



Promoting health and activity in the summer trial: Implementation and outcomes of a pilot study

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ABSTRACT

The objectives of this study were to implement, test adherence to and examine the preliminary effectiveness of a summertime weight-gain prevention intervention in youth from a low-income, Rhode Island community. In 2016, 51 children, ages 6–12 years, participated in a daily, summertime intervention, which offered a minimum of two hours of physical activity programming and free lunch through the USDA's Summer Food Service Program (SFSP). Thirty children from the same community with similar SFSP access served as a comparison group. Height and weight were measured before and at the end of summer to assess change in body mass index z-score (BMIz). Diet and physical activity were assessed midsummer. Multivariate mixed models were used to test group differences in change in BMIz over the summer and weight-related behaviors midsummer. Repeated measures ANOVA was used to examine the relationships of intervention participation with change in BMIz and weight-related behaviors in intervention participants. On average, intervention participants attended 65.6% of program sessions. They lost 0.04 BMIz units, while those in the comparison group gained 0.03 BMIz units ($p = 0.07$). Midsummer, intervention participants spent 4.6% less time sedentary on weekdays as compared to comparison participants ($p = 0.03$). Among intervention participants, attendance was significantly associated with change in BMIz ($p = 0.01$), spending 41 more minutes in moderate to vigorous physical activity (MVPA) ($p = 0.004$) and 8.5% less time sedentary ($p < 0.001$). Implementing a summertime obesity prevention intervention in a low-income community is feasible. Despite moderate adherence, preliminary findings suggest that participation in the intervention was associated with reductions in BMIz.

Clinical trials registration: ClinicalTrials.gov NCT03118635

1. Introduction

Obesity is common and results in worse health outcomes among those from low-income communities (Centers for Disease Control and Prevention - Division of Community Health, 2013; Schreier and Chen, 2013). Nationally representative data suggest that children from the lowest income households are nearly twice as likely to become obese during childhood as compared to those from wealthier households (Cunningham et al., 2014). A multitude of individual-, family- and community-level contextual factors interact to contribute to this health disparity, including poor diet, physical inactivity, and sedentary behavior, an unhealthy home food environment, limited access to low-cost, nutrient-dense foods, and unsafe neighborhoods that provide few

opportunities for physical activity (Schreier and Chen, 2013; Gordon-Larsen, 2004)

Nearly 20% of American youth are obese and > 90% of youth are enrolled in schools (U.S. Department of Education, National Center for Education Statistics, 2016). Thus, significant efforts have been made to address children's access to healthy nutrition and physical activity within the school environment (Centers for Disease Control and Prevention, 2014). Despite these efforts, income-related disparities in obesity prevalence continue to widen (Wang et al., 2011; May et al., 2013). Convergent findings from several studies suggest that accelerated summer weight gain may be a significant, unrecognized influence, particularly among youth from low-income households, those of minority backgrounds, and those with overweight or obesity

Abbreviations: BMI, Body Mass Index; BMIz, Body Mass Index z-score; GEMS, Girls health Enrichment Multisite Studies; MVPA, Moderate to Vigorous Physical Activity; NDSR, Nutrition Data Systems for Research; PHAST, Promoting Health and Activity in the Summer Trial; SDH, Structured Day Hypothesis; SFSP, Summer Food Service Program; SPARK AS, Sports, Play, and Active Recreation for Kids - After School

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(Economos et al., 2013; von Hippel et al., 2007; von Hippel and Workman, 2016; McCue et al., 2013; Moreno et al., 2013; Baranowski et al., 2014; Franckle et al., 2014; Chen et al., 2016; Moreno et al., 2015).

Whereas the cause of excess summer weight gain is not fully understood, Brazendale and colleagues proposed the “Structured Day Hypothesis” (SDH) (Brazendale et al., 2017) as a potential mechanistic framework. The SDH posits that the structured nature of the school day is protective against obesogenic behaviors in youth, as it provides energy-controlled meals and regular physical activity opportunities. By contrast, the summer has less structure and may provide greater exposure to the home food environment and fewer opportunities for physical activity, particularly for children from low-income communities. The SDH is supported by evidence that physical inactivity, increased screen time, and changes in eating behaviors occur over the summer (Rodriguez et al., 2014; Christodoulos et al., 2006; Tovar et al., 2010). Thus, summer represents an ideal intervention period, one that may have specific implications for addressing income-related health disparities in youth.

Few studies have examined the efficacy of summertime weight gain prevention interventions. As part of a larger study, Baranowski et al. conducted a 4-week summer day camp with 8-year old African American girls. They found no significant differences in BMI between intervention and control groups at the end of the camp (Baranowski et al., 2003). In BOUNCE, a 4-week summertime physical activity intervention for minority girls with overweight or obesity and their mothers, Olvera and colleagues found a significant 15 min increase in daily moderate to vigorous physical activity (MVPA) and a significant decrease in BMI (0.65 kg/m^2) (Olvera et al., 2010; Olvera et al., 2013a). Similarly, after a 4-week summer physical activity intervention with adolescent, minority females, Bohnert et al. found that participants engaged in an additional 26 min of MVPA ($p < 0.001$) (Bohnert et al., 2014). These interventions successfully impacted weight or weight-related behaviors (Olvera et al., 2010; Olvera et al., 2013a; Bohnert et al., 2014); however, they included a single sex, were of brief duration (4-weeks), and only one included a comparison group (Baranowski et al., 2003). Therefore, to fully appreciate the potential of summertime weight gain prevention interventions, studies are needed that include both sexes, last the duration of the summer, and include a comparison group.

The Promoting Health and Activity in the Summer Trial (PHAST) was a pilot study designed to assess the implementation and preliminary effectiveness of a summertime weight gain prevention intervention in a diverse, low-income community. The intervention was a daily camp-like summer program for children, ages 6–12 years, which provided physical activity programming and lunch through the USDA's Summer Food Service Program (SFSP). Using a quasi-experimental design, the primary aim of the study was to develop, implement and test adherence to the intervention. Secondary aims were to test preliminary group differences in change in BMIz over the summer and weight-related behaviors midsummer, and to examine the association between intervention participation and weight related behaviors in intervention participants. We anticipated that intervention participants would experience greater reductions in BMIz and would be more active and consume fewer calories midsummer than those in the comparison group, and that intervention participation would be inversely associated with change in BMIz and total energy intake and positively associated with physical activity.

2. Methods

2.1. Study design

PHAST was a quasi-experimental trial designed to compare excess summer weight gain in children who participated in a camp-like physical activity intervention to that of a comparison group of children

recruited from the same community. The intervention included daily physical activity programming and a free lunch meal provided by the SFSP. Participants in the comparison group had similar access to the SFSP, but they did not have access to intervention programming. This study was funded by the Hassenfeld Child Health Innovation Institute at Brown University and was approved by the Institutional Review Board at Rhode Island Hospital. It is registered with [ClinicalTrials.gov](https://clinicaltrials.gov/ct2/show/study/NCT03118635) (NCT03118635).

2.2. Participants

Through partnerships with the local housing authority and public school district, we recruited children, ages 6–12 years, from two housing communities within the same low-income community. Given the geographic location of the intervention site (a public park across the street from one of the housing communities), recruitment efforts for the intervention group focused on families living within walking distance of the park. A second housing community within one mile of this park, but not easily walkable due to area traffic patterns, was identified for comparison group recruitment. Flyers inviting families to participate in either the intervention or comparison groups (based on geographic location) were sent out through the housing authority and the school district to families in the spring of 2016. Participants were also recruited through a series of community events during the same period.

Interested families were invited to attend an enrollment visit. To enroll, children had to 1) qualify for free or reduced-price meals at school, 2) speak, read and write English (for purposes of assessment and intervention), and 3) agree, along with their parent(s), to study participation. Participants were excluded if they had a medical condition that interfered with participation in physical activity or were otherwise enrolled in a full-time summer camp. We did not have any restrictions on siblings enrolling together. A total of 55 families expressed interest in the study (85 children in all). Four participants did not complete the baseline assessment, such that the final sample included 81 children (51 intervention and 30 comparison). Parental informed consent was obtained for all children enrolled in the study. Child assent was obtained from those ≥ 8 years.

Participants in both groups completed study assessments at the end of the school year (baseline), during weeks four and five of the 8-week summer (midsummer), and during the last week of summer (post-intervention). At the baseline assessment visit, a parent/guardian completed a sociodemographic questionnaire on participant age, sex, race/ethnicity, and maternal education. Participants were weighed and measured at baseline and post-intervention. At midsummer, participants completed three 24-h diet recalls and wore an ActiGraph for 24-h per day for seven days.

2.3. Summer intervention

The intervention was offered from 9 AM to 1 PM, Monday through Friday, for 8-weeks over the 2016 summer. Primary intervention components included a minimum of two hours of physical activity programming and lunch offered through the SFSP. The physical activity programming consisted of the Sports, Play, and Active Recreation for Kids - After School (SPARK AS) curriculum (Marcoux et al., 1999) and activity programming offered by six community organizations. SPARK AS, an evidence-based physical activity curriculum for school-age children, is associated with increased MVPA and decreased BMI (Sandoval Iversen et al., 2011). It was offered by eight college-age summer staff. Daily, a separate activity was also offered by a partnering community organization, which included: karate, Lego building, obstacle courses, hip hop dance, and creative movement.

Table 1 shows the schedule of a typical intervention day and examples of games and activities offered throughout the summer. After sign-in and warm-up, participants were broken up into groups by age and assigned to two staff members. Groups rotated through three, 30-

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