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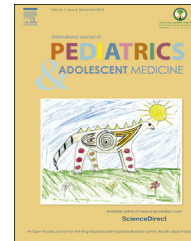


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ORIGINAL RESEARCH ARTICLE

# Associations between child and sibling levels of vigorous physical activity in low-income minority families



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## KEYWORDS

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**Abstract** *Background and objectives:* A child's level of habitual physical activity is partly determined by a familial component, but the literature is limited regarding sibling influences. Multiple studies suggest that targeting siblings is an effective strategy for improving child health behaviors.

*Patients and methods:* We analyze Moving to Opportunity for Fair Housing (MTO) data to study associations between the odds of a child attaining 20 min or more of vigorous physical activity at least 3 days every week and parallel measures from an older sibling and a parent. We include covariates representing the social environment such as household income and neighborhood safety.

*Results:* There were 1347 study units that consisted of a child (age 11.2 y ± 2.6), an older sibling (age 14.8 y ± 2.8), and a parent (age 38.3 y ± 7.5). A child's odds of vigorous physical activity for 20 min or more was increased if the older sibling (OR 1.67; 95% CI 1.32–2.11) or parent (OR 1.36; 95% CI 1.08–1.72) had a comparable activity level compared to children whose older siblings or parents did not exhibit a comparable level of activity.

*Conclusions:* A younger sibling's level of physical activity is positively associated with an older sibling's and/or parent's level of physical activity. Family-based approaches, especially those incorporating siblings, may be effective at increasing physical activity in children.

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## 1. Introduction

Despite clear benefits, physical activity among children is inadequate and perhaps even decreasing over time [1–3]. Increasing the physical activity of children in the U.S. is a public health priority, especially in light of the current obesity epidemic [4]. Research is needed to expand our understanding of which factors influence the physical activity of children at various developmental stages and in different familial and contextual situations [5].

Several studies suggest that familial context influences an individual's level of habitual physical activity [6–12]. In many health behavior models, such as social learning theory [13] and social support theory [14], the family is conceptualized as an important socializing agent, constituting an interactive-interdependent network and a source of multiple environmental influences [15–17]. Family dynamics including family rules, emotional support, encouragement, reinforcement from other family members, and family member participation are important determinants of a family's health-behavior patterns [18]. Family-based interventions that promote physical activity in children by establishing positive modeling or by increasing social support may yield more beneficial and enduring effects [12,17,19].

Studies of parent-offspring correlations with respect to physical activity participation have demonstrated low to moderate familial resemblance in exercise behaviors [20]. Similar results have been reported in studies of spousal physical activity [21]. In addition, heritability estimates for physical activity have been highly variable, ranging from no genetic effect in family designs to high heritability coefficients in twin studies [22,23].

Given that much of the research regarding familial physical activity associations has focused exclusively on parent-child relations, our objective in this study was to examine the relationship between a child's physical activity and that of an older sibling, as well as that between a child and a parent. While there is a fair amount of literature regarding associations between siblings with respect to risky behaviors such as tobacco use, teenage pregnancy, and delinquency, the literature regarding sibling influences on youth physical activity is limited. For example, research indicates that sibling effects are statistically stronger than the effects of cigarette price and youth access control policies on teen smoking [24]. Analyses of sister pairs from the National Longitudinal Survey of Youth identified associations wherein an older sister's teenage pregnancy predicted a younger sister's teenage pregnancy [25]. Sibling correlations regarding delinquent behaviors are greater than any of the correlations between peers defined as adolescents' best friends or between schoolmates living in the same neighborhood [26]. Such findings suggest that important peer effects may operate through sibling interactions. In addition, interventions targeting siblings, in addition to parents or other family members, may have multiplier effects in deterring risky youth behaviors.

We hypothesized that children with physically active families are more likely to be active. We further hypothesized that siblings and parents have distinct influences on a child's physical activity.

## 2. Patients and methods

### 2.1. Study design

This was a cross-sectional study, using interim data collected from the Moving to Opportunity for Fair Housing (MTO) study by the U.S. Department of Housing and Urban Development. In this study, families in public housing in five metropolitan areas (Baltimore, Boston, Chicago, Los Angeles, and New York) were recruited and randomized to one of three study groups:

1. remained in public housing (control group);
2. moved to any neighborhood outside of public housing (Section 8 group);
3. moved to a low-poverty neighborhood, defined as having less than 10% of its residents with household incomes below the federal poverty line (experimental group).

Interim data were collected five years after randomization among participating families. Up to two children per household were interviewed. Recruitment and selection procedures are described in detail on the study's web site (<http://www.hud.gov/progdesc/mto.cfm>). MTO is authorized under Section 152 of the Housing and Community Development Act of 1992 and is jointly administered by HUD's Offices of Policy Development and Research, Fair Housing and Equal Opportunity, and Public and Indian Housing. Adult research subjects provided written informed consent, and child subjects provided assent, to have de-identified data analyzed for research purposes. The institutional review board of the Indiana University School of Medicine approved this study.

### 2.2. Setting/participants

The MTO study obtained self-reported data from up to two children aged 7–18 years per family at the time of interim data collection (total child subjects = 4612). From this group, we included data for 1347 family units after excluding subjects because they had no siblings or had a sibling of the same age. At baseline, two-thirds of the subjects were African American, and approximately one-third was Latino. The average total household income was \$9300, and approximately 60% of participating families received federal public assistance. Representation was approximately equivalent across MTO project sites – Baltimore, MD (14%); Boston, MA (20%); Chicago, IL (24%); Los Angeles, CA (20%); New York, NY (22%). The subjects in this analysis were also evenly distributed across MTO study arms: voucher to move to low-poverty neighborhood (41%); voucher to move to any neighborhood (31%); control group (28%).

## 3. Measures

### 3.1. Outcome

Physical activity was defined using a U.S. Centers for Disease Control and Prevention Youth Risk Behavior Survey

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