Comparison of Older and Newer Generations of ActiGraph Accelerometers With and Without the Low Frequency Extension

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Background

- Accelerometers gold standard for PA measurement
- Many population-based studies (NHANES, EYHS, Attitude Behavior and Change Study) used the 7164 model
- 79% of youth accelerometer studies from 2005-2010 reported using the 7164 model
  

- Older Actigraph models (7164 and 71256) have been replaced with newer generation devices (GT1M, GT3X, GT3X+ & wGT3X+)
Background

- The new generation devices have a different type of internal mechanism (solid state MEMS vs piezoelectric accelerometer)
- Actigraph developed a new digital filtering algorithm for use with the new models

ARE OLDER AND NEWER DEVICES COMPARABLE?
- Relevant for *between* study comparisons (e.g., comparing prevalence rates to national studies)
- Relevant for *within* study comparisons (e.g., longitudinal studies which change models)
Background

- Laboratory studies have shown that the data are generally comparable for MVPA but not on the lower end of the intensity spectrum


- Newer generation devices require larger accelerations to record non-zero counts
Purpose

• Actigraph introduced a ‘Low Frequency Extension’ to extend the lower threshold for signal detection in the new generation devices.

• Purpose of this study was to compare data collected with the 7164 and the GT3X+ with and without the Low Frequency Extension (LFE).
Methods

• 25 adults, mean age 32.8 (SD 11.3); 52% female
• Wore 2 accelerometers (7164 and GT3X+) around waist on same belt
  ▫ Centered on right hip
  ▫ Position order randomized
• 7164’s calibrated prior to data collection
• Wore for 3 days and instructed to engage in typical behaviors – free living
• LFE was applied post-data collection
• 60 second epoch
• 3 sets of data (7164, GT3X+R and GT3X+LFE)
Methods

- Days with at least 8 valid hours included
- Data scored using Freedson adult cut points and sedentary ≤ 100 counts per minute
- 60 second epoch
- Non-wear = 60+ minutes of consecutive ‘0’ counts
- Average minutes per day in sedentary, light, moderate, vigorous, MVPA and average hourly counts calculated
- Repeated measures ANOVA with post-hoc pairwise comparisons used to compare mean values for all activity categories across the 3 datasets
Results

<table>
<thead>
<tr>
<th></th>
<th>Sedentary†</th>
<th>Light†</th>
<th>Moderate†</th>
<th>Vigorous</th>
<th>MVPA†</th>
<th>Hourly Counts‡</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GT3X+</strong></td>
<td>478.9</td>
<td>217.1</td>
<td>23.5</td>
<td>6.3</td>
<td>29.8</td>
<td>10550.8</td>
</tr>
<tr>
<td><strong>Regular</strong></td>
<td>(82.0)</td>
<td>(84.2)</td>
<td>(12.1)</td>
<td>(9.0)</td>
<td>(16.9)</td>
<td>(3884.6)</td>
</tr>
<tr>
<td><strong>7164</strong></td>
<td>453.4</td>
<td>248.3</td>
<td>26.4</td>
<td>6.1</td>
<td>32.5</td>
<td>11529.1</td>
</tr>
<tr>
<td></td>
<td>(84.3)</td>
<td>(88.8)</td>
<td>(13.0)</td>
<td>(8.2)</td>
<td>(16.9)</td>
<td>(3549.1)</td>
</tr>
</tbody>
</table>

† p<.05  ‡ p<.001

- GT3X+ R showed significantly
  - more sedentary (+25.6 min/day)
  - less light (-31.2 min/day)
  - less moderate (-2.9 min/day)
  - less MVPA (-2.6 min/day)
  - fewer hourly counts (-978.3 counts/hr) than the 7164
## Results

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<tr>
<td><strong>GT3X+ LFE</strong></td>
<td>449.8</td>
<td>244.0</td>
<td>26.0</td>
<td>6.5</td>
<td>32.6</td>
<td>11581.0</td>
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<td>(92.8)</td>
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<td>(17.2)</td>
<td>(3963.5)</td>
</tr>
</tbody>
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‡ *p < .001

- GT3X+ R showed significantly
  - more sedentary (+29.1 min/day)
  - less light (-26.8 min/day)
  - less moderate (-2.6 min/day)
  - less MVPA (-2.7 min/day)
  - fewer hourly counts (-1030.2 counts/hr) than the GT3X+ LFE
## Results

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- Differences become non-significant when the LFE is applied
Results

Sedentary

7164 GT3X+ R
GT3X+ LFE

Light

7164
GT3X+ R
GT3X+ LFE
Conclusions

- Significant differences detected between older and newer generation Actigraph data in all intensity categories (except vigorous) without the LFE.
- Differences significantly reduced when the LFE was applied:
  - Sedentary – from approx 26 min to 4 min/day
  - Light – from approx 31 min to 5 min/day
  - MVPA – approx 3 min to 0.1 min/day
- Studies using the newer generation ActiGraphs should employ the low frequency extension for more comparable results to studies using the older models and greater sensitivity to lower intensity activity.
"I'm trying to fit 30 minutes of daily exercise into my busy schedule. Today I took 120 fifteen-second walks."

"The only diet shake I recommend is the shake your booty makes when you exercise."

"We have an excellent employee health plan: we built our parking garage 2 miles away from the office!"