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Physical activity patterns in youth with intellectual disabilities

Samantha J. Downs[a], Stuart J. Fairclough[a,b], Zoe R. Knowles[c], and Lynne M. Boddy[c],

a. Department of Sport and Physical Activity, Edge Hill University, St Helens Road, Ormskirk, L39 4QP.

b. Physical Education and Sport Sciences Department, University of Limerick, Limerick, Ireland.

c. The Physical Activity Exchange, Research Institute for Sport and Exercise Sciences, Liverpool John Moores University, 62 Great Crosshall Street, Liverpool, L3 2AT,UK.

Corresponding author: Samantha Jayne Downs

Mailing address: Department of Sport and Physical Activity, Edge Hill University, St Helens Road, Ormskirk, L39 4QP.

Phone number: +44(0) 1695 584840

Email: Samantha.Downs@edgehill.ac.uk

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Abstract

The aim of this study was to assess the physical activity (PA) patterns of youth with intellectual disabilities (ID). PA was monitored for 7 days in 70, 5 – 15 year old participants using accelerometers. Thirty two participants were included in the final analysis. Habitual PA and the number of continuous bouts accrued for a range of bout lengths (5-600 seconds) for light (LPA), moderate (MPA) and vigorous (VPA) intensity PA were calculated. Multivariate analysis of covariance was used to assess differences in the number of continuous bouts by sex, age, ID group and between week and weekend days. Participants exhibited short sporadic bursts of activity. The number of continuous bouts decreased as the intensity and duration increased. Few differences in PA patterns were reported by sex, ID group, age group and between week and weekend days, possibly due to the generally low PA levels within this population.

Key words: tempo, Autistic Spectrum Condition, accelerometry, disability, children and adolescents

Physical activity patterns in youth with intellectual disabilities

It is well established that physical activity (PA) is associated with a range of mental (WHO, 2010) and physical (Ekelund et al., 2005) health benefits. The Chief Medical Officer (CMO) recommends that children and young people (5 – 18 years) should engage in a minimum of 60 minutes and up to several hours of moderate to vigorous intensity PA (MVPA) every day (Department of Health, 2011). Despite the established health benefits of PA, many children and adolescents do not meet the minimum recommended amount of PA (Griffiths et al., 2013). Moreover, a wealth of evidence describing youths PA engagement, correlates, determinants and PA behaviours has been conducted, yet data investigating the PA patterns, of children and adolescents with intellectual disabilities (ID) is rare. Patterns of PA refers to how individuals accrue PA, providing greater detail on the PA behaviours of individuals' rather than simply providing total levels of PA. ID can range in severity from mild through to severe, for the current study ID are defined as "a significantly reduced ability to understand new or complex information and to learn and apply new skills (impaired intelligence). This results in a reduced ability to cope independently (impaired social functioning), and begins before adulthood, with a lasting effect on development" (WHO, 2014, para. 1). Emerging evidence suggests that PA levels of children and adolescents with ID are consistently lower when compared to youth without ID and they do not achieve the recommended PA guidelines (Hinckson & Curtis, 2013). Furthermore, children with ID reportedly spend 424min (boys) and 452.8 (girls) repsectively sedentarty (Boddy, Downs, Knowles & Fairclough, 2015), suggesting that the combination of low activity and high sedentary behaivour is an important health issue within the ID population. Hinckson and Curtis (2013) also highlights that methods and procedures between studies are inconsistent (i.e. epoch length used) making comparison of studies difficult. Accurate measurement and understanding of PA levels, behaviours and patterns of this population are fundamental to build on association between PA, health and disease (Biddle, Gorely, & Stensel, 2004), and to ensure that appropriate PA interventions and activities are implemented (Hinckson & Curtis, 2013).

Saris (1986) reported that children's natural activity patterns do not typically involve prolonged activity bouts. Further, Bailey et al. (1995) highlighted via direct observations that PA patterns of children without ID were sporadic involving short bursts of high intensity PA broken up with brief interludes of low and moderate levels of PA. These sporadic PA patterns were also confirmed by Baquet, Stratton, Van Praagh, and Berthoin (2007) when objectively investigating children's PA patterns using accelerometers. The rapid fluctuations between intensities (rest, low, moderate, vigorous) make PA patterns amongst children and adolescents difficult to measure (Bailey et al., 1995). Furthermore, Baquet et al. (2007) reported that the majority of PA bouts lasted less than 10s in duration, which included 80% of moderate intensity PA (MPA) bouts, 93% of vigorous intensity PA (VPA) bouts, and 96% of very high intensity PA (VHPA) bouts. Due to characteristics that children some with ID exhibit in day to day life it is possible that they may demonstrate even more sporadic PA behaviours compared to children without ID. For example, children with Angelman syndrome (another form of ID) exhibit short attention spans (Kyllerman, 2012). It is unclear though, whether the short attention span for these children is present in all aspects of their daily life, and in particular when engaging in PA.

To our knowledge, no study has investigated PA patterning that specifically examines continuous bouts of light, moderate and vigorous PA in durations of <5 minutes in youth with ID. This is important to improve our understanding of how youth with ID participate in PA. As children and adolescents with ID are consistently reported to be less active than their non-ID peers, such novel research investigating the tempo of PA in this population is warranted to provide key information to improve accuracy of PA measurement. Furthermore, by learning more about the activity patterns of individuals with ID population, we can better design PA intervention programmes that take natural PA patterns and preferences into account. Thus, the aims of this study were to: 1. objectively investigate habitual PA sedentary behaviours in children and adolescents with ID, and 2. to examine the tempo of PA by sex, age and disability.

Methods

Participants

Initial contact was made to two local authorities in the North West of England who supplied a list of appropriate special educational needs (SEN) providers within their respective areas. Twelve SEN schools were invited to take part in the research. School gatekeeper consent was provided from four SEN schools including two Primary SEN schools (4 – 11 years), a specialist sports SEN High school (11-18 years), and a High SEN school (11-18 years). The two Primary schools and one of the High schools enrolled children and adolescents who had severe learning disabilities (SLD) or profound and multiple learning disabilities, the specialist sports High school enrolled children and adolescents who had moderate learning disabilities (MLD). Study information packs including informed parental consent and participant assent were distributed inviting approximately 280 pupils to take part within the study. Full parent/carer consent was provided for a total of seventy 5 – 15 year old children and adolescents (mean age 9.97 years, n = 57 boys) from the four schools equating to a ~25% response rate in total. All participants had a statement of SEN which was written by the Local Authority as a result of them having either; MLD (n = 19) or SLD (n = 51), some participants also had one or more additional diagnosis of specific condition/s. For example, 27 participants were diagnosed with SLD with an additional diagnosis of autistic spectrum condition (ASC). Additional conditions and disabilities of this sample included: ASC, Down syndrome, global developmental delay, microcephaly, cerebral palsy, attention deficit hyperactive disorder, Angleman syndrome, dyspraxia and visual impairment. The SEN statement outlines the individual's Primary disability and any additional diagnoses, with this information the schools and parents/carers provided details on the participants' Primary diagnosis. The most common additional diagnosis was ASC making up over half the sample (51%), as a result and to be comparable with previous studies (Bingham et al., In Press), for this study participants were then grouped into Autistic spectrum condition (ASC) (n = 36) or non-ASC (n = 34) categories. Within the ASC and non-ASC subgroups were both participants with MLD and SLD. Full institutional ethical approval was granted prior to the start of the study.

Anthropometrics

Data collection took place on the school sites at two time points; January 2013 and September 2013. Stature and sitting stature were measured to the nearest 0.1cm using a portable stadiometer (Leicester Height Measure, Seca, Birmingham, UK). Body mass was assessed to the nearest 0.1 kg using calibrated scales (Seca, Birmingham, UK). Standard measurement techniques were used (Lohman, Roche, & Martorell, 1988). Body mass index (BMI) (body mass (kg) / stature^2 (m^2)) and BMI Z-scores were calculated for each participant (Cole, Freeman, & Preece, 1995). Somatic maturation was calculated using standard regression equations (Mirwald, Baxter-Jones, Bailey, & Beunen, 2002). BMI and somatic maturation are variables known to influence PA (Ekelund et al., 2012) and fitness (Boddy et al., 2014) for children and adolescents. Calculating BMI and somatic maturation provides an opportunity for them to be accounted for within analysis models. Similarly, the weather can affect the levels of PA and sedentary behaviours engaged in by individuals (Goodman, Paskins, & Mackett, 2012). As a result throughout the monitoring periods local daily weather records were sourced (Tutiempo Network, S. L.) and collected for rainfall and temperature, after which an average for the monitoring week was calculated and retained for analysis.

Physical activity assessment

Uniaxial accelerometers (ActiGraph, Model GT1M, ActiGraph LLC, Pensacola, USA) were used to measure participants' PA levels over 7 days. The ActiGraph accelerometer is widely used with children and adolescents to objectively assess the intensity and volume of PA engaged in (Trost et al., 1998). The researcher distributed, fitted and verbally explained how, where, and when to/not to wear the monitor to participants and school staff. Participants were asked to wear the accelerometer over their right hip for 7 consecutive days during all waking hours except when engaging in water based activities i.e., bathing or swimming.

Accelerometers were set to record data using a 5 second epoch. This epoch length is commonly used in youth without disability due to the sporadic nature of PA exhibited to ensure that short bursts of high intensity PA are not underestimated (Baquet et al., 2007; McClain, Abraham, Brusseau, & Tudor-Locke, 2008). Twenty minutes of consecutive zero counts were used to define non-wear time (Catellier et al., 2005). Participants were included in analysis if they had worn the monitors for at least 480 minutes (8hrs) per day (min/day) for a minimum of three days in total (Wells et al., 2013). This criterion has previously been used in youth and demonstrated acceptable reliability, while limiting numbers of participants excluded from the final analysis (Mattocks et al., 2008). Studies involving children and adolescents with ID tend to consist of a small cohort of participants (Hinckson & Curtis, 2013) and therefore maximising the sample size within this research area is crucial. Sedentary time (ST) was coded as ≤100 counts per minute (cpm), light intensity physical activity (LPA)

101-2295cpm, MPA 2296-4011cpm, and VPA ≥4012cpm (Evenson, Catellier, Gill, Ondrak, & McMurray, 2008).

ActiLife software (ActiGraph, ActiLife version 6.10.1, ActiGraph LLC) was used to score accelerometer data into the different PA thresholds and bout durations of 5s, 10s, 15s, 30s, 60s, 180s, 300s, and 600s. Data were manually inspected to examine PA patterns for individual participants, initially calculating the weekly number of continuous PA bouts for all durations. The daily average time spent in each PA intensity per bout duration was calculated for each participant (Baquet et al., 2007).

Statistical analysis

One-way analysis of variance (ANOVA) was used to examine differences in stature, sitting stature, weight, BMI data and somatic maturation by sex. Multivariate analysis of covariance (MANCOVA) was used to assess habitual ST, LPA, MPA, VPA, moderate to vigorous physical activity (MVPA) and total PA in boys and girls, controlling for BMI, accelerometer wear time, maturation, temperature and rainfall (MANCOVA 1). MANCOVA was also used to assess the differences by sex (MANCOVA 2), age (MANCOVA 3) and ID (MANCOVA 4) in the number of continuous PA bouts for each duration, controlling for BMI, accelerometer wear time, maturation, sex (except MANCOVA 2), temperature and rainfall. An additional analysis (MANCOVA 5) was conducted to compare weekday to weekend PA and bout duration data for LPA, MPA, and VPA, controlling for BMI, accelerometer wear time, maturation, sex, temperature and rainfall. SPSS V21 (SPSS Statistics, IBM) software was used to conduct all statistical analyses, and an alpha value of $P \leq 0.05$ was used to denote statistical significance. In addition partial eta squared (η_p^2) were used to provide estimates of effect sizes throughout (Cohen, 1973). Reporting the η_p^2 when using multivariate statistics is supported by Brown (2008) moreover, η_p^2 can also minimise the effects that can cause issues when reporting effect size (ES) through other means, e.g., eta squared. The following values, outlined by Cohen (1988), were used to define the effect size magnitude: 0.01 – 0.06 = small effect, 0.06 – 0.14 = medium effect, >0.14 = large effect. Lakens (2013) described that the ES is the most important value when presenting primary data from empirical studies. Sullivan and Feinn (2012) suggest that the P value alone 'is not enough', and Field (2013) continues to explain, that a study's statistical significance does not provide detail about the importance or magnitude of an effect. In fact, it is the ES that allows researchers to outline the practical implications of their findings which can then be applied to 'real life' (Lakens, 2013). Moreover, reporting the ES is particularly useful when statistic tests provide non-significant results as important effects may still be apparent (Field & Wright, 2006; Sullivan and Feinn, 2012). Non-significant findings can be a result of a small sample size (which is common in this research area) as this is likely to result in analyses that are underpowered preventing the detection of differences at $P < 0.05$ (Batterham & Hopkins, 2006).

Results

Thirty two participants failed to meet the accelerometer wear time inclusion criteria for analysis; therefore the sample size was reduced to thirty eight participants. There were no significant differences for somatic maturation, BMI, sex, ID severity (MLD and SLD) or age group (Primary and High) ($P > 0.05$) between participants who were included in the final analyses and those that were excluded. Table 1 displays descriptive characteristics of boys and girls and the whole sample. Girls were more mature than boys ($F(1, 36) = 10.21$, $p = .003$). No significant differences were observed between boys and girls for stature ($F(1, 37) = 0.68$, $p = .416$), sitting stature ($F(1, 36) = 1.22$, $p = .277$), weight ($F(1, 37) = 0.84$, $p = .365$) or BMI ($F(1, 37) = 0.64$, $p = .429$) data.

[INSERT TABLE 1 HERE]

Habitual physical activity

Thirty eight participants (29 boys and 9 girls) met wear time criteria and were included in the final analysis, resulting in a 54% compliance rate. Mean habitual MVPA levels for all participants were 49.4 minutes per day (min•day^{-1}), with only 23.7% (n = 9 (8 boys)) of participants meeting the 60 min•day^{-1} MVPA guideline for health. Moreover, the majority of the participants' waking hours (i.e., time spent awake) were spent in ST (410.8 min•day^{-1}) and the amount of time spent in each PA component reduced as intensity increased. Further, there were no significant differences between boys and girls in the time spent in sedentary activities ($F(1, 31) = 0.15$, $p = .698$, $\eta_p^2 = 0.01$), LPA ($F(1, 31) = .00$, $p = .995$, $\eta_p^2 = .00$), MPA ($F(1, 31) = 0.83$, $p = .369$, $\eta_p^2 = 0.03$), VPA ($F(1, 31) = 1.50$, $p = .230$, $\eta_p^2 = 0.05$), MVPA ($F(1, 31) = 1.50$, $p = .230$, $\eta_p^2 = 0.05$) and total PA ($F(1, 31) = 0.15$, $p = .698$, $\eta_p^2 = 0.01$) (Table 2). However, boys tended to engage in more PA than girls and results demonstrate some large and potentially meaningful differences, for example there was a 12 min•day^{-1} sex difference in MVPA. The non-significant findings may be a result of the small sample size resulting in an under powered data set (Batterham & Hopkins, 2006).

[INSERT TABLE 2 HERE]

Physical activity patterns whole week

Table 3 and Table 4 show the variability of continuous bouts of PA between boys and girls and between non-ASC and ASC groups according to their duration and intensity. Boys accrued significantly more continuous LPA bouts lasting at least 180s ($F(1, 31) = 4.44$, p =

0.043, $\eta_p^2 = 0.13$) and MPA bouts lasting at least 15s ($F(1, 31) = 5.65$, $p = 0.024$, $\eta_p^2 = 0.15$) than girls. Moreover, children in the non-ASC group accumulated significantly more continuous LPA bouts lasting at least 5s ($F(1, 30) = 4.16$, $p = .050$, $\eta_p^2 = 0.12$) , 10s ($F(1, 30) = 4.63$, $p = .040$, $\eta_p^2 = 0.13$) and 15s ($F(1, 30) = 4.41$, $p = .044$, $\eta_p^2 = 0.13$) in comparison to children in the ASC group (Table 4). Differences in LPA 30s bouts between the non-ASC and ASC groups approached statistical significance ($F(1, 30) = 4.08$, $p = .052$, $\eta_p^2 = 0.12$). Primary age children accrued significantly fewer bouts of at least 180s (Primary 0 [0.03] and High 0.2 [0.04], $F(1, 30) = 21.08$, $p <0.001$, $\eta_p^2 = 0.41$) continuous bouts for MPA than High school aged children. No participants engaged in any continuous bouts of PA at any intensity lasting 300s or more.

[INSERT TABLE 3 & 4 HERE]

Physical activity patterns weekdays and weekend days

When assessing continuous bouts of PA for weekdays, boys (23.8 [1.7]) accrued significantly more MPA bouts lasting at least 15s than girls (13.6 [3.7], $F(1, 31) = 4.94$, $p = .034$, $\eta_p^2 = 0.06$). Also for weekdays, children in the non-ASC group accumulated significantly fewer VPA bouts lasting at least 180s (0 [0.01]) than children in the ASC group (0.1 [0.02], $F(1, 30) = 6.21$, $p = .018$, $\eta_p^2 = 0.17$). Primary aged children accrued significantly fewer continuous bouts for MPA lasting at least 30s (Primary 0.8 [0.7] and High 5.4 [0.9], $F(1, 30) = 10.92$, $p = .002$, $\eta_p^2 = 0.27$), at least 60s (Primary -0.4 [0.2] and High 1.7 [0.3], $F(1, 30) = 18.71$, $p < 0.01$, $\eta_p^2 = 0.38$) 180s (Primary -0.1 [0.03] and High 0.3 [0.04], $F(1, 30) = 48.55$, $p < 0.01$, $\eta_p^2 = 0.62$) and at least 300s (Primary 0 [0.01] and High 0.4 [0.01], $F(1, 30) = 8.33$, $p = .007$, $\eta_p^2 = 0.22$) durations on weekdays in comparison to High school aged children. When assessing continuous bouts of PA for weekend days, boys (10.9 [2]) accumulated significantly more 60s bouts of LPA than girls (-2.1 [5.2], $F(1, 18) = 4.96$, $p = .039$, $\eta_p^2 = 0.22$).The additional analyses assessing weekdays to weekend days showed significant differences in VPA lasting at least 30s (weekday 4.6 [0.7] and weekend 1.9 [0.9], $F(1, 55) = 5.69$, $p = .020$, $\eta_p^2 = 0.09$) and at least 60s (weekday 0.8 [0.2] and weekends 0.1 [0.2], $F(1, 55) = 6.18$, $p = .016$, $\eta_p^2 = 0.10$) bouts. No other significant differences were observed.

Figure 1 shows the percentage of continuous bouts for each duration and PA intensity. For the whole sample 87% of LPA bouts, 95% MPA bouts and 91% VPA bouts lasted 10s or less. No 300s or 600s continuous bouts of light, moderate or vigorous PA were recorded for girls or boys. Furthermore, no continuous bouts of MPA were recorded for girls and no continuous bouts of VPA were recorded for boys and girls that lasted for ≥180s duration.

[INSERT FIGURE 1 ABOUT HERE]

Discussion

This study aimed to investigate habitual PA and sedentary behaviour examining the tempo of PA by sex, age and disability in children and adolescents with ID. The results demonstrated that participants did not engage in enough health enhancing PA to meet the CMO's PA recommendations (≥60 MVPA every day) (Department of Health, 2011). Only 23% (n = 9) of participants achieved and/or exceeded these guidelines. Average MVPA levels for all participants were 49.4 min•day^{-1}, which are similar to those recently reported by Bingham et al. (In Press) who assessed activity levels of 25 children with SEN, however differences in the two studies methods were apparent, for example Bingham, Boddy, Ridgers and Stratton (In Press) used the Freedson, Pober, and Janz (2005) accelerometer cut points to define PA intensity whereas the current study used Evenson et al. (2008) cut points. Differences like this make comparing studies and suggesting consistency between results somewhat problematic, a consistent approach to activity monitoring and data treatment is needed. The low levels of habitual PA engaged in by the majority of participants within this study supports previous research e.g., Hinckson and Curtis (2013), and suggests that this population compared to mainstream peers may be at an increased risk of various health related diseases and conditions that are associated with inactivity. Appropriate PA interventions are needed to address the low activity levels observed in this population, which may provide benefits to physiological (Boddy et al., 2014), psychological (Fedewa, Candelaria, Erwin, & Clark, 2013) and academic and cognitive development (Fedewa & Ahn, 2011). Further, accurate assessments of PA levels and behaviours are needed to ensure firstly, that interventions are appropriately designed and secondly, that interventions are assessed correctly providing accurate findings (Hinckson & Curtis, 2013).

The results from the main analyses investigating the tempo of PA showed that the majority of PA engaged in by participants was gained in short bouts of less than 15 s, with the number of bouts decreasing as the bout duration increased (Figure 1). Further, no participants accrued any continuous bouts of LPA, MPA or VPA lasting >300s. The short bursts of PA and the absence of prolonged continuous bouts of PA are similar to previous findings which assess PA patterns of children without ID using both observational (Bailey et al., 1995) and objective (Baquet et al., 2007) methods. The findings of this study though are novel as it is the first to investigate PA patterns in children and adolescents with ID assessing continuous bouts lasting 5s and more. Comparatively, Whitt-Glover, O'Neill, and Stettler (2006) investigated PA patterns in siblings (aged between 3 – 10 years) with and without DS. The study used methods somewhat similar to those of our own but did not assess LPA, also, different accelerometers (Actitrac activity monitor) and PA intensity threshold values were used. Collectively the sample and methodology differences limits comparability between Whitt-Glover et al. (2006) study and the current study.

Typically within studies involving children without disability it is reported that boys engage in significantly more PA at a greater frequency, duration and intensity than girls e.g. Rowlands, Pilgrim, and Eston (2008) and Griffiths et al. (2013). Furthermore, Baquet et al. (2007) reported that PA patterns differ between sexes, with boys spending significantly longer periods in VPA. In the current study these differences were not apparent. Although there was a trend towards boys accruing more continuous PA bouts than girls, significant differences were only observed for LPA lasting 180s and MPA lasting 15s demonstrating medium and large effect sizes, respectively. The lack of significance differences between sexes in PA bouts may be because the vast majority of participants within this sample were low active in general, regardless of their sex. Further, the sex differences in the current study may have been attenuated as maturation was controlled for. Additionally, the ratio of boys to girls (29: 9) was unequal, and this is typical amongst studies examining PA with this population (Hinckson & Curtis, 2013). This unequal ratio may be due to the uneven sex ratio in the ID population more generally; for example, for idiopathic autism the male: female ratio is 4-10:1 which increases as the severity of ASC decreases (Folstein & Rosen-Sheidley, 2001), as a result, such differences in prevalence makes having equal sized sex groups difficult to achieve in this population. Moreover, unequal and small sample sizes impact on the outcome of the statistical tests performed (Batterham & Hopkins, 2006). As was alluded to earlier, these factors could effect clinically meaningful findings resulting in non-significant P values. This may be an issue throughout the study particularly when examining sex differences due to the unequal groups, and has been reported previously in PA research in children and adolescents with ID (Einarsson et al., 2015). Because of the higher prevalence of ID amongst males compared to females the unequal sex sub group is difficult to overcome (Einarsson et al., 2015).

Participants in the present study were grouped on their ID as either ASC or non-ASC. Participants in the non-ASC group accumulated significantly more continuous LPA bouts in multiple durations (5s – 15s) in comparison to the ASC group. These results along with those which approached statistical significance (i.e., LPA 30s bouts between non-ASC and ASC) also showed medium effect sizes (η_p^2 = 0.06-0.14), which again suggest some differences were apparent. Other evidence has described children with ASC as less active than their non-ASC peers (Bingham et al., In Press), however these authors did not investigate differences in PA bouts between ID groups. The reduced continuous bouts observed in the ASC group may be partly explained by differences in play behaviours and group size. Compared to non-ASC peers, ASC children and adolescents have been observed to engage in more solitary play (e.g. imaginative play) and less group play (Boddy et al., 2015), which is positively associated with MVPA in youth without ID (Ridgers, Stratton, & McKenzie, 2010).

Phillips and Holland (2011) not only reported an age related decline in PA levels of individuals with ID, but also a significant reduction in the number of steps completed by participants with severe ID compared to those with mild and moderate ID was observed. Further, Pan and Frey (2006) observed that Primary school aged children with ASC engaged in more MVPA continuous bouts in 5 min, 10 min and 20 min durations than children and adolescents in middle and high schools. These findings suggest an age related decline in habitual PA and in continuous bouts of MVPA. However, the results from the current study contradict those described above demonstrating that Primary aged children accumulated significantly fewer continuous bouts of PA than High school age children and adolescents, showing a significant difference and a large effect for MPA in 180s duration. In our sample the majority of High school aged participants attended a school for children with moderate ID whereas the Primary aged participants were all based within schools for children with severe or profound multiple learning disabilities. The conflicting findings and the differences between Primary and High school aged children's and adolescents' continuous bouts of PA may be explained by the differences in the severity of their ID. Furthermore, although Phillips and Holland (2011) did not assess continuous bouts of PA their findings may still relate to the present study with regard to the association between habitual PA engagement and ID severity. It is very difficult to determine whether age or ID severity were more important, however, in the future analysis could include either school type (MLD or SLD) or school age (Primary or High), or perhaps include ID severity as a covariate to try and control at least one of these factors. Further research is needed to examine PA tempo by ID severity (mild, moderate and severe) and age so that we can fully understand PA behaviours within these groups. However, to date, no research has investigated the tempo and continuous bouts of PA within this population to this extent; assessing shorter bouts of PA (5s, 10s, 15s etc.) allowing associations to be made between PA patterning and data describing how these children and adolescents are active. This level of detail surrounding the tempo of PA allows researchers to more fully understand the PA behaviours of youth with ID. Understanding how individuals engage in PA in addition to how much PA they engage in provides evidence of the natural PA behaviours within this group, and informs the design of PA intervention studies by allowing researchers to design activities that are similar to and compliment these behaviours.

Literature within mainstream populations describes how children's PA behaviours can be influenced by the environment where the activity takes place (Fairclough, Boddy, Mackintosh, Valencia-Peris, & Ramirez-Rico, 2014). Further, the family and home setting may influence PA, for example positive associations are reported between family social support and PA engagement out of school including weekends (McMinn, Griffin, Jones, & van Sluijs, 2013). It is important that the full week's (weekdays and weekends) PA behaviours are captured to ensure that behaviours are accurately assessed and suitable interventions are appropriately implemented (Corder et al., 2013). When comparing weekdays to weekend days, significant differences in PA patterns were observed for VPA in 30s and 60s durations with more continuous bouts being accrued on weekdays. However, no significant differences between weekdays and weekend days were observed for habitual PA at any intensity. In comparison differences in habitual PA are noted within mainstream populations, for example, at weekends most children would usually engage in less MVPA than on weekdays (Fairclough et al., 2014), although Fairclough et al. (2014) did not examine PA bouts and therefore it is difficult to offer comparison to the present study. Rowlands et al. (2008) however did examine the frequency and duration of PA bouts (≥4 s and ≥5 min) and differences between weekdays and weekend days in a cohort of 9 – 11 year old children. Results demonstrate that the duration of bouts was greater during the week compared to at weekends, also, the amount of participants achieving a ≥5 min bout of at least VPA intensity reduced on weekends compared to weekdays (Rowlands et al., 2008). The higher amounts and longer bout durations reported on weekdays is similar to the current study's findings, however, no participant's in the current study accrued any continuous PA bouts lasting at least 5mins in any intensity, thus, suggesting that children with ID engage in less continuous bouts of PA compared to those without ID. More research is needed to support this notion examining PA bout differences between weekdays and weekend days in children with ID, however our findings show medium and large effect sizes which suggest meaningful differences likely exist. It may be suggested that both populations are more active throughout the week compared to at the weekend though perhaps in different ways. For example, Fairclough, Beighle, Erwin, and Ridgers (2012) reports children without disability to be more active outside of school compared to during school, whilst opportunities for children and adolescents with ID to be active outside of school may not be as easily accessible (Downs, Boddy, Knowles, Fairclough, & Stratton, 2013). Moreover, the current study suggests that participants engaged in more sustained bouts of VPA on weekdays compared to weekend days, perhaps this is down to the variety and regularity for PA engagement in the school environment. Further, a possible explanation for the reduction in PA levels at weekends in mainstream populations may be linked to the routinely organised PE lessons, recess, and activity/ sports clubs and also the additional opportunities for unstructured PA via active travel and play that are available on school days (Fairclough et al., 2012). In contrast, within SEN schools opportunities to be active during the week are not as easily accessible particularly after school; this can be due to a number of factors including access, transport, staffing and support (Downs et al., 2013; Downs et al., 2014). Therefore when compared to children without ID it is perhaps unsurprising that children and adolescents with ID exhibit reduced levels of PA due to the lack of opportunities to be physically active regularly. Moreover, this sample of children and adolescents were inactive throughout the week regardless of the day, therefore providing a low baseline from which a limited decline in PA was possible.

Limitations

This study has a number of limitations. Firstly, the sample size was small which reduced the statistical power to detect differences, also, there were issues with accelerometer adherence, which reduced the sample size further making the option of imputing missing data unfeasible. However, relative to previous research that has investigated PA in children and adolescents with ID the sample size was comparable (Hinckson & Curtis, 2013). Furthermore, PA tempo based research by Bailey et al. (1995) and Baquet et al. (2007) used small sample sizes (n = 15 and n = 26 respectively). For the current study parents and carers were asked to ensure that participants were wearing the ActiGraph monitors every day, no additional adherence strategies were implemented (e.g. incentives, rewards). No studies have investigated accelerometer adherence in youth with ID. It is suggested that in order to improve accelerometer adherence moving forward, further investigation is needed to better understand methods that may be suitable to promote adherence specifically for ID populations. As an example, this may include morning reminders via text messaging service to parents/carers ensure their child is wearing the monitor or to prompt them to put it on. Further, for some of the participants' the unfamiliarity of the monitor and feeling restricted by the belt was a concern resulting in them refusing to wear the monitor. Perhaps working with the school staff to design a feasible induction process to ensure participants are familiar with the equipment used including the monitor may help with adherence. This study did not assess the reactivity by participants when wearing the monitor, as a result authors were unable to depict the typical length of time participants wore the monitor for, for example. Further, authors could not report whether participants reacted or behaved any differently when wearing the accelerometer, this information would be particularly useful for future researchers in order to control for influential factors and additionally improve assessment procedures. The data collection was completed at two time points (January and September) and as a result there may be some seasonal variation in PA behaviour. Seasonal variation has been shown to have an effect on PA levels in the general population (Goodman et al., 2012; Ridgers, Fairclough, & Stratton, 2010) and therefore to control for this issue researchers logged the weather within testing periods which allowed authors to control for average rainfall and average temperature within the analysis process. Within the current study a 5 second epoch was selected as the shortest data collection duration. Baquet et al. (2007) used a 2 second epoch and reported that more than half of VPA (~70%) and very high PA (~80%) bouts were captured in 2s and 4s durations. Therefore it could be argued that VPA in this study has been underestimated, however unfortunately researchers were unable to use a shorter epoch (<5s) due to the lack of storage capacity on the ActiGraph GT1M when processing the data. Due to variability in severity of the participants' ID which was alluded to earlier, it was difficult to compare differences in PA levels between schools and therefore age groups (Primary vs high school). In order to avoid potential difficulties future studies should aim to better match the schools' on their severity of ID, though inevitably problems may arise when doing this. For example, local authorities hold details of different SEN schools and more specifically details of the pupils' enrolled at certain schools and their statement of disability, for confidentiality issues data sharing restrictions are in place which can make even the recruitment of schools a lengthy process before pupils' are invited to take part. Alternatively future studies may look to recruit participants through other avenues rather than through the school setting, for example contacting organisations such as the Down's Syndrome Association or The National Autistic Society. This study aimed to assess PA patterns of youth with ID collectively, participants were diagnosed with either MLD or SLD in addition some participants were diagnosed with specific conditions i.e., Down syndrome and ASC. PA behaviours amongst different conditions and disabilities can vary (Phillips & Hollands, 2011) thus, future studies should categorize subgroups based on disability or look to control for the variation within analysis.

Conclusion

This study demonstrates that children and adolescents with ID are not sufficiently active to benefit health and further highlights that greater amounts of MVPA engagement by this sample are necessary to reach PA recommendations. The tempo of PA observed in children and adolescents with ID is of a similar nature to that described in children without disability, with the majority of PA comprising short sporadic bursts with the number of continuous bouts decreasing as the intensity and duration of activity increases. In contrast to previous research conducted in children without disability, few differences in PA patterns were reported by sex, ID group, age group and weekday/weekend, which may be partially due to the generally low PA levels within this population. This study has established a clearer understanding of PA patterns within this population. Future research should investigate PA in relation to context, preferences for PA and behavioural aspects related to PA engagement, also, accelerometer familiarity processes should be trialed to examine and monitor adherence issues. In turn this would aid future researchers and policy makers as regards the design, measurement and implementation of appropriate PA interventions, with the aim to increase overall PA levels and the number of continuous PA bouts in longer durations.

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References

Bailey, R. C., Olson, J., Pepper, S. L., Porszasz, J., Barstow, T. J., & Cooper, D. M. (1995). The Level and Tempo of Childrens Physical Activities - an Observational Study. Medicine and Science in Sports and Exercise, 27(7), 1033-1041. doi: 10.1249/00005768-199507000-00012

Baquet, G., Stratton, G., Van Praagh, E., & Berthoin, S. (2007). Improving physical activity assessment in prepubertal children with high-frequency accelerometry monitoring: A methodological issue. Preventive Medicine, 44(2), 143-147. doi: 10.1016/j.ypmed.2006.10.004

Batterham, A. M., & Hopkins, W. G. (2006). Making Meaningful Inferences About Magnitudes. International Journal of Sports Physiology and Performance, 1(1), 50-57. Retrieved from http://www.researchgate.net/publication/23711947_Making_meaningful_inferences_about_magnitudes

Biddle, S. J. H., Gorely, T., & Stensel, D. J. (2004). Health-enhancing physical activity and sedentary behaviour in children and adolescents. Journal of Sports Sciences, 22(8), 679-701. doi: 10.1080/02640410410001712412

Bingham, D., Boddy, L. M., Ridgers, N. D., & Stratton, G. (In Press). The physical activity levels and play behaviours of children with special needs: an exploratory cross-sectional study. Archives of Exercise in Health and Disease, In Press.

Boddy, L. M., Downs, S. J., Knowles, Z. R., & Fairclough, S. J. (2015). Physical activity and play behaviours in children and young people with intellectual disabilities: A cross-sectional observational study. School Psychology International, 36(2), 154-171. dio: 10.1177/0143034314564242

Boddy, L. M., Murphy, M. H., Cunningham, C., Breslin, G., Foweather, L., Gobbi, R., . . . Stratton, G. (2014). Physical Activity, Cardiorespiratory Fitness, and Clustered Cardiometabolic Risk in 10-to 12-year-old School Children: The REACH Y6 Study. American Journal of Human Biology, 26(4), 446-451. doi: 10.1002/Ajhb.22537

Brown, J. D. (2008). Effect size and eta squared. JALT Testing & Evaluation SIG Newsletter, 12(2), 38-43. Retrieved from http://jalt.org/test/PDF/Brown28.pdf

Catellier, D. J., Hannan, P. J., Murray, D. M., Addy, C. L., Conway, T. L., Yang, S., & Rice, J. C. (2005). Imputation of missing data when measuring physical activity by accelerometry. Medicine and Science in Sports and Exercise, 37(11 Suppl), S555-562. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2435061/pdf/nihms52127.pdf

Cohen, J. (1973). Eta-sqaured and partial-eta squared in fixed factor ANOVA designs. Educational and Psychological Measurments, 33(1), 107-112. doi: 10.1177/001316447303300111

Cohen, J. (1988). Statistical power analysis for the behavioural sciences (2nd ed.). Hillsdale, NJ: Erlbaum Associates.

Cole, T. J., Freeman, J. V., & Preece, M. A. (1995). Body-Mass Index Reference Curves for the UK, 1990. Archives of Disease in Childhood, 73(1), 25-29. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1511150/pdf/archdisch00623-0033.pdf

Corder, K., Craggs, C., Jones, A. P., Ekelund, U., Griffin, S. J., & van Sluijs, E. M. (2013). Predictors of change differ for moderate and vigorous intensity physical activity and for weekdays and weekends: a longitudinal analysis. International Journal of Behavioral Nutrition and Physical Activity, 10, 69. doi: 10.1186/1479-5868-10-69

Department of Health. (2011). Stay active, Start active - A report on physical activity for health from the four home countries. London.

Downs, S. J., Boddy, L. M., Knowles, Z. R., Fairclough, S. J., & Stratton, G. (2013). Exploring opportunities available and perceived barriers to physical activity engagement in children and young people with Down syndrome. European Journal of Special Needs Education, 28(3), 270-287. doi: 10.1080/08856257.2013.768453

Downs, S. J., Knowles, Z. R., Fairclough, S. J., Heffernan, N., Whitehead, S., Halliwell, S., & Boddy, L. M. (2014). Exploring teachers' perceptions on physical activity engagement for children and young people with intellectual disabilities. European Journal of Special Needs Education, 29(3), 402-414. doi: 10.1080/08856257.2014.906979

Einarsson, I. T., Olafsson, A., Hinriksdottir, G., Johannsson, E., Daly, D., & Arngrimsson, S. A. (2015). Differences in Physical Activity among Youth with and without Intellectual Disability. Medicine and Science in Sports and Exercise, 47(2), 411-418. doi: 10.1249/Mss.0000000000000412

Ekelund, U., Brage, S., Franks, P. W., Hennings, S., Emms, S., & Wareham, N. J. (2005). Physical activity energy expenditure predicts progression toward the metabolic syndrome independently of aerobic fitness in middle-aged healthy Caucasians: the Medical Research Council Ely Study. Diabetes Care, 28(5), 1195-1200. Retrieved from http://care.diabetesjournals.org/content/28/5/1195.full.pdf+html

Ekelund, U., Luan, J., Sherar, L. B., Esliger, D. W., Griew, P., Cooper, A., & International Children's Accelerometry Database, C. (2012). Moderate to vigorous physical activity and sedentary time and cardiometabolic risk factors in children and adolescents. American Medical Association, 307(7), 704-712. doi: 10.1001/jama.2012.156

Evenson, K. R., Catellier, D. J., Gill, K., Ondrak, K. S., & McMurray, R. G. (2008). Calibration of two objective measures of physical activity for children. Journal of Sports Sciences, 26(14), 1557-1565. doi: 10.1080/02640410802334196

Fairclough, S. J., Beighle, A., Erwin, H., & Ridgers, N. D. (2012). School day segmented physical activity patterns of high and low active children. BMC Public Health, 12. doi: 10.1186/1471-2458-12-406

Fairclough, S. J., Boddy, L. M., Mackintosh, K. A., Valencia-Peris, A., & Ramirez-Rico, E. (2014). Weekday and weekend sedentary time and physical activity in differentially active children. Journal of Science and Medicine in Sport. doi: http://dx.doi.org/10.1016/j.jsams.2014.06.005

Fedewa, A. L., & Ahn, S. (2011). The Effects of Physical Activity and Physical Fitness on Children's Achievement and Cognitive Outcomes: A Meta-Analysis. Research Quarterly for Exercise and Sport, 82(3), 521-535. doi: 10.1080/02701367.2011.10599785

Fedewa, A. L., Candelaria, A., Erwin, H. E., & Clark, T. P. (2013). Incorporating Physical Activity Into the Schools Using a 3-Tiered Approach. Journal of School Health, 83(4), 290-297. doi: 10.1111/Josh.12029

Field, A. (2013). Discovering statistics using IBM SPSS Statatistics, 4th Edition. London: SAGE.

Field, A. P., & Wright, D. B. (2006). A bluffer's guide to effect sizes.PsyPAG Quarterly, 58, 9-23.

Folstein, S. E., & Rosen-Sheidley, B. (2001). Genetics of autism: Complex aetiology for a heterogeneous disorder. Nature Reviews Genetics, 2(12), 943-955. doi: 10.1038/35103559

Freedson, P., Pober, D., & Janz, K. F. (2005). Calibration of accelerometer output for children. Medicine and Science in Sports and Exercise, 37(11), S523-S530. doi: 10.1249/01.mss.0000185658.28284.ba

Goodman, A., Paskins, J., & Mackett, R. (2012). Day length and weather effects on children's physical activity and participation in play, sports, and active travel. Journal of Physical Activity & Health, 9(8), 1105-1116. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3584676/pdf/emss-52057.pdf

Griffiths, L. J., Cortina-Borja, M., Sera, F., Pouliou, T., Geraci, M., Rich, C., . . . Dezateux, C. (2013). How active are our children? Findings from the Millennium Cohort Study. BMJ Open, 3(8), e002893. doi: 10.1136/bmjopen-2013-002893

Hinckson, E. A., & Curtis, A. (2013). Measuring physical activity in children and youth living with intellectual disabilities: A systematic review. Research in Developmental Disabilities, 34(1), 72-86. doi: DOI 10.1016/j.ridd.2012.07.022

Kyllerman, M. (2012). Angelman syndrome. Handbook of clinical neurology, 111, 287-290.

Lakens, D. (2013). Calculating and reporting effect sizes to facilitate cumulative science: a practical primer for t-tests and ANOVAs. Frontiers in psychology, 4, 863.

Lohman, T., Roche, A. F., & Martorell, R. (1988). Anthropometric Standardization reference manual. . Champaign, Illinois: Hunman Kinetics.

Mattocks, C., Ness, A., Leary, S., Tilling, K., Blair, S. N., Shield, J., . . . Riddoch, C. (2008). Use of accelerometers in a large field-based study of children: protocols, design issues, and effects on precision. Journal of Physical Activity & Health, 5 Suppl 1, S98-111. Retrieved from http://scholarcommons.sc.edu/cgi/viewcontent.cgi?article=1371&context=sph_epidemiology_biostatistics_facpub

McClain, J. J., Abraham, T. L., Brusseau, T. A., Jr., & Tudor-Locke, C. (2008). Epoch length and accelerometer outputs in children: comparison to direct observation. Medicine and Science in Sports and Exercise, 40(12), 2080-2087. doi: 10.1249/MSS.0b013e3181824d98

McMinn, A. M., Griffin, S. J., Jones, A. P., & van Sluijs, E. M. (2013). Family and home influences on children's after-school and weekend physical activity. The European Journal of Public Health, 23(5), 805-810. doi: 10.1093/eurpub/cks160

Mirwald, R. L., Baxter-Jones, A. D. G., Bailey, D. A., & Beunen, G. P. (2002). An assessment of maturity from anthropometric measurements. Med Sci Sports Exerc, 34(4), 689-694. doi: 10.1097/00005768-200204000-00020

Pan, C. Y., & Frey, G. C. (2006). Physical activity patterns in youth with autism spectrum disorders. Journal of Autism and Developmental Disorders, 36(5), 597-606. doi: 10.1007/s10803-006-0101-6

Phillips, A. C., & Holland, A. J. (2011). Assessment of objectively measured physical activity levels in individuals with intellectual disabilities with and without Down's syndrome. PLoS One, 6(12), e28618. doi: 10.1371/journal.pone.0028618

Ridgers, N. D., Fairclough, S. J., & Stratton, G. (2010). Variables associated with children's physical activity levels during recess: the A-CLASS project. International Journal of Behavioral Nutrition and Physical Activity, 7, 74-81. doi: 10.1186/1479-5868-7-74

Ridgers, N. D., Stratton, G., & McKenzie, T. L. (2010). Reliability and Validity of the System for Observing Children's Activity and Relationships During Play (SOCARP). Journal of Physical Activity and Health, 7(1), 17-25. Retrieved from http://dro.deakin.edu.au/eserv/DU:30029899/ridgers-reliabilityandvalidity-2010.pdf

Rowlands, A. V., Pilgrim, E. L., & Eston, R. G. (2008). Patterns of habitual activity across weekdays and weekend days in 9-11-year-old children. Preventive Medicine, 46(4), 317-324. doi: 10.1016/j.ypmed.2007.11.004

Saris, W. H. M. (1986). Habitual Physical-Activity in Children - Methodology and Findings in Health and Disease. Medicine and Science in Sports and Exercise, 18(3), 253-263. doi: 10.1249/00005768-198606000-00001

Sullivan, G. M., & Feinn, R. (2012). Using effect size-or why the P value is not enough. Journal of graduate medical education, 4(3), 279-282.

Trost, S. G., Ward, D. S., Moorehead, S. M., Watson, P. D., Riner, W., & Burke, J. R. (1998). Validity of the computer science and applications (CSA) activity monitor in children. Medicine and Science in Sports Exercise, 30(4), 629-633.

Wells, S. L., Kipping, R. R., Jago, R., Brown, J., Hucker, D., Blackett, A., & Lawlor, D. A. (2013). Characteristics associated with requested and required accelerometer wear in children. BMJ Open, 3(8), e003402. doi: 10.1136/bmjopen-2013-003402

Whitt-Glover, M. C., O'Neill, K. L., & Stettler, N. (2006). Physical activity patterns in children with and without Down syndrome. Pediatric Rehabilitation, 9(2), 158-164. doi: 10.1080/13638490500353202

WHO. (2010). Global Recommendations on Physical Activity for Health. Retrieved from http://whqlibdoc.who.int/publications/2010/9789241599979_eng.pdf.

WHO. (2014). Definition: Intellectual Disability. Retrieved 10.03. 2013, from http://www.euro.who.int/en/health-topics/noncommunicable-diseases/mental-health/news/news/2010/15/childrens-right-to-family-life/definition-intellectual-disability

Table 1 Mean [standard deviation] for anthropometrics, BMI and maturation offset for boys and girls and the whole sample

	Boys (n =29)	**Girls (n = 9)**	**All (n = 38)**
Stature (cm)	136.3 [14.2]	141 [17.8]	137.4 [15]
Weight (kg)	41.1 [20.1]	48.2 [21.5]	42.8 [20.4]
Sitting stature (cm)	69.3 [7]	72.5 [9.3]	70.0 [7.6]
BMI (kg/m^2)	21.3 [7.3]	23.4 [5.4]	21.7 [6.9]
BMI Z-score	1.0 [1.9]	1.7 [1.4]	1.1 [1.8]
Somatic maturation (years)	-3.2 [1.8]*	-1.0 [1.9]	-2.7 [2.1]

*: significantly different between boys and girls ($P < .05$)

Table 2 Adjusted means [standard error] *for boys' and girls' time spent in sedentary* activities, LPA, MPA, VPA, MVPA and total PA

	Boys (n = 29)	**Girls (n = 9)**
Sedentary (min•day^{-1})	408.1 [11.0]	419.4 [23.6]
LPA (min•day^{-1})	191.9 [8.8]	191.7 [19]
MPA (min•day^{-1})	31.0 [1.9]	26.4 [4.1]
VPA (min•day^{-1})	21.1 [2.1]	14.5 [4.4]
MVPA (min•day^{-1})	52.1 [3.5]	40.9 [7.5]
Total PA (min•day^{-1})	244.0 [11.0]	232.7 [23.6]

Table 3 Estimated marginal means [standard error] after adjustment for the number of continuous bouts of whole week (WW) PA according to their duration and intensity for boys and girls

Bout duration	**WW_LPA mean total bouts per week**		**WW_MPA mean total bouts per week**		**WW_VPA mean total bouts per week**	
	Boys (n=29)	**Girls (n=9)**	**Boys (n=29)**	**Girls (n=9)**	**Boys (n=29)**	**Girls (n=9)**
5s	2289.7 [98.9]	2116.5 [213.1]	365.8 [20.6]	287.4 [44.3]	252 [24.9]	165.7 [53.6]
10s	808.7 [40.7]	729.7 [87.6]	74.3 [4.5]	53.1 [9.8]	66.5 [8.5]	33.5 [18.3]
15s	383.8 [22.7]	334.9 [48.8]	24.1 [1.8]*	13 [3.8]	26.3 [4.0]	10.8 [8.7]
30s	79.2 [6.6]	60.5 [14.3]	3.7 [0.5]	1.3 [1.1]	5.0 [1.0]	0.9 [2.2]
60s	10.1 [1.2]	5.1 [2.6]	0.7 [0.1]	0.1 [0.3]	1.0 [0.3]	0 [0.5]
180s	0.2 [0.04]*	0 [0.1]	0.1 [0]	-	-	-

*: significantly different between boys and girls (P = <.05)

Table 4 Estimated marginal means [standard error] after adjustment for the number of continuous bouts of whole week (WW) PA according to their duration and intensity for non-ASC and ASC groups

Bout duration	**WW_LPA mean total bouts per week**		**WW_MPA mean total bouts per week**		**WW_VPA mean total bouts per week**	
	Non-ASC (n=29)	**ASC (n=9)**	**Non-ASC (n=29)**	**ASC (n=9)**	**Non-ASC (n=29)**	**ASC (n=9)**
5s	2372.9 [95.6]*	2035.7 [127.8]	355.3 [21.1]	333.4 [28.2]	217.4 [25.4]	255.8[33.9]
10s	843.5 [39.1]*	698.3 [52.2]	70.4 [4.7]	67.3 [6.2]	52.7 [8.6]	69.0 [11.5]
15s	401.5 [21.8]*	322.2 [29.2]	22.1 [1.8]	20.4 [2.4]	19.2 [4.0]	28.5 [5.4]
30s	83.0 [6.4]	60.6 [8.6]	3.1 [0.5]	3.1 [0.7]	3.2 [1.0]	5.5 [1.3]
60s	10.1 [1.2]	6.8 [1.6]	0.6 [0.1]	0.5 [0.2]	0.5 [0.3]	1.1 [0.3]
180s	0.1 [0.1]	0.1 [0.1]	0.1 [0]	-	-	-

*: significantly different between Non-ASC and ASC subgroups (P = <.05)