



## HABITUAL PHYSICAL ACTIVITY PATTERNS OF INNER-CITY CHILDREN

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### ABSTRACT

**Purpose.** Understanding the physical activity patterns of youth is an essential step in addressing the obesity epidemic and, ultimately, developing programs that reverse this trend. Therefore, the purpose of this study was to explore the habitual physical activity patterns of Hispanic and African-American children living in a northeastern USA urban environment. **Methods.** Participants included 39 inner-city children (10.5 ± 0.61 years old; 78% African American, 14% Hispanic; 85% free/reduced lunch; 20.3 ± 4.3 BMI with 45% overweight/obese). Children wore a pedometer for seven consecutive days. Means and standard deviations were calculated and Student's *t* test was utilized to examine difference across gender and day of the week. **Results.** Children averaged 9535 ± 2594 steps/day. The weekday step count mean was 10090 ± 2939 and the weekend step count was 7557 ± 4337, Δ = 2533. Students were significantly more active during the week; *t*(16) = 2.38, *p* = 0.03. Children averaged 10610 ± 2842 steps on physical education weekdays and 8338 ± 2802 steps on non-physical education weekdays. Children were significantly more active on days with physical education classes; *t*(30) = 4.7, *p* = 0.00, Δ = 2272. **Conclusions.** Very few children in the current sample met daily step recommendations. Our results support previous research that suggests that the 'suburban built' environment is more conducive to promoting physical activity than the inner city. Our sample was less active than those in the majority of other studies exploring physical activity in primary school-aged children. Our findings (compared with previous research) found reduced physical activity among African-American children, especially girls.

**Key words:** pedometer, physical activity, children, physical education

### Introduction

Understanding the physical activity patterns of youth is an essential step in understanding the obesity epidemic and ultimately developing programs that reverse this trend [1]. The benefits associated with regular physical activity are numerous and well documented [2]. However, these advantages are currently overshadowed by the lack of physical activity [3] among American children especially when compared with international youth. Physical inactivity is the fourth leading cause of death worldwide [1] and a primary risk factor for the leading causes of death in the United States [4]. Moreover, the prevalence of obesity in youth aged 6 to 11 has tripled over the last three decades from 6.4% in 1980 to 19.6% in 2008, with similar trends in adolescents aged 12 to 19 years [5].

The importance of understanding the physical activity patterns of youth has led to an explosion of surveillance studies exploring the habitual activity patterns of youth around the world. Over the last decade the pedometer has become an important tool in understanding the physical activity patterns of youth primarily because of its ease of use and affordability [6]. Two recent review papers [3, 6] found 43 and 31 pedometer

studies examining habitual physical activity of youth worldwide, respectively. These reviews along with more recent surveillance work [7, 8] would suggest that boys accumulate between 12000–16000 steps/weekday and girls accumulate 10000–13000 steps/weekday. Research has also suggested that youth physical activity levels peak at age 12 [9], marking the later primary school years as especially important in this regard. Weekend physical activity has been found to range from 7600–13000 (boys) and 7300–12000 (girls) steps [10–12]. To date, most of these surveillance studies have primarily included Caucasian children living in suburban communities. A few recent studies have begun to explore American-Indian youth [10], Hispanic youth [13], and inner city African-American and Hispanic youth in the southwestern United States [8, 14]. In the US, a vast majority of the pedometer-based habitual physical activity research in youth has been localized to the southwest and the southeast parts of the United States, with very little attention spent on children living in urban areas and to our knowledge no studies based in the northeastern US. It is also essential that surveillance research of youth account for gender, BMI, and various physical activity segments.

Therefore, the purpose of this study was to describe the habitual physical activity of children living in an inner-city environment in the northeastern United States. A secondary purpose was to explore differences across gender, BMI category (healthy weight, overweight,

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obese), and physical activity performed on weekday and weekends and on days with or without physical education.

### Material and methods

A total 39 inner city children were invited to participate in this study with 36 obtaining parental consent and providing assent. The mean age of the children was  $10.5 \pm 0.61$  years old.

The children attended one of two 5<sup>th</sup> grade classes in an urban primary school, located in the northeastern US. The school was chosen due to its location and an existing relationship with school personnel.

All procedures were consistent with previous research [7] and approved by the University institutional review board, school district, principal, and participating teachers. Participant's parents provided their written informed consent and completed a basic demographic questionnaire (asking for children's age, gender, race, and ethnic background). School data suggested that 85% of the children were eligible for free or reduced breakfast/lunch programs, indicating the children come from lower income families. The ethnic/racial background for the children in the study was: 78% African American, 14 % Hispanic, and 8% Caucasian. Participants had a mean BMI of  $20.3 \pm 4.3$ , with 45% being classified as overweight/obese (CDC Growth Charts, [15]). BMI was obtained by weighing (to nearest 0.1 kg) each child on a digital scale and measuring height (to nearest 0.5 cm) on a model 703 stadiometer (Seca, Germany) and using the formula:  $\text{kg/m}^2$ . The participants lived in a city consisting of 210000 people (57% ethnic minority) with a median home value of \$74000 and median household income of \$30367 [16].

Physical activity in this study was measured by a Dig-walker pedometer (Yamax, Japan). This pedometer was shown to produce valid and reliable data in pediatric populations [17] and is the most widely used pedometer in the research literature [6]. Prior to data collection the batteries of each pedometer were replaced and both a shake test [18] and step test [19] were performed to ensure instrument accuracy. Trained researchers provided the participants with instructions and practice sessions. The students were provided with their pedometer on Monday morning at the start of the school day on the week of data collection during class time in order to limit reactivity. To maintain consistency all children were instructed to wear the pedometer on the waist band above their right knee and told not to wear the pedometer when sleeping nor during any water activities such as bathing or swimming.

Data was collected for a period of 7 consecutive days during the winter season of 2012. The children were prompted by researchers to record their daily step counts during the school week at the start of each school day. During the weekend, children were sent home with re-

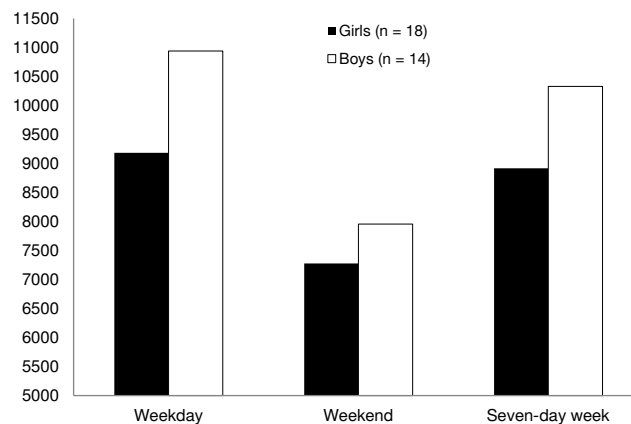
ording sheets and reminder letters for parents to ensure that they recorded their step counts for Saturday and Sunday.

Each morning the researchers walked around the room observing the students, answered any questions, and looked for any outliers or unusual numbers of steps (such as below 1000 or above 30000). Any extreme or unverified step values (< 1%) were eliminated. As a validity check, the children were asked to answer eight simple questions each morning (e.g., did the child wear the pedometer the entire day or did they have a physical education class the day before).

Statistical analysis included calculating means and standard deviations. Student's *t* test was utilized to examine difference across gender and day of the week. ANOVA was utilized to examine differences across BMI categories. SPSS ver. 20.0 software (IBM, USA) was utilized for all analyses. A minimum of two days of data from each participant were required to be included in the study [12].

### Results

The children averaged  $9535 \pm 2594$  steps over the 7 days (5 weekdays and 2 weekend days) of data collection. The weekday step count mean was  $10090 \pm 2939$  and on the weekend was  $7557 \pm 4337$ ,  $\Delta = 2533$ . The paired samples *t* test revealed that students were significantly more active during the week;  $t(16) = 2.38$ ,  $p = 0.03$ . The means for the weekday, weekend, and seven-day week step counts for the children by gender are illustrated in Figure 1. The differences in step counts between boys and girls for weekdays, weekend days, and the seven-day week was 1756, 681, and 1409 steps, respectively, with boys performing more steps in each case. Independent *t* tests revealed that the boys and girls were similarly active across all three time categories: weekday steps  $t(30) = 1.86$ ,  $p = 0.07$ ,  $\Delta = 1756$ ; weekend steps  $t(15) = 0.31$ ,  $p = 0.76$ ,  $\Delta = 681$ ; and seven-day week  $t(30) = 1.56$ ,  $p = 0.13$ ,



Note: children were significantly more active during the week ( $p < 0.05$ ); there were no significant differences by gender

Figure 1. Weekday, weekend, and seven-day week step counts

$\Delta = 1409$ . Although not significant  $F(2,29) = 0.10, p = 0.90$ , children in the healthy weight category averaged slightly more steps/day ( $9707 \pm 2309$ ) than their overweight and obese ( $9275 \pm 3123$ ) peers. Levene's test verified the equality of variances in the sample ( $p > 0.05$ ).

Children averaged  $10610 \pm 2842$  steps on weekdays with physical education classes and  $8338 \pm 2802$  steps on non-physical education weekdays. Paired samples  $t$  test indicated that children were significantly more active on physical education days;  $t(30) = 4.7, p = 0.00, \Delta = 2272$  steps. Boys averaged  $11633 \pm 2405$  and girls averaged  $10176 \pm 3356$  steps ( $\Delta = 1457$ ) on physical education days. The mean step count for boys on non-physical education weekdays was  $8982 \pm 2990$  and  $7873 \pm 2645$  for girls ( $\Delta = 1109$ ). Boys increased their step count by 2651 and girls by 2303 on physical education days.

### Discussion

This study explored the habitual physical activity patterns of primary school-aged children living in a northeastern United States city. The findings suggest that the present youth are falling well short of the daily recommendation of 12000 steps/day [20]. Only 17% of the current sample averaged 12000 steps/day, suggesting that this population of boys and girls needs to increase their daily step count on average by 2700 and 3100 steps, respectively. When compared with the physical activity patterns of other American children, the current sample lags well behind children living in the midwestern [21] and southwestern parts of the US [7, 22]. The present group of children did accumulate similar steps/day when compared with children living in the southern US [23]. When compared with previous work on inner-city children in the southwestern US [14], boys accumulated approximately 1600 less steps/day while girls accumulated a similar number of steps (9200 with 9500). Previous findings [24] have suggested that both single-parent homes and socioeconomic status may play a role in limiting children's physical activity. Furthermore, parental modeling of physical activity may be especially important for girls [25]. In our study, approximately half of the participants came from single parent households and 85% qualified for free or reduced meals. It is also possible that children in urban single-parent homes have more home responsibilities and less disposable income to engage in and participate in structured physical activities compared with children from suburban and dual/married-parent homes. Another reason for the low step counts may also be explained by safety concerns in the neighborhood [26].

Gender differences in this study (although not significant) support previous research that suggests that boys are generally more active than girls [7]. Similarly, the results (although not significant) are also in line with BMI differences found in previous studies suggesting that overweight and obese children are less active than

healthy-weight peers [7]. The lack of significance in the current sample is likely due to the small sample size.

The present participants were significantly less active on the weekend, which supports previous research [10, 11] that found that children fail to make up for physical activity accumulated while attending school. The low physical activity patterns of youth (especially on weekends) highlight the need for additional low cost and safe activity programs on weekends.

Physical education was extremely important for the current sample and appears to have had a much greater impact on the daily activity patterns of youth when compared with previous studies [10, 11]. Prior research has suggested that physical education had the potential to increase daily activity by 1000–2000 steps/day. In the current study, physical education impacted habitual physical activity by 2500 steps. It would appear that increasing the frequency of quality physical education could have a significant impact on daily physical activity. Brusseau et al. [7] found that as the number of days of physical education increases so do children's daily physical activity levels.

Weather may have impacted the habitual physical activity of the current sample. Data were collected in the winter in the northeastern US. Although temperatures were unseasonably warm during data collection, fields and parks remained unusable. Previous research has found that youth tend to be less active (especially outside of school) during winter months [27, 28]. Beighle et al. [27] found that southeastern US children decreased their out-of-school activity by 1153 steps during the winter. Brusseau et al. [28] found that southwestern American-Indian children decreased their school physical activity by 400–800 steps during the winter. These numbers are especially alarming since the climate in the southeast and southwestern parts of the US can be considered mild when compared with the northeast.

Recent studies have highlighted various time segments that hold potential both in and out of school for increasing physical activity. For example, Beets, Huberty, and Beighle [29] found that children in a two-hour after-school program might expect to accumulate nearly 3000 steps. Daily free periods (or extra free periods) during school had the potential to add over 1000 steps [7]. Furthermore, classroom activity breaks may add extra physical activity. Bershinger and Brusseau [30] found that low-cost, classroom-based activity breaks/lessons might increase daily physical activity by 1000+ steps. Lastly, studies that have explored active transportation in urban areas found that students that walked to school were significantly more active than bus/car riders [14].

To our knowledge this is the first study to explore the habitual step counts of northeastern US children and one of very few studies that have focused on the physical activity patterns of inner-city children. However, the small sample size is worth noting as it may limit generalizability across other inner-city samples.

Future research with larger sample sizes from multiple cities is needed to confirm these findings. Furthermore, it is also important to address the fact that pedometers do not account for physical activity intensity or context, albeit their ease of use and affordability.

### Conclusions

Very few children in the current sample met their daily step recommendations. Our results support previous research that suggests that suburban-built environment appears more conducive to promoting physical activity when compared with urban areas [31]. Our sample was less active than most other studies' exploring physical activity in primary school-aged children. Our findings are also supported by Johnson, Brusseau, Vincent-Graser et al. [8], who found reduced physical activity among African-American children and youth, especially girls, and among children and youth living in urban areas. Physical education appears to be an important element to the daily physical activity levels of this population, suggesting the need for increased frequency of physical education classes and that increased physical activity opportunities are warranted on weekends.

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