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Hispanic maternal and children's perceptions of neighborhood safety related to walking and cycling

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ABSTRACT

This study examined neighborhood safety as perceived by children (mean age=10 years) and their mothers, and its association with children's physical activity. For all eight safety items examined, children perceived their environment as less dangerous than mothers ($p<0.05$). None of the multiple regression models predicting children's physical activity by safety perceptions were significant ($p>0.10$). The maternal perception model explained the highest percentage of variance ($R^2=0.26$), compared to the children's perception model ($R^2=0.22$). Findings suggest that future studies should explore relations between self-reported and objectively measured safety barriers to Hispanic youth walking and cycling.

1. Introduction

Walking and cycling to/from school are common activities for children and contribute to overall physical activity levels (Loucaides and Jago, 2008; Mendoza et al., 2011; Michaud-Tomson et al., 2003; Timperio et al., 2006; Tudor-Locke et al., 2003), and cardiovascular fitness in youth (Kirsten et al., 2008). Despite health benefits, walking and cycling to school in the US declined from 48% in 1969 to 16% in 2001 (US Department of Transportation, 2003), which is a steeper decline than reported in the UK (Department for Transport, 2006) and Australia (Transport Data Center, 2001). Several factors have been identified to explain this decline (US Centers for Disease Control and Prevention, 2002). Along with the increasing distance between homes and schools, parental safety concerns have been reported consistently as major barriers to walking and cycling to school (McDonald, 2008; Napier et al., 2011; Panter et al., 2009; Wen et al., 2007; Zhu and Lee, 2009). Children's perceived safety of the neighborhood has also shown to be a predictor of walking to/from school (Voorhees et al., 2010). Furthermore, Napier et al. (2011) reported that children walked to school more when parents and children perceived fewer barriers to walking. Parents living in less walkable or low-income communities perceived more barriers (Napier et al., 2011) and were more concerned about road safety than their children (Timperio et al., 2004). Safety concerns appear to be more serious in low-income, inner-city settings, contributing not only to reduced walking and cycling, but also to lower overall physical activity among children and adolescents (Weir et al., 2006; Gomez et al., 2004; Zhu et al., 2011). Given the relevance of parental and child's perceived safety to walking, the purposes of this study were to assess: (1) differences between Hispanic children and their mothers in the perception of neighborhood safety related to walking and cycling, and (2) the relationship of mothers' and children's neighborhood safety perceptions and children's actual physical activity. We targeted Hispanic families because they are the largest minority group in the United States (US Census Bureau, 2009) and have higher obesity rates than their Caucasian counterparts (Ogden et al., 2008). Thus, it is important to understand the behaviors that can contribute to obesity in this high risk group.

2. Methods

2.1. Study sample and procedure

Data collection was conducted in 2008–2009 and was approved by the University of Houston and the Texas A and M

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University Committees for the Protection of Human Subjects and the Houston Independent School District Research Committee. Participants were recruited from elementary schools (3rd–5th grade) located in the targeted neighborhood described below. Upon permission from the school administrators, research assistants met with eligible mothers at school events (e.g., open house) as well as at drop off and pick up times to inform them about the study. Flyers with information about the study were also sent home through children. Of the 250 names on class rolls for 8 classes across 4 elementary schools, 132 mother-child dyads agreed to participate by the beginning of the study (53% response rate). All 132 children completed child measures, but only 102 mothers completed maternal measures. Study eligibility criteria included only one mother-child pair per family of Hispanic ethnicity, with the ability to communicate in English or Spanish, and not having any medical restrictions affecting physical activity patterns.

2.2. Neighborhood characteristics

Study participants resided in the East End district located on the east side of Houston, TX, bounded by State Highway 59 on the west, Buffalo Bayou and the Houston Ship Channel on the north, Loop 610 on the east, and Interstate Highway 45 on the south. About 92% of the district's residents are of Hispanic ancestry; 35% are aged younger than 18; and 54% of residents 25 years and older have no high school diploma (US Census Bureau, 2000). East End's poverty rate is high with 36% of families with an annual income lower than $15,000. This inner-city neighborhood has fairly compact (about 7.5 persons/acre) and diverse land use patterns, including 21% residential, 23% industrial, 10% commercial and office, and 6% park and open spaces (City of Houston, 2007). Street networks in this area are predominantly grid-like, but include a small number of loops and dead-end streets near the waterways. Sidewalks are on most streets, but bike lanes and trail systems are rarely found in this area. The City of Houston has one of the highest crime rates in the US with 6698 crimes per 100,000 persons per year, much higher than 2416 for New York and 3371 for Los Angeles (City of Houston, 2009). East End has about the same crime rate as the citywide average. Further, studies showed East End to have several crash "hot spots," areas with concentrated traffic crash incidences (Levine, 2006a; Levine, 2006b).

2.3. Self-reported demographic and obesity status

Mothers reported standard demographic items (i.e., gender, ethnicity, age, birthplace, education). Children's body weight and height were assessed using a Tanita TBF 310 scale and a height rod without shoes. Height and weight were used to calculate body mass index using Quetelet's index [body weight (kg)/height (m^2)]. Obesity status was determined using BMI values for the age and gender specific percentiles according to the CDC guidelines (US Centers for Disease Control and Prevention, 2011).

2.4. Neighborhood safety perceptions

Mothers' and children's neighborhood safety perceptions were collected using parallel survey items related to 8 common environmental risks, including: (1) too much traffic, (2) cars going too fast, (3) no sidewalks, (4) no signals at crosswalks, (5) no lighting, (6) gangs, (7) strangers, and (8) stray dogs. The individual survey items were selected based on the previous literatures (Craig et al., 2003; Hume et al., 2006), and existing validated/tested instruments including Neighborhood Environment Walkability Survey (Saelens et al., 2003; Brownson et al. 2004) and the Children's Leisure Activities Study survey (Telford et al., 2004). The selected items were modified to ensure consistent wording and format, and designed to be answered on a five-choice Likert (1=strongly disagree to 5=strongly agree) response scale. The final safety survey scales had acceptable reliability levels for mothers (Cronbach's Alpha=0.83) and children (Cronbach's Alpha=0.86).

2.5. Measurement of moderate-to-vigorous physical activity (MVPA)

The ActiGraph GT1M accelerometer (ActiGraph LLC, Fort Walton Beach, FL) was used to determine time spent in MVPA during 7 consecutive days. Due to budgetary constraints, every third child (20 boys and 31 girls) wore the accelerometer after their completion of survey data. Following protocols research assistants showed each child individually how to wear the accelerometer on their body. Wearing time was determined from time in the morning when the child woke up and placed accelerometer on his waist until child took it off before going to bed (except while showering or swimming). The accelerometers were set to record activity counts in 30 s epochs to capture short motion intervals for this age group. Activity counts were uploaded to a custom-designed MATLAB data reduction program (MATLAB 2009a, MathWorks, USA) for determination of time spent in MVPA (3 METs lower limit) using the age-specific cut-off thresholds developed by Freedson et al. (2005).

2.6. Statistical analysis

Basic descriptive analyses were performed on the family's background, maternal and children's neighborhood safety perceptions, and children's daily minutes of MVPA. Mothers' and children's mean neighborhood safety perceptions were compared using the non-parametric, Tukey-Kramer Honestly Significant Difference (HSD) test. The Tukey–Kramer test calculates the actual absolute difference in the means minus the HSD, which is the difference that would be significant (Hayter, 1984). Pairs with positive values were significantly different. Standard multiple regression analyses were then used to evaluate the relationships between children's daily average MVPA and neighborhood safety as measured by mothers' and children's perceptions. Pearson correlation and the Variance Inflation Factor (VIF) were used to assess intercorrelations and multicollinearity problems among the mother's safety perception items.

3. Results

3.1. Sample characteristics

The sample consisted of 55 boys and 77 girls with the average child being 10 years old, born in the US, and overweight. The average mother was young in her mid-thirties, born in Mexico (61%), had a high school education or less (61%). 35% of mothers had an annual income of less than $20,000 and over 66% were married. In a subset sample ($n=51$), data reveal that children spent an average of 49.11 min (SD $\pm$ 26.6) of MVPA per day. The mean MVPA for boys was greater than for girls (Table 1).

3.2. Maternal and children's neighborhood safety perceptions

For all eight, maternal and children's ratings of safety, Tukey–Kramer HSD comparisons of means were significantly different (Table 2). Children perceived their neighborhood as safer than their mothers. Mothers' two highest neighborhood safety

Table 1
Characteristics of study participants.

Demographic characteristics		
Participants	Mother	Child
N	102	132
Boys		77
Girls		55
Mean (SD) age	36.2 (±7.3)	10.0 (±0.7)
Place of birth		
United States	28%	78%
Mexico	61%	20%
Central America	11%	2%
Marital status		
Single	14%	
Married	66%	
Divorced, Separated, Widowed	11%	
Other	9%	
Level of education		
1st–6th Grade	17%	
7th–12th Grade	61%	
Some college	9%	
Did not answer	13%	
Family income (per year)		
Less than 10k	17%	
10–20k	18%	
21–30k	17%	
More than 30k	23%	
Not sure/Refused	25%	
Mean (SD) body mass index		
Boys		22.9 (±5.5)
Girls		20.9 (±5.7)
Weight status-overweight		
Boys		67%
Girls		47%
Daily mean (SD) MVPA ($_{min}$)		
Boys (n=21)		58.2 (±26.2)
Girls (n=30)		42.4 (±25.2)

Table 2
Comparison of children's and mothers' neighborhood safety perceptions related to walking and bicycling.

It is dangerous for my child to walk or ride his/her bike because of things like:	Tukey–Kramer HSD[a]		
	Child (α=0.86) Mean(SD)	Mother (α=0.83) Mean(SD)	q-value[b]
1. Too much traffic	1.27 (0.55)	4.02 (0.77)	2.57
2. Cars going too fast	2.18 (1.50)	4.08 (0.95)	1.55
3. No crosswalks	2.16 (1.52)	3.51 (1.41)	0.99
4. No signals at crosswalks or intersections	2.26 (1.57)	3.40 (1.41)	0.73
5. No lighting	1.97 (1.44)	3.03 (1.46)	0.66
6. Stray dogs	2.58 (1.60)	3.75 (1.38)	0.75
7. Gangs	2.27 (1.56)	3.23 (1.40)	0.55
8. Strangers	2.87 (1.64)	3.54 (1.38)	0.25

Note: 5-point Likert-scale (1: Strongly disagree to 5: Strongly agree).

[a] Tukey–Kramer HSD comparison of means test is an exact alpha-level test if the sample sizes are the same, and conservative if the sample sizes are different (Hayter, 1984).

[b] Tukey–Kramer HSD q-values shown are the absolute differences in the pairwise means, minus the HSD, which is the difference that would be significant ($p<05$, q-value=1.97). All of the HSD positive q-values in the table indicate significantly different means.

concerns had to do with traffic ("cars going too fast," and "too much traffic") and the lowest concern was about lack of lighting. Children's two most serious neighborhood safety concerns had to do with strangers and stray dogs and the least serious concern was about the lack of lighting.

Table 3
Regression of mothers' perceptions on children's MVPA daily average.

Variables	Multiple regression[a]				VIF
	Estimate	SEE	t	p-value	
	–	25.61	–	0.121	
1. Too much traffic	−3.39	3.42	−0.99	0.328	2.141
2. Cars going too fast	3.51	3.67	0.96	0.344	2.472
3. No crosswalks	−8.39	3.86	−2.17	0.036*	2.761
4. No signals at crosswalks	4.31	3.60	1.20	0.293	2.110
5. No lighting	−2.43	4.44	−0.55	0.587	3.378
6. Stray dogs	2.60	3.03	0.86	0.396	1.899
7. Gangs	7.30	3.26	2.26	0.029*	2.092
8. Strangers	−4.98	3.85	−1.29	0.206	2.492

[a] Explanation of child MVPA daily average from mother safety perceptions R^2=0.26 (N=49, p=0.12).

* $p<0.05$.

3.3. Maternal and children's neighborhood safety perceptions as related to physical activity

To assess the relationship of mothers' and children's neighborhood safety perceptions with children's daily average MVPA, we completed two multiple regression analyses using mothers' perceptions of neighborhood safety and children's perceptions of neighborhood safety as independent variables. None of the multiple regression models were statistically significant ($p>0.10$). However, the maternal perception model explained higher percentage of variance (R^2=0.26) compared to the children's model (R^2=0.22). Thus, only the maternal model is reported in Table 3. Of interest, the perceived lack of crosswalks [$t(48)=-2.17$, $p<0.05$] and the perception of gangs [$t(48)=3.26$, $p<0.05$] contributed most to the model. We also conducted a post-hoc analysis of the mother's safety item intercorrelations (Table 4). Many items were significantly correlated ($p<0.10$) corroborating that mother's safety perceptions are connected rather than independent. However, the VIF values of all items were lower than 0.4 indicating the multicollinarity among safety items in the regression is acceptable (Table 3).

4. Discussion and conclusion

Findings from this study suggest that Hispanic mothers and children have different ratings of neighborhood safety related to walking and cycling in a low-income, inner-city neighborhood. For all 8 safety items examined, mothers perceived neighborhoods less safe than their children, particularly, related to traffic volume and speed. The results of this investigation are consistent with studies reporting parental safety concerns of their neighborhood as more serious than their children's (Timperio et al., 2004; Timperio et al., 2006), particularly in less walkable communities (Napier et al., 2011). The differences between child and mother perceptions not only reflect developmental and role perspectives, but also point toward promising areas for additional study and intervention.

Parents are crucial to the formation of healthy habits in children. Therefore, understanding parental perceptions pertaining to the safety of the neighborhood as associated with physical activity is an important endeavor. Results from this study indicated that the maternal safety perception model (R^2=0.26) predicted the explained children's MVPA slightly better than the children's safety perception model (R^2=0.22). Due to the

Table 4
Mother's perceptions of neighborhood safety inter-item correlations.

Item[a]	1	2	3	4	5	6	7
1. Too much traffic							
2. Cars going too fast	0.588						
3. No crosswalks	0.423	0.616					
4. No signals at crosswalks	0.254	0.425	0.691				
5. No lighting	0.320	0.297	0.469	0.553			
6. Stray dogs	0.460	0.395	0.398	0.239	0.335		
7. Gangs	0.177†	0.312	0.367	0.215†	0.296	0.439	
8. Strangers	0.238	0.357	0.264	0.152†	0.346	0.444	0.669

[a] All inter-item correlations were significant where alpha was set at 0.10 except these three marked by †s.

interrelatedness of safety items and the exploratory nature of the study, individual item results should be viewed cautiously. Yet, some findings about specific items contributing to the model should warrant further study. For example, the lack of crosswalks identified as a key barrier to physical activity by mothers, is related to traffic safety concerns (especially traffic volume and speed). Mothers reported traffic-related safety problems to be more serious than crime-related safety concerns. Crosswalks are relatively easy and permanent interventions, and could be considered top priority items for local jurisdictions. Furthermore, future studies should identify objective thresholds for the speed and volume of traffic considered acceptable by parents, which will facilitate the development of evidence-based policies and guidelines.

This study also demonstrated that mothers with more physically active children expressed greater concerns about gangs. While this finding may seem counter-intuitive, it can partly be explained by the fact that mothers of active children are more likely to be active. Those active mothers tend to walk more and spend more time out in the neighborhood, and therefore more likely to witness and be aware of gang activities. Therefore, further studies are necessary to clarify the causal and independent relationships among objectively measured gang (and other crime) activities, subjectively measured parental perception of those activities, and children's physical activity. Overall, findings from this study suggests the need for large-sample, preferably longitudinal, studies allowing for more thorough investigations of the complex relationships among demographic, built environmental (e.g., crosswalks and traffic conditions) and psychosocial variables (perceptions, awareness, attitudes, social norms, and social support) that are potentially associated with children's physical activity.

Several limitations of this study are noted. The small sample size along with the interrelatedness of safety items suggest that results from this exploratory study should be viewed cautiously. In addition, because of the small sample size and power concerns, we did not control for several covariates such as gender. Future studies should investigate the effects of children's gender and other demographic variables on neighborhood safety perceptions and MVPA. Another limitation is the lack of objective measures on safety. All data came from self-reported surveys, because objective crime and crash data were not available for the study area in a disaggregated format that can be geocoded for spatial analyses. Finally, this is a cross-sectional study with primarily Hispanic parents and their children living in an inner-city district of Houston, Texas. Therefore, no casual relationships were examined and findings are not generalizable to other settings or populations.

Despite these limitations, to our knowledge this exploratory study is the first that has assessed the differences in the perceptions of neighborhood safety between Hispanic children and their mothers. Furthermore, the significant differences between maternal and child perceptions on the neighborhood safety and the better fit of the maternal model in explaining children's MVPA present an interesting paradox. Do maternal perceptions of neighborhood safety lead to restrictions on children's walking and cycling and, in turn, place limits on their MVPA or other physical activity? Are their concerns appropriate reflections of reality or overstated judgment of the actual condition? Because this research was exploratory and the findings were inconclusive, the role of parent's neighborhood safety perceptions and children's physical activity needs further study, especially considering the "actual" environments with objective data on safety and other variables. An obvious next step in the research is to enhance understanding of the relation of perceived and objectively measured traffic and crime safety, and how they may interact to influence youth MVPA. It would be useful to explore how these associations might differ across ethnic/racial groups and across socioeconomic groups.

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