Assessment of physical activity in children & youth

Chair & Discussant
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School of Exercise & Nutrition Sciences,
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Acknowledgements: NHFA, NHMRC
Outline for symposium

• 252 Rachel Colley (Mark Tremblay): Step count target to measure adherence to physical activity guidelines in children

• 254 Didier Garriguet (Mark Tremblay): Comparing parent-report and directly measured physical activity, sedentary behaviour and sleep in Canadian children and their association with health

• 386 Britni Belcher (David Berrigan): Self-reported versus objectively measured physical activity & cardiometabolic biomarkers among youth in NHANES

• 393 Rachel Colley (Mark Tremblay): The pattern & timing of sedentary behaviour are related to body mass index in boys but not girls

• Discussant: Jo Salmon
Main focus of today’s papers

1) Use of objective measures to determine meaningful levels of PA & SB in children

2) Objective vs subjective measures: which do we believe?

3) Taking objective data to the next level: examining patterns of activity & associations with health
Use of objective measures to determine meaningful levels of PA & SB in children

• Colley: 12,000 steps/day for determining whether 6-19 year olds meet current PA recs of 60 minutes of daily MVPA

• Tudor-Locke: graduated step index (steps/day scale) incorporates child & adolescent-specific step-based translations of PA recs within the context of the full lifespan. Ranges from 0-18,000+ steps/day *

* Amish men have provided the highest mean value reported for any sample at this time
Figure 1: Steps/day scale schematic linked to time spent in MVPA

Tudor-Locke et al. IJBNPA 2011
Do steps reflect EE or something else..?

- These studies in part reflect normative behaviour which is then measured against objective criterion (eg, accelerometry, BMI, BF%, other health indicators?)

- Different steps/day for younger boys & girls, but not adolescents or adults

- Generalisability across countries may depend on step norms for those populations
Objective vs subjective measures: which do we believe?

- Garriguet:

<table>
<thead>
<tr>
<th></th>
<th>Parent-report</th>
<th>Accelerometer</th>
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<tbody>
<tr>
<td>MVPA</td>
<td>105 mins</td>
<td>63 mins</td>
</tr>
<tr>
<td>Screen-time</td>
<td>2.5 hrs</td>
<td>7.6 hrs</td>
</tr>
<tr>
<td></td>
<td>2.5 hrs</td>
<td>sed time*</td>
</tr>
<tr>
<td>Sleep</td>
<td>9.7 hrs</td>
<td>10.1 hrs</td>
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</tbody>
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- Both measures found MVPA signif related with BMI

*not directly comparable with screen time
• Belcher:

<table>
<thead>
<tr>
<th></th>
<th>Accelerometer</th>
<th>Self-report</th>
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<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td>MVPA mins/day</td>
<td>33.6</td>
<td>18.2</td>
</tr>
<tr>
<td></td>
<td>30.5</td>
<td>23.8</td>
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Both measures found MVPA significantly related with health, but objectively measured PA more strongly associated with biomarkers than S-R PA in NHANES (particularly for boys).

*nb: S-R corr accelerometer: $r = 0.16$ (boys) $r = 0.095$ (girls)
• Is this giving us contradictory evidence or are we simply measuring different things?

• Should we really expect different measures that are often poorly correlated with each other to have same associations with health or correlates??
Objective vs subjective measures: which do we believe?

• Should we expect any of these measures to be relevant to factors related to biomarkers?

• Measures may assess behaviors not highly correlated to EE - a major influence on physiological pathways & thus measured biomarkers

• Issues of measurement error & attenuation (as per Monday keynotes by Lawrence Freedman & Tim Key)
Comparison of 3 measures of PA & associations with health in adols: **Hearst et al, JPAH 2012**

<table>
<thead>
<tr>
<th>N=700 adolescents</th>
<th>Mean</th>
<th>Met recs</th>
<th>% BF (p&lt;0.001)</th>
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<tbody>
<tr>
<td>a) Modified Activity Questionnaire (MAQ): average number days 20 mins MVPA/wk</td>
<td>0.8</td>
<td>36%</td>
<td>-0.24</td>
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<tr>
<td>b) 3-Day Physical Activity Recall (3DPAR): average no. 30-min blocks of MVPA/day</td>
<td>3.5</td>
<td>69%</td>
<td>-0.21</td>
</tr>
<tr>
<td>c) Accelerometer: average MVPA mins.day</td>
<td>30.7</td>
<td>6%</td>
<td>-0.22</td>
</tr>
</tbody>
</table>

Berrigan: “Different self-report instruments (e.g. the NHANES vs. MAQ vs. 3DPAR) may differ in constructs measured &/or validity”
Correlates of pedometer-measured & self-reported PA among young Australian adults: Cleland et al JSAMS 2012

• n=1800 Australian adults (C-DAH study)
• Pedometer: biological correlates (e.g. age, live births, BMI)
• Self-report: demographic (e.g. education, occupation, employment) or behavioural (e.g. smoking, extra foods) correlates
SEP & children’s PA & SB: Longitudinal findings from the CLAN study: Ball et al. JPAH, 2009

• Girls of higher SEP demonstrated greater decreases in TV-viewing behaviors than those of low SEP
• no prospective associations bw SEP & objectively assessed PA
• a small no. prospective assocns noted bw SEP & self-reported PA, but these were generally weak & inconsistent in direction
Taking objective data to the next level: examining patterns of activity & associations with health

• Colley: patterns & timing of SB accumulation & associations with health

• Found that prolonged bouts of SB, particularly those accumulated after school assocd with boys’ obesity but not girls’
Not just total PA or SB that is important?
Contribution of sitting bouts (2-min increments) to total sitting time (activPAL)
Associations bw sedentary, sitting time & 25(OH)D* in 8 yr old children

- Daily sedentary time: -0.18 nmol/L; p=0.09
- Daily sitting time: -0.08 nmol/L; p=0.039
- Freq 10-min bouts daily sitting: -0.67 nmol/L; p=0.08
- Standing (not stepping): 0.11 nmol/L; p=0.05
- Freq transitions: NS
- 2% less likely to be VitD insufficient for every min spent sitting

*all analyses adjusted for date blood taken, parents’ country of birth, zBMI, MVPA, activPAL wear time
Children’s PA Assessment: Conundrum or Confirmation?

- Advancements in instruments of assessment mean it is now possible to examine not just associations between total volume of PA or SB & health, but also how & when these behaviours are accumulated.

- How much credibility do we give to findings if used SR vs objective measure? Perhaps we worry too much about the ‘perfect’ measure!!

- PA is a robust measure that even crude measures (ie, type of occupation) can show associations with premature morbidity & mortality.

- SB may be similarly robust (eg, Katzmarzyk).
Survival curve for all-cause mortality across categories of daily sitting time, Canada Fitness Survey, 1981–1993
Just because it is objective may not mean it is better!

- Whether measuring ambulatory movement or postural changes, or EE, it is important to be confident that the measure is *meaningful* & is providing the information you want
- This may vary depending on the purpose
  - Popn estimates of meeting recommendations
  - Intervention effects
  - Observational cross-sectional or cohort study
  - Health outcomes, correlates etc.
Questions from the authors

• How do we move forward with data interpretation from various measurement methods? (e.g., self-report, pedometers, accelerometers etc.)
  – Can they be used interchangeably?
  – What are the risks in doing so?
• Can we maximize the benefits of each to somehow use the approaches in a complementary fashion?
• The research on SB & health in children is mixed & highly dependent on measurement approach. What is the future of SB research in children & youth?
Questions from the authors

• Weaker associations bw PA & health (no matter the measure) among adolescents compared with adults - thus it harder to detect differences in measures & also to detect relationships
  – reverse causality…

• How to interpret the differential association of self-report & accelerometry with various biomarkers?
  – Are accelerometer-derived measures superior to the NHANES PA Questionnaire? Or are they just different..?