
Physical Activity Assessment of BOKS Using Accelerometers

Introduction

Researchers from the National Institute on Out-of-School Time (NIOST) at the Wellesley Centers for Women at Wellesley College studied the physical activity levels of 112 Kindergarten and First Grade children from September 2013 through May 2014 in Natick, Massachusetts. Fifty-two ($n=52$) of these children were participants in the BOKS before-school physical activity program and the others ($n=60$) comprised the comparison group. This study specifically examined time spent in sedentary, light, moderate, and vigorous physical activity (PA) during three waves of data collection.

Study Methods and Findings

Study participants were recruited in September 2013 through flyers sent home in children's backpacks. All families gave voluntary written informed consent for all study data collection protocols. Physical activity data were collected using the ActiGraph GT3X Activity Monitor. Data were analyzed in SPSS v21 and ActiLife software version 6.11.4 was used to process the accelerometer data to identify the outcomes of energy expenditure (METs) and time spent in each intensity category. Data for each 60-second epoch was extracted and matched by date and time. Children were fitted with and wore accelerometers for five days (weekdays) in September (Baseline), December (Time 2), and May (Time 3). Researchers fitted each child with an accelerometer via a waist belt on the first morning of data collection and then removed the accelerometer on the last day of data collection. The children were instructed to wear the monitor during all waking hours and to remove it only during sleeping time and for any water-based activity. Families were provided with instructions and protocols for supervising their child's monitor wearing. Children, with support from parents, were asked to complete a time sheet recording the time and reason why the device was removed for five minutes or more for any activity such as swimming, bathing, or a contact sport. All days with less than 480 minutes (6 hours) wear time were removed from the data set. When conducting data analysis of program time only, a minimum of 20 minutes was used for a valid time (standard BOKS activity period is 40 minutes). At the end of the second data collection wave, all participants were included in a lottery for local professional sports team game tickets. All children received a lunch bag, water bottle, notebook, and pencils at the conclusion of the study.

Findings

BOKS program time was removed from the analysis at Baseline to test differences in activity levels between BOKS participants and the comparison group. At Baseline, there were no significant differences in sedentary, light, or moderate to vigorous physical activity (MVPA) activity levels between BOKS participants and the comparison group. Similar PA patterns were observed at Time 2.

However, BOKS children had slightly more MVPA and steps than non-BOKS children at both Baseline and Time 2. At Time 3, with program time removed, BOKS children ($M=10,038$ steps per day) showed significantly more steps per day ($M=1,290$ steps) than the comparison group children ($M=8,747$ steps per day), $p<.05$. Mean vigorous daily PA minutes was also significantly higher for BOKS children ($M=22$ minutes) than comparison children (17 minutes); and daily MVPA for BOKS children (127 minutes) was significantly higher than MVPA for non-BOKS children (113 minutes), $p<.05$. In the analyses of Time 3 data, with program time included, BOKS children showed significantly more steps ($M=1,598$ more steps) and significantly more time in vigorous PA per day ($M=7.3$ minutes) and MVPA per day ($M=17.3$ minutes) compared to the non-BOKS group.

Analysis of program time only at Time 3, which was an average of 40 minutes, showed that BOKS programming accounted for, on average, 1,807 steps and 20 minutes of MVPA ($n=47$ BOKS children). During the BOKS sessions children spent, on average, 49% of the time in MVPA and 36% of the time in light activity.

Summary

The research findings highlight the potential benefits to youth who regularly engage in PA through a before-school physical activity program like BOKS. Previous research recommends selected cut points for daily steps for 6-12 year olds of 12,000 and 15,000 steps for girls and boys, respectively.¹ Achieving 1,807 steps during program time would account for approximately 15% and 12% of girls and boys recommended daily steps, respectively. Significant differences in mean daily step count and daily MVPA minutes at Time 3 suggest prolonged participation in a program such as BOKS can stimulate noteworthy differences in physical activity for participating children, including differences which persist on non-program days.

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¹ Tudor-Locke, C., Pangrazi, R.P., Corbin, C.B., Rutherford, W.J., Vincent, S.D., Raustorp, A., Tomson, L.M., & Cuddihy, T.F.(2004). BMI-referenced standards for recommended pedometer-determined steps/day in children. *Prev. Med.* Jun; 38 (6):857-64.