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Impact of a park-based afterschool program replicated over five years on modifiable cardiovascular disease risk factors

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ABSTRACT

Major challenges to the current childhood obesity epidemic include availability of prevention and/or treatment programs that are affordable and acc5essible. We evaluated the change in several modifiable, obesity-related cardiovascular disease risk factors after participation in Fit2Play™, a structured afterschool program housed in a large urban county parks system. Children ages 6–14 who participated in Fit2Play™ in one of 34 parks for one school year during a five-year period (2010–2015) had height, weight, 4-site skinfold thicknesses, systolic/diastolic blood pressure (SBP/DBP), fitness tests, and a health/wellness behavior/knowledge test collected at the beginning and end of the school year. Comparison of pre/post outcome measures were assessed via general linear mixed models for normal weight, overweight, and obese participants and both aggregate and cohort/year-specific results were generated. Aggregate (N = 1546, 51% Hispanic, 44% NHB) results showed after one year of participation (U.S. Department of Health and Human Services, 2016) both the obese and overweight groups significantly decreased their mean body mass index (BMI) percentile (98th to 95th percentile, $p < 0.001$; 91st percentile to 89th percentile, $p < 0.001$, respectively); (Ogden et al. 2015) the normal weight group maintained a healthy BMI percentile (54.6th); (Ogden et al., 2014) mean SBP and DBP significantly decreased (3.6 percentile and 6 percentile points, respectively, $p < 0.001$ for both). Mean number of sit-ups, push-ups, 400 meter run time, and nutrition knowledge scores improved in all participants ($p < 0.001$ for all). These findings suggest that parks-based afterschool health/wellness programs can be a low-cost, high value tool in both preventing and treating the current childhood obesity epidemic and among high-risk groups in particular.

1. Introduction

The United States Department of Health and Human Services' Healthy People 2020 identifies the reduction of childhood overweight/obesity as a leading public-health priority (U.S. Department of Health and Human Services, 2016); yet, the prevalence of childhood overweight/obesity and its associated cardiometabolic health consequences (e.g. elevated blood pressure, lipids, insulin, glucose) continues to be a vexing public health and clinical challenge, especially among children from ethnic minority backgrounds and low income, underserved groups (Ogden et al., 2015; Ogden et al., 2014).

Published randomized controlled trials show that current international policy directions for primary care surveillance and brief counseling are not effective in reducing childhood obesity, improving physical activity and/or quality dietary intake (Hardy et al., 2015; Wake et al., 2009). Moreover, it has been suggested that significant investment of healthcare resources to conduct such trials would be more efficiently directed in community-based programs (Hardy et al., 2015; Wake et al., 2009). However, to the authors' knowledge, no park-based childhood obesity prevention and/or treatment programs are documented in the literature that are affordable, provide minimal barriers for participation, and have replicated study findings over several years.

Given the intersection of the health disparities and obesity crisis, it will be increasingly important to capitalize on existing resources such as our nation's park systems to conduct prevention efforts. Recent literature has highlighted the benefits of community parks and exposure to nature on health and wellness (West et al., 2012). Park systems are some of our nation's richest resources and in most cases provide free resources and amenities to be physically active. Recent studies show that among adults, parks play an important role in the ability of that community's residents to be physically active and to maintain

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a normal body weight in large metropolitan areas (Trust for America's Health (TFAH) and the Robert Wood Johnson Foundation (RWJF), 2012).

The purpose of this study was to determine both the aggregate and cohort/year-specific effects of Fit-2-Play™, a park-based afterschool program on the prevalence of overweight and obesity, cardiovascular health, fitness and health and wellness behaviors/knowledge outcomes among 5 cohorts of 6-to-14 year olds followed over one school year.

2. Methods

2.1. Study design

A non-controlled pre-post design was used to report outcomes of children/adolescents from five cohorts who participated in Fit-2-Play ™ for one year.

2.2. Study participants

Children ages 6-to-14 who participated in the Miami Dade County Parks, Recreation and Open Spaces (MDPROS) Fit-2-Play™ afterschool program, (conducted in 34 Miami Dade County parks 2 pm–6 pm daily in one of 5 school years (2010–11, 2011–12, 2012–13, 2013–14, 2014–15) were included in this analysis (N = 1546). At the beginning of the school year parents complete a registration form at the MPDROS park where their child will participate or online via the MDPROS website (http://www.miamidade.gov/parks/activities-after-school.asp. The form includes Fit-2-Play™ information and an informed consent for measurements collected at the beginning and end of the school year. Annual registration in Fit-2-Play™ is mandatory for all participants but informed consent to join the study/data collection component is voluntary. The informed consent applies to all years (not just that current year) the child participates in the research component. That is, Fit-2-Play™ is an ongoing afterschool program, with volunteer participation in the research study-component. Parents typically learn of the both the ongoing and research program(s) through local media (e.g. radio spots, bus ads, informational flyers posted at the parks, and word-of-mouth). Response rate, or those parents who agreed to have their child's pre-post measures collected each year were as follows: 63% in Year 1, 68% in Year 2, 71% in Year 3, 82% in year 4 and 84% in year 5. Only children with both pre- and post-data for one year of participation in Fit2Play™ were included in the analytic population (those who participated for more than one year only had their first year of participation data included). The study was approved by the University of Miami (UM) Institutional Review Board.

The aggregate sample was stratified at baseline into three groups for analysis: (normal weight (body mass index [BMI] < 85th percentile for age and sex), overweight (85th percentile ≤ BMI < 95th percentile for age and sex) and obese (BMI ≥ 95th percentile for age and sex) participants (Kuczmarski et al., 2002) to determine program effects across weight categories.

3. Data collection

All consented Fit-2-Play™ participants completed a baseline (August/September) and post-test (May/June) assessment that included the measures described below. Data collection was performed by a core MDPROS measurement team (n = 12) who were trained and certified by UM faculty. Additionally, MDPROS bachelor/master's level recreation directors oversaw on-site measurement procedures and collection of all pre-and post-data to ensure measurement fidelity. Data were then uploaded to a shared (parks and university) database via a data management team.

4. Measures

4.1. Demographics

Demographic data was provided by parents via self-report at program registration, including participants' age, sex and race/ethnicity.

4.2. Anthropometric measures

Anthropometric outcome measures included height and weight which were converted to a BMI. Weight was collected on calibrated scales (Seca Model 869, Seca North America East Medical Scales & Measuring Devices, Hanover, MD). Children did not wear shoes or jewelry, were asked to empty their pockets, and only wore light clothing. Height was measured using a stadiometer (Seca 217 Mechanical Telescopic, Seca North America East Medical Scales & Measuring Devices, Hanover, MD). BMI was calculated as weight (kilograms) divided by height (meters) (Ogden et al., 2015) and was then converted to an age-and sex-adjusted percentile and z score (Kuczmarski et al., 2002). BMI is a proxy of adiposity and is easily attainable in a community-based setting such as a park (Dietz and Bellizzi, 1999).

Waist circumference (Brambilla et al., 2006) and its relationship to both height (Li et al., 2006) and hip circumference (Taylor et al., 2000) are simple, yet valid surrogate measures of cardiometabolic disease risk (e.g. cardiovascular disease and/or type 2 diabetes) (Katzmarzyk et al., 2004; Janssen et al., 2005). Waist, hip and midarm circumferences were measured with a tape measure (Gulick model 1098990, Mabis, Jesup, GA). Waist circumference was measured in the horizontal plane at a point marked just above the right ileum on the mid-axillary line at minimal respiration (Lee and Ng, 1965).

Skinfold thickness measurements are another traditional techniques that can provide a reliable estimate of obesity and regional fat distribution (Slaughter et al., 1988; Borkan et al., 1982; Centers for Disease Control and Prevention, 2007). Biceps, triceps, suprailiac, and subscapular skinfold measurements were collected on the right side of the body and recorded to nearest 0.1 mm with skinfold calipers using standard procedures (Slaughter et al., 1988) (Baseline Evaluation Measures model 12-1110, Plains, NY), and age, sex, and ethnicity-adjusted mean values for both individual and sum of the 4 skinfold measures were used in the analysis.

All anthropometric measures were collected in triplicate and averaged for analysis to reduce measurement error.

4.3. Blood pressure

Systolic and diastolic blood pressures were measured with electronic sphygmomanometers (American Diagnostic Corporation model 9005, Drive Hauppauge, NY) using either a child or adult cuff, depending on the girth of the upper arm, a widely accepted and valid technique (Urbina et al., 2008). A total of three diastolic and systolic measurements were taken successively with one-minute in between each measure. For analysis, the first value was dropped and the subsequent two averaged and then assessed for age, sex and height-adjusted normo- , pre- or hypertension based on standardized values (Urbina et al., 2008; National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents, 2004).

4.4. Physical fitness

The Presidential Youth Fitness Program, a standardized and validated testing protocol for children and adolescents (The Presidential Youth Fitness Program, 2016; President's Council on Physical Fitness and Sports, 1986), was used to test physical fitness. Flexibility was assessed with the modified sit and reach test (Novel Products Flex Tester sit-and-reach box model 00004, Rockton, IL) (Castro-Piñero et al., 2009) which t was repeated 3 times with the best value was recorded. To assess