Development and feasibility of mHAT:
a smartphone app to improve awareness of hypoglycaemia


1. The Australian Centre for Behavioural Research in Diabetes, Melbourne, Australia
2. Deakin University, School of Psychology, Geelong, Australia
3. Charles Darwin University, Psychological and Clinical Sciences, Darwin, Australia

Background
- ‘Mobile Hypo Awareness Training’ (mHAT) is a smartphone application (app) designed to raise awareness of hypoglycaemic symptoms/cues
- mHAT will be one part of an online psycho-behavioural intervention to prevent severe hypoglycaemia in adults with type 1 diabetes
- mHAT is based on the paper diary of Blood Glucose Awareness Training (BGAT), an evidence-based psycho-behavioural intervention to improve hypoglycaemic awareness (1)

Aim
- To test the acceptability and feasibility of mHAT version 1 (v1) in adults with type 1 diabetes

mHAT version 1
- Before each routine blood glucose (BG) check, users are invited to:
  1. reflect on external cues (activity, food/drink, insulin)
  2. identify hypoglycaemic symptoms
  3. record their estimate of their BG level
  4. check and record their actual BG level
- After working through all 4 steps, 3 summary screens are generated:
  1. list of identified cues/symptoms
  2. graph with last estimated/actual BG level
  3. summary graph with all estimated/actual BG levels

Methods
Study design
The study was approved by Deakin Human Research Ethics Committee and all participants provided informed consent

1. User acceptance testing:
   - 6 adults worked through the mHAT demonstration version in the presence of researchers and their feedback was incorporated into the fully functional mHAT v1
2. Feasibility testing:
   - Eligibility: Adults (18+ years) with type 1 diabetes, residing in Australia with access to a smartphone and internet
   - Recruitment was via Twitter/Facebook from Nov 2016 to Jan 2017
   - Participants completed questionnaires (Qualtrics®), read information about hypoglycaemia (2), watched an instruction video, and had access to app over a 3-week period
   - After 3 weeks, participants provided feedback via online questionnaires
Interviews were conducted with participants, purposely selected for (high/low) frequency of mHAT use during the 3 weeks

Results
Participant characteristics

<table>
<thead>
<tr>
<th></th>
<th>Feasibility Study (N=24)</th>
<th>Interviews (N=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>44 (18-86)</td>
<td>50 (26-86)</td>
</tr>
<tr>
<td>Gender: female</td>
<td>15 (63)</td>
<td>6 (60)</td>
</tr>
<tr>
<td>University degree</td>
<td>10 (42)</td>
<td>6 (60)</td>
</tr>
<tr>
<td>Living alone</td>
<td>2 (8)</td>
<td>1 (10)</td>
</tr>
<tr>
<td>Type 1 diabetes duration, years</td>
<td>13 (&lt;1-39)</td>
<td>18.5 (5-39)</td>
</tr>
<tr>
<td>Insulin pump use</td>
<td>13 (54)</td>
<td>4 (40)</td>
</tr>
<tr>
<td>Impaired awareness of hypoglycaemia: Gold 24</td>
<td>7 (29)</td>
<td>2 (28)</td>
</tr>
<tr>
<td>Any hypo in past week</td>
<td>3 (0-12)</td>
<td>2.5 (1-12)</td>
</tr>
<tr>
<td>Severe hypoglycaemia in past 6 months: Yes</td>
<td>10 (42)</td>
<td>2 (28)</td>
</tr>
<tr>
<td>HFS-9 Worry score</td>
<td>17.5 (1-50)</td>
<td>17.5 (1-32)</td>
</tr>
</tbody>
</table>

Data are median (min-max) or N (%)

Conclusions
- As an alternative to a traditional paper diary, an ‘app’ has significant benefits for the end user in terms of convenience, direct and automated feedback
- Transferring content to a mobile platform was challenging: e.g. keeping the right balance between an app that is ‘quick and easy’ to use (i.e. reduce burden) and relevant/useful content (e.g. symptoms and cues, feedback)
- mHAT was acceptable and feasible to users, and it offered constructive feedback, though many had not experienced problematic hypoglycaemia

Suggestions for mHAT v2 were identified:
- Improve graph with more feedback on accuracy, relation between cues/symptoms and accurate BG estimations, trends
- Enable retrospective use, e.g. after managing hypoglycaemia
- Enable offline use and consider integration with other diabetes apps
- Future directions: We plan to develop mHAT v2 and test it in a large group of adults with impaired awareness of hypoglycaemia and history of severe hypoglycaemia

References
2. Little S, Chadwick T, Choudhary P, et al. BMC Endocrine Disorders, 2012; 33

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Enquiries chendrieckx@acbrd.org.au