B-MOBILE

A Smartphone-Based Intervention to Reduce Time Spent in Sedentary Behavior (SB) in Adults with Obesity

Dale S. Bond, PhD
Associate Professor (Research)
Dept of Psychiatry and Human Behavior
E-mail: dbond@lifespan.org
1. Rationale for *B-MOBILE* intervention approach

2. Description of *B-MOBILE* intervention approach

3. Evidence for preliminary efficacy of *B-MOBILE* intervention approach for reducing SB

4. Beyond primary outcomes—examination of behavioral response to *B-MOBILE* intervention approach

5. Conclusions and Future Directions
RATIONALE FOR
B-MOBILE
INTERVENTION APPROACH
SB is Ubiquitous in Adults’ Daily Lives

- American adults spend ~60% of daily waking hours in SB (*more than time spent sleeping)
- Adults with obesity are at risk for even higher levels of SB

SB vs. Inactivity: Distinct Health Behavior Change Challenges

**EXCESSIVE SB**
Too *much* time spent in *waking* activities involving very *low* energy expenditure & sitting or reclining posture

**INACTIVITY**
Too *little* time in activities requiring moderate to high effort and cause noticeable to substantial increases in heart rate—i.e. not meeting public health guidelines <150 MVPA min/wk in bouts ≥ 10 min

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SB vs. Inactivity: Important Health Risk Implications

- Both total SB and fewer SB interruptions are linked, independent of MVPA, with higher levels of adiposity, cardiometabolic and inflammatory risk biomarkers, and type 2 diabetes, CVD, and cancer incidence and mortality.

- Conversely, less overall time spent in SB and more frequent SB interruptions are associated with lower adiposity and decreased levels of cardiometabolic risk biomarkers in individuals with overweight/obesity.

SB vs. Inactivity: Important Intervention Considerations

- Given that SB, unlike bout-related MVPA, is highly habitual, accounts for most waking hours, and involves minimal conscious processing, interventions to interrupt and decrease SB may be particularly effective when they:
  - Are simple
  - Are usable across settings
  - Require little planning
  - Automatically monitor SB and prompt movement upon meeting a clinically relevant threshold

Benefits of Mobile Health Technology for SB Intervention

- Real-time Measurement and Intervention
- Used During Daily Activities in the Natural Environment
- Treatment Tailoring
- Automation of Routine and/or Tedious Tasks
- Intervention Engagement
DESCRIPTION OF
B-MOBILE
INTERVENTION APPROACH
**B-MOBILE Study Objectives**

- Pilot-test *B-MOBILE* intervention in adults with obesity
- Compare 3 approaches to interrupting SB with PA breaks and delivering feedback on time spent in SB and PA.
  1. Prompt to walk $\geq 3$ min after 30 continuous SB min
  2. Prompt to walk $\geq 6$ min after 60 continuous SB min
  3. Prompt to walk $\geq 12$ min after 120 continuous SB min
**B-MOBILE Methods and Procedures**

**Baseline**
- Education on SB
- Smartphone w/ B-MOBILE app

**Days 1-7**

**Day 8**

**R**

**Days 8-14**
- 1st of 3 break conditions

**Days 15-21**
- 2nd of 3 break conditions

**Days 22-29**
- 3rd of 3 break conditions

**Day 29**

**Evaluation**
**B-MOBILE Intervention Approach**

- Target SB performed across all settings
- Automatically monitor SB
- Issue automatic prompts to interrupt prolonged SB with brief PA breaks
- Provide continuous real-time feedback on SB and PA throughout day and amount of time until next PA break
- Deliver immediate reinforcement for adherence to prompts and performing PA breaks
B-MOBILE Methods: Intervention Approach (cont.)

Smartphone activated & idle

Activity prompt is presented

Onboard accelerometer detects that break goal accomplished

“Go lights” have been earned by accomplishing break goals

PRELIMINARY EVIDENCE FOR EFFICACY OF B-MOBILE INTERVENTION APPROACH
**B-MOBILE Results: Participant Characteristics at Baseline (N=30)**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Mean ± SD yrs)</td>
<td>47.5 ± 13.5</td>
</tr>
<tr>
<td>Female (%)</td>
<td>83.3</td>
</tr>
<tr>
<td>Non-White Race (%)</td>
<td>66.7</td>
</tr>
<tr>
<td>Hispanic Ethnicity (%)</td>
<td>10.0</td>
</tr>
<tr>
<td>≥ 4 year college degree (%)</td>
<td>40.0</td>
</tr>
<tr>
<td>BMI (Mean ± SD kg/m²)</td>
<td>36.2 ± 7.5</td>
</tr>
<tr>
<td>Weight (Mean ± SD kg)</td>
<td>98.1 ± 21.6</td>
</tr>
</tbody>
</table>
**B-MOBILE** Results: SB at Baseline

<table>
<thead>
<tr>
<th>SB and PA Level</th>
<th>Mean (±SD) min/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB</td>
<td>9.9 h</td>
</tr>
<tr>
<td>LPA</td>
<td>3.1 h</td>
</tr>
<tr>
<td>MVPA</td>
<td>0.7 h</td>
</tr>
</tbody>
</table>

% of daily monitor wear time (13.6 ± 1.7 h/d)

- SB: 72%
- LPA: 23%
- MVPA: 5%

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**B-MOBILE** Results: Changes from Baseline in Total Daily Minutes Spent in SB, LPA, and MVPA

**SB**
- Approach 1 (3-min break after 30 SB min)
  - *p < 0.05 (vs. baseline)
  - **p < 0.05 (vs. baseline and approach 3)
- Approach 2 (6-min break after 60 SB min)
  - *p < 0.05 (vs. baseline)
- Approach 3 (12-min break after 120 SB min)

**LPA**
- Approach 1 (3-min break after 30 SB min)
  - +3.9%
- Approach 2 (6-min break after 60 SB min)
  - +3.9%
- Approach 3 (12-min break after 120 SB min)
  - +1.9%

**MVPA**
- Approach 1 (3-min break after 30 SB min)
  - **p < 0.05 (vs. baseline)
  - +2.1%
- Approach 2 (6-min break after 60 SB min)
  - **p < 0.05 (vs. baseline and approach 3)
  - +1.7%
- Approach 3 (12-min break after 120 SB min)
  - **p < 0.05 (vs. baseline and approach 3)
  - +1.7%

**B-MOBILE** Results: Changes from Baseline in Time Spent in Prolonged SB Bouts (≥ 30 min)

<table>
<thead>
<tr>
<th></th>
<th>% daily time spent in SB</th>
<th>% of daily SB time spent in bouts ≥ 30-min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>72%</td>
<td></td>
</tr>
<tr>
<td>Approach 1 (3-min)</td>
<td>48%</td>
<td>*</td>
</tr>
<tr>
<td>Approach 2 (6-min)</td>
<td>40%</td>
<td>*</td>
</tr>
<tr>
<td>Approach 3 (12-min)</td>
<td>43%</td>
<td>*</td>
</tr>
</tbody>
</table>

*% daily time spent in SB

*p < 0.05 (compared to baseline)*
BEYOND PRIMARY OUTCOMES—EXAMINATION OF BEHAVIORAL RESPONSE TO THE B-MOBILE INTERVENTION APPROACH
**B-MOBILE Behavioral Response Results**

- **Intervention Engagement**
  - On average, participants carried the smartphone for 6.9 d per each 7-day condition for 14.9 h/d (* no differences between men and women)

- **Number of Walking Prompts and Walking Breaks Per Day**

  ![Bar chart showing walking prompts and breaks per day with p < .05](chart.png)

  - 3-min approach
  - 6-min approach
  - 12-min approach

Thomas, Bond. *Health Psychol* 2015
B-MOBILE Behavioral Response Results (cont.)

- Adherence to Walking Prompts (% of walking prompts that resulted in a walking break of the prescribed duration)

![Graph showing adherence to walking prompts across different approaches](image)

- 3-min approach
- 6-min approach
- 12-min approach

Significance levels:
- $p < .05$

Thomas, Bond. *Health Psychol* 2015
**B-MOBILE** Behavioral Response Results (cont.)

- **Duration of Prompted Walking Breaks**

![Bar chart showing the comparison of Minutes Per Prompted Walking Break and Total Daily Minutes Spent in Prompted Walking Breaks for different approaches: 3-min, 6-min, and 12-min.](Image)

Thomas, Bond. *Health Psychol* 2015
CONCLUSIONS

- **B-MOBILE** produced significant SB reductions in adults with obesity
  - All 3 approaches reduced total % time spent in SB, which was replaced with increases in both LPA and MVPA
  - All 3 approaches reduced % time spent in prolonged bouts ≥ 30 min
  - 3-min approach superior to 12-min approach for reducing SB and increasing LPA

- **B-MOBILE** produced a high level of engagement and behavioral adherence
  - More frequent SB prompts resulted in the highest levels of adherence
  - Approaches that required shortest walking breaks per prompt resulted in the greatest number of total daily minutes spent in walking breaks
  - *Frequent prompts for small change may be an optimal strategy for reducing SB*
FUTURE DIRECTIONS

- Enhancing **B-MOBILE** approach with functionality to support long-term use
  - Long-term goal setting and feedback
  - Tailoring of prompts based on *chosen prompting scheme, context* (location) and *source(s) of motivation*
  - Progressive goals with gamification and friendly competition
  - “Push notifications” for SB education and intervention engagement

- Test whether enhanced **B-MOBILE** can produce longer-term reductions in SB and related improvements in cardiometabolic and inflammatory risk biomarkers among adults with obesity
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