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School gardens and physical activity: A randomized controlled trial of low-income elementary schools

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ABSTRACT

Objective: This study examines effects of a school garden intervention on elementary school children's physical activity (PA).

Method: Twelve schools in New York were randomly assigned to receive the school garden intervention (n = 6) or to the waitlist control group that later received gardens (n = 6). PA was measured by self-report survey (Girls Health Enrichment Multi-site Study Activity Questionnaire) (N = 227) and accelerometry (N = 124, 8 schools) at baseline (Fall 2011) and follow-up (Spring 2012, Fall 2012, Spring 2013). Direct observation (N = 117, 4 schools) was employed to compare indoor (classroom) and outdoor (garden) PA. Analysis was by general linear mixed models.

Results: Survey data indicate garden intervention children's reports of usual sedentary activity decreased from pre-garden baseline to post-garden more than the control group children's ($\Delta = -.19$, $p = .001$). Accelerometry data reveal that during the school day, children in the garden intervention showed a greater increase in percent of time spent in moderate and moderate-to-vigorous PA from baseline to follow-up than the control group children ($\Delta = +.58$, $p = .010$; $\Delta = +1.0$, $p = .044$). Direct observation within-group comparison of children at schools with gardens revealed that children move more and sit less during an outdoor garden-based lesson than during an indoor, classroom-based lesson.

Conclusion: School gardens show some promise to promote children's PA.
Clinical Trials Registration: clinicaltrials.gov # NCT02148315.

Introduction

Children and youths in the United States are not achieving recommended levels of physical activity (PA) (NASPE, 2004; Pate et al., 2002). Among 11 year olds in the U.S., only 24% of girls and 30% of boys achieve the recommended 1 h of moderate-to-vigorous PA (MVPA) daily (World Health Organization, 2012). In New York State, 34.1% of school-aged children engaged in at least 20 min of vigorous PA 4–6 days per week, compared to 37.8% of children nationwide. Additionally, only 24.6% of New York children engaged in vigorous PA everyday compared to 28.0% of children nationwide (National Survey of Children's Health). Physical inactivity has been linked both cross-sectionally and prospectively to obesity (Dietz and Gortmaker, 1985; Gortmaker et al., 1996; Hancox et al., 2004). Health benefits associated with PA throughout the life course are well-documented (Blair and Morris, 2009; Nocon et al., 2008; Woodcock et al., 2011). Strategies to reduce sedentary behavior and increase PA during childhood may help to curb the obesity epidemic and set youths on a more active, healthy life-course trajectory (Elder, 1998; Wethington, 2005; Wheaton and Gotlib, 1997).

School gardens have gained prominence as a potential contributor to public health (Christian et al., 2012; Ozer, 2007; Twiss et al., 2003). Gardens are unique in their potential to affect both sides of the energy balance equation: dietary intake and physical activity (Hill and Peters, 1998; Wells et al., 2007), and yet relatively few studies have examined the effects of gardens on children's health or health behaviors. Moreover, the extant research on the topic of gardens and children's health has focused almost exclusively on the potential for gardens to impact children's diet-related outcomes such as fruit and vegetable consumption or fruit and vegetable preference (Christian et al., 2012, 2014; Lineberger and Zajicek, 2000; Morris and Zidenberg-Cherr, 2002; Morris et al., 2001, 2002, Robinson-O'Brien et al., 2009), while studies of gardens' effects on children's PA are rare (Hermann et al., 2006; Phelps et al., 2010). For evidence-based garden interventions to be developed and implemented, there is a need for a clearer understanding of the potential for gardens to bolster children's PA and reduce sedentary behaviors.

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This study addresses the following three research questions:

1. Is there an effect of a school garden intervention on children's overall PA and sedentary activity, as measured by self-report survey?
2. Is there an effect of a school garden intervention on children's PA levels during the school day, as measured with accelerometry?
3. In a within-subjects comparison, does PA, measured by direct observation, differ during an indoor classroom lesson versus during an outdoor garden lesson?

Methods

Study design and procedure

In this longitudinal cluster randomized controlled trial, schools were randomly assigned to the garden intervention or to the waitlist control group that received gardens at the end of the study (Wells et al., in press). Baseline data were collected in Fall 2011 (wave 1). The garden intervention began in Spring 2012 and continued through Spring 2013. Three waves of post-garden implementation data were collected (wave 2: late Spring 2012, wave 3: Fall 2012, wave 4: late Spring 2013). All procedures were approved by the authors' University's Institutional Review Board. The study was deemed exempt and therefore did not require child assent or parental consent.

The intervention

The intervention, developed as part of the *Healthy Gardens, Healthy Youth* pilot program, consisted of four components. (1) The garden was a $4' \times 8'$ raised bed for each class. (2) Access to a curriculum of 20 lessons for children in grades 4–6; 11 lessons for year 1, and 9 for year 2. The curriculum toolkit was created based on a review of 17 extant garden curricula and focused on nutrition, horticulture, and plant science and included activities and snack suggestions. Aside from the lessons, educators led other activities in the garden such as planting, weeding, and harvesting. (3) Resources for the school included information about food safety in the garden and related topics. (4) The garden implementation guide provided guidance regarding planning, planting and maintaining the garden throughout the year; gardening during the summer; engaging volunteers; building community capacity; and sustaining the program.

Schools and classes

This study targeted low-income schools that did not already have school gardens used for teaching and learning and had at least 50% of students qualifying for free or reduced price meals (FRPM). A total of 12 schools in 5 regions of

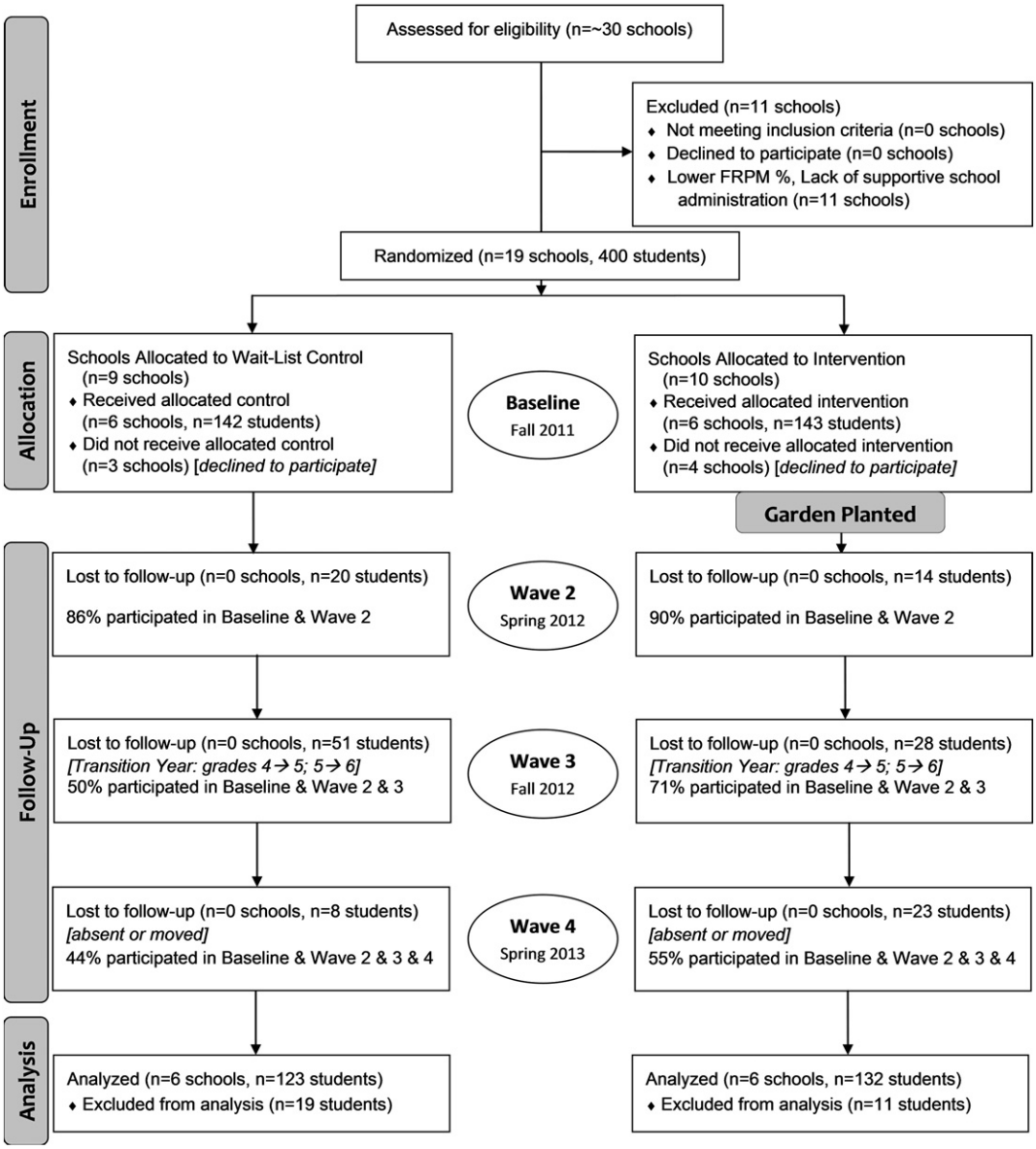

Fig. 1. Flow diagram for school gardens RCT.