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Active design in affordable housing: A public health nudge

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ABSTRACT

This pilot study investigates the impact of active design (AD) strategies on physical activity (PA) among adults living in two Leadership in Energy and Environmental Design (LEED) certified affordable housing developments in the South Bronx, New York. One building incorporates LEED Innovation in Design (ID) Credit: Design for Health through Increased Physical Activity. Tenants in an affordable housing building (AH) incorporating active design strategies completed PA self-assessments at their lease signing and one year later in 2015. Trained research assistants obtained body measurements. Residents of neighboring non-AD affordable housing (MCV) served as a comparison. Thirty four adults were recruited from AH and 29 from MCV, retention was 56% (n = 19) and 52% (n = 15) respectively at one year. The two groups' body mass index (BMI) and high-risk waist-to-hip ratio (WHR) were not statistically significantly different when analyzed as continuous variables, although BMI category had a greater decline at AH than at MCV ($p = 0.054$). There was a 31.5% increase in AH participants meeting MPA requirements and a statistically significant improvement in females ($p = 0.031$); while there was no change in the MCV participants overall or when stratified by gender. AH participants were significantly more likely to have reported increased stair use and less likely to have reported no change or decreased stair use than participants from MCV participants ($p = 0.033$). Housing has a role in individual health outcomes and behavior change, broad adoption of active design strategies in affordable housing is warranted to improve physical activity measures.

1. Introduction

Regular physical activity (PA) is associated with optimal health, decreased cardiovascular disease (CVD) and comorbidities, and reduced risk of mortality (Samitz et al., 2011; Sattelmair et al., 2011). To heighten public awareness of the need for increased PA and to subsequently decrease rates of obesity, the U.S. Department of Health and Human Services issued the Physical Activity Guidelines for Americans in 2008 (Office of Disease Prevention and Health Promotion, 2008). The guidelines as set forth by the Centers for Disease Control (CDC), recommend that adults 18–65 years of age engage in 150 min of moderate-intensity physical activity (MPA) or 75 min of vigorous physical activity (VPA) per week and two days per week of strength training to reduce risk of disease and promote a healthy lifestyle (Centers for Disease Control and Prevention, 2015a). These lifestyle changes have shown to improve mental health, help control weight, and decrease the risk for chronic medical conditions such as type 2 diabetes, metabolic syndrome, and CVD. Research findings suggest that PA may decrease the risk for breast, endometrial, colon and lung cancers (Centers for Disease Control and Prevention, 2015b; Dethlefsen et al., 2017; Wolin et al., 2009). However, there is a national trend towards increasing sedentary behavior due in part to lack of resources and available outlets for exercise, work environments that encourage seated-static positions, and the availability of technologies such as entertainment systems and computers (Owen et al., 2011; Barwais and Cuddihy, 2015; Parry and Straker, 2013). A recent study showed that adults spend approximately 50–60% of their day engaged in activities that require low-intensity movement whether at home, work, or school (Wolin et al., 2009).

Efforts to increase PA among Americans have been largely unsuccessful. Only 20% of adults living in the U.S. met both the aerobic and muscle strengthening national recommendations (Centers for Disease Control and Prevention, 2011). The introduction of small amounts of PA in the daily routines of Americans may be an effective strategy in increasing health benefits (Centers for Disease Control and

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Prevention, 2015b).

Recent evidence suggests that the built environment and structural design strategies can impact human behavior and promote health (Barnett et al., 2017; Suminski et al., 2006). The built environment is a multifaceted concept that includes land use, active transportation systems, community design in its built and natural form; and patterns of human activity within the physical environment (Boarnet et al., 2002). Studies on barriers to PA within the built environment include poor neighborhood walkability, perceptions of neighborhood safety, lack of playgrounds or access to recreational facilities, and neighborhood planning that encourages automobile, rather than walking or bicycle use (Suminski et al., 2006). In response, urban planners, architects and interior designers have created active design initiatives to promote PA and create healthy, livable communities in welcoming, safe environments (Garland et al., 2014).

Regular stair use has been associated with enhanced health, increased strength and fitness, weight loss and reduced risk for osteoporosis and CVD (Kerr et al., 2001). Active design (AD) strategies such as delayed speed elevators and motivational signs or point-of-decision prompts in combination with stairwell enhancements, encourage stair use and decrease the likelihood of people choosing elevators or escalators (Task Force on Community Preventive Services, 2010; Boutelle et al., 2001). These design elements are used to change an individual's knowledge and attitudes about stairs use and the overall value of PA (Soler et al., 2010).

The use of AD strategies in the built environment is a means of promoting PA (Boarnet et al., 2002). Few studies have evaluated the correlation between AD and increased PA in affordable housing. In an effort to promote health in New York City (NYC) residents, in 2000 the NYC Department of Health and Mental Hygiene collaborated with NYC Department of Design and Construction as well as the Mayor's Office of Management and Budget to develop a Leadership in Energy and Environmental Design (LEED) Innovation in Design (ID) Credit: Design for Health Through Increased Physical Activity (Lee, 2012). This pilot study investigates the impact of AD strategies on PA among adults living in two LEED-certified affordable housing developments in the South Bronx; one of which incorporates the LEED ID credit.

2. Methods

2.1. Study site

Arbor House (AH) and Melrose Commons V (MCV) are platinum LEED-certified affordable housing buildings in the South Bronx occupied in May 2010 and February 2013, respectively. Both residences were constructed by the same developers with nearly identical unit layouts. AH, an eight-story, 124-unit building, served as the intervention site. It earned the LEED ID credit by including features such as delayed elevator speed and non-prominent location of elevators, an indoor gym and outdoor exercise circuit. It includes central stairwell placements which are wide, well-lit, with music playing and visible artwork, along with point-of-decision prompts encouraging their use. MCV, a five-story, 63-unit building served as the control, without any LEED ID credit features.

2.2. Participant recruitment

A lottery to allocate housing in AH was performed in June 2012 by the NYC Department of Housing Preservation and Development. The lottery process was publicized to the community via newspapers, internet, and telephone housing hotlines. Eligibility criteria for the lottery were based on proof of NYC residence and an income level below 60% of the median income for that year in that neighborhood. Both buildings are located in the same neighborhood of the South Bronx. In 2014, 39% of residents lived below the Federal Poverty Level with a median income of $27,209 (United States Census Bureau, 2017). Current neighborhood residents were given priority. Housing in MCV was allocated in late 2009 with the same methodology and eligibility criteria.

The pilot study was conducted using convenience sampling of consenting adult residents of AH and MCV. Researchers were provided with the AH lease signing schedule, beginning in March of 2013. Prospective study participants were approached after their lease signing by trained research assistants (RA) who introduced the study and obtained written consent. Those interested but lacked time were provided alternative dates. RAs recruited control group subjects in the MCV lobby and via fliers. The study was conducted during weekday business hours, evenings, and weekends. In both buildings, up to two adults per household were consented. Follow-up was conducted 12 to 15 months following initial recruitment. Study participants were contacted at least three times via email, phone, and/or letter under the door to repeat data collection before considering them lost to follow-up.

Inclusion criteria included being over 18 years of age and English-speaking. Participants did not have to be lease signers themselves but needed to reside in the unit. Exclusion criteria included having a physical disability that precluded stair use (i.e. wheelchair use or use of walking aids). Sociodemographic information such as age, gender, and smoking status were collected. Non-participation did not affect housing eligibility. Recruitment in AH continued up to one month after occupancy. Recruitment at MCV was held simultaneously, to reduce impact of seasonality. All participants provided informed consent and the Institutional Review Board of the Icahn School of Medicine at Mount Sinai approved this study. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

2.3. Data collection

Height, weight, waist and hip circumference were measured to calculate body mass index (BMI), as kg/m^2, and waist-to-hip ratio (WHR), using the World Health Organization data gathering protocol on WHR. Waist circumference measurement was made at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest. The hip circumference measurement was taken around the widest portion of the buttocks. All measurements were taken two times and averaged (World Health Organization, 2011). Each individual was categorized for BMI as 'normal' (18.5–24.9), 'overweight' (25–29.9), or 'obese' (≥ 30); and for WHR as being at "low" (< 0.95 for males and < 0.80 for females), "moderate" (0.96–1.0 for males and 0.81–0.85 for females) or "high" risk (> 1.0 for males and > 0.85 for females) (World Health Organization, 2011; Centers for Disease Control and Prevention, 2016).

Questionnaires were administered by the RA at the time of study enrollment (T_0) and 12–15 months later (T_1). Frequency and intensity of PA were determined using the Physical Activity Questionnaire© which consisted of 11 validated questions derived from the Block Dietary Data Systems. The questionnaire utilized the Compendium Coding Scheme which categorizes each specific activity as MPA or VPA based on energy expenditure (Ainsworth et al., 2011). Four questions were added by the research team to further measure stair use both inside and outside the home. Each individual was classified as having reported less stair use at T_1 than at T_0 ("decline"), the same stair use at both time points ("no change") or more stair use at T_1 than at T_0 ("increase"). The Brief Food Questionnaire© was administered to calculate food frequencies on usual eating habits in the past year. Study participants received $40 cash as incentives at both data collection points.

2.4. Statistical analyses

IBM SPSS statistical software Version 22.0 (SPSS, INC., Chicago, IL) was used for data analysis. Descriptive statistics were produced for all study variables, stratified by site (AH or MCV). Baseline comparisons of