Standardising the ‘after-school’ period for children’s physical activity and sedentary behaviour

Lauren Arundell¹,², Jo Salmon¹, Jenny Veitch¹, Eoin O’Connell¹, Trina Hinkley¹ and Clare Hume¹

¹Centre for Physical Activity and Nutrition Research, School of Exercise and Nutrition Sciences, Deakin University, 221 Burwood Highway, Burwood, Vic. 3125, Australia.
²Corresponding author. Email: lauren.arundell@deakin.edu.au

Abstract

Issue addressed: Studies examining children’s after-school physical activity (PA) and sedentary behaviours (SB) often use arbitrary times to signify the period start and end. A standardised time is required for future research examining this period. The aim of the present study was to compare children’s after-school behaviour using three definitions of the after-school period, namely (1) end of school to 6 pm; (2) end of school to dinner time; and (3) end of school to sunset, to determine the extent of variability in PA and SB during the after-school period depending on the definition used.

Methods: Children (n = 308; aged 8 years) from the Melbourne Transform-Us! intervention wore an accelerometer and a subsample (n = 112) wore an activPAL inclinometer in 2010. The end of school bell time was obtained from the child’s school, parents completed a 2-day log reporting their child’s dinner time and sunset times were obtained from Geoscience Australia. ActiGraph accelerometers assessed the proportion of time spent sedentary (SED) and that spent in light (LPA), moderate (MPA) and moderate-to-vigorous (MVPA) PA during the three time periods; activPAL inclinometers assessed the proportion of time spent sitting (SIT).

Results: Apart from the end of school time (3:30 pm), dinner (range 3:30 pm – 8:40 pm) and sunset (range 5:07 pm – 7:34 pm) times varied. Despite this, there were no significant differences in estimates of the proportions of time children spent in SED, LPA, MPA, MVPA or SIT between the three after-school periods examined.

Conclusion: Given the small differences in SED, PA and SIT during the after-school period regardless of the definition (6 pm, sunset or dinner time), it appears that applying a standardised definition of end of school to 6 pm is acceptable for defining children’s PA and SB during the after-school period.

So what? The use of a standardised after-school definition (end of school to 6 pm), will enable future studies exploring children’s after-school PA and SB to be more comparable.

Key words: physical activity, sedentary behaviour, children, measurement development.

Received 27 July 2012, accepted 11 January 2013, published online 21 March 2013

Introduction

The after-school period offers an opportunity to promote children’s physical activity (PA) and reduce sedentary behaviours (SB).¹ After school, primary school children are not restricted by school timetabling and may have the opportunity to engage in active and sedentary pastimes,² particularly during daylight hours. However, studies have examined after-school PA and SB during a variety of periods, including 1:05 pm–bedtime,³ 3 pm–5 pm,¹ 3 pm–7:30 pm,⁴ 3 pm–11:30 pm,⁵ 3:30 pm–8:30 pm,⁶ 4 pm–6 pm⁷ and from the school bell until 6 pm.⁸ The variation in these definitions potentially excludes important PA of varying intensities (e.g. light PA (LPA), such as walking home from school; or moderate-to-vigorous PA (MVPA), such as sports training) or SBs (e.g. TV viewing after dinner), or could provide behavioural information that is not conducive to discretionary PA and SB intervention development and delivery (e.g. being dark outside).

It is unknown whether a standardised definition may result in an under- or overestimation of children’s PA or SB during this period; however, a standardised after-school period definition would enable population comparisons of children’s PA and SB prevalence and patterning. This will assist in establishing the contribution the after-school period makes to the achievement of PA and SB recommendations, and after-school intervention development and implementation. A standardised definition does not diminish the
potential for children to accumulate PA and SB outside of this period, although it has been identified as a ‘critical window’ when PA and/or SB interventions are likely to be highly amenable. The aim of the present study was to compare children’s after-school behaviour using three definitions of the after-school period, namely (1) end of school to 6 pm; (2) end of school to dinner time; and (3) end of school to sunset, to determine the extent of variability in PA and SB during the after-school period depending on the definition used.

Methods

Participants
The present study was nested within the baseline data collection of the randomised controlled trial Transform-Us! (ACTRN12609000715279; ISRCTN83725066). Grade 3 children (n = 1606) at 20 primary schools in Victoria (Australia) received information explaining the assessments and consent forms. Of these children, 551 consented to wear accelerometers and inclinometers (34% response rate). Assessments were conducted in February–June 2010.

Approval was obtained from Deakin University Human Research Ethics Committee, the Victorian Department of Education and Early Childhood Development and the Catholic Education Office.

Measures

Period time points
Schools provided the end of school bell times. Parents of consenting children were asked to complete a 2-day after-school log, marking when their child ate dinner. Sunset times for these days were obtained using the National Mapping Division’s Sunriseset Program (version 2.2; Australian Government Geoscience, Symonston, ACT, Australia). From this the three after-school periods were created that were specific to each child: (1) end of school to 6 pm; (2) end of school to dinner time; and (3) end of school to sunset.

After-school PA, SB and sitting time
Children were fitted with a GT3X Actigraph accelerometer (Actigraph, Pensacola, FL, USA), which provides objective estimates of PA and sedentary time and has acceptable validity among children.10 Accelerometers were worn on a belt at the child’s right hip and collected data in 15-s epochs.11 To measure sitting time, a subsample of children also wore an activPAL inclinometer (PAL Technologies, Glasgow, UK). The inclinometer classifies activity into periods of sitting and/or lying down, standing and stepping12 and has acceptable validity in adults13,14 and pre-school children.15 The activPAL was worn on an elastic garter positioned at the midanterior aspect of the right thigh. Both units were worn during waking hours (excluding water-based activities) for 8 consecutive days.

Data management and analysis
Accelerometer data were downloaded using Actilife Lifestyle Monitoring System (v5.1; Actigraph), whereas activPAL data were downloaded using activPAL Professional (v8.3.5; PAL Technologies). The PAL data files were transformed into Excel files reporting time spent sitting/lying (SIT), standing and stepping in 15-s epochs. Raw accelerometer data files and transformed PAL files were run through specifically developed Excel macros to determine non-wear time (≥10 consecutive minutes of zero counts). Wear time criteria were set at ≥70% of the period for inclusion in analysis. Using age-specific accelerometer cut-off points,16 children’s accelerometer-derived sedentary time (SED; ≤1.5 metabolic equivalents (METs), defined as <100 counts min−1), LPA (1.6–3.9 METS), moderate PA (MPA; 4.0–5.9 METs) and MVPA (≥40 METs) were calculated. The PA, SED and SIT data were matched to the 2 days that the after-school log was completed and were extracted for the three after-school periods that were calculated for that child. The proportion of each of the three periods spent engaged in SED, LPA, MPA, MVPA and SIT was then calculated. Figure 1 shows an example of the accelerometer data for one participant.

Mean values and 95% confidence intervals (CI) were calculated for the proportion of time children spent in SED, LPA, MPA, MVPA and SIT during the three after-school periods. Significant differences were determined by examining whether the 95% CIs overlapped. The median and range for the end of school, sunset and dinner times were calculated for descriptive purposes.

Results

Three hundred and eight children (aged 8 years; 42% boys) had ActiGraph and after-school log data and 112 children had activPAL and after-school log data. The median end of school, dinner and sunset times were 3:30 pm (no variation), 6:20 pm (range 3:30 pm–8:40 pm; however, only four children reported dinner at 3:30 pm) and 5:53 pm (range 5:07 pm–7:34 pm), respectively.

Fig. 1. Example of one child’s accelerometer measured after-school behaviours during the three periods examined (end of school to 6 pm (18:00 hours), end of school to dinner time and end of school to sunset). SED, sedentary time; LPA, light physical activity; MVPA, moderate-to-vigorous physical activity.
Table 1. Proportion of time spent in accelerometer-derived sedentary, light, moderate and moderate-to-vigorous physical activity, as well as inclinometer-derived sitting during three after-school periods. Data show mean values with 95% confidence intervals in parentheses. SED, sedentary time; LPA, light physical activity; MPA, moderate physical activity; MVPA, moderate-to-vigorous physical activity; SIT, sitting time.

<table>
<thead>
<tr>
<th></th>
<th>Period 1 (end of school to 6:00 pm)</th>
<th>Period 2 (end of school to dinner time)</th>
<th>Period 3 (end of school to sunset time)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accelerometer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SED</td>
<td>47.5% (46, 49)</td>
<td>47.3% (45, 49)</td>
<td>47.0% (46, 48)</td>
</tr>
<tr>
<td>LPA</td>
<td>24.7% (24, 25)</td>
<td>24.6% (24, 25)</td>
<td>24.6% (24, 25)</td>
</tr>
<tr>
<td>MPA</td>
<td>21.7% (21, 23)</td>
<td>22.0% (21, 23)</td>
<td>22.0% (21, 23)</td>
</tr>
<tr>
<td>MVPA</td>
<td>27.9% (27, 29)</td>
<td>28.2% (27, 30)</td>
<td>28.3% (27, 30)</td>
</tr>
<tr>
<td>ActiPedometer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIT</td>
<td>48.9% (46, 52)</td>
<td>47.7% (45, 52)</td>
<td>47.3% (45, 52)</td>
</tr>
</tbody>
</table>

*Obtained from the after-school log.

**Obtained from the National Mapping Division’s Sunrisenet Program (version 2.2; Australian Government Geoscience, Symonston, ACT, Australia).

The proportion of time spent in SED, LPA, MPA, MVPA and SIT from end of school to 6 pm (Period 1), end of school to dinner time (Period 2) and end of school to sunset (Period 3) is given in Table 1. The maximum difference in the proportion of time spent in these five behaviours during these three periods was 2%. There were no significant differences between the three after-school periods for each of the behaviours assessed because all 95% CIs overlapped.

Discussion

The present study is the first to determine the extent of variability in children’s PA and SB during the after-school period depending on the definition used. The results of the present study showed no significant differences in the proportion of time children spent in accelerometer-determined SED time, LPA, MPA or MVPA, or activPAL-determined SIT between end of school bell time to children’s dinner time, end of school bell time to sunset time and the end of school bell time to 6 pm. Therefore, in relation to Australian primary school children’s PA and SB in the after-school period, a standardised time of end of school bell time to 6:00 pm may be used to signify the beginning and end of the after-school period, respectively. Further, given the variability of children’s dinner times and the changes in sunset times across seasons, end of school bell time to 6:00 pm is a feasible time period to use in large population studies because it would eliminate methodological issues that may arise when using different times for different children or seasons.

Limitations of the present study include the generalisability of the findings to other countries, where children’s school days may conclude at different times. In addition, objective measures do not provide behavioural information, which may be important for the development of interventions. Nevertheless, the use of objective measures of PA, SB and sitting time is a study strength, as is the use of time markers (i.e. end of school, dinner and sunset times) specific to each child.

Conclusion

There were no significant differences in the proportion of the time Australian children spent in SED, LPA, MPA, MVPA or SIT between the three after-school periods. Therefore, the use of a standardised time period (end of school bell time to 6:00 pm) adequately represents children’s after-school PA and SB behaviours and may be used in future studies.

Acknowledgements

JS was supported by a National Health and Medical Research Council of Australia (NHMRC) Principal Research Fellowship (APP1026216). CH and JV were supported by a National Heart Foundation of Australia Postdoctoral Fellowship Award. This project was funded by the NHMRC (533815).

References