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Section: Original Research

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Comparing the Actical and ActiGraph Approach to Measuring Young Children’s Physical Activity Levels and Sedentary Time

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Abstract

Young children’s activity and sedentary time were simultaneously measured via the Actical method (i.e., Actical accelerometer and Pfeiffer et al.’s cut-points) and the ActiGraph method (i.e., ActiGraph accelerometer and Pate et al.’s cut-points) at both 15s and 60s epochs to explore possible differences between these two measurement approaches. For seven consecutive days, participants ($n = 23$) wore both the Actical and ActiGraph side-by-side on an elastic neoprene belt. Device-specific cut-points were applied. Paired sample $t$-tests were conducted to determine the differences in participants’ daily average activity levels and sedentary time (mins/hr) measured by the two devices at 15s and 60s time sampling intervals. Bland-Altman plots were used to examine agreement between Actical and ActiGraph accelerometers. Regardless of epoch length, Actical accelerometers reported significantly higher rates of sedentary time (15s: 42.7 mins/hr vs. 33.5 mins/hr; 60s: 39.4 mins/hr vs. 27.1 mins/hr). ActiGraph accelerometers captured significantly higher rates of moderate-to-vigorous physical activity (15s: 9.2 mins/hr vs. 2.6 mins/hr; 60s: 8.0 mins/hr vs. 1.27 mins/hr) and total physical activity (15s: 31.7 mins/hr vs. 22.3 mins/hr; 60s: 39.4 mins/hr vs. 25.2 mins/hr) in comparison to Actical accelerometers. These results highlight the present accelerometry-related issues with interpretation of datasets derived from different monitors.

Keywords: Actical, ActiGraph, accelerometer, Bland-Altman, preschoolers, physical activity, sedentary time
Physical activity plays a crucial role in optimizing young children’s health including the affordance of many physiological (3, 20, 36, 37) and psychosocial benefits (36, 37). Similarly, high levels of sedentary behaviors have been linked to increased adiposity and decreased cognitive development and psychosocial health (19). Because children form many health habits early in life (11, 28), it is important that active behaviors are established among young children, and that sedentary behaviors minimized wherever possible. In light of the growing body of research focusing on preschoolers’ physical activity levels and sedentary time (13-15, 19, 21, 28, 34, 36, 37, 39-41, 45), there appears to be mixed reviews concerning whether preschoolers are truly engaging in adequate levels of physical activity. In fact, some studies have purported that preschoolers are sufficiently active (8, 21) while others report that this group is insufficiently active (13, 17, 39, 43) to meet current daily physical activity guidelines of 180 minutes (any intensity) (2, 6, 10). Such discrepancies in total physical activity (TPA) levels could be attributed to a difference in tools used to assess these particular behaviors. Consequently, as a means of better comparing and understanding the differences in physical activity levels and sedentary time observed among this young cohort, additional exploration is warranted to ease the translatability of findings across multiple studies.

Accelerometers have been recognized as the gold standard for measuring physical activity among preschoolers (7, 27). Actical™ (Bend, OR) and ActiGraph™ (Fort Walton Beach, FL) accelerometers are two of the most frequently used devices internationally (38), with the latter recently gaining more prominence in the literature (5). Despite the growing popularity and appropriateness of these two accelerometers, the variation in data output and cut-points makes comparing preschoolers’ physical activity levels and sedentary time challenging, and adds an additional layer of complexity to the already difficult task of quantifying children’s physical
activity levels (38). While a growing body of literature suggests that the physical activity levels of preschoolers vary dramatically across studies (8, 13, 21, 23, 25, 30, 34, 45); such discrepancies could be attributed to the use of different accelerometers (21). For instance, in two studies comparing the physical activity levels of preschoolers in childcare, Temple et al. (i.e., home-based) (34) and Vanderloo et al. (i.e., centre-based) (45) reported that their samples accumulated approximately 1.76 (SD = 0.90) mins/hr and 1.54 (SD = 1.41) mins/hr of moderate-to-vigorous physical activity (MVPA) via Actical accelerometry, respectively. In comparison, a study by Gunter et al. (12) which examined home-based childcare using ActiGraph accelerometers, found that preschoolers’ achieved upwards of 9.48 (SD = 4.3) mins/hr of MVPA. Consequently, the need to understand the comparability across data collected by these two devices is warranted (7, 26, 33). Among adult populations, previous work by Paul et al. (26; uniaxial ActiGraph) and Straker and Campbell (33; triaxial ActiGraph) have compared Actical and ActiGraph activity monitors, along with creating translation equations (which underscored the linear relationship between the two devices, and thus the ability to convert between them). The findings from their papers both report more activity counts measured via the ActiGraph model, and note that the comparability between these devices is challenging. However, no studies to date have examined this measurement issue specific to the early year’s population when using Actical and ActiGraph accelerometers. Exploring this population is important as young children (e.g., preschoolers) have very unique activity patterns which are characterized by sporadic and intermittent bouts of activity, with frequent rest periods (22). As such, exploring the utility and comparability of these two commonly used accelerometers with this young cohort is necessary. Doing so would increase researchers’ ability to compare and interpret young
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...children’s physical activity levels and sedentary time across multiple studies and gather a more accurate depiction of these behaviors.

Further complicating the issue is the fact that different cut-points across the same device can produce varied physical activity levels and sedentary time. For example, with regard to MVPA, preschool-specific cut-points can range from > 287.5 counts (Actical) (1), to > 420 counts (ActiGraph) (24), to ≥ 585 counts (ActiGraph) (44), to ≥ 715 counts (Actical) (27), and even to ≥ 891 counts (ActiGraph) (32) per 15s epoch. The effect of different cut-points on activity levels was demonstrated in recent unpublished data by Rice (29) which indicated that participating preschoolers’ levels of MVPA (measured using ActiGraph accelerometers) was approximately 10.1 (SD = 4.2) mins/hr when analyzed with Pate et al.’s cut-points (24) but decreased to 5.8 (SD = 3.2) mins/hr when analyzed with van Cauwenberghe et al. cut-points (30;44). Also of note, differences in how accelerometers are calibrated may account for some of the variance in cut-points. However, research has been undertaken to try and minimize such effects by validating different devices using similar protocols. For instance, Pfeiffer et al.’s (27) and Pate et al.’s (24) cut-points for Actical and ActiGraph accelerometers, respectively, were both calibrated in a similar manner using VO₂ measures, structured activities, and were cross-validated with unstructured activities. These calibration techniques endorsed both the Actical and ActiGraph accelerometer as a reliable and appropriate method for measuring physical activity among young children. Despite this, the ongoing challenge of deciding which cut-points to apply continues to make measuring physical activity problematic. Consequently, such limitations in comparability between studies render it difficult to truly understand the prevalence of physical activity and sedentary time among young children.
As stated by Colley et al. (8), the accurate measurement of young children’s physical activity level and sedentary time is required to not only ascertain any health-related linkages, but to establish the degree to which this particular cohort is meeting/missing newly released physical activity and sedentary behavior guidelines. Consequently, in the interest of aiding researchers in comparing findings between studies and understanding the differences in measurement across devices, it is important to examine the variation in physical activity data collected and processed by the frequently used Actical and ActiGraph accelerometers. The ability to accurately measure, analyze, and contrast the activity levels and behaviors of young children (regardless of device used) is imperative to increasing the translation and usability of such data. And yet, despite the popularity and wide acceptance of accelerometers, the use of different devices, multiple cut-points, and various sampling intervals leads to grossly different estimates of physical activity levels and sedentary time. Moreover, given that cut-points are specific and solely appropriate for the devices for which they were validated, it is not only the associated accelerometers that need to be compared, but rather the accelerometers with their associated protocol.

Physical activity measurement should be viewed as a compendium, in that such data are not only measured by a particular device, but are currently also processed and analyzed specific to the device used. Accelerometers and their respective cut-points should be viewed as a ‘package' or protocol to assessing and understanding activity levels. As such, the overarching purpose of this study was to compare two frequently adopted measurement techniques undertaken to quantify young children’s physical activity and sedentary time. Specifically, young children’s activity and sedentary time were simultaneously measured using the Actical method (i.e., Actical accelerometer and Pfeiffer et al.’s cut-points) versus the ActiGraph method (i.e., ActiGraph accelerometer and Pate et al.’s cut-points) at both 15s and 60s epochs, and to explore
possible differences between these two measurement approaches. The intent of this paper was not to compare the impact of applying standardized cut-points to physical activity data measured via two different devices, because in practice, researchers use cut-points that have been validated specifically for their respective devices.

Although Actical and ActiGraph are two of the most popular brands of accelerometers used during the early years, no study to date has compared these measurement approaches among young children. While both monitors have been validated using 15s epochs, exploring activity classification at a 60s epoch is also of interest as this will help determine whether differences in measuring young children’s physical activity and sedentary time using two devices exist, and whether these differences remained true across various epoch lengths. The use of 60s epochs will also aid in increasing the generalizability of the present study’s findings, as those who have measured preschoolers’ activity levels at 60 seconds (e.g., Canadian Health Measures Survey [CHMS] data) can consider this relationship when interpreting their own data.

Methods

Study design and recruitment

To examine the physical activity levels and sedentary time of young children using two different measurement approaches (i.e., two brands of accelerometer and their respective cut-points), a cross-sectional study was undertaken. Specifically, this study was carried out in conjunction with the Health Outcomes and Physical activity in Preschoolers (HOPP) study; Canada’s first longitudinal investigation to explore the relationship between physical activity and health in preschool-aged children (35). Included in this study was a convenience sample of a portion of HOPP participants (aged 4 or 5 years) during one of their follow-up appointments. All study procedures and related documents were approved by the Hamilton Health Sciences
Centre/Faculty of Heath Sciences Research Ethics Board and parents/guardians of participating children provided written informed consent for all data collection procedures.

Tools

Actical accelerometers (B series) are omnidirectional (38), and have demonstrated high specificity and sensitivity in estimating young children’s activity intensities (27). Slightly smaller and lighter than the ActiGraph (28 mm x 27 mm x 10 mm; 17g), these devices detect movement across the 0.5-3 Hz range. In comparison, ActiGraph accelerometers are the most readily available monitor on the market (38), and have repeatedly exhibited high validity in measuring preschoolers’ physical activity (7, 27, 32). The ActiGraph GT3X+ (38 mm x 37 mm x 18 mm; 27g) functions on a frequency range of 0.25-2.5 Hz.

Data collection

Data collection took place between July and August 2013 in Hamilton, Ontario and surrounding area. At their appointment, each participant was fit with their assigned accelerometers; both the Actical and ActiGraph devices were placed side-by-side on the same elastic neoprene belt. Parents/guardians were instructed to place the accelerometers around their child’s waist (i.e., right hip) upon waking in the morning, and to remove them prior to going to sleep, swimming, and bathing for seven consecutive days. All wear-time related information was recorded by the parents/guardians in a daily log. Participants’ height and weight were measured by trained researchers at the appointment.

Data analysis

To allow for comparability with the Actical, raw ActiGraph data (which was recorded at 30Hz) were re-integrated into 15- and 60- second epochs. In combination with the wear-time
logs, *KineSoft* (version 3.3.67; KineSoft, Saskatchewan, Canada) was used to conduct reliability analyses (for both Actical and ActiGraph data files) in an effort to determine the number of hours/days necessary to provide accurate activity data, and thus helped direct the inclusion of participants in the analysis. Parameters applied to the present data were: non-wear time was defined as 60 minutes of consecutive zeroes (9); 8 hours of wear time constituted a valid day; and participants with 3 or more valid days (i.e., at least two weekdays and one weekend day) were retained for analyses. Only children who met the inclusion parameters for both devices on the same days were retained for analyses.

Physical activity intensity and sedentary time were determined by the application of age- and device-appropriate cut-points. Using the *KineSoft* program, Actical data were analyzed using Pfeiffer et al.’s (27) cut-points and ActiGraph data (vertical plane only) using Pate et al. (24) cut-points. Specifics regarding the cut-points for sedentary time and light physical activity can be seen elsewhere (i.e., Temple et al. [34] for Actical and Hnatiuk et al. [17] for ActiGraph). Given that both sets of cut-points are specific to 15s epochs, these thresholds were multiplied by four to allow for comparison with the 60s epoch. Based on the common use of these cut-points in the literature (4, 21, 27, 34, 43, 45), combined with the fact that they were developed using similar (if not the exact same) techniques by the same lab group (24, 27), the selection of Pfeiffer et al.’s and Pate et al.’s thresholds were thought to be the most appropriate in aiding investigators compare research using both devices. While Pate et al.’s (24) cut-points were originally validated for the MT1 ActiGraph, Robusto and Trost (31) concluded in a recent paper that cut-points developed in the vertical axis of this model can be applied to data collected by the GT3X+ ActiGraph. See Table 1 for applied cut-points.
All data were analyzed in SPSS (version 22). Frequencies, means, and standard deviations were calculated to describe the sample. While both monitors were initiated to start collecting data at the same time, and were worn adjacently on the same belt, a slight “drift” in one of the device’s internal clocks was noted following visual inspection (similar to Paul et al.’s work [26]). Consequently, data starting at the first full hour of the day until the last full hour of the day was examined. To account for participants’ varied adherence to the measurement protocol; MVPA, TPA, and sedentary time were expressed per hour of wear-time. Percentage of monitoring time spent at the various intensity levels were also calculated. Six paired t-tests were conducted to determine the differences in young children’s MVPA, TPA, and sedentary time (mins/hr) measured using both devices, at 15s and 60s epochs. A Bonferonni correction was applied to control for multiple comparison bias and to maintain an experiment-wise alpha of .05; consequently, all effects were reported at a level of significance of .008. Bland-Altman plots were used to assess agreement between Acticals and ActiGraphs for MVPA, TPA, and sedentary time. The difference was set as Actical minus ActiGraph for each intensity. To examine the apparent systematic bias within plots A, B, and F (Figure 1), bivariate correlations between the values on the x-axis and the y-axis were undertaken.

Results

Participant demographics

Twenty-eight 4 and 5 year olds (12 boys and 16 girls) participated in this study. Their average age, height, weight, and BMI percentile were 5.08 (SD = 0.7) years, 111.5 (SD = 6.6) cm, 19.4 (SD = 3.0) kg, and 51.11 (SD = 27.76), respectively. After wear-time parameters were applied, only 23 participants were retained for analyses. Average daily accelerometer wear time was 10.82 hours (SD = 0.97).
Rates of physical activity and sedentary time using a 15s epoch

Paired t-test results revealed that participants accumulated significantly lower rates of both MVPA \( t[22] = -12.75, p < .00, \text{Cohen’s } d = -2.93 \) and TPA \( t[22] = -5.75, p < .00, \text{Cohen’s } d = -1.52 \) as measured with the Actical method compared to the ActiGraph using a 15s epoch. A significantly higher level of sedentary time was noted via the Actical method in comparison to ActiGraph method \( t[22] = 11.00, p < .00, \text{Cohen’s } d = 1.73 \). See Table 2 for exact values.

Rates of physical activity and sedentary time using a 60s epoch

Paired t-test analyses identified that participants accumulated significantly lower rates of both MVPA \( t[22] = -11.57, p < .00, \text{Cohen’s } d = -2.87 \) and TPA \( t[22] = -12.50, p < .00, \text{Cohen’s } d = -2.54 \) as measured via the Actical method in comparison to the ActiGraph. A significantly higher level of sedentary time was noted with the Actical method in comparison to the ActiGraph method \( t[22] = 12.41, p < .00, \text{Cohen’s } d = 2.14; \text{ Table 2} \).

Comparing rates of physical activity and sedentary time – limits of agreement analysis

Bland-Altman plots for physical activity levels and sedentary time are shown in Figure 1. Specifics regarding limits of agreement (bias \( \pm 2 \text{SD} \)) between the two accelerometers are in Table 3. It was noted that 95.7\% \( (n = 22 \text{ of } 23) \), 95.7\% \( (n = 22 \text{ of } 23) \), 95.7\% \( (n = 22 \text{ of } 23) \), 95.7\% \( (n = 22 \text{ of } 23) \), 95.7\% \( (n = 22 \text{ of } 23) \), and 100\% \( (n = 23 \text{ of } 23) \) of the values were within 2 \text{SD} of the difference between the Actical and ActiGraph method for MVPA at 15s and 60s, TPA at 15s and 60s, and sedentary time at 15s and 60s, respectively. The systematic bias in Figure 1 (plots A, B, and F), were explored and a significant relationship \( r = -.41, p = .049 \) was only noted for the points in plot B (i.e., MVPA – 60s epoch).


Discussion

The primary objective of this study was to compare young children’s physical activity levels and sedentary time when simultaneously measured via Actical and ActiGraph accelerometers, and their associated protocols, to explore possible differences using these two approaches. Despite being previously identified as appropriate tools for measuring preschoolers’ physical activity and sedentary time, a lack of published comparability studies renders the results of such work challenging to interpret.

The findings of this study suggest a wide discrepancy in rates of physical activity and sedentary time as measured by both techniques at 15s and 60s epochs. More specifically, the ActiGraph method captured significantly higher rates of MVPA and TPA (regardless of epoch length) in comparison to the Actical method (i.e., 15s epoch: an approximate difference of 6.61 and 9.41 mins/hr of MVPA and TPA, respectively; 60s epoch: an approximate difference of 6.78 and 14.19 mins/hr of MVPA and TPA, respectively). In contrast, the Actical method reported a significantly higher rate of sedentary time among the sample at both 15s and 60s epochs (i.e., an approximate difference of 9.18 and 12.70 mins/hr at 15s and 60s epochs, respectively). These findings are in line with the preschool literature which has noted higher rates of MPVA and TPA, and lower rates of sedentary time, when using the ActiGraph approach as compared to that of the Actical (e.g., 8, 21, 34, 45).

Inspection of the Bland-Altman plots suggest that the limits of agreement (i.e., bias ± 2 SD) at each intensity level for both 15s and 60s epochs are quite wide. These differences are important to consider, and may suggest that both measurement approaches do not equally capture young children’s physical activity and sedentary time. By reviewing the plots for MVPA at 15s and 60s (Figure 1: A and B), it can be noted that as the time spent in MVPA increases, the
difference between the Actical and ActiGraph methods gets larger. Similar trends can be seen in the plots for TPA (C and D) and sedentary time (E and F); as the amount of time spent in TPA and sedentary activity increases, as does the difference between both measurement approaches. When comparing congruency in measurement, the two devices and their respective data processing protocols show the most similarity for TPA at a 15s epoch (Figure 1: C). While there appears to be a form of systematic bias present in plots A, B, and F, only plot B (MVPA – 60 seconds) was found to be statistically significant. This may suggest that as time spent in MVPA increases, as does the difference between the two measurement approaches. These results are salient and shed light on the present accelerometry-related interpretation issues.

Given that the children in this study were shown to have consistently accumulated higher rates of MVPA and TPA and a lower rate of sedentary time with the ActiGraph method, it can be postulated that there are differences in measurement across the two methodological approaches. As per the high correlations between count output from the two monitors reported in previous studies (26, 33), these results may actually reflect differences in the processing/conversion of data into various intensity levels (rather than the devices themselves). Specifically, the variation in values across the two accelerometer methods might be a result of differences in thresholds applied to the collected data (i.e., Pate et al.’s [24] cut-points were lower than those created by Pfeiffer et al. [27]), which is consistent with interpretations of Kahan et al.’s (18) work. As a result, it is possible that more activity counts were considered ‘active’ and less considered ‘sedentary’ in light of the ActiGraph cut-points applied, rather than the activity measured by this device. While the cut-points used for each device in this study were different, these cut-points were established using similar protocols, and are widely accepted in practice. Despite this, there are still large differences in activity. These results are noteworthy, as for the first time, the same
children have worn both device models and a large discrepancy in activity levels and sedentary time was observed.

This work highlights the need to be cautious when interpreting previous studies. For instance, the CHMS (8), which used Actical accelerometers to carry out data collection, have reported that approximately 84% of Canadian preschoolers (aged 3-4 years) are meeting the physical activity guidelines of 180 minutes of active play per day (at any intensity). However, when a different set of cut-points were applied to the same data (i.e., Pfeiffer et al.’s [27]); the same cut-points that were used in the present study), Colley and colleagues (8) noted a drastic decrease in activity counts classified as MVPA (from 14% to 0.5% of 5 year-old children meeting physical activity guidelines for this age group). Interestingly, based on the present findings of this paper and in light of the Actical/ActiGraph discrepancies, many more Canadian preschoolers may have met daily guidelines had activity data been recorded using the ActiGraph method (with Pate et al.’s cut-points [24]). This research further reinforces the notion that various cut-points for the same device also impact the accuracy of assessing young children’s activity levels and sedentary time.

The findings of this work are important because, to date, no study has provided the degree to which these two devices differ on activity levels and sedentary time. As a consequence of this study, researchers can now consider how their participants’ activity levels or sedentary time, in conjunction with the findings from the present study, fit with the literature. Specifically, researchers using the Actical method (with Pfeiffer et al.’s cut-points [27]) can now compare (with caution, particularly in light of the wide limits of agreement) their participants’ activity levels with those previously reported using the ActiGraph method (with Pate et al.’s cut-points [24]), and know that a rough discrepancy of approximately 6.74 mins/hr of MVPA and 9.52
mins/hr of TPA is anticipated at a 15s time sampling interval, or 6.91 mins/hr of MVPA and 14.34 mins/hr of TPA at a 60s time sampling interval.

This study identified a large discrepancy between devices which suggests that consistency in devices and cut-points is necessary for comparability data. This study also confirms that long-term measurements of physical activity and sedentary time need to occur using the same device so that measurement error does not compound any changes. While it can be argued that these devices vary simply as a consequence of the difference in technology and sensitivity, this paper provides further insight into how much they differ as a consequence of their associated protocols (including specific cut-points and sampling interval) which will allow researchers to account for differences in their study results when compared to the literature. Should researchers use Acticals with Pfeiffer et al.’s cut-points (27), they can anticipate a much lower rate of MVPA and TPA when comparing to studies which have used ActiGraphs with Pate et al.’s cut-points.

When considering the mean rates of MVPA measured at both 15s and 60s epochs, more activity was captured using a shorter time sampling interval. This was not a surprising finding; given young children’s sporadic activity behaviors, such large variances between epoch lengths could result in major differences in daily rates of MVPA. These findings are consistent with the investigations by Hislop et al. (16) and Vale et al. (42). Similarly, Obeid and colleagues suggested that the number of missed minutes of MVPA increased as the applied time sampling interval lengthened (e.g., a daily average of 2.9, 9.0, and 16.7 missed minutes of MVPA resulted when a sampling interval of 15s, 30s, and 60s was applied to preschoolers’ activity data in comparison to a 3s epoch, respectively)(21). Shorter epoch lengths also resulted in significantly more minutes of activity being classified as sedentary, but less as TPA. This is potentially
troublesome as preschoolers may be seen as less active than previously thought when shorter epoch lengths are used to assess their activity levels.

**Limitations**

One limitation was the lack of an observation component and/or VO₂ measurements within this study; ‘validated’ activities of different intensities of physical and sedentary activity were not carried out, thus we do not know which device is better and/or closer to capturing ‘more accurate’ values of physical activity and sedentary time. As a means of improving the interpretability of accelerometry data across studies, future work should focus on finding ways to enhance the comparability of physical activity data collected using different devices and cut-points. This is particularly important given that no one set of cut-points has been identified as the ‘gold standard’, and the application of different cut-points makes comparisons challenging. Lastly, given that only participants who met the inclusion criteria for both devices were included, it is possible that participants with sufficient data on only one device (i.e., Actical or ActiGraph) were excluded from analysis.

**Conclusion**

This is the first study to examine the differences in young children’s physical activity levels and sedentary time measured via Actical and ActiGraph accelerometers, and their associated protocols, simultaneously. Given the unique activity patterns of this population, coupled with the challenge of measuring and converting physical activity data, the results of this work have important implications for physical activity researchers interested in interpreting the activity levels of their participants, in the context of previous research. Moreover, the present study’s findings have highlighted that physical activity levels are reported as significantly lower
and sedentary time as significantly higher when measured using Actical accelerometers, as compared with the ActiGraph model, in this age group. While this information is insightful for drawing conclusions on various studies using the two approaches, until a unified tool with corresponding cut-points is accepted in the literature, the challenge of interpreting reported physical activity levels and sedentary time will continue.

Acknowledgements

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References


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A

B
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Figure 1: Bland-Altman plots showing differences in activity (min/hr) between accelerometer protocols (Actical minus ActiGraph) plotted against mean activity rates for (A) MVPA with 15s epoch, (B) MVPA with 60s epochs, (C) TPA with 15s epochs, (D) TPA with 60s epochs, (E) sedentary time with 15s epochs, and (F) sedentary time with 60s epochs. Solid lines represent the mean difference (bias) and dashed lines the 95% limits of agreement. MVPA = moderate-to-vigorous physical activity; TPA = total physical activity.
### Table 1: Applied Preschooler-Specific Cut-Points for Actical and ActiGraph Accelerometers at 15s and 60s Epoch

<table>
<thead>
<tr>
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<th>ActiGraph (24)</th>
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<td></td>
<td>Sedentary</td>
<td>MVPA</td>
<td>TPA</td>
<td>Sedentary</td>
</tr>
<tr>
<td>15 second Epoch</td>
<td>&lt;50 counts</td>
<td>≥715 counts</td>
<td>≥50 counts</td>
<td>&lt;38 counts</td>
</tr>
<tr>
<td>60 second Epoch</td>
<td>&lt; 200 counts</td>
<td>≥ 2860 counts</td>
<td>≥ 200 counts</td>
<td>&lt; 152 counts</td>
</tr>
</tbody>
</table>

*Note. MVPA = moderate-to-vigorous physical activity; TPA = total physical activity. See Temple et al. (34; Actical) and Hnatiuk et al. (17; ActiGraph) for details regarding the cut-points for sedentary time and light physical activity.*
Table 2: Mean (SD) Physical Activity and Sedentary Time (Mins/Hr and Percentage of Wear Time) and Ranges of Physical Activity and Sedentary Time for Actical and ActiGraph Methodological Approaches at 15s and 60s Epochs

<table>
<thead>
<tr>
<th>Epoch Length</th>
<th>Actical</th>
<th>ActiGraph</th>
<th>Actical</th>
<th>ActiGraph</th>
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<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Range</td>
<td>Mean (SD)</td>
<td>Range</td>
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<tr>
<td>Sedentary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate</td>
<td>42.66 (5.94)</td>
<td>32.58-54.21</td>
<td>33.48 (4.58)</td>
<td>21.51-42.53</td>
</tr>
<tr>
<td>% of wear time</td>
<td>71.10 (9.90)</td>
<td>54.31-90.35</td>
<td>55.80 (7.64)</td>
<td>35.86-70.89</td>
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<td>MVPA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate</td>
<td>2.63 (2.06)</td>
<td>0.68-10.53</td>
<td>9.24 (2.44)</td>
<td>5.37-14.67</td>
</tr>
<tr>
<td>% of wear time</td>
<td>4.39 (3.43)</td>
<td>1.13-17.55</td>
<td>15.41 (4.06)</td>
<td>8.96-24.45</td>
</tr>
<tr>
<td>TPA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate</td>
<td>22.31 (7.11)</td>
<td>13.33-46.87</td>
<td>31.72 (5.15)</td>
<td>20.60-39.30</td>
</tr>
<tr>
<td>% of wear time</td>
<td>37.18 (11.85)</td>
<td>22.22-78.12</td>
<td>52.86 (8.58)</td>
<td>34.33-65.50</td>
</tr>
</tbody>
</table>

Note. A significant difference (p < .008) in activity rates was found between Actical and ActiGraph data at all intensities for both 15s and 60s epochs; MVPA = moderate-to-vigorous physical activity; TPA = total physical activity; SD = standard deviation.
Table 3: Mean Differences and Limits of Agreement of Physical Activity and Sedentary Time in Mins/Hour as Measured by Actical and ActiGraph Methodological Approaches at 15s and 60s Epochs (Bias ± 2 SD)

<table>
<thead>
<tr>
<th>Epoch Length</th>
<th>Intensity Level</th>
<th>Sedentary</th>
<th>MVPA</th>
<th>TPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>15s</td>
<td>9.18 ± 7.84</td>
<td>-6.61 ± 4.87</td>
<td>-9.41 ± 15.37</td>
<td></td>
</tr>
<tr>
<td>60s</td>
<td>12.70 ± 9.62</td>
<td>-6.78 ± 5.50</td>
<td>-14.19 ± 10.67</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* MVPA = moderate-to-vigorous physical activity; TPA = total physical activity.