



# Objective reports versus subjective perceptions of crime and their relationships to accelerometer-measured physical activity in Hispanic caretaker-child dyads



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## ABSTRACT

Crime and safety are commonly cited barriers to physical activity (PA). We had three objectives, 1) describe the association between objective crime measures and perceptions of crime, 2) analyze the relationships between each type of crime and accelerometer-measured physical activity in caretakers and young children (ages 3–5 years), and 3) explore for early gender differences in the relationship between crime and physical activity in young children. Data are from the cross-sectional baseline data of an ongoing randomized controlled trial in Nashville, Tennessee spanning September 2012 through May 2014. Data was analyzed from 480 Hispanic dyads (adult caretaker and 3–5 year old child). Objective crime rate was assessed in ArcGIS and perception of crime was measured by caretaker agreement with the statement “The crime rate in my neighborhood makes it unsafe to go on walks.” The primary outcome was accelerometer-measured physical activity over seven consecutive days. Objective and perceived crime were significantly positively correlated. Caretaker vigorous PA was significantly related to perceptions of crime; however, its relationship to objective crime was not significant. Child PA was not significantly related to caretaker perceptions of crime. However, interactions suggested that the relationship between crime rate and PA was significantly more negative for girls than for boys. Objective and subjective measures of crime rate are expected to be important correlates of PA, but they appear to have complex relationships that are different for adults than they are for young children, as well as for young girls compared to boys, and research has produced conflicting findings.

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## 1. Introduction

While the health benefits of physical activity (PA) are well established, there is evidence that activity levels remain inadequate and vary widely across demographic subgroups. Minority females report the lowest levels of PA and almost half (47.8%) of adult Hispanic women do not engage in leisure time PA compared with 29.2% of non-Hispanic white women (Larsen et al., 2013). This disparity extends to Hispanic children (Gordon-Larsen et al., 2000) as PA levels from racial/ethnic minority groups are generally found to be lower compared to their white counterparts (Whitt-Glover et al., 2009). Within child subgroups, there are also differences between gender as boys are typically more active compared to girls (Gordon-Larsen et al., 2000; Tucker, 2008). Together, these racial/ethnic and gender disparities can lead to

adverse health outcomes, such as obesity and its associated complications (e.g., metabolic and endocrine disorders including glucose intolerance, hypertension, and dyslipidemia) and further, increase the risk of physical inactivity-related complications into adulthood (Whitaker et al., 1997) (e.g., cardiovascular disease and type 2 diabetes (Butte et al., 2007)).

Perceived safety in the built environment is a modifiable facilitator of PA for both children and adults. Research examining neighborhood environments, important venues for outdoor play and PA for children (Carver et al., 2008) and walking for adults (Foster and Giles-Corti, 2008), identifies crime and fear of crime as a potential negative influence on PA. This is especially problematic considering that walking is the most common form of moderate-intensity activity (Foster and Giles-Corti, 2008). In a study examining environmental contexts for PA behaviors in adults wearing accelerometers, results indicate that 30% of all PA episodes were categorized as walking and all walking occurred outdoors (Doherty et al., 2013). Further, Hispanic families are more likely than non-Latino whites to live in low-income urban neighborhoods with higher crime and worse environmental conditions

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(Larsen et al., 2013) likely exacerbating barriers to being physically active. Related research also suggests that perceptions of safety are rooted in sociohistorical factors related to prejudice and racism, particularly among minority males – an often underexplored issue of criminality in relation to PA in outdoor environments (Gilbert and Ray, 2015). Characterizing the association between crime and PA, especially among low-income Hispanic populations may therefore be an important contribution to combating the rising levels of physical inactivity.

Previous studies examining the relationship between neighborhood crime and PA for adults and children produced conflicting results. One study (Weir et al., 2006) found higher levels of self-reported parental anxiety about neighborhood safety leading to a lower level of children's PA in poor inner city communities compared with middle-class suburban communities. Other U.S. studies found no significant associations between adult perceived crime and PA (Voorhees and Rohm Young, 2003; Wilbur et al., 2003). Additionally, while few studies have investigated the association between objective crime and PA (Foster et al., 2014a), some that did supported the hypothesis that higher objective crime constrained walking and other physical activities (Evenson et al., 2012; McDonald, 2008). Yet, others reported no association between crime and PA (Foster et al., 2014b; Oh et al., 2010) or counter-intuitive positive associations (Mason et al., 2013). To date, however, studies examining perceived and objective crime together with objectively measured PA have not directly focused on Hispanic populations for both adults and young children.

The purpose of this study, therefore, was to characterize the relationships between crime and PA for low-income Hispanic caretaker-child dyads. Exploring this growing population and emphasizing the dyadic relationship between caretakers and children as young as three to five years old may present unique findings that ultimately contribute to understanding behavior and health outcome trajectories for growing children. Using a framework based in the socioecological model where child PA occurs in the context of family and community, we had three objectives: 1) examine the association between objective and perceived measures of crime, 2) analyze the separate relationships of objective and perceived crime with parent and child PA, and 3) use post-hoc exploratory regression analyses to determine whether there were child gender-crime interactions that might be related to child PA. For objective 2, we analyzed sedentary, light, moderate-to-vigorous, and vigorous PA levels, for objective 3, we focused on child moderate-to-vigorous PA (MVPA).

## 2. Methods

### 2.1. Participants

This study was a cross-sectional analysis of data collected prior to randomization from an on-going randomized controlled trial (RCT) of a parent-child intervention designed to prevent childhood obesity in underrepresented, minority communities – primarily Hispanic and African-American neighborhoods (Po'e et al., 2013). In our targeted recruitment zip codes, the 2010 Census reports a range in percent Hispanic or Latino (of any race) from 15.7% to 21.3%, highlighting key underrepresented populations of interest for the ongoing RCT. Our prior research has already shown that parental and child PA is correlated (Ruiz et al., 2011) leading us to focus exclusively on the associations of crime and parental or child PA, separately. Study procedures were approved by the Institutional Review Board of Vanderbilt University Medical Center. The trial is registered at [ClinicalTrials.gov](http://ClinicalTrials.gov) (NCT01316653). Caretaker-child dyads were recruited from Davidson County, TN. Dyads were eligible to participate if they received at least one form of government assistance, spoke English or Spanish, the parent was over 18 years old, the child was between ages three and five and normal weight or overweight (based on body mass index percentile  $\geq 50$ th and  $< 95$ th assessed by trained research staff), and both parent/caretaker and child could participate in PA.

The full trial recruited 610 caretaker-child dyads; however, for the current study we focused on the 555 dyads with a Hispanic caretaker. Due to missing data stemming from several sources (incomplete subjective crime surveys ( $n = 6$ ), incomplete objective crime data ( $n = 26$ ), adults who opted out or did not meet minimum wear time criteria for accelerometry ( $n = 43$ ), and children who did not meet the minimum wear time criteria ( $n = 3$ )), our final analytic sample was 480 for analyses that utilized adult accelerometry and 520 for analyses that utilized child accelerometry.

### 2.2. Measures

The primary exposure variables measured included objective crime counts and caretaker perception of neighborhood crime. The primary outcome variables were PA for both caretakers and children, as measured by accelerometry. Bivariate correlations involving PA utilized percent wear time (as opposed to minutes of wear time) because of the necessity to capture PA with a single variable while still accounting for individual differences in wear time. Regression models used minutes of PA as the outcome and included wear time as a covariate to adjust for differences.

### 2.3. Objective and perceived crime

Objective crime data from 2011 to 2012 was obtained from the Nashville Metropolitan Police Department (NMPD). This dataset consisted of all crimes reported to the police department and crimes were categorized into 74 categories. Crimes were analyzed if they were related to personal safety (e.g., aggravated assault, simple assault, robbery, intimidation, etc.) and if they had an associated address, allowing abstraction of XY coordinates for subsequent geocoding. Exclusion criteria included crime categories not related to personal safety (e.g., bad checks, betting/wagering, embezzlement, found/lost property, etc.) and if crimes did not have XY coordinates. Just over 98,000 total crimes were included in the original NMPD dataset. After removing irrelevant crime categories and those with incomplete addresses, 24,583 of the remaining crimes were geocoded in ArcGIS (v10.3). Final crime distillation included creating a half-mile radial buffer around each dyad's home address and spatially joining a count of reported crimes. Two investigators independently categorized crime data as being related to personal safety and discrepancies were discussed. Inter-rater reliability was high for identifying personal safety categories (IRR = 94%). Fig. 1 shows a consort diagram.

Perceived crime was measured by a single item assessing caretaker agreement with the statement “the crime rate in my neighborhood makes it unsafe to go on walks.” Response options were coded as: 0 = “I disagree” (safe), 1 = “I don't know/am not sure”, and 2 = “I agree” (unsafe). “I don't know/am not sure” was interpreted as an intermediate category between actively disagreeing and agreeing that crime is a problem. Informed consent and all study communication (including survey administration) were conducted in either English or Spanish according to participant preference. Bilingual research assistants administered the survey and all data were collected and stored in REDCap (Harris et al., 2009).

### 2.4. Physical activity

Objective PA was measured using accelerometers (ActiGraph GT3X) worn by both caretakers and children for seven consecutive days. Validation cut-points for four categories of PA (i.e., sedentary, light, moderate or vigorous, and vigorous) were based on previously validated algorithms for both adults and children (Troiano et al., 2008; Trost et al., 2005). Dyads achieved valid wear time if worn for at least three weekdays and one weekend for at least six hours during waking hours (5:00 am to 11:59 pm). Sensitivity analyses compared weekday to

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