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Original article

A Multimodal Counseling-Based Adolescent Physical Activity Intervention

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A B S T R A C T

Purpose: National guidelines recommend adolescents achieve 60 minutes of moderate-to-vigorous physical activity (MVPA)/day, yet few adolescents meet these guidelines.
Methods: We piloted a novel quasi-randomized physical activity intervention to promote adolescent's use of their surrounding built environment among 30 intervention and 30 control overweight/obese adolescents aged 10–16 years living in greater Boston from 2013 to 2015. Location-specific MPVA was measured by accelerometry and global positioning system for three one-week periods (Time 1 [T1], Time 2 [T2], and Time 3 [T3]). One month after T1, intervention participants received individualized counseling on how to use their surrounding built environment to increase MVPA, and control participants received standard-of-care lifestyle modification counseling; both groups received their T1 physical activity data. T2 assessment occurred the week after the counseling visit and T3 assessment 3–4 months later. The main outcome was change in average daily minutes of MVPA; the secondary outcome was meeting national MVPA guidelines. Multivariable modeling accounted for covariates (baseline MVPA, body mass index, age, sex, race/ethnicity) and clustering by study group and town.
Results: Among the 60 adolescents recruited, 55 (92%) completed data collection. Short-term (T2) intervention effects included increased average MVPA of +13.9 minutes intervention versus −.6 minutes control ($p < .0001$). Differential increase in mean daily MVPA was sustained at T3 (9.3 minutes more in intervention group; $p = .0006$). The proportion of adolescents in the intervention group who achieved 60 minutes/day of MVPA increased from 11% (T1) to 21% (T2), whereas declining (7%–0%) among controls.
Conclusions: Individualized counseling about the built environment can help increase MVPA among overweight and obese adolescents.

IMPLICATIONS AND CONTRIBUTION

Most youth do not achieve recommended daily levels of physical activity. Prior adolescent physical activity interventions have not utilized the built environment for activity promotion. This article reports on a successful intervention using combined geographical information system-global positioning systems –accelerometry mapping technology to encourage adolescents to use their surrounding built environment to improve physical activity.

One third of U.S. adolescents are either overweight or obese [1]. Insufficient physical activity, along with dietary factors, plays an important role in weight status. National guidelines, including those of the American Academy of Pediatrics, recommend that all children and adolescents achieve 60 minutes of moderate-to-vigorous physical activity (MVPA) a day [2,3], yet physical activity

Conflicts of Interest: The authors report no potential, perceived, or real conflicts of interest.

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levels decrease as children age and less than one adolescent in 10 in the United States meet these guidelines [4,5]. Prior pediatric physical activity interventions with objectively measured physical activity have had limited effect, resulting on average in a 4-minute daily increase in walking or running [6].

The built environment, defined as all human-made surroundings that provide the setting for human activities, has been shown in cross-sectional analyses to be associated with adolescent physical activity and obesity [7–9]. Time spent in parks, playgrounds, and sidewalks is associated with increased walking and MVPA among adolescents [7,10]. Despite this, few studies have empirically tested using the built environment to impact physical activity. To the best of our knowledge, no study has tested counseling adolescents on how to use their surrounding built environment to increase physical activity, and obesity interventions have yet to explore the impact of incorporating built environment counseling into physical activity promotion. We conducted the Children's Use of the Built Environment (CUBE) study [11], a controlled trial testing whether a novel multimodal physical activity intervention that includes global positioning systems (GPS) tracking and counseling on use of the built environment could increase daily MVPA among overweight and obese adolescents. The study had 2 hypotheses: the CUBE intervention would increase (1) adolescents' daily MVPA and (2) the number of adolescents achieving the recommended 60 minutes of daily MVPA. This article reports on the preliminary efficacy of the CUBE study intervention.

Methods

We conducted the CUBE study among 30 intervention and 30 control adolescents aged 10–16 years, residing in low- and middle-income towns within greater metropolitan Boston. Adolescents with an age- and sex-specific body mass index (BMI) at or above the 85th percentile, having no health conditions limiting ambulation, and followed at an academic outpatient community health center in eastern Massachusetts were recruited starting in the fall of 2013 over one year. Details of the study rationale, design, and methods have been published previously [11] and are briefly reviewed here. This study was approved by the Partners HealthCare Institutional Review Board, which oversees all hospital- and patient-affiliated research occurring within the Partners HealthCare network in Massachusetts.

Design

A quasi-randomized, unblinded, controlled study design with participants sequentially assigned 1:1 to a study group was chosen to account for known seasonal effects on built environment use in adolescents and to ensure an equal distribution of study group participants enrolled during each study season [7,12]. Time 1 (T1, baseline) data were collected for each participant for one week at study enrollment starting in October 2013 (Figure 1). Time 2 (T2) measurements occurred 1 month after T1, with data collected for one week. A third week of data (T3) were collected approximately 3–4 months after T2. The intervention occurred before T2 data collection.

Intervention

The CUBE intervention aimed to increase adolescent physical activity by testing the American Academy of Pediatrics recommendation that pediatric obesity counseling incorporate the built environment to achieve physical activity goals [2,13]. Intervention participants and a parent or guardian participated in a 30-minute team meeting with a pediatrician, during which they received feedback on their baseline average daily MVPA level. In this visit, intervention participants also received individualized counseling based on their T1 data on how to increase their daily physical activity using their specific surrounding built environment, including geocoded physical activity data displayed on color maps and color charts that classified their built environment use as mean daily MVPA and sedentary time spent in specific land use categories, including parks, playgrounds, home, school, streets, and sidewalks. The maps and charts were reviewed with the participant and parent/guardian at the team meeting and then provided to intervention participants. The participant and pediatrician also decided on a physical activity goal, which the subject agreed to achieve two to three times per week and which involved a new use of the surrounding built environment. Intervention participants received weekly text message and/or phone call reminders about their agreed on goal after their team meeting. Adolescents in the intervention group also received a physical activity promoting gift valued under $5 at T2, along with financial incentives ($5 to the subject and $10 to the family) for meeting their agreed on built environment goal and competed for a prize valued at several hundred dollars for the participant achieving the greatest increase in MVPA over the course of the study. In a parallel study visit, control participants received a handout reviewed in-person containing feedback on their average daily T1 MVPA level along with standard-of-care diet and physical activity recommendations.

Measures

Physical activity. The primary outcome, MVPA, was measured by accelerometry to obtain a valid, objective measure of physical activity. Participants were asked to wear the GT3X accelerometer (ActiGraph LLC, Ft. Walton Beach, FL) on a belt over the hip during waking hours for 7 days at Times 1, 2, and 3. Physical activity data were collected every 30 seconds. Thresholds specific to adolescents classified sedentary time as $<$100 activity counts per minute and MVPA as $\geq$2,296 counts per minute [14,15]. A valid day was defined as $\geq$4 hours (240 minutes) of time-matched accelerometer and GPS wear time, with nonwear defined as $>$60 minutes of consecutive zeros (by accelerometry) with a spike tolerance of 2 minutes, consistent with prior studies combining GPS and accelerometer data [16–18]. Participants were required to have three or more valid days of data for study inclusion. Each participant's daily MVPA was calculated using the total minutes at or above the MVPA threshold, divided by the number of valid study days. Although at least four valid days have been recommended for estimating physical activity levels, these recommendations are based on studies using only accelerometers, and collecting combined accelerometry-GPS data are known to produce lower data yields [16–18]. Only two participants in the study provided less than four valid days of data for one of the data collection periods, and a sensitivity analysis with these participants removed did not change results (results in the following section).

Primary outcome. The primary outcome was the change in mean daily MVPA, measured over one week.