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# The Physical Activity Levels and Play Behaviours of Children with Special Needs: An Exploratory Cross-sectional Study

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***Objectives:*** This study examined whether children with special needs (SN) achieve current physical activity (PA) guidelines and identify whether habitual PA levels, recess PA and play behaviours differed between different SN's. ***Methods:*** Twenty-five children (aged 11.16 ± 2.37) had PA monitored over 7-days using accelerometry. Recess behaviours were observed using the System for Observing Children's Activity and Relationships during Play (SOCARP). Participants' SN(s) were categorised as either autism (AUS), behavioural and emotional needs (BEN) or any other SN (OTH). ***Results:*** Children took part in 46.88 minutes ± 9.10 of MVPA. BEN children (65.55 min ± 20.50) were more active than AUS (43.40 minutes ± 27.50). AUS children spent more time playing alone and less time in groups then the BEN and OTH groups ($p \leq 0.05$). ***Conclusions:*** Only 3 children met PA guidelines, with all 3 having BEN. PA levels and play behaviours differ by SN.

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**Key Words:** Physical activity; play; special needs; disability; children

## INTRODUCTION

Moderate-to-vigorous physical activity (MVPA) is a vital component for maintaining good health in children (34) with evidence to support that children's physical activity (PA) tracks from childhood into adolescences and adulthood (6). It is recommended that all children should engage in at least 60 minutes of MVPA every day; take part in vigorous activities which include activities that strengthen bone and muscle on at least three days a week; and to reduce the amount of time spent being sedentary (31). Insufficient PA is associated with a range of disorders including obesity and cardio-metabolic disease (1). Evidence suggests that a large proportion of English children (boys = 77% and girls 21%) do not meet PA guidelines when assessed using objective measures (23). The vast majority of PA research within children has focussed on the non-disabled population, and PA evidence within individuals with special needs (SN) is small in number. The proportion of children with SN that meet current PA guidelines for health is unknown; however previous research suggests that children with intellectual disabilities are less active than non-disabled peers (7). Furthermore, scant research has compared the activity levels of children with different SN to investigate whether activity differs by SN. This should be addressed, as a lack of activity within this population may lead to additional lifestyle disabilities(20) in addition to the widely accepted benefits associated with leading a sufficiently active lifestyle.

For the relatively small volume of research conducted with SN children, the focus has often been on comparing the activity levels of children with and without SN during curricular (e.g. physical education) (3) and non-curricular time (e.g. recess)(13). These periods of the day are seen as opportunities for SN



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children to accumulate most of their MVPA (3). Of these contexts, recess (which includes lunchtime) provides daily opportunities for children to engage in discretionary PA (19). A systematic review of the correlates of recess PA described inconsistent evidence regarding the differences between children with and without SN (17). However, limited research has examined the activity levels of children attending SN schools and compared activity levels across different SNs. Sit and colleagues found that children with intellectual disabilities engaged in less PA during recess than children with hearing impairment and/or visual impairment (57.4% vs 71.5% vs 77.1% in MVPA), suggesting that there are PA inequalities across different SN groups (24). More research observing behaviours of children with different SN's during recess could provide an insight in the differences between SN and how best to approach any PA engagement during recess would increase the knowledge base surrounding this under-researched group, and may help to inform future recess interventions delivered in these populations.

The aims of this study were to a) examine whether children with SN achieve current PA daily guidelines, b) identify whether PA levels differ between SN groups across the day and during recess, and c) explore whether play behaviours during recess differ across SN groups.

## MATERIAL AND METHODS

### *Participants and Settings*

Twenty-nine children (27 boys and 2 girls) aged 8-16 years old were randomly selected from three Special Educational Needs schools in the North West of England. The large percentage of boys compared to girls is very common within this population, and these proportions are similar to those reported within a UK government analysis report (29) and previous peer reviewed studies (7). All children returned written informed parental consent and gave individual assent to participate in the study. Each of the participants' SN was reported by the parents using a form that was designed using categories reported in the Special Needs code of practice (30). Based on this information, children were categorised and assigned to one of the following groups: autistic spectrum disorder (Autistic group; AG), behaviour and emotional disorder (behaviour and emotional needs group; BEN), and other (other; OTH). The research protocol received full ethical approval from the University Research Ethics Committee, of which follows the principles outlined in the Declaration of Helsinki. Data was collected in 2010/2011 and final analyses took place in Decemeber 2012.

### *Measures*

**Accelerometry**

Physical activity was objectively measured every 5 seconds for 7 consecutive days using a hip-mounted ActiGraph accelerometer (GT1M ActiGraph, Pensacola, FL, USA). The ActiGraph is a commonly used and validated measure of children's PA (27) and has been used previously in SN populations (9, 14, 22, 32).

**Accelerometry Data Reduction**

Accelerometers were collected after the seven day period and data were downloaded via USB, and analysed using MAHUffe software. Age-specific cut points determined the time spent in Light PA (LPA; 1.5-3.99 METs), Moderate (MPA; 4-5.99 METS) and Vigorous PA (VPA; ≥6 METs) (4). Sedentary time was defined as <100 counts per minute, which provides a good estimate of free-living sitting time (18). Moderate and vigorous PA was combined to give the sum of time spent in MVPA for a whole day.

Currently there is no universally accepted criterion for the number of hours of wear time required to represent a typical day (16). For a day to be considered valid in this study, children were required to have worn the monitor for 9 hours on weekdays and 8 hours on weekend days (5, 10, 21). Sustained periods of 20 minutes of consecutive zero counts were used to indicate that the monitor had been removed (33). To be included in the statistical analyses, participants were required to have worn the monitor on at least 3 valid days (11).

**Direct Observation**

The System for Observing Children's Activity and Relationships during Play (SOCARP) (19) was used to examine children's PA levels, social group sizes, activity types and social interactions during school recess. SOCARP is a valid and reliable tool and the PA variables have been objectively validated using heart rate monitoring (12) and accelerometry (19).

Participants were observed individually for 10 consecutive minutes using momentary time sampling techniques with alternating 10 seconds observe-record intervals being paced by audio cues on a MP3 player (19). At the record prompt, the observer noted the children's PA intensity, group size, activity type and social interactions. These outcome variables were expressed as a mean percentage of intervals. Once the 10 minute period (30 observations) was completed, the number of supervisors, presence and availability of play equipment and the temperature were recorded. The next target child was then identified and the process was repeated.

All SOCARP data were collected by the first author

following training with an expert observer. Reliability criteria were set at 80% using interval-by-interval agreement for each category (12). It took approximately 12 hours to reach acceptable inter observer criteria (PA = 93%, group size = 93%, activity type = 93% and interactions = 100%).

### *Procedures*

Each school was visited twice to administer accelerometers (handing out and collection). On the first day of data collection, children and teachers were familiarised with the accelerometer. Due to logistical issues such as agreed times to observe children during recess and the times allowed to hand out of accelerometers, accelerometer data for only 10 participants was collected on days of which recess observations took place. Recess observation occurred over 14 days for each school.

All schools had two daily recess periods (morning and lunchtime). Times and duration of recess periods was provided by teaching staff to the researchers. The observer arrived at the school premises 10 minutes before recess began and positioned themselves in an inconspicuous position where they could see the whole playground. Each of the participants was individually observed for 10 consecutive minutes before the observer located the next participant. Ten of the 22 observations were conducted 'live' using a SOCARP recording form and 12 of the observations were recorded using a digital video recorder and coded in the university laboratory. The reason for this was due to not all parents agreeing consent for video recordings of their children. Ambient playground temperature was also measured at this time and weather conditions recorded. Once a target child entered the playground the observations began, and this process continued until the recess period had finished.

### *Data Analysis*

In total data were obtained for 25 participants (24 male; 1 female). Accelerometer data were collected for 16 participants (AUS = 5; BEN = 5; OTH = 6). SOCARP data were collected for 22 participants (AUS = 7; BEN = 7; OTH = 8).

Reasons for missing SOCARP data included absence from school on days of data collecting and participants not entering the playground environment due to disciplinary reasons or choosing alternative indoor activities (Information Communication Technology and Table Tennis) that were available during recess. Reasons for missing accelerometer data was noncompliance with the protocol, and two monitors malfunctioned.

Descriptive statistics of measured dependent variables for the whole group and SN groups were calculated, and tests of normality (Shapiro-Wilk) and homogeneity variance (Levene) for SN groups were conducted. Mean MVPA was used to assess the number of participants that met the recommended amount of 60mins/day MVPA (Department for Health, 2011). One-way MANOVA's and follow up ANOVA's were used to investigate differences between SN groups for habitual and recess PA, as well as recess behaviours (group size, type of play, interactions). Turkey HSD was used for post hoc analyses of data that met assumptions of homogeneity of variance, and Games-Howell was used for data when homogeneity of variance was questioned (Fields, 2009). Alpha was set at $p \leq 0.05$ for all statistical tests. All data were analysed using IBM SPSS 21.0 (SPSS Inc. Chicago, IL.).

## RESULTS

### *Compliance to PA guidelines and levels of habitual PA*

Out of 16 participants only 3 had met the PA guidelines of 60 minutes MVPA, with all 3 participants within the BEN group. None of the participants with AUS and OTH met the guidelines.

Table 1 presents the mean scores for age, sex, and daily minutes of habitual PA and mean percentage of intervals for each of the SOCARP variables. Overall, SN children engaged in 47.3 min (21.0) of MVPA, 30.8min (13.5) of MPA and 16.5 (8.8) of VPA per day.

Results from the one-way MANOVA's between groups (Pillai's trace) showed statistically significant differences between SN groups for habitual PA ($P$ = 0.23). Follow-up ANOVA's (Table 2) found significant differences between SN groups for CPM ($P < 0.05$); MPA ($P < 0.05$), VPA ( $P < 0.05$), and MVPA ($P < 0.05$). Post hoc Turkey HSD tests (Table 2) found that BEN children were most habitually active group, and had higher CPM (533.24 ± 16.45), MPA (43.01 ± 13.34), VPA (22.54 ± 9.09) and MVPA (65.55 ± 20.05) compared to the OTH group (CPM = 350.62 ± 124.78; MPA = 22.29 ± 11.22; VPA = 10.06 ± 7.13: MVPA = 32.35 ± 17.84).

### *Recess Variables*

MANOVA analyses described significant differences for the group size and type of activities that SN children took part in during recess. Non-significant differences were observed between SN groups recess PA and social interactions during recess ($P \geq 0.05$). Follow-up ANOVA's revealed significant results for

**Table 1.** Demographics, habitual physical activity levels and recess behaviour of SN children

| | | All | AUS | BEN | OTH | | |
|---|---|---|---|---|---|---|---|
| | *Age (Years)* | *11.16 ± 2.37* | *10.88 ± 2.70* | *10.22 ± 1.92* | *12.50 ± 2.37* | | |
| | *Male (n)* | *24* | *8* | *9* | *7* | | |
| | *Female (n)* | *1* | *0* | *0* | *1* | | |
| | *Total (n)* | *25* | *8* | *9* | *8* | | |
| | ***Accelerometer*** | *16n* | *5n* | *5n* | *6n* | ***F*** | ***POST HOC DESCRIPTION*** |
| ***Habitual PA*** | *CPM* | *442.93 ± 114.07* | *463.37 ± 74.62* | *533.24 ± 16.45* | *350.62 ± 124.78* | *6.04** | *BEN > OTH*, BEN > AUS, AUS > OTH* |
| | *Sedentary* | *583.26 ± 64.62* | *570.11 ± 70.12* | *577.20 ± 60.71* | *599.26 ± 71.62* | *0.28* | |
| | *MPA* | *30.82 ± 13.48* | *28.85 ± 6.77* | *43.01 ± 13.34* | *22.29 ± 11.22* | *5.11** | *BEN > OTH*, BEN > AUS, AUS > OTH* |
| | *VPA* | *16.45 ± 8.84* | *18.03 ± 6.01* | *22.54 ± 9.09* | *10.06 ± 7.13* | *3.94** | *BEN > OTH*, BEN > AUS, AUS > OTH* |
| | *MVPA* | *47.27 ± 20.99* | *46.88 ± 9.09* | *65.55 ± 20.05* | *32.35 ± 17.84* | *5.42** | *BEN > OTH*, BEN > AUS, AUS > OTH* |
| | ***SOCARP*** | *22n* | *7n* | *7n* | *8n* | ***F*** | ***POST HOC DESCRIPTION*** |
| ***Recess PA*** | *Lying %* | *5.45 ± 17.92* | *10 ± 26.46* | *0 ± 0* | *6.25 ± 17.68* | *0.57* | |
| | *Sitting %* | *12.34 ± 27.14* | *18.78 ± 33.88* | *0.48 ± 1.26* | *17.08 ± 31.90* | *0.99* | |
| | *Standing %* | *34.81 ± 20.56* | *27.35 ± 13.38* | *37.77 ± 15.65* | *38.75 ± 28.67* | *0.66* | |
| | *Walking %* | *33.87 ± 19.92* | *31.97 ± 19.70* | *45.91 ± 17.22* | *25 .00 ± 19.11* | *2.38* | |
| | *Vigorous %* | *13.16 ± 13.48* | *11.43 ± 17.83* | *15.17 ± 6.98* | *12.92 ± 14.95* | *0.13* | |
| | *Sedentary %* | *52.60 ± 26.49* | *56.13 ± 27.61* | *38.24 ± 16.13* | *62.08 ± 30.13* | *1.70* | |
| | *MVPA %* | *47.03 ± 26.22* | *43.40 ± 27.52* | *61.08 ± 15.27* | *37.92 ± 30.13* | *1.65* | |
| ***Groups Sizes*** | *Alone %* | *42.83 ± 36.64* | *78.28 ± 25.84* | *28.71 ± 26.37* | *24.17 ± 31.71* | *8.10** | *BEN > OTH, BEN < AUS*, AUS > OTH** |
| | *Small %* | *40.78 ± 31.71* | *16.00 ± 13.91* | *41.70 ± 19.56* | *61.67 ± 37.54* | *5.56** | *BEN > OTH, BEN > AUS*, AUS < OTH** |
| | *Medium %* | *5.00 ± 10.43* | *0.95 ± 2.52* | *9.05 ± 15.72* | *5.00 ± 8.73* | *1.06* | |
| | *Large %* | *9.87 ± 22.19* | *0 ± 0* | *20.54 ± 26.32* | *9.17 ± 25.93* | *1.59* | |
| | *Any Group %* | *55.65 ± 36.49* | *16.96 ± 14.70* | *71.29 ± 26.37* | *75.83 ± 31.71* | *11.74** | *BEN > OTH, BEN > AUS*, AUS < OTH** |
| ***Activities*** | *Sport Games%* | *20.39 ± 35.02* | *0 ± 0* | *53.13 ± 39.29* | *9.58 ± 27.11* | *7.48** | *BEN > OTH, BEN > AUS*, AUS < OTH* |
| | *Playground Games %* | *21.85 ± 30.97* | *8.72 ± 13.80* | *25.67 ± 34.37* | *30.00 ± 37.92* | *0.96* | |
| | *Sedentary Games %* | *36.97 ± 33.52* | *58.18 ± 27.60* | *12.31 ± 15.86* | *40.00 ± 37.88* | *4.41** | *BEN < OTH, BEN < AUS*, AUS > OTH* |
| | *Locomotion %* | *15.18 ± 15.41* | *28.34 ± 21.40* | *9.37 ± 5.01* | *8.75 ± 6.65* | *5.27** | *BEN > OTH, BEN < AUS, AUS > OTH* |
| ***Interactions*** | *Positive Physical %* | *36.77 ± 44.38* | *28.57 ± 48.80* | *37.66 ± 38.99* | *43.18 ± 49.50* | *0.19* | |
| | *Positive Verbal %* | *3.31 ± 11.06* | *0 ± 0* | *3.90 ± 10.31* | *5.68 ± 16.07* | *0.48* | |
| | *Negative Physical %* | *5.30 ± 21.45* | *0 ± 0* | *2.38 ± 6.30* | *12.50 ± 35.36* | *0.71* | |
| | *Negative Verbal %* | *3.79 ± 12.53* | *0 ± 0* | *11.90 ± 20.89* | *0 ± 0* | *2.45* | |
| | *Ignore Interaction %* | *9.912 ± 29.28* | *14.29 ± 37.80* | *15.58 ± 37.38* | *1.14 ± 3.21* | *0.54* | |

the different recess PA levels/types between SN groups for time spent playing in small groups; playing alone, and playing within any size group. Post Hoc Games-Howell tests found that AUS spent significantly greater periods of recess time alone in comparison to BEN and OTH. BEN and OTH spent a significant greater amount of time within groups compared to AUS.

Table 1 also shows the percentage of time SN groups spend participating in different recess activities. There were significant differences between groups for time spent in sporting activities; sedentary games; and engaged in locomotion ($P \leq 0.05$). Post hoc Games-Howell tests found that AUS spend significantly less time playing sporting games and engaged in sedentary games compared to BEN. The most common interaction observed between SN groups during recess was positive physical behaviour (good sportsmanship). Although no significant differences were observed between groups few interactions at all were observed across the SN groups during recess observations (Table 1).

# DISCUSSION

The three aims of this study were to address whether children with SN reached current PA daily guidelines, whether PA levels differed between different SN groups, and whether active play behaviour during recess differed across the different SN groups. One of major findings of this study was that the sample of SN children as a whole did not meet current national PA

guidelines, and the few participants that did all had behavioural and emotional needs. This result is unsurprising as previous research has reported no significant differences of PA levels of children with ADHD in comparison to non-SN children (28). This finding along with the current study may indicate that having behavioural and emotional needs such as ADHD might not be a confounding factor for PA engagement. However more research is required with greater participant numbers and more powerful study design to adequately investigate this hypothesis, particular with a growing literature providing evidence of the therapeutic events that exercise can have upon the symptoms of ADHD in children(15, 26).

The findings of this study are in contrast to a number of previous studies, which report children with autism took part in 127 min ± 72.3 (14) and 132.58 min of MVPA (22). These values are nearly double the amount of the MVPA described within the present study (all children: 47.27 ± 20.99 minutes) and children with Autism (46.88 ± 9.09 minutes). These differences between studies may be explained by the different accelerometry data collection epoch lengths used. Previous studies selected a 60 second epoch length whereas this study applied a 5 second epoch (14, 22). Children's PA is known to be sporadic in nature, and a 5 second data collection period is more likely to capture short bursts of moderate and vigorous activity typically lasting for less than 10 seconds (2). Differences could also be due to the selection criteria of participants. Previous studies recruited children that attended mainstream schools whereas all children within this study attended special schools (14, 22). Special schools cater for children with SN that require extra support on a daily basis that cannot be provided by mainstream schools and thus their behavioural patterns may have differed due to the combination of SN severity and school environment.

Recess is a component of the school day that has been shown to be an ideal opportunity for children to engage is large quantities of PA (17). This study found SN children as a whole (not characterised for type of SN) took part in 47.03% MVPA during recess. AUS spent a lower proportion of time in MVPA in comparison to BEN (MVPA 43.40 % vs. 61.08%). Previous research found similar results with SN children being reported of spending up to 58.2% of recess in MVPA (25). Recess may be viewed in children with SN as a key opportunity to engage in MVPA that would contribute towards the daily target of 60 minutes MVPA (24, 25). Interestingly, other recess variables differed by SN. Children with AUS spent 78% of recess time alone and with the majority of play activities being locomotion based (28%) and sedentary based (58%). These findings are in agreement with previous work which reported children with autism mainly took part in solitary play and sedentary based activities such as solving puzzles, investigating their surroundings and mimicking play of peers but not interacting (8). Children with BEN in comparison spent significantly more time engaging within sport activities and play within groups in comparison to children with autism. This could be explained due to the majority of participants with BEN attending the same school, which had a different approach to the traditional free living activity of recess. The school gave children a choice of football, ICT or table tennis during recess, therefore supervised football replaced the sense of traditional free play that was apparent within the other schools. The majority of children chose to play football. When recruited to the study this policy of structured recess choice was not disclosed by the school. The researcher (1st author) found out about this recess policy on the 1st day of data collection. Although this is a major limitation, the findings of this study are consistent with a previous study. Ridgers and colleagues reported that boys tended to spend large amounts of time during recess in large groups and boys MVPA during recess was positively associated by participating in large groups of which tended to be during organised games (19). Whilst the one school providing organized games during recess may introduce bias within the data when comparing to the other traditional free play recess schools, it is interesting that only the BEN children met the PA guidelines, and participated in greater amounts of habitual PA than children other classifications of SN. The structured sporting games offered during recess in one school may have had a positive effect upon PA levels, which is similar to previous research that has shown that special school polices and focus on sport can have a positive impact on PA levels of SN children (24).

Future research should investigate not just the different type of SN, but different types of special schools and the impact that polices, curriculum and schools individual ethos has upon PA levels. The finding that BEN children engaging in larger quantities and intensities of PA during recess through organized sport is an interesting finding with increasing evidence suggesting that PA and exercise can have positive effects upon symptoms of ADHD (15, 26).

Limitations of the study are the cross-sectional nature of the study meaning causality or the direction of relations cannot be derived. Furthermore, the study failed to control for a range of confounders known to influence PA in children and young people, including BMI, fitness, socioeconomic status and maturation. The sample in this study was small and may not be generalizable to individuals of different SN, age or educational/geographical location. However, the small

participant's numbers is similar and consistent across previous published studies that have investigated PA in SN children (7). However, as this study was a small-scaled exploratory study, practicalities precluded data collection in larger numbers including a wider range of variables. Furthermore, the objective measures and direct observation of recess PA are robust measures of PA and pose interesting questions regarding PA in SN groups. Future suitably powered studies are required that include the range of covariates within data collection processes in order to improve the knowledge base surrounding PA and recess play behaviours of children and young people with SN. Such information may help to inform the design of a targeted PA intervention study.

## CONCLUSION

This study found that majority of measured children with special needs did not meet UK PA guidelines. Only children with behavioural and emotional needs met the guidelines and were also found to engage in more habitual MVPA and time spent in MVPA during recess than children with other special needs. Differences in time spent during recess could be due to the fact that children with AUS were found to choose to play sedentary based games while being alone, whereas BEN children took part in structured sport during recess. More research with a greater quantity of participants are required to better understand SN children who are considered to be inactive and have greater risk of associated health outcomes later in life.

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