</td>
<td>iPhone &amp; iPad</td>
<td>tracker</td>
<td>3</td>
<td>112</td>
<td>2.99</td>
</tr>
<tr>
<td>My Glu</td>
<td>iPhone</td>
<td>tracker</td>
<td>n/a</td>
<td>n/a</td>
<td>free</td>
</tr>
<tr>
<td>myDiabetes</td>
<td>iPhone</td>
<td>tracker</td>
<td>n/a</td>
<td>n/a</td>
<td>free</td>
</tr>
<tr>
<td>myMedtronic Connect</td>
<td>iPhone &amp; iPad</td>
<td>education</td>
<td>2.5</td>
<td>8</td>
<td>free</td>
</tr>
<tr>
<td>Onsync</td>
<td>iPhone</td>
<td>tracker</td>
<td>n/a</td>
<td>n/a</td>
<td>free</td>
</tr>
<tr>
<td>Shot in the Arm</td>
<td>iPhone &amp; iPad</td>
<td>education</td>
<td>5</td>
<td>5</td>
<td>free</td>
</tr>
<tr>
<td>WaveSense Diabetes Manager</td>
<td>iPhone</td>
<td>both</td>
<td>3.5</td>
<td>411</td>
<td>free</td>
</tr>
<tr>
<td>Your Diabetes Diary</td>
<td>iPhone &amp; iPad</td>
<td>tracker</td>
<td>n/a</td>
<td>n/a</td>
<td>3.99</td>
</tr>
<tr>
<td>Your Life with Diabetes</td>
<td>iPhone &amp; iPad</td>
<td>education</td>
<td>n/a</td>
<td>n/a</td>
<td>0.99</td>
</tr>
</tbody>
</table>
Ratings

- Identified and trained second coder

- Intercoder reliability
  - Coders blindly rated 5 randomly selected apps of the 27 total (18%)
  - The coders agreed completely on 33 of the 44 criteria
  - Items the coders disagreed on were functionality features of the apps and could be reconciled by the coders identifying its location within the app
Results
## Final Scores Low Across the Board

<table>
<thead>
<tr>
<th>Application</th>
<th>Skills Score</th>
<th>Theory Score</th>
<th>Overall Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>dLife Diabetes Companion</td>
<td>36</td>
<td>14</td>
<td>50</td>
</tr>
<tr>
<td>myGlu</td>
<td>30</td>
<td>12</td>
<td>42</td>
</tr>
<tr>
<td>Diabetes Self-Management Magazine for iOS</td>
<td>28</td>
<td>9</td>
<td>37</td>
</tr>
<tr>
<td>Shot in the Arm</td>
<td>26</td>
<td>9</td>
<td>35</td>
</tr>
<tr>
<td>Your Life with Diabetes</td>
<td>26</td>
<td>9</td>
<td>35</td>
</tr>
<tr>
<td>DailyCarb Premium</td>
<td>21</td>
<td>9</td>
<td>30</td>
</tr>
<tr>
<td>DiabetesTeamLite</td>
<td>19</td>
<td>10</td>
<td>29</td>
</tr>
<tr>
<td>Wave Sense</td>
<td>19</td>
<td>10</td>
<td>29</td>
</tr>
<tr>
<td>Your Diabetes Diary</td>
<td>18</td>
<td>8</td>
<td>26</td>
</tr>
<tr>
<td>iFORA Diabetes Manager</td>
<td>16</td>
<td>6</td>
<td>22</td>
</tr>
<tr>
<td>Diabetes Pal by Telcare - Blood Glucose Manager</td>
<td>11</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td>Glucose Buddy</td>
<td>12</td>
<td>7</td>
<td>19</td>
</tr>
<tr>
<td>LogFrog DB</td>
<td>14</td>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>myDiabetes</td>
<td>12</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>myMedtronic Connect</td>
<td>12</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>Glooko Logbook</td>
<td>10</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>Glucose Companion iPad free</td>
<td>7</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Glucose Companion iPad</td>
<td>8</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>Onsync</td>
<td>7</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Diabetes Management Database</td>
<td>7</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>iBGStar Diabetes Manager</td>
<td>8</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Glucose</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Glucose Manager Patient</td>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Bolus Bridge</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Diabetes Management Database Lite</td>
<td>5</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Diabetes Management</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Low GI Diet Tracker</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total available points</strong></td>
<td><strong>57</strong></td>
<td><strong>20</strong></td>
<td><strong>77</strong></td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td><strong>13.67</strong></td>
<td><strong>6.04</strong></td>
<td><strong>19.7</strong></td>
</tr>
<tr>
<td><strong>Standard Deviation</strong></td>
<td><strong>9.29</strong></td>
<td><strong>3.54</strong></td>
<td><strong>12.58</strong></td>
</tr>
</tbody>
</table>
Strong Link Between Skills and Theory Scores

Overall app scores were low, with only one app earning more than half of available points.
Discussion
Discussion

• Apps tended to be strong in self-monitoring blood glucose and risk-reduction

• Employment of theoretical constructs is relatively high across apps

• Every app employed at least one construct from the Social Cognitive Theory

Ratings show that none of the apps reviewed are comprehensive diabetes self-management tools
Discussion – Limitations

- Windows and Android phones not examined
- Just three behavioral theories assessed
- Survey instrument not validated by subject matter expert
- Second coder reviewed 18% of apps
- Review limited to apps available in September 2012
Conclusions & Recommendations
Conclusions & Recommendations

• No app replaces in-person diabetes self-management education
• Apps may acts as a booster
• Apps needed which provide complete support across all skill areas
• More research needed on mobile apps for health
Questions?
Appendix: Sources


