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Parental perception of neighborhood safety and children's physical activity

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Abstract

Parental perception of neighborhood safety and children's physical activity

By Deena S. Zytnick

Objective: This research examines the relationship between parental perception of neighborhood safety and children's physical activity among 5th grade children, and factors associated with physical activity behavior based on the ecological model. The specific outcome variables explored were the number of days per week children engaged in vigorous physical activity and children's regular use of recreational facilities for physical activity.

Methods: Data from the parents of the Early Childhood Longitudinal Study Kindergarten (ECLS-K) cohort 5th grade sample (N=9,725) were analyzed. Linear regression was used to examine the association between parental perception of neighborhood safety and mean days per week children engaged in vigorous physical and also the association between regular use of at least one recreational facility for physical activity and the number of days per week children engaged in vigorous physical activity. Logistic regression was used to examine the association between parental perception of neighborhood safety and regular use of at least one recreational facility for physical activity.

Results: Overall, 5th graders engaged in vigorous physical activity an average of 3.73 days per week. Parental perception of neighborhood safety was associated with the number of days per week children engaged in vigorous physical activity. The majority of 5th graders (81.6%) regularly used recreational facilities for physical activity. However, parental perception of neighborhood safety was not associated with children's regular use of recreational facilities for physical activity. Regular use of at least one recreational facility for physical activity was associated with the number of days per week children engaged in vigorous physical activity.

Conclusion: It is important to consider parental perception of neighborhood safety when designing interventions to increase physical activity. Further research is needed to see how changes at the physical environment and policy levels affect parental perception of neighborhood safety.

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Chapter 1: INTRODUCTION

Problem definition and justification

The prevalence of childhood obesity in America is the highest it has ever been (Ogden, Carroll, Kit, & Flegal, 2012). Data collected from 2009-2010 showed that 18% of American children ages 6 to 11 years old were obese (Ogden, et al., 2012). A study using NHANES data found that obesity in 6 to 11 year olds in 2007-2008 was nearly five times as prevalent as in 1971-1974 (Ogden & Carroll, 2010). Childhood obesity is associated with many adverse health effects. Physically, obese children are at higher risk of cardiovascular disease (Freedman, Mei, Srinivasan, Berenson, & Dietz, 2007), orthopedic problems (Stamatakis, Wardle, & Cole, 2010), sleep apnea (Daniels et al., 2005), and Type 2 diabetes (U.S. Department of Health and Human Services, 2001). Additionally, obese children are at greater risk of suffering from behavioral and psychological problems (Puder & Munsch, 2010), mental health problems such as depression (Pine, Goldstein, Wolk, & Weissman, 2001), and lower quality of life (Schwimmer, Burwinkle, & Varni, 2003). Compared with non-obese children of the same age, obese children are more likely to become overweight or obese adults and are therefore at greater risk of associated health problems as adults (U.S. Department of Health and Human Services, 2001).

There are a number of reasons for the high prevalence of childhood obesity, but the two largest contributing factors are improper nutrition and lack of physical activity (Rahman, Cushing, & Jackson, 2011). The CDC defines physical activity as "any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a basal level" (CDC, 2011a). Regular physical activity in childhood

provides great benefits to children's health and well-being. It improves cardiorespiratory endurance, strength and endurance, helps build healthy bones and muscles, reduces anxiety and stress (U.S. Department of Health and Human Services, 2008a), helps control weight, increases self-esteem, and may improve blood pressure and cholesterol levels (CDC, 2011b). Research also shows that physical activity has positive effects on children's alertness and increases children's capacity to learn (US Department of Education, 2000).

American children today are more sedentary than ever (American Academy of Pediatrics, 2006). The National Health and Nutrition Examination Survey found 26% of children watch four or more hours of television per day and these children have a lower likelihood of participating in vigorous physical activity ever (American Academy of Pediatrics, 2006). Researchers have found that an increase in sedentary indoor activities is directly associated with childhood obesity (Dietz & Gortmaker, 2001). The CDC's Youth Media Campaign Longitudinal Survey found only 39% of children ages 9 to 13 participated in an organized physical activity (CDC, 2003). The lack of physical activity among US children as a whole is cause for concern about their future health.

The CDC's *Physical Activity Guidelines for Americans* (2008) recommends children do 60 minutes or more of physical activity each day (U.S. Department of Health and Human Services, 2008b). The physical activity should be a majority of aerobic activity, but also include muscle strengthening and bone strengthening activities. Aerobic activity can consist of walking or running, while the muscle and bone strengthening activity can include gymnastics, playing on jungle gyms, climbing trees, or jumping rope (CDC, 2011).

Part of CDC's guidelines that children ages 6 to 17 get at least 60 minutes of physical activity per day is the recommendation that children do vigorous-intensity aerobic activity at least 3 days per week (CDC, 2011). According to the CDC, a child is doing vigorous intensity exercise when the activity causes his or her heart to beat much faster and the breathing to be harder than normal (U.S. Department of Health and Human Services, 2008b). On a scale of 0 to 10 where 0 is sitting and 10 is the highest level of activity, vigorous-intensity activity is a 7 or 8 (CDC, 2011).

Theoretical Framework for Current Research

Several factors influence whether children engage in adequate daily physical activity (Sallis, Prochaska, & Taylor, 2000). The ecological model can serve as a framework to explain the complexities. The ecological model is a paradigm often used in public health for understanding health behaviors, such as children's physical activity (Sallis, Bauman, & Pratt, 1998). The theory behind the model, the Ecological Systems Theory, postulates that individuals are surrounded by multiple levels of influence, including policies, physical environments, social environments, and individual factors (Davison & Birch, 2001). Each subsequent aforementioned level of influence is more directly associated with physical activity than the one before.

The actual physical and social contexts where physical activity occurs make up the behavior settings (Sallis, et al., 1998). Behavior settings designed to promote children's physical activity and discourage barriers to adopting active lifestyles would increase their physical activity (Evans, Christoffel, Necheles, & Becker, 2010). Behavioral settings are likely to influence physical activity behavior; understanding the

influence can optimize physical activity interventions in those behavioral settings (Sallis, et al., 1998). In order to effectively modify individuals' physical activity behavior, interventions should target each level of influence and should be tailored to each type of behavior setting (e.g. urban environments have different constraints from suburban environments) (Sallis, et al., 1998). Behavioral settings of particular importance to children's physical activity include sports fields, gymnasia, and bicycle trails; behavioral settings that restrict children's physical activity include classrooms, theaters, and highways (Sallis, et al., 1998).

The need for multilevel and multi-sectoral interventions to achieve population-level behavioral changes has become more apparent in recent years. In the past, efforts to promote physical activity were aimed at increasing only leisure-time physical activity (CDC, 2010a). But in the late 1990s, public health professionals who worked on recreational physical activity began collaborating with urban planners who were interested in designing cities to increase active transportation (Sallis et al., 2006). The concept of "active living" was developed through the combination of transdisciplinary goals from the fields of transportation, planning, and public health. There are four active living domains that reflect the purpose of the physical activity: transportation, recreation, household, and occupation (Sallis, Linton, & Kraft, 2005). Successfully increasing physical activity requires the transdisciplinary approach of targeting all active living domains using multilevel interventions (Sallis, et al., 2006).

The ecological model demonstrates the effect of policies and physical environment influences on the four active living domains (Sallis, et al., 2005). Policies, such as zoning codes, school physical education funding and budgets, transportation and

built environment investments, health care incentives, park policies, public recreation investments, and "safe routes to school" policies are all associated with physical activity (Sallis, et al., 2006). Components of the physical environment, such as home and school neighborhood walkability, parking, traffic, aesthetics, school physical activity programs and building design, parks, trails, physical activity programs, sedentary environment options, access and availability of recreational centers, and actual safety are also all associated with physical activity (Sallis, et al., 2006).

At the social environment level are factors that are more directly associated with physical activity. The determinants of children's physical activity at the social environment level of influence are encouragement and modeling for physical activity from parents and friends, parental support (transportation, activity organization), physically active role models, social norms, cultural beliefs, and acculturation (NCCDPHP, 1999; Sallis, 2004). Parents' encouragement of their children's physical activity is influenced by their perception of neighborhood safety (Timperio, Crawford, Telford, & Salmon, 2004).

Lastly, biological, psychological, and other traits are associated with physical activity behavior. Biological determinants of physical activity include age, gender, race and ethnicity, and health/disability status (Fitzgerald & Spaccarotella, 2008; Sallis, 2004). Psychological determinants of physical activity include knowledge, motivation, self-efficacy, perception of physical activity competence, outcome expectations, intentions, perceived benefits, and physical activity enjoyment (Fitzgerald & Spaccarotella, 2008; NCCDPHP, 1999). Other traits associated with physical activity include SES and size of geographic location.

All aforementioned factors at each level of the ecological model are associated with types of physical activity behavior, including vigorous-intensity physical activity and regular physical activity through use of a recreational facility. Vigorous physical activity is beneficial to children's health. Mark and Janssen (2011) analyzed a sample of 1,165 8 to 17 years olds from the US National Health and Nutrition Examination Survey and found an inverse correlation between vigorous intensity physical activity and total body fat (Mark & Janssen, 2011). The relationship between physical activity and adiposity was found to be stronger for vigorous-intensity activity than for moderate-intensity activity (Gutin, Yin, Humphries, & Barbeau, 2005), which suggests vigorous-intensity physical activity has greater benefits on children's weight than moderate-intensity physical activity.

Recreational facilities serve as an important behavioral setting in the community where children are able to engage in physical activity. Roemmich et al (2006) found the presence of parks and recreational places in the community was associated with greater physical activity among 8 to 12 year olds (Roemmich et al., 2006) and these findings were consistent with previous studies. Adolescents are more likely to use public recreational facilities than private ones, though cost and transportation limitations are barriers to using private facilities (Ries, Yan, & Voorhees, 2011). The same study found that recreational facility use was affected by social influences from parents and friends (Ries, et al., 2011).

Figure 1 is a visual depiction of the complete ecological model that provides the context for the current study based on the literature. Figure 2, derived from the Figure 1 model, is a visual depiction of the model with only characteristics analyzed in this study.

Figure 1: Influences of physical activity behavior in children, based on the ecological model

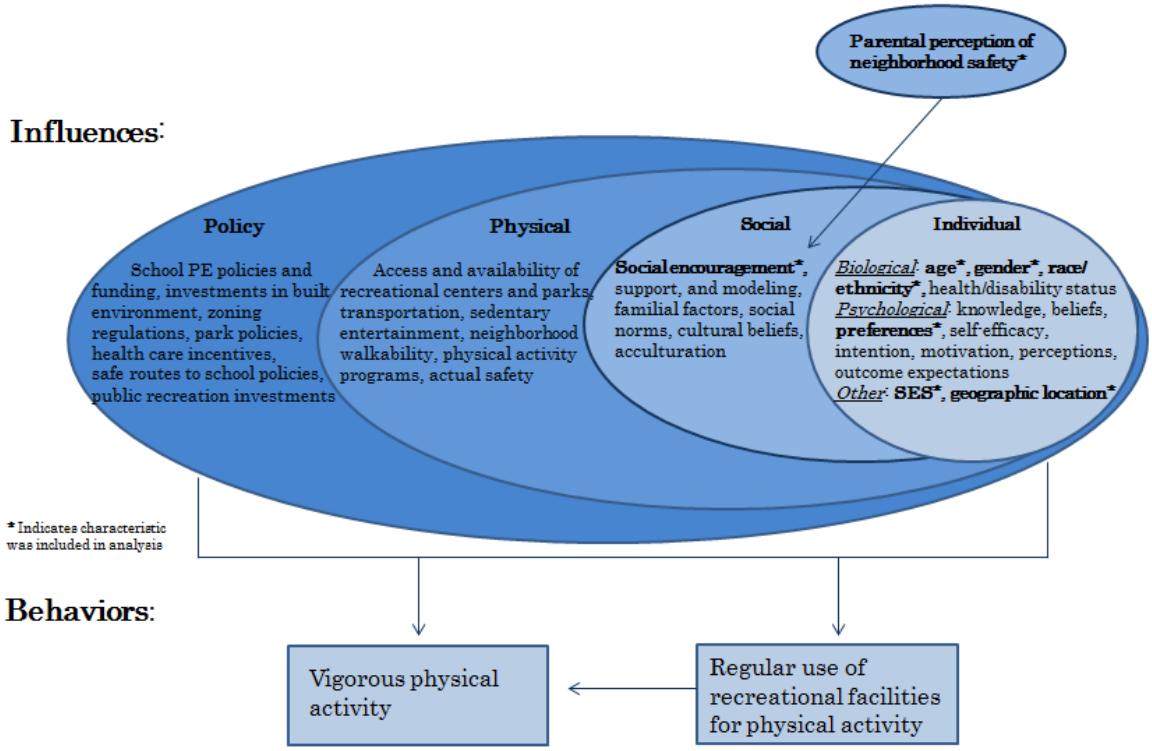
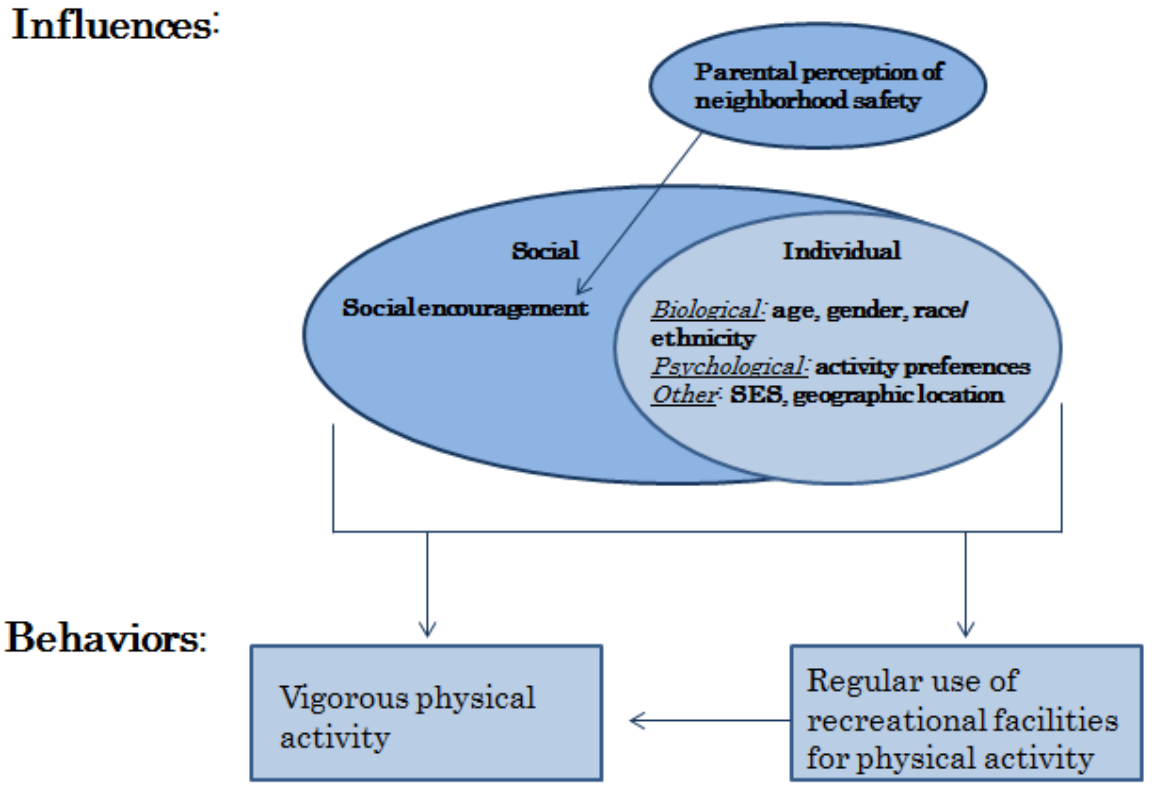


Figure 2: Influences of physical activity behavior in children used in the current study, based on the ecological model



Current Physical Activity Programs Using the Ecological Model

Healthy People 2020, a national initiative launched by the Department of Health and Human Services, emphasizes an ecological approach to health promotion (Healthy People 2020, 2011). Interrelationships among factors at the policy, environmental, social, and individual levels determine individual and population health (Healthy People 2020, 2011). Healthy People 2020 emphasizes the importance of non-traditional public health sectors, such as education, housing, transportation, agriculture, and environment, for improving population health (Healthy People 2020, 2011).

The National Physical Activity Plan (NPAP), a private-public sector collaborative supported by the CDC and partnered with NIH and other federal agencies, is another national plan aimed to increase physical activity across America. It includes a comprehensive set of policies, programs, and initiatives that support peoples' physically active lifestyles (NPAP, 2010). The NPAP recommends changes and strategies for business and industry, education, health care, mass media, recreation and fitness, public health, transportation and community design, and volunteer and non-profit work (NPAP, 2010). The NPAP is grounded in the ecological model and targets all socio-demographic groups (NPAP, 2010).

Rationale of the Current Study

It is important to recognize determinants of children's physical activity behavior at all levels of influence in the ecological model because each is associated with children's physical activity behavior. Parental influence, specifically encouragement of their children's physical activity, is an important type of social support that is associated

with children's physical activity behavior. The aim of this research study is to examine the association between parental perception of neighborhood safety and children's vigorous physical activity and regular use of recreational facilities for physical activity. Since research shows children engage in physical activity at recreational facilities, this study also seeks to examine the association between regular use of recreational facilities for physical activity and vigorous physical activity.

Hypotheses:

1. There is an association between parental perception of neighborhood safety and the number of days per week children engage in vigorous physical activity.
2. There is an association between parental perception of neighborhood safety and children's regular use of at least one recreational facility for physical activity.
3. Regular use of at least one recreational facility for physical activity is associated with the number of days per week children engage in vigorous physical activity.

Chapter 2: LITERATURE REVIEW

Significance

Children and adolescents' physical activity habits in the early 1900s were markedly different from today. In 1910, 12% of youth ages 10 to 13 and nearly one-third of adolescents ages 14 to 15 worked (Markel & Golden, 2005). Much of the work, like mining or walking around to sell merchandise was laborious, requiring long hours of daily physical activity (McElroy, 2008). After WWII, the country became more prosperous. People began supplementing their diet with foods that caused excess weight and "overnutrition" became a problem for children (McElroy, 2008). Because of the general downward trend in children's active movement, health professionals in the early 1980s focused on increasing physical activity of children (McElroy, 2008).

The relationship between physical activity and weight are often related. As the Mark and Janssen (2011) study shows, higher intensity activity is correlated with less body fat. Soric and Misigoj-Durakovic (2010) evaluated the time and amount of energy that 91 normal weight and overweight fifth graders spent on physical activity (Soric & Misigoj-Durakovic, 2010). The children wore a SenseWear Armband body monitor and were assessed over four days. Taking gender and weight group into account, the researchers found normal weight children spent significantly more time doing physical activity than overweight children. The researchers did not discuss which came first: children's weight status or their level of physical activity. However, children with larger body masses expend increased energy to move (Soric & Misigoj-Durakovic, 2010) and that could affect exercise intensity levels.

Despite the importance of physical activity for health, children today are not getting the recommended amount they need. The CDC reported that 23% of children ages 9 to13 years old do not engage in any free-time physical activity (CDC, 2003). The same study found that 62% of children ages 9 to 13 years old do not participate in any organized physical activity (CDC, 2003).

Physical Activity Recommendations for Children

The American Academy of Pediatrics has age-appropriate recommendations for the types of physical activity children should do ever (American Academy of Pediatrics, 2006). The AAP encourages parents of infants and toddlers to provide them with a safe, nurturing, and minimally structured play environment so that the baby can develop a liking for outdoor physical activity and unstructured exploration ever (American Academy of Pediatrics, 2006). Children ages 4 to 6 should be encouraged to have fun, playful, and exploratory play time that involves supervised activities on flat surfaces with limited instructions (American Academy of Pediatrics, 2006). Children in later elementary school should still have free play, but involve more sophisticated movement patterns and fundamental skill acquisition in order to improve motor skills, visual tracking, and balance. They can also begin organized sports participation, but limit instructions and the focus on competition (American Academy of Pediatrics, 2006). Middle schoolers can focus on activities that develop their skills and involve tactics and strategies from complex sports (American Academy of Pediatrics, 2006). Because children hit puberty at different rates, placement on contact sports teams should be based on maturity rather than chronological age (American Academy of Pediatrics, 2006).

Adolescents should pick activities that they enjoy doing so they do not lose interest (American Academy of Pediatrics, 2006). These activities can include dance, yoga, active transport, household chores, weightlifting, and sports.

Policy Role

The ecological model's levels of influence each have elements that promote and restrict behavior, including the broadest level of the model - the policy environment - which can explain behaviors beyond more direct influences (Sallis, et al., 1998). Policies can affect each subsequently narrower level of the ecological model and the active living domains; therefore policies are important determinants of children's physical activity behavior. The physical activity children get in school is limited by physical education class policies, funding, and access to facilities and equipment (Sallis, et al., 2006). Active transportation to school can increase children's physical activity, however funding would need to be allocated for safe routes to school and traffic demand management (Sallis, et al., 2006). Physical activity from recreation and household policies stem from zoning codes, park policies, public recreation investments, and health care (Sallis, et al., 2006).

Between 1999 and 2000, a cross-sectional, population-based study was conducted among US adults that examined policy determinants of physical activity behavior (Brownson, Baker, Housemann, Brennan, & Bacak, 2001). The majority of respondents supported a physical education requirement in schools (95.2%) and zoning requirements that would include walking and biking paths (85.8%), both of which children can increase children's physical activity (Brownson, et al., 2001). Supporting the use of local

government funds for walking and jogging trails was positively associated with physical activity in adults (Brownson, et al., 2001). The study found that addressing barriers to physical activity behavior at each level of the ecological model was instrumental in helping people change their behavior (Brownson, et al., 2001). Individual support for policies that promote physical activity can increase physical activity.

Researchers conducted a literature review to determine whether policy interventions can lead to an increase in physical activity (Matson-Koffman, Brownstein, Neiner, & Greaney, 2005). The studies were published from 1970 to 2003 and reported behavioral, physiological, or organizational change outcomes. Seven of the studies found that policy changes related to physical education in schools with better-trained PE teachers lead to increased physical activity among school children (Matson-Koffman, et al., 2005).

Physical Environment Role

The physical environment level of the ecological model involves the physical environment in where a child lives and can be physically active (Sallis & Owen, 1999). Outdoor play is a strong determinant of physical activity and a neighborhood serves as an important place for children to play outdoors (Klesges, Eck, Hanson, Haddock, & Klesges, 1990). The built environment of a neighborhood can encourage, restrict, or prohibit children's physical activity (Wicker, 1979). The CDC defines built environment as "the buildings, roads, utilities, homes, fixtures, parks and all other man-made entities that form the physical characteristics of a community" (CDC, 2009).

Farley et al (2007) found increasing evidence that physical environments influence children's levels of physical activity (Farley et al., 2007). A cross sectional study with over 400 children ages 6 to 11 years old was conducted to examine the association between physical activity and their built environment (de Vries, Bakker, van Mechelen, & Hopman-Rock, 2007). Based on physical activity diaries, neighborhood observations, and anthropometric measures, researchers found that the children's physical activity was associated with the proportion of green space in the neighborhood (de Vries, et al., 2007). Having space to play allowed for children to be physically active.

Davison and Lawson (2006) found a positive association between children's physical activity and availability of recreational facilities (Davison & Lawson, 2006). Neighborhoods containing playgrounds, sports fields, basketball courts, health clubs, bicycle trails, or community recreational facilities are more likely to encourage physical activity than a neighborhood without these features (Wicker, 1979). Neighborhood organizations also serve as places for physical activity. YMCAs around the country offer a variety of organized sports for children and their facilities contain swimming pools, gyms, and courts for children to play on (YMCA). The Boy Scouts of America has programs for its members to develop their personal fitness (Boy Scouts of America, 2011). Places of worship, farm clubs, and health clubs are additional neighborhood locales where children can engage in physical activity.

Research shows growing evidence that physical activity levels for residents increase when neighborhoods contain sidewalks, safe intersections, accessible destinations, appealing green spaces, public transit, and a mix of residential, commercial, retail, and recreational destinations (Rahman, et al., 2011). When children have easy and

safe access to neighborhood facilities, they are able to go to destinations to do physical activity more independently. In general, having recreational facilities in the neighborhood was found to be a predictor of active travel for children (Leslie, Kremer, Toumbourou, & Williams, 2010). Children lacking access to sidewalks or paths, parks, playgrounds, or recreation centers have 20% to 45% higher odds of becoming obese or overweight compared with children who have regular access to such facilities (Rahman, et al., 2011).

Having neighborhoods with parks, playgrounds, and sports fields provide a close and inexpensive place for children to engage in physical activity. In a study that focused on the relationship between socioeconomic status (SES) and physical activity from youth's perspective, both high and low SES youth mentioned cost and proximity to home as factors that affected their physical activity (Humbert et al., 2006). In addition, low SES youth discussed the importance of aesthetic appearance (Humbert, et al., 2006). Another study found graffiti was likely to prevent children from being active outdoors (Rahman, et al., 2011).

Even adults' physical activity is affected by their neighborhood. A Victoria Transport Policy Institute report found 43% of all-aged people who lived within a safe 10 minute walking distance of destinations achieved physical activity goals (Litman, 2010). Only 27% of people living in less walkable neighborhoods achieved these goals (Litman, 2010).

Neighborhood safety is another critical component of the physical environment that affects children's physical activity. Safety comprises several components, including "stranger danger", road and traffic safety, personal injury, and verbal or physical bullying

(Carver, Timperio, & Crawford, 2008). A large, qualitative study from England found "stranger danger" and road safety were the largest reasons parents restricted children's unsupervised physical activity in the neighborhood (Valentine & McKendrick, 1997). Several studies that examined children's physical activity found physical activity was more strongly associated with general neighborhood safety than with the availability of neighborhood recreational facilities (Nichol, Janssen, & Pickett, 2010). Children tended to spend more time being inactive indoors when their neighborhood lacks safe places to play (Rahman, et al., 2011).

Objective neighborhood safety falls under the realm of children's physical environment because the categorization of neighborhood safety is known. Kawachi and Berkman (2003) found that objective ratings of crime are less predictive of people's behavior than subjective ratings of crime (Kawachi & Berkman, 2003).

Social Environmental Role

The social environment level of the ecological model includes interpersonal relationships between children and their parents. Parental encouragement of physical activity may be influenced by their perceptions of neighborhood safety, which may not reflect objective indicators. Studies have shown perception of neighborhood safety is not always accurate with only moderate or low levels of agreement between objective and perceived safety measures (Giles-Corti & Donovan, 2002; Hoehner, Brennan Ramirez, Elliott, Handy, & Brownson, 2005; Kamphuis et al., 2010). Groups of people that are more likely to feel unsafe (due to crime and traffic) include women, older people, and people of lower SES (Kamphuis, et al., 2010).

"Stranger danger" is a top concern for parents when allowing their children to play outside. A study in Australia found that 81% of parents were concerned about "stranger danger" involving their 10-12 year old children (Timperio, et al., 2004). Studies indicate that low SES parents have greater concerns about "stranger danger" for their children than high SES parents. One study found inner city children's physical activity levels were negatively correlated with parental anxiety about neighborhood safety (Weir, Etelson, & Brand, 2006). They engaged in less physical activity than suburban children (Weir, et al., 2006).

On the contrary, children are more physically active in low SES neighborhoods when measures are in place to ensure safety. A neighborhood play yard with safety attendants was opened to all children in an inner-city neighborhood. The majority of children who used the play yard were between 2nd and 5th grade (Farley, et al., 2007). Over a two year period, the number of children who used the neighborhood play yard was 84% greater than the number of children in a control neighborhood who had an unmonitored play yard (Farley, et al., 2007). The results of this study provided empirical evidence that safety is an important determinant of physical activity in children.

In rural areas, children's safety is also an impediment to physical activity. Using townscape audits, focus groups with children ages 10 to 18 years old, and key informant interviews, researchers explored youth physical activity in rural areas (Yousefian, Ziller, Swartz, & Hartley, 2009). The children in the study reported that concerns about crime and safety and "gangs" of kids were barriers to their physical activity. Stranger danger and threatening individuals may deter children from physical activity in a rural location more than in an urban location because of its isolated setting (Yousefian, et al., 2009).

Road and traffic safety are the other top concerns for parents when it comes to letting their children play outside. With children's physical activity, there was a positive association with pedestrian safety and a negative association with traffic volume (Davison & Lawson, 2006). Roads with heavy traffic were likely to deter children from being active outdoors (Rahman, et al., 2011).

Researchers found unsafe road environments were negatively associated with walking and cycling among 10 to 12 year olds (Timperio, et al., 2004). Walking or biking to school used to be a more common mode of transportation for children, but the prevalence has declined. In 1969, 42% of 5 to18 year olds walked or biked to school, compared with 13% in 2001 (CDC, 2008). The decline in active transportation to school is correlated with the decline in children's physical activity. Children who walk to and from school are more physically active than their non-walking peers (Cooper, Andersen, Wedderkopp, Page, & Froberg, 2005). How safe parents perceive the route from home to school is a determinant of children's mode of transportation to school (Rahman, et al., 2011).

Parental perception of neighborhood safety can differ from that of their children. In an Australian study, researchers found both younger (ages 5 to 6) and older (ages 10 to 12) children had different perceptions of neighborhood safety from their parents (Timperio, et al., 2004). The children were less concerned than their parents about both stranger danger and road or traffic safety (Timperio, et al., 2004). In this same study, the parents' perception of neighborhood safety had more influence on children's physical activity than the children's perception. In a separate study, Jago et al (2009) found parents who perceived a lack of safety in the neighborhood reduced their 10 to 11 year

old's ability to be independently physically active (Jago, Thompson, et al., 2009). Parents were more restrictive despite feeling their children should have greater independence than when they were younger children.

Other social environmental influences on children's physical activity behavior include support and modeling by friends. A study of 10 to 11 year olds examined spatial analysis in the context of social networks and found an association between the physical activity levels of children and their school friends (Macdonald-Wallis, Jago, Page, Brockman, & Thompson, 2011). Another study of 10 to 11 year olds found children's friends provide support and modeling when initiating and engaging in physical activity together (Jago, Brockman, et al., 2009).

Cultural norms and beliefs, with varying standards for health behavior, are another social environmental influence on children's physical activity. Ethnic minorities are disproportionately overweight (Nesbitt et al., 2004). A study on weight-related attitudes and behaviors of black women found 40% of the overweight women in the sample had a relatively positive body image (Kumanyika, Wilson, & Guilford-Davenport, 1993). The overweight women were less likely to exercise than the non-overweight women and their positive body image limited weight loss efforts such as physical activity (Kumanyika, et al., 1993). A prospective study of nearly 2,400 black and white girls who were enrolled in the National Heart, Lung, and Blood Institute Growth and Health Study from the ages of 9 or 10 to the ages of 18 or 19 years, found a 100% decline in black girls' physical activity, compared with a 64% decline in white girls' physical activity (Kimm et al., 2002).

Individual Role

The most direct influences on children's physical activity behavior involve characteristics from the individual level of the ecological model. Children's behavioral choices also evolve from biological traits, psychological, and other characteristics. Gender, in particular, plays a role in physical activity behavior, so it is beneficial to have play places that cater toward divergent interests. A large cross-sectional study of nearly 3,000 students ages 10 to 14 not only found that boys were generally more active than girls, but boys also enjoyed physical activity more and received more social support when doing it (Leslie, et al., 2010). Notably, boys received social support from teammates on the same sports team. As Brooks and Magnusson (2006) found, some school-aged children, particularly girls, benefit from having places in the neighborhood where they can be physically active outside of team sports (U.S. Department of Health and Human Services, 2001).

In order to help lay the foundation for being physically active throughout life, children should have positive experiences from a young age (U.S. Department of Health and Human Services, 2001). Some children find playing at neighborhood parks and playgrounds or walking on trails to be more pleasurable than vigorous physical activity through competitive sports. Leslie et al (2010) found that boys and girls have different preferences for actively travelling to school. A higher proportion of boys biked to and from school, while a higher proportion of girls walked to and from school.

Gender differences may also contribute to the amount of vigorous physical activity in which children engage. A longitudinal study of 297 elementary school-aged children was conducted to see the impact of a playground redesign on children's vigorous

physical activity levels during recess (Ridgers, Stratton, Fairclough, & Twisk, 2007). The study did not find significant results related to the intervention, but it did find that boys engaged in significantly more vigorous physical activity than girls (Ridgers, et al., 2007). The boys and girls in this study likely have divergent preferences for recess physical activity. A meta-analysis found that boys ages 6 to 7 years old were about 20% more active than girls of the same age and boys had a less steep decrease in activity level as they aged (Sallis, 1993). Of female youths ages 12 to 21, 14% are totally inactive compared with 7% of male youths (NCCDPHP, 1999). The Youth Risk Behavior Surveillance study found 24.8% of male high school students met the CDC's physical activity guidelines of being physically active at least 60 minutes per day every day of the week compared with only 11.4% of females (CDC, 2010b).

While some activity preferences and intensity differ by gender, age also contributes to children's physical activity choices and level. The aforementioned meta-analysis found that 6 to 7 year olds engaged in an average of 46 minutes of moderate to vigorous physical activity per day compared with 16 to 45 minutes per day for 10 to 16 years olds (Sallis, 1993). By high school, the prevalence of being physically active for 60 minutes per day every day of the week declines from 21.3% of 9th graders to 15.3% of 12th graders (CDC, 2010b). The 1996 Surgeon General's Report on Physical Activity and Health reported that nearly half of Americans ages 12-21 years old were not vigorously active on a regular basis.

Other demographic variables associated with lower levels of physical activity include being a preadolescent or adolescent ethnic minority, living in poverty, having disabilities, and living in apartments or public housing (Raine, 2004).

Humbert et al. (2006) found that low SES youth are hindered from doing physical activity because of their perception of neighborhood safety more than high SES youth (Humbert, et al., 2006). Results from the focus group found a significant number of low SES youth refrained from participating in physical activity programs because they did not want to deal with fights and intimidation or be under parental supervision (Humbert, et al., 2006).

Summary

Both indirectly and directly, all four levels of influence in the ecological model impact children's physical activity behavior. Using the ecological model as a guide, this study analyzes the effect of parental perception of neighborhood safety on children's physical activity behavior, incorporating individual-level biological, psychological, and other influences as control variables.

Chapter 3: METHODS

Participants

ECLS-K

The data are from the Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K). ECLS-K collected information on children's early school experiences, development, environments, and activities from the perspective of the children, and their parents, teachers, and school administrators (National Center for Education Statistics, n.d.). ECLS-K is part of the National Center for Education Statistics' Early Childhood Longitudinal Study that followed a nationally representative sample of children beginning in fall of kindergarten in 1998 through spring of 8th grade in 2007 (National Center for Education Statistics, n.d.). Data were collected at seven time points . The 6th round of data collection was in spring of 2004 when the sample of children was in 5th grade.

The data for this study mostly came from the 5th grade parent interview, which asked questions of ECLS-K 5th graders' parents. Most of the covariate data - including age, gender, race, SES, and location - came from previous rounds of interviews. The preference for the parent interview respondent was the same respondent from the previous round, who was usually the mother (Tourangeau, Nord, Le, Pollack, & Atkins-Burnett, 2006). The next order of preference was another parent or guardian and then another household member (Tourangeau, et al., 2006). The respondent had to be knowledgeable about the child's care and education, be at least 18 years old, and live in the household with the child. The 5th grade parent interviews were completed most often

by the child's mother (81% of cases), then by another adult (often grandparents) (11% of cases), and then by the child's father (8% of cases) (Tourangeau, et al., 2006).

ECLS-K used multistage probability sampling to select a nationally representative group of children attending kindergarten in 1998 (National Center for Education Statistics, 2009). In the first round of sampling, geographic areas (counties or groups of counties) were the primary sampling units (National Center for Education Statistics, 2009). Schools within the sampled primary sampling units were second stage units (National Center for Education Statistics, 2009). Children within schools were the third stage units (National Center for Education Statistics, 2009). There were multi-level linkages established during sampling so that a child's data could be linked to the data from his or her parents, school, and community (Chen & Zhu, 2005) .

There were originally 21,387 participants in the baseline data collection during the fall of kindergarten in 1998. After ineligible and non-respondents were removed, the initial round of baseline data collection included 19,684 participants (National Center for Education Statistics, 2009). The sample size in the 6th round of data collection during the spring of 5th grade excluded those who: 1. Died or moved out of the country; 2. Moved and were not selected for follow-up; and, 3. Refused or were lost to follow-up (Tourangeau, Lê, Nord, & Sorongon, 2009). 11,820 participants completed their interviews (Tourangeau, et al., 2009).

The Current Study

The sample was reduced through list-wise deletion of those who were missing data on: age (N=1,354), gender (N=824), race (N=839), family socioeconomic status (SES) (N=824), location type (N=1,680), activity preference (N=919), parental

perception of neighborhood safety (n=863), number of days per week the child does vigorous exercise (N=1,084), and use of recreational facilities for physical activity (N=950). The resulting sample size was 9,725.

Procedure

ECLS-K

ECLS-K evaluators were trained to conduct the parental questionnaire over the phone in a structured interview format. Most of the parent interviews were conducted using computer-assisted interviews (CAI), but were conducted in person if the participant did not have a telephone (Tourangeau, Le, & Nord, 2005). The interviews lasted 45-50 minutes (National Center for Education Statistics, n.d.).

The Current Study

For this study, all variables with responses of 'refused', 'don't know', 'not ascertained', and 'not applicable' were coded as missing.

The public-use, de-identified ECLS-K Longitudinal Kindergarten-Eighth Grade data file was ordered through the National Center for Education Statistics and obtained on CD-ROM. The study did not need to be reviewed by the Institutional Review Board (IRB) because the data was de-identified and was therefore not considered human subjects research.

Measures

Dependent Variables

One of the two dependent variables in this study was the number of days per week children engaged in vigorous physical activity. Parents were asked: "In a typical week, on how many days does [child] get exercise that causes rapid breathing, perspiration, and a rapid heartbeat for 20 continuous minutes or more?" The response parents provided were categorized by the numeric response between 0 and 7.

The second dependent variable in this study was children's regular use of at least one recreational facility for physical activity. Parents were asked: "In the last 12 months, did [child] regularly get exercise through any of the following organizations: A public park or recreation center? A church or other place of worship? A sports team or league not affiliated with churches? YMCA, YWCA, or other similar organizations? A health club or private spa? Cub scouts, Brownies, or other scouts? 4-H or other farm clubs?" Parents indicated 'yes' if their child used it regularly for physical activity or 'no' if they did not. For this study, parents who indicated their children used at least one of the organizations for regular physical activity were categorized in the 'yes' group (coded as 1). Parents who indicated their children did not use any of the organizations for physical activity were categorized in the 'no' group (coded as 0).

Independent Variable

Parents were asked about their perception of neighborhood safety in the 5th grade parent interview. The question was stated: "How safe is it for children to play outside during the day in your neighborhood? Would you say it's not at all safe, somewhat safe, or very safe?". Two dummy variables were created to define the three mutually

exclusive categories of parental perception of neighborhood safety: not at all safe and somewhat safe, with very safe as the reference group.

Covariates

Covariates were included in this study if they were found in the literature to be associated with physical activity behaviors and if the variables were part of the ECLS-K dataset. Child's age was an ECLS-K created variable. It was categorized into children younger than 10.5 years old, three subsequent half-year age groupings, and children older than 12 years old. ECLS-K ascertained the child's age by subtracting the days between the date of the direct child assessment and the child's birth date (Tourangeau, et al., 2006). Age was entered as dummy codes, with the 11-11.5 age group as the reference.

Gender was taken from a composite of the parent interview, child report, and Field Management System (FMS) from round 5 of data collection (spring of 3rd grade) (Tourangeau, et al., 2006). The FMS was used by field supervisors to enter information about the sampled participants and to monitor production on data collection activities (National Center for Educational Statistics, 1999). Information on the child's race was collected from the previous parent interviews or the FMS, with FMS data used only if parent data on race were missing (Tourangeau, et al., 2006).

Children's race was categorized into White (reference), Black (including African Americans), Hispanic (race specified or not), Asian, or other (including Native Hawaiian or Pacific Islander, American Indian or Alaska native, or more than one race).

Family socioeconomic status (SES) was a composite variable created by ECLS-K that combined father/male guardian's education and occupation, mother/female guardian's education and occupation, and household income. The children were

categorized into SES quintiles, with quintile 1 representing the lowest SES category and quintile 5 (reference) representing the highest SES category (Tourangeau, et al., 2006).

Children's location was categorized based on the size of the town or city in which they lived. A large or mid-sized city is a central city of a metropolitan area (Tourangeau, et al., 2006). A large or mid-sized suburb or a large town (reference) includes urban fringes of a large or mid-size city or a town with greater than or equal to 25,000 residents (Tourangeau, et al., 2006). A small town or rural location has fewer than 25,000 residents (Tourangeau, et al., 2006).

Parents were also asked about the activities children preferred doing in their free time. Parents categorized their children's free time activity preferences into one of three groups: 1) Sedentary activities, such as reading, playing video games, or watching TV; 2. Physically active activities, such as riding a bike, swimming, and playing sports; or 3. Both sedentary and physically active activities (reference). Activity preference was also entered as dummy codes, with the children who like both sedentary and physically active activities as the reference.

Data Analysis

Statistical analyses were performed using SAS (version 9.3, SAS Institute Inc, Cary, NC). Sample weights were used to account for differential nonresponse, noncoverage, and to adjust for planned oversampling of some groups. To accommodate the complex sampling design of the ECLS-K, Taylor series estimation was used with weights assigned by the National Center for Educational Statistics. This study used the weight variable "C6PW0", which is used for child-level estimates associated with data

collected through the parent interview when the child is in 5th grade. This study also used the strata "C6TPWSTR" and the primary sampling unit "C6TPWPSU" as part of the survey adjustment.

Univariate frequency procedures were run to examine descriptive statistics of all variables. The percent of the sample for each level of the children's characteristics and dependent variables was obtained along with the standard errors. The mean and standard error were obtained for the independent variable.

Chi-square (χ^2) tests were used to determine bivariate associations between parental perception of neighborhood safety and children's characteristics. The chi-square p-values indicate if there are differences between any level of parental perception of neighborhood safety within each level of children's characteristic. Mean number of days per week of vigorous physical activity by parental perception of neighborhood safety was also calculated, along with an ANOVA test. Significance was set at $p<0.05$.

A second chi-square (χ^2) test was used to determine bivariate associations between regular use of at least one recreational facility for physical activity and children's characteristics. The chi-square p-values indicate if there are differences between children who use and children who do not use at least one recreational facility regularly for physical activity and children's characteristics. Mean number of days per week of vigorous physical activity by regular use of recreational facilities for physical activity was also calculated, along with an ANOVA test. Significance was set at $p<0.05$.

Differences between levels of children's characteristics and parental perception of neighborhood safety were examined with analysis of variance (ANOVA) for the mean number of days of vigorous physical activity per week. Significance was set at $p<0.05$.

A bivariate linear regression model was fit to examine the association between parental perception of neighborhood safety and mean days per week children engaged in vigorous physical activity. Another bivariate linear regression model examined the association between mean days per week children engaged in vigorous physical activity and regular use of at least one recreational facility for physical activity. Significance was set at $p<0.05$.

Multivariate linear regression was used to examine the association between parental perception of neighborhood safety and mean days per week children engaged in vigorous physical activity. Multivariate linear regression was also used to examine the association between regular use of at least one recreational facility for physical activity and the number of days per week children engage in vigorous physical activity. Both models controlled for the following variables: age, gender, race, family SES, location type, and activity preferences. Missing data was excluded from the analyses. Significance was set at $p<0.05$.

A bivariate and a multivariate logistic regression model were fit to examine the association between parental perception of neighborhood safety and regular use of at least one recreational facility for physical activity. The only difference between the models was the bivariate model did not control for other variables. The multivariate model controlled for covariates, including age, gender, race, family SES, location type, and activity preferences. Odds ratios and 95% confidence intervals were obtained. Missing data was excluded from the analyses. Significance was set at $p<0.05$.

Chapter 4: RESULTS

Descriptive Characteristics

As shown in Table 1, the majority (96%) of 5th graders were between 10.5 and 12 years old. White children comprised 57% of the population, followed by Hispanics (19.4%), and Blacks (16.4%). Most of the children lived in large and mid-size suburbs and large towns (41.8%) and most parents (59.6%) said their children preferred to spend their free time doing both sedentary and active activities.

The majority of parents perceived their neighborhood to be very safe (73.2%). This was followed by 24.3% who perceived their neighborhood to be somewhat safe and 2.5% who perceived their neighborhood to be not at all safe. A vast majority of parents (81.6%) said their children used at least one recreational facility for physical activity. The mean number of days per week that children engaged in vigorous physical activity was 3.73.

Children's Characteristics by Parental Perception of Neighborhood Safety

Table 2 presents the parents' perception that the neighborhood is not at all safe, somewhat safe, or very safe neighborhoods by children's characteristics.

The oldest group of children (12+ years old) contained the greatest percentage (80.1%) of children who lived in parental perceived very safe neighborhoods. Each subsequently younger age group had a subsequently lower percentage of children who lived in parental perceived very safe neighborhoods. Among the different races, Whites had the highest percentage (85.2%) living in parental perceived very safe neighborhoods and the lowest percentage (1.1%) living in parental perceived not at all safe

neighborhoods. Conversely, Blacks and Hispanics had the lowest percentages of children living in parental perceived very safe neighborhoods (53.7% and 55.9%, respectively).

Of children whose families were in the highest SES quintile, 90% lived in parental perceived very safe neighborhoods. Conversely, about half (51.3%) of children in the lowest SES quintile had parents who felt their neighborhood was very safe.

Nearly 84% of children from small and rural towns had parents who perceived their neighborhood as very safe, compared with 61.3% of children from large and mid-sized cities. Children who like physically active activities had the highest percentage of parents who perceived their children's neighborhood as very safe (77.5%), but also had the highest percentage of parents who perceived their children's neighborhood as not at all safe (3.1%).

Three-quarters of parents whose children used recreational facilities for physical activity felt their children live in very safe neighborhoods, compared with 65.2% of parents whose children did not regularly use recreational facilities for physical activity. On average, children from parental perceived very safe neighborhoods engage in vigorous physical activity on 3.9 days per week, compared with 3.4 and 2.9 days per week, respectively, for children from parental perceived somewhat safe neighborhoods and parental perceived not at all safe neighborhoods.

With the exception of gender, there were statistically significant differences across levels of children's characteristics within each category of parental perception of neighborhood safety.

Children's Characteristics by Regular Use of at least One Recreational Facility for Physical Activity

Table 3 presents the percent of children within each characteristic by regular use or non-regular use of at least one recreational facility for physical activity. With the exception of age, there were statistically significant differences in regular recreational facility use for physical activity across all children's characteristics.

Boys used recreational facilities for physical activity more than girls (83.6% and 78.9%, respectively) and Whites and other races used them more than Blacks, Hispanics, and Asians. Higher SES quintile was associated with greater use of recreational facilities for physical activity. Significantly fewer children who preferred sedentary activities (74%) regularly used recreational facilities for physical activity, compared with children who preferred active activities.

Children in parental perceived very safe neighborhoods used recreational facilities more than those in not at all safe neighborhoods. Those who regularly use recreational facilities for physical activity engage in vigorous physical activity an average of 3.8 days per week, compared with 3.3 days per week for non-regular recreation facility users.

Mean Days of Vigorous Physical Activity by Children's Characteristics

Table 4 presents the mean number of days per week that children engaged in vigorous physical activity. Boys engaged in vigorous physical activity on 4.02 days per week, compared with 3.41 days per week for girls. Asian children spent the fewest days per week engaging in vigorous physical activity compared with children of other races. Generally, the higher the SES quintile, the more days per week children engaged in

vigorous physical activity. On average, children living in very safe neighborhoods engaged in vigorous physical activity about one more day per week than children in not safe neighborhoods (3.85 and 2.92 days, respectively).

Analysis of variance (ANOVA) tests showed that, with the exception of age, there were statistically significant differences in categories of children's characteristics and mean days of vigorous physical activity per week.

Linear Regression Models for Vigorous Physical Activity

As shown in Table 5, significant findings emerged from examining bivariate linear associations between the mean number of days of vigorous physical activity and parental perception of neighborhood safety. When not controlling for any covariates, compared with children who lived in parental perceived very safe neighborhoods, the results indicated children who lived in parental perceived not at all safe neighborhoods engaged in vigorous physical activity on 0.93 fewer days ($p < 0.0001$) and children who lived in parental perceived somewhat safe neighborhoods engaged in vigorous physical activity on 0.43 fewer days ($p < 0.0001$). The difference remained even when controlling for covariates. When controlling for covariates, compared with children who lived in parental perceived very safe neighborhoods, the results indicated children who lived in parental perceived not at all safe neighborhoods engaged in vigorous physical activity on 0.86 fewer days ($p=0.0007$) and children who lived in parental perceived not at all safe neighborhoods engaged in vigorous physical activity on 0.28 fewer days ($p=0.0022$).

Several covariates were also significant in the final model, including gender, race, SES, geographic location, and activity preference. Regular use of at least one

recreational facility for physical activity was also found to be associated with the number of days per week children engaged in vigorous physical activity. When not controlling for any covariates, the results indicated that children who used recreational facilities for physical activity engaged in vigorous physical activity on 0.55 more days ($p<0.0001$) than children who did not use recreational facilities. The difference remained even when controlling for covariates. When controlling for covariates, the results indicated that children who used recreational facilities for physical activity engaged in vigorous physical activity on 0.33 more days ($p<0.0001$) than children who did not use recreational facilities.

When controlling for covariates, there were other statistically significant differences. There was a difference in mean number of days of vigorous physical activity between the two genders. Boys engaged in vigorous physical activity an estimated 0.59 more days per week than girls ($p<0.0001$). Compared with children in a large or midsized suburb or large town, the results indicated children in a small town engaged in vigorous exercise 0.17 more days per week ($p=0.0351$). The results indicated that other races engaged in vigorous physical activity on 0.29 more days than Whites ($p=0.0277$).

Not surprisingly, results indicated that children who preferred sedentary activities in their free time engaged in vigorous physical activity an estimated 0.84 fewer days per week than children who like both sedentary and active activities ($p<0.0001$). It was also estimated that children who preferred only active activities in their free time did vigorous physical activity on 0.53 more days per week ($p<0.0001$).

Logistic Regression Models for Use of Recreational Facilities

As shown in Table 6, when not controlling for covariates, there were significantly fewer children who used recreational facilities for physical activity in parental perceived somewhat safe neighborhoods (OR 0.65; p=0.0001) and parental perceived not at all safe neighborhoods (OR 0.47; p=0.0015) compared with children in parental perceived very safe neighborhoods. However, the significant differences disappeared when controlling for covariates. In the adjusted model, there were no statistically significant differences in regular use of recreational facilities for physical activity between children in parental perceived very safe neighborhoods and those in parental perceived not at all safe neighborhoods (OR 0.86; p=0.5650) or in somewhat safe neighborhoods (OR 1.06; p=0.6059).

When controlling for covariates, results indicated that boys used recreational facilities 37% more than girls (OR 1.37; p=0.0018). Blacks, Hispanics, and Asians used recreational facilities for physical activity significantly less than Whites. There was no statistically significant difference between Whites and other races (OR 1.14; p=0.4298). Compared with the highest SES quintile, each subsequently lower SES quintile used recreational facilities less, with the lowest SES quintile using recreational facilities for physical activity 76% less than the highest SES quintile. Children who preferred sedentary activities in their free time used recreational facilities for physical activity 40% less (OR 0.60; p=0.0017) than children who preferred both sedentary and active free time activities.

Chapter 5: DISCUSSION

Findings and Conclusions

This study sought to identify the association between parental perception of neighborhood safety and physical activity in 5th grade children. When controlling for covariates, there was a significant association between parental perception of neighborhood safety and the number of days per week children engaged in vigorous physical activity. Additionally, this study explored if regular use of recreational facilities for physical activity was associated with the number of days per week children engaged in vigorous physical activity. When controlling for covariates, there was found to be an association between the two variables. Lastly, this study examined if there was an association between parental perception of neighborhood safety and regular use of recreational facilities for physical activity, but did not find an association.

Hypothesis 1: Parental perception of neighborhood safety and vigorous physical activity

The relationship between parental perception of neighborhood safety and vigorous physical activity was found to be significant. Given the levels of influence of the ecological model, social encouragement (i.e. from parents) is one element that plays a critical role in children's physical activity behavior. Perception of safety is a determinant in the decision parents make to allow their children to engage in outdoor physical activity. When the element of safety is perceived by parents to be compromised, children are less likely to engage in outdoor vigorous physical activity.

This finding is consistent with prior literature. Timperio et al. (2004) found a positive association between 10 to 12 year old children's walking or biking to local

destinations and parents who perceived road and traffic conditions in their neighborhood to be safe (Timperio, et al., 2004). However, there were differences between this study and the current study. For one, Timperio et al. (2004) did not distinguish between levels of physical activity intensity, so the results did not indicate whether parental perception of neighborhood safety was associated with children's walking or biking at a vigorous level of intensity. The study was also conducted in Australia with parents and children who were raised in a different culture and type of environment than America. Also, unlike the present study, the sample of children was not nationally-representative and only received a moderate response rate, so the sample may have been filled with families who were interested in the study topic.

Carver et al. (2010) defined defensive behavior as altering habits and activities to reduce the perceived risk, such as when parents accompany their children to school or restrict their children's outdoor play to the backyard (Carver, Timperio, Hesketh, & Crawford, 2010). The Carver et al. (2010) study found a negative association between defensive behavior in parents of 10 to 11 year old boys and their sons' moderate-to-vigorous physical activity (MVPA) on the weekends (Carver, et al., 2010). These findings -- that a lack of parental perception of safety was associated with a decrease in MVPA -- were consistent with the findings in the current study. However, among girls, the researchers found a positive association between defensive behavior in parents of 10 to 11 year old girls and their daughters' moderate-to-vigorous physical activity on the weekends, which was inconsistent with the findings in the current study (Carver, et al., 2010). Carver et al. (2010) speculated that parents of girls may drive their daughters to

structured activities outside the neighborhood. Unlike the current study, this study only sampled 170 children and measured MVPA instead of vigorous physical activity alone.

In addition to parental perception of neighborhood safety, factors at the individual level of the ecological model -- gender, race, family SES, geographic location, and activity preference -- were found to be associated with physical activity, which was mostly consistent with prior literature.

The current study found that boys tended to engage in vigorous physical activity more than girls, just as Ridgers et al. (2007) found in their longitudinal study of elementary school children (Ridgers, et al., 2007). Other previous research had similar results (Nader, Bradley, Houts, McRitchie, & O'Brien, 2008; Sallis, et al., 2000; Sallis, Zakarian, Hovell, & Hofstetter, 1996)

Previous research found high SES students spent more time engaging in vigorous physical activity in their physical education classes and participated in more physical activity outside of school than low SES students (Sallis, et al., 1996). Low SES parents had greater concern for their children's safety than high SES parents and therefore limited their children's physical activity (Humbert, et al., 2006). The current study only found a statistically significant difference in vigorous physical activity between the highest and lowest SES quintiles, but found no difference between the highest SES quintile and any other quintile. The current study was the first study to examine the association between children's vigorous physical activity and SES in a cross-sectional study of 5^{th} graders, taking into account household income and parents' education levels and occupations.

Results from past studies are mixed on whether there is an association between children's physical activity and geographic location (urban/suburban/rural). Sirard et al. (2005) examined data from nearly 4,000 elementary school students and found no association between rates of walking or biking to school and school location (urban or suburban) (Sirard, Ainsworth, McIver, & Pate, 2005). The study did not collect data on the physical activity intensity level of active transport to school. They also did not examine children from rural elementary schools, presumably because schools there are likely further from children's homes and less accessible by active transportation. Felton et al. (2002), on the other hand, found white 8th grade girls in urban areas and black 8th grade girls in rural areas engaged in more self-reported physical activity than white 8th grade girls in rural areas and black 8th grade girls from urban areas, respectively (Felton et al., 2002). Unlike the current study, the two aforementioned studies did not examine vigorous physical activity in a nationally representative sample of 5th graders. The current study found a statistically significant difference in vigorous physical activity between large/mid-size suburbs (suburban) and rural areas, but not between large/mid-size suburbs and large/mid-size cities (urban).

The current study's findings were not in accordance with prior literature on children's vigorous physical activity by race. The current study found that black, Hispanic, and Asian 5th graders engaged in a statistically similar number of days of vigorous physical activity as white 5th graders. Andersen et al. (1998) analyzed NHANES III data from 1988 to 1994, which included a nationally representative sample of children ages 8 to 16 years old, and found more white boys and girls reported engaging in vigorous physical activity more than twice per week compared with their black and

Hispanic peers (Andersen, Crespo, Bartlett, Cheskin, & Pratt, 1998). Belcher et al. (2010) analyzed NHANES data from 2003 to 2006 on children ages 6 to 11 years old that had accelerometer data for at least 10 or more hours on four or more days. They found Whites spent fewer minutes per day engaging in vigorous physical activity than both Blacks and Hispanics ($p < 0.001$ and $p = 0.004$) (Belcher et al., 2010). Kimm et al. (2002) also found differences in physical activity levels between Whites and Blacks, but reported White girls engaged in more physical activity than Black girls (Kimm, et al., 2002). The current study relied on parents' reporting of their children's vigorous physical activity, which may have been different from their children's reports.

Hypothesis 2: Parental perception of neighborhood safety and use of recreational facilities

When controlling for covariates, there was no statistically significant relationship between parental perception of neighborhood safety and regular use of recreational facilities for physical activity found in this study. Children from parental perceived very safe neighborhoods were no more likely to regularly use recreational facilities for physical activity than children from parental perceived less safe neighborhoods. Parents who perceive their neighborhood as more safe tend to be of higher SES because they can afford to live in a seemingly safer neighborhood. Since the literature showed that high SES children have fewer financial limitations regarding physical activity costs than low SES children (Humbert, et al., 2006) and many recreational facilities, such as the sports teams, YMCAs, or cub scouts cost money to join, it was hypothesized that parental

perception of neighborhood safety would be associated with regular use of recreational facilities for physical activity.

However, there is another plausible hypothesis that, if also true, would have negated the association between parental perception of neighborhood safety and regular use of recreational facilities for physical activity. Since the highest percentage of children living in parental perceived not at all safe neighborhoods are children in the lowest SES quintile, perhaps children from less safe neighborhoods used recreational facilities for physical activity in order to be safe (despite the cost) and children from parental perceived more safe neighborhoods did not use recreational facilities for physical activity because it was safe to play outside in their own neighborhoods. If both hypotheses were true, any association between parental perception of neighborhood safety and use of recreational facilities in this study would have been negated.

No previous studies have examined recreational facility use for physical activity without further breakdown of the recreational facility type since cost can hinder children's ability to use the recreational facility (Ries, et al., 2011). Some of the recreational facilities in this study were likely free for the user (e.g. public parks or recreation centers); others likely charged a fee (e.g. YMCA, boy scouts, sports teams).

According to the ecological model, the same children's characteristics that were associated with vigorous physical activity should have been associated with regular use of recreational facilities for physical activity. This was true for all children's characteristics in the current study, except for geographic location. This makes sense in the specific context of the association between geographic location and recreational facilities because previous literature found that long distance between home and a

physical activity destination in rural areas made active transport an unrealistic option and driving by car a major barrier (Yousefian, et al., 2009).

Similar to the children's characteristics that were associated with vigorous physical activity, gender, race, SES, and activity preferences were all associated with regular use of recreational facilities for physical activity. Boys used recreational facilities for physical activity significantly more than girls, and Whites used them significantly more than Blacks, Hispanics, and Asians. Children from higher SES quintiles used recreational facilities more than those from lower SES quintiles. Lastly, children who liked to do both sedentary and physically active activities used recreational facilities for physical activity more than children who only liked doing sedentary activities in their free time.

Hypothesis 3: Use of recreational facilities and vigorous physical activity

This study found an association between regular use of at least one recreational facility for physical activity and number of days per week children engaged in vigorous physical activity. These results indicate that children who use recreational facilities for physical activity might be engaging in vigorous physical activity while at the recreational facility. The significant difference in mean number of days of vigorous physical activity between those who do and do not use recreational facilities for physical activity shows that recreational facilities can be a good venue for children to engage in physical activity.

Strengths and Limitations

A strength of this study was data were from a nationally representative sample of 5th grade children. A second strength of the study was that it was grounded in theory based on the ecological model. It incorporated both individual and social environmental influences that could affect the two dependent variables that were explored.

However, there were also several limitations to this study. Firstly, it was a cross-sectional study, so it only captured information about the 5th graders at one point in time. Therefore we cannot explore causal relationships. Parental perception of neighborhood safety may affect children's amount of vigorous physical activity or children's amount of vigorous physical activity may affect parental perception of neighborhood safety.

This study did not examine all the variables from the literature at each level of the ecological model that were associated with children's physical activity. It did not include variables from the physical or policy levels and did not include all the desired variables from the individual and social environmental levels. For example, a fuller exploration of the ecological model would have included analysis that examined associations between children's physical activity and factors such as school physical education policies and funding, safe routes to school policies, neighborhood walkability, and physical activity programs.

Additionally, the question that ECLS-K asked in the parent interview about the number of days per week the child does "exercise that causes rapid breathing, perspiration, and a rapid heartbeat for 20 continuous minutes or more?" describes a child doing vigorous physical activity. But the description in the question is ambiguous enough to also fall under the CDC's definition of moderate-intensity physical activity.

For the purposes of this study, the question was analyzed as the child doing vigorous physical activity, but secondary analysis did not allow for further clarification of the question.

It could not be determined whether the recreational facilities the children used were in their neighborhood. If so, children could have more opportunities to transport themselves there independent of their parents. Also, if the recreational facilities were in the same neighborhood as children's homes, they would have the same parental perception of safety.

Children who had missing data on any of the variables being analyzed were removed from the sample. Of the original 11,820 eligible 5th graders, this study had a sample size of 9,725. It is possible that the 2,095 children shared similar characteristics that made them more likely to be removed from the sample, but no analysis was conducted to check. The results of the study could have potentially been impacted if there was a pattern to the children who were missing data.

The main independent variable in this study was parental perception of neighborhood safety. Since it is not based on actual neighborhood safety, it is a subjective measure based on the parents' opinions about their neighborhood. Since perception of neighborhood safety is independent of children's age, it would have been assumed that the distribution of each level of age would be fairly even across levels of neighborhood safety. However, the oldest age group of children contained the greatest percentage of children living in very safe neighborhoods with each subsequently younger age group having a lower percentage in very safe neighborhoods. Older 5th graders may

be physically bigger than younger 5th graders and therefore their parents may perceive the neighborhood to be safer for them than parents of younger children.

Also concerning the measure of parental perception of neighborhood safety, it was unclear if parents assessed level of neighborhood safety with regards to stranger danger, road/traffic safety, or bullying.

Implications and Recommendations for Further Study

Despite the study's limitations, the findings provide some insight into the association of parental perception of neighborhood safety and children's physical activity among 5th graders. The ecological model can serve as a theoretical basis for how to positively affect children's physical activity behavior. If changes that support physical activity are made at the individual, social, physical, and policy levels of children's environment, children might be more inclined to engage in physical activity.

The ecological model covers a breadth of factors that are associated with physical activity behavior. It would be challenging to overhaul one's entire environment at each level of the model. But changes at the policy level can affect change at each subsequent inner level, and likewise, changes at the individual level can affect change at each subsequent outer level. Making changes to improve children's physical activity behavior at any level of the ecological model can be helpful. The best way to see the most effective changes in children's physical activity behavior would be to make changes at multiple levels of the ecological model. The current study suggests that children's physical activity would increase if parents perceived an improvement in neighborhood safety (e.g. by decreasing crime, increasing the presence of security, and improving road

and pedestrian walkability in neighborhoods) and if neighborhoods added several different safe, fun, accessible, free to use, and aesthetically pleasing venues for children to play.

In order to improve children's physical activity at the physical environment level, urban planners should design walkable neighborhoods that have easy and safe access to schools, recreational facilities, and healthy food stores. Programs and events that engage the community in physical activity should be made available to children and adults. Parks should have a variety of activities that appeal to divergent interests of children. At the policy level, parents and school administrators should advocate for additional funding that supports physical education in schools. Community members can speak to their local political representatives to discuss the need for safe routes to school, health care incentives, and public recreation investments in order to improve the health of the community. These are the types of changes that can lead to an increase in physical activity throughout a community.

In future studies, researchers can explore the relationship between parental perception of neighborhood safety and physical activity in children of other ages to see if there is a difference in physical activity behaviors between 5^{th} graders and either younger children or older children. Alternatively, researchers can examine longitudinal data in order to both look at trends over time and be able to assign directional causality to the independent and dependent variables. Another suggestion is to gather additional data on actual neighborhood safety and compare the findings with the parental perception of neighborhood safety.

Given the high prevalence of childhood obesity in the US, it is imperative that efforts are made to increase children's physical activity. Improving children's physical activity is no small feat, which is why an ecological approach is a useful method to implement changes both at an individual and population level. From the current study, it is clear that improvements at any level of the ecological model can impact children's physical activity, but the combination of physical activity interventions at multiple levels and across multiple sectors can have the greatest impact.

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TABLES

Table 1: Descriptive statistics of 5th graders from ECLS-K data collection by children's characteristics[1], N=9,725

Characteristics	% or Mean (SE)
Age	
<10.5 years old	1.1% (0.19)
10.5 - <11 years old	29.0% (0.96)
11 - <11.5 years old	44.6% (1.07)
11.5 - <12 years old	22.5% (0.97)
>12 years old	2.9% (0.33)
Gender	
Male	48.9% (0.92)
Female	51.1% (0.92)
Race	
White, non-Hispanic	57.0% (1.84)
Black, non-Hispanic	16.4% (1.18)
Hispanic	19.4% (1.40)
Asian	2.8% (0.24)
Other[2]	4.5% (1.02)
Family SES[3]	
Quintile 1 (lowest)	20.6% (0.96)
Quintile 2	20.6% (0.74)
Quintile 3	20.1% (0.82)
Quintile 4	19.3% (0.74)
Quintile 5 (highest)	19.4% (0.91)
Location type	
Large and mid-size city	35.4% (1.53)
Large and mid-size suburb and large town	41.8% (2.58)
Small town and rural	22.9% (2.37)
Preferences	
Sedentary activities	17.5% (0.68)
Physically active activities	22.9% (0.73)
Both	59.6% (0.83)
Parental perception of neighborhood safety	
Not at all safe	2.5% (0.30)
Somewhat safe	24.3% (0.98)
Very safe	73.2% (1.08)
Regular use of recreational facilities for physical activity	
Yes	81.6% (0.74)
No	18.4% (0.74)
Number of days per week of vigorous physical activity (Mean)	3.73 (0.04)

[1] From ECLS-K 5th grade data collection, round 6 parent interview, based on survey-adjusted data
[2] Other race includes Native Hawaiian or Pacific Islander, American Indian, Alaska native, or multiracial
[3] ECLS-K composite variable created from household income and parents' education and occupation

Table 2: Children's characteristics by parental perception of neighborhood safety[1], N=9,725

	Parental perception of neighborhood safety			
Characteristics	**Not at all safe[2]**	**Somewhat safe[2]**	**Very safe[2]**	**p-value[3]**
Age, %				0.0302**
<10.5 years old	3.9%	28.5%	67.6%	
10.5 - <11 years old	2.7%	26.3%	71.0%	
11 - <11.5 years old	3.1%	24.3%	72.6%	
11.5 - <12 years old	1.1%	22.5%	76.4%	
>12 years old	1.5%	18.4%	80.1%	
Gender, %				0.0643
Male	2.7%	22.5%	74.8%	
Female	2.3%	26.3%	71.4%	
Race, %				<0.0001***
White, non-Hispanic	1.1%	13.8%	85.2%	
Black, non-Hispanic	3.0%	43.3%	53.7%	
Hispanic	5.9%	38.2%	55.9%	
Asian	4.4%	22.9%	72.7%	
Other[4]	3.2%	29.6%	67.3%	
Family SES[5], %				<0.0001***
Quintile 1 (lowest)	5.6%	43.1%	51.3%	
Quintile 2	2.7%	30.3%	67.0%	
Quintile 3	3.0%	21.5%	75.5%	
Quintile 4	0.7%	15.6%	83.6%	
Quintile 5 (highest)	0.2%	9.7%	90.0%	
Location type, %				<0.0001***
Large and mid-size city	4.0%	34.7%	61.3%	
Large and mid-size suburb and large town	1.8%	20.8%	77.4%	
Small town and rural	1.3%	14.9%	83.8%	
Preferences, %				0.0029***
Sedentary activities	2.3%	29.5%	68.2%	
Physically active activities	3.1%	19.4%	77.5%	
Both	2.3%	24.7%	72.9%	
Regular use of recreational facilities for physical activity, %				<0.0001***
Yes	2.1%	22.9%	75.0%	
No	4.0%	30.7%	65.2%	
Number of days per week of vigorous physical activity, mean	2.9[+]	3.4[+]	3.9[+]	<0.0001^***

[1] From ECLS-K 5th grade data collection, round 6 parent interview, based on survey-adjusted data
[2] Row percent, unless otherwise noted
[3] Chi-square p-value, unless otherwise noted
[4] Other race includes Native Hawaiian or Pacific Islander, American Indian, Alaska native, or multiracial
[5] ECLS-K composite variable created from household income and parents' education and occupation
[+] Mean days per week of vigorous physical activity by parental perception of neighborhood safety
^ ANOVA p-value
*p < 0.10; **p < 0.05; ***p < 0.01

Table 3: Children's characteristics by use of recreational facilities for physical activity[1], N=9,725

	Regular use of recreational facilities for physical activity		
Characteristics	**Yes[2]**	**No[2]**	**p-value[3]**
Age			0.2516
<10.5 years old	70.8%	29.2%	
10.5 - <11 years old	81.8%	18.2%	
11 - <11.5 years old	80.6%	19.3%	
11.5 - <12 years old	83.2%	16.8%	
>12 years old	76.5%	23.5%	
Gender			0.0012***
Male	83.6%	16.4%	
Female	78.9%	21.1%	
Race			<0.0001***
White, non-Hispanic	86.5%	13.5%	
Black, non-Hispanic	75.4%	24.6%	
Hispanic	71.6%	28.4%	
Asian	72.0%	28.0%	
Other[4]	85.3%	14.7%	
Family SES[5]			<0.0001***
Quintile 1 (lowest)	67.6%	32.4%	
Quintile 2	77.8%	22.2%	
Quintile 3	84.0%	16.0%	
Quintile 4	87.0%	13.0%	
Quintile 5 (highest)	91.2%	8.8%	
Location type			0.0131**
Large and mid-size city	78.1%	21.9%	
Large and mid-size suburb and large town	83.2%	16.8%	
Small town and rural	82.8%	17.2%	
Preferences			<0.0001***
Sedentary activities	74.0%	26.0%	
Physically active activities	84.8%	15.2%	
Both	82.1%	17.9%	
Parental perception of neighborhood safety			<0.0001***
Not at all safe	70.0%	30.0%	
Somewhat safe	76.4%	23.6%	
Very safe	83.3%	16.7%	
Number of days per week of vigorous physical activity	3.8*	3.3*	<0.0001^***

[1] From ECLS-K 5th grade data collection, round 6 parent interview, based on survey-adjusted data
[2] Row percent, unless otherwise noted
[3] Chi-square p-value, unless otherwise noted
[4] Other race includes Native Hawaiian or Pacific Islander, American Indian, Alaska native, or multiracial
[5] ECLS-K composite variable created from household income and parents' education and occupation
* Mean days per week of vigorous physical activity by regular use of recreational facilities for physical activity
^ ANOVA p-value
*p < 0 10; **p < 0.05; ***p < 0.01

Table 4: Children's characteristics and mean days of vigorous physical activity[1], N=9,725

Characteristics	**Mean days of vigorous physical activity per week**	**p-value[2]**
Overall	3.73	--
Age		0.1122
<10.5 years old	3.20	
10.5 - <11 years old	3.76	
11 - <11.5 years old	3.66	
11.5 - <12 years old	3.83	
>12 years old	3.73	
Gender		<0.0001***
Male	4.02	
Female	3.41	
Race		<0.0001***
White, non-Hispanic	3.79	
Black, non-Hispanic	3.66	
Hispanic	3.61	
Asian	3.28	
Other[3]	3.98	
Family SES[4]		0.0110**
Quintile 1 (lowest)	3.51	
Quintile 2	3.73	
Quintile 3	3.70	
Quintile 4	3.82	
Quintile 5 (highest)	3.88	
Location type		0.0053***
Large and mid-size city	3.60	
Large and mid-size suburb and large town	3.73	
Small town and rural	3.90	
Preferences		<0.0001***
Sedentary activities	2.87	
Physically active activities	4.31	
Both	3.75	
Parental perception of neighborhood safety		<0.0001***
Not at all safe	2.92	
Somewhat safe	3.42	
Very safe	3.85	

[1] From ECLS-K 5th grade data collection, round 6 parent interview, based on survey-adjusted data
[2] ANOVA p-value; Significant at p<0.05
[3] Other race includes Native Hawaiian or Pacific Islander, American Indian, Alaska native, or multiracial
[4] ECLS-K composite variable created from household income and parents' education and occupation
*p < 0 10; **p < 0.05; ***p < 0.01

Table 5: Linear regressions of mean number of days of vigorous physical activity[1], N=9,725

	Mean number of days of vigorous physical activity per week			
	Bivariate Models		Adjusted Model[2]	
Characteristics	**Coefficient Estimate**	**SE**	**Coefficient Estimate**	**SE**
Parental perception of neighborhood safety				
Not at all safe	-0.93***	0.21	-0.86***	0.25
Somewhat safe	-0.43***	0.09	-0.28***	0.09
Very safe (ref)	1.0	--	1.0	--
Regular use of recreational facilities for physical activity				
Yes	0.55***	0.09	0.33***	0.09
No (ref)	1.0	--	1.0	--
Age				
<10.5 years old			-0.28	0.25
10.5 - <11 years old			0.10	0.07
11 - <11.5 years old (ref)			1.0	--
11.5 - <12 years old			0.14*	0.08
>12 years old			-0.04	0.23
Gender				
Female (ref)			1.0	--
Male			0.59***	0.07
Race				
White, non-Hispanic (ref)			1.0	--
Black, non-Hispanic			0.18	0.14
Hispanic			0.09	0.11
Asian			-0.20*	0.10
Other[2]			0.29**	0.13
Family SES[3]				
Quintile 1 (lowest)			-0.26**	0.11
Quintile 2			-0.12	0.11
Quintile 3			-0.14	0.11
Quintile 4			-0.10	0.10
Quintile 5 (highest) (ref)			1.0	--
Location				
Large and mid-size city			0.01	0.10
Large and mid-size suburb and large town (ref)			1.0	--
Small town and rural			0.17**	0.08
Preferences				
Sedentary activities			-0.84***	0.10
Physically active activities			0.53***	0.08
Both (ref)			1.0	--

[1] From ECLS-K 5th grade data collection, round 6 parent interview, based on survey-adjusted data
[2] Other race includes Native Hawaiian or Pacific Islander, American Indian, Alaska native, or multiracial
[3] ECLS-K composite variable created from household income and parents' education and occupation
*p < 0 10; **p < 0.05; ***p < 0.01

Table 6: Odds of regular use of recreational facilities[1], N=9,725

	Regular use of recreational facilities for physical activity	
	Bivariate Model	**Adjusted Model**
Characteristics	**Odds Ratio (95% CI)**	**Odds Ratio (95% CI)**
Parental perception of neighborhood safety		
Not at all safe	0.47 (0.29-0.75)***	0.86 (0.50-1.46)
Somewhat safe	0.65 (0.52-0.81)***	1.06 (0.85-1.33)
Very safe (ref)	1.0	1.0
Age		
<10.5 years old		0.57 (0.30-1.08)*
10.5 - <11 years old		1.11 (0.89-1.43)
11 - <11.5 years old (ref)		1.0
11.5 - <12 years old		1.19 (0.90-1.56)
>12 years old		0.84 (0.44-1.62)
Gender		
Female (ref)		1.0
Male		1.37 (1.12-1.67)***
Race		
White, non-Hispanic (ref)		1.0
Black, non-Hispanic		0.72 (0.54-0.96)**
Hispanic		0.58 (0.46-0.72)***
Asian		0.46 (0.34-0.63)***
Other[2]		1.14 (0.82-1.60)
Family SES[3]		
Quintile 1 (lowest)		0.24 (0.18-0.32)***
Quintile 2		0.38 (0.27-0.53)***
Quintile 3		0.54 (0.38-0.78)***
Quintile 4		0.66 (0.46-0.93)**
Quintile 5 (highest) (ref)		1.0
Location		
Large and mid-size city		0.96 (0.78-1.18)
Large and mid-size suburb and large town (ref)		1.0
Small town and rural		1.07 (0.81-1.42)
Preferences		
Sedentary activities		0.60 (0.44-0.83)***
Physically active activities		1.19 (0.92-1.52)
Both (ref)		1.0

[1] From ECLS-K 5th grade data collection, round 6 parent interview, based on survey-adjusted data
[2] Other race includes Native Hawaiian or Pacific Islander, American Indian, Alaska native, or multiracial
[3] ECLS-K composite variable created from household income and parents' education and occupation
*p < 0 10; **p < 0.05; ***p < 0.01