

A PLACE TO LIVE, LEARN, & PLAY: INCREASING CHILDHOOD  
PHYSICAL ACTIVITY THROUGH THE BUILT ENVIRONMENT

By

JENNIFER K. LENCHIK

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Approved By:

Gary Miller, Ph.D., Advisor \_\_\_\_\_

Examining Committee:

Carol Shively, Ph.D. \_\_\_\_\_

Patricia Nixon, Ph.D. \_\_\_\_\_

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Jennifer K. Lenchik

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Thesis under the direction of Gary Miller, Ph.D., Associate Professor of Health and  
Exercise Science.

The built environment is where human activity occurs in relation to buildings, other structures, and infrastructure within a given community. There has been increasing research examining the association between built environment, physical activity, and childhood obesity. Currently, American children do not meet the daily recommendation of sixty minutes of moderate to vigorous physical activity. This is due in part to an increasingly sedentary lifestyle among children brought upon by changes to the built environment beginning in the 1950s. These changes have created barriers to achieving adequate levels of physical activity on an individual and community level. Childhood obesity and overweight has been declared a world health crisis among developed nations. Without intervention the current generation of American children will develop unprecedented rates of chronic illness and premature death related to obesity. Economic burden due to lost wages and direct healthcare cost of managing obesity related diseases will continue to strain the healthcare system.

This thesis paper will examine the role of neighborhoods, urban design, recreation centers, parks, and schools in increasing physical activity within the built environment. Creating safe common play areas like playgrounds and green spaces, better neighborhoods that encourage foot and bike transportation through sidewalks and mix land use, and schools that implement physical activity programs to teach a love of being active, will allow children to have an opportunity for increased physical activity regardless of their socioeconomic status. Through these changes in the built environment children can overcome current barriers to use resources close at hand to become more physically active and in turn grow into healthy active adults, helping to reverse the current obesity epidemic.

## INTRODUCTION

Children in the United States are gaining weight at an alarming rate. Childhood overweight and obesity is now a national epidemic, since 1980 the percentage of children age 2 to 5 years considered overweight and obese has doubled and the percentage of overweight adolescents has tripled (Galson 2008).

Overweight and obesity are defined based on body mass index (BMI), which is calculated by taking weight (in kilograms) and dividing it by the square of height (in meters). Although BMI does not measure body fat directly, it correlates highly with more direct measures of fat such as underwater weighing (CDC website). In adults, BMI between 25 and 29.9 kg/m<sup>2</sup> is overweight and BMI of 30 kg/m<sup>2</sup> or greater is obese. In children, interpretation of BMI requires age- and sex- specific growth charts. This is because of sporadic growth periods in childhood, the amount of body fat changing with growth, and the amount of body fat differing between boys and girls. In children and adolescents (<20 years old), obesity is defined as at or above 95<sup>th</sup> percentile of sex-specific BMI for age and overweight is defined as between 85<sup>th</sup> and 95<sup>th</sup> percentile (CDC website).

According to National Health and Examination Survey (NHANES), the prevalence of overweight among children and adolescents has increased from 1976-1980 to 2003-2004. In 2-5 year olds, overweight increased from 5.0% to 13.9 %. In 6-11 year olds it increased from 5.0% to 17.4% and in 12-19 year olds it increased from 5% to 17.4% (Ogden et al. 2002 and 2006). Research indicates that overweight children grow into obese adults (Goran et al.1999). Not only are children at greater risk of becoming

obese adults, but they are also at greater risk for developing chronic diseases including type 2 diabetes, cardiovascular disease, arthritis, and some cancers (Daniels 2006, Fagot-Campagna et al. 2001, Dietz 1998, Freedman et al. 2004). If this crisis is left unattended, future generations will suffer premature deaths, economic hardship, and increased burden to our healthcare system.

Recently, research in the field of physical activity within the built environment has been exploring ways to increase childhood physical activity. These studies indicate that children who live in active living environments (for example, those that promote active commuting, include safe common play spaces, and schools with intact physical education programs) are more physically active and have a lower incidence of overweight and obesity (Frank et al. 2007, Sallis et al. 2006). This paper will examine individual and community barriers to physical activity within the built environment. The barriers that contribute to the increasingly sedentary lifestyle of American children include cost, accessibility to play spaces, parental concerns of safety, and opportunity for diverse activities. Additionally, this paper will review research that shows that changes to the built environment can make a positive impact on childhood health by increasing physical activity levels of children.

In order for children to be physically active the built environment must transform from an obesogenic environment to an active environment. Creating affordable, safe play spaces like parks and recreation centers, redesigning neighborhoods to include mixed land use that encourages foot and bike transportation, and encouraging schools to implement physical activity programs will provide opportunities for children to increase their daily amount of physical activity. An active living community where children are

more physically active should result in these children growing into healthy active adults, helping reverse the current obesity epidemic.

## CHAPTER ONE

### ORIGINS OF THE OBESITY EPIDEMIC

Childhood overweight and obesity is a complex public health problem that has many causes. Human weight gain occurs through an energy imbalance, where caloric intake is greater than energy output. Previous interventions to correct the intake imbalance have focused on improving nutrition using educational programs. Solving the energy imbalance with nutrition alone seems unrealistic. Studies have shown that increased physical activity and improved nutrition together promote effective and efficient weight loss (Phelan et al. 2006, Savoye et al. 2007). In addition to receiving education about nutrition children need to learn how physical activity can reduce the energy imbalance, reducing their risk of overweight and obesity.

In 1950, American society and landscape began to experience major structural changes. A thriving economy, a growing middle class, and technological advances made life easier for an average American. In particular, food was easy to acquire with little physical exertion. Machines and gadgets made cooking, yard work, and home maintenance easier and less physically demanding. The increase in income allowed for many middle class families to buy larger homes in new neighborhoods called suburbs, located outside city limits. For the growing majority automobile use was increasing. Instead of walking to market or growing their own food people began driving to supermarkets where they bought fast, convenient, ready-made, energy dense meals. As supermarkets sprang up at most suburban strip malls the urban sprawl was born.

Businesses, jobs, and schools followed the growing middle class from the city to the suburbs, leaving behind the empty inner-city buildings and the economically disadvantaged people. Infrastructure development included bridges and highways connecting outlying suburbs to the larger metropolitan areas, making walking and cycling impractical as modes of transportation. The built environment was becoming obesogenic, easier food acquisition and lower daily energy expenditure created a more sedentary environment, contributing to energy imbalance responsible for weight gain and obesity (Hill et al. 2003, Morland et al. 2009, Ard 2007).

Technological advances allowed many Americans to have more time for recreational activities but, like other activities of daily living, leisure time became increasingly more sedentary. Movies, television, and car rides along the parkway replaced physically vigorous activities such as gardening, tennis, swimming, and hiking. Americans began watching more television, eating more fast foods, and relying more on their cars for transportation. As adults adapted to this easier, more sedentary, lifestyle their children acquired their habits. Today's youth are less active than their parents and grandparents were as children. They play indoors more and are more likely to ride the bus or car to school (Anderson et al. 2008, Beschen 1972, Burdette et al. 2005, McDonald 2007). In their home environments children are less physically active owing in part to parental worries that it is unsafe to bike or walk to school and to play unsupervised outside. Increased pressure for academic performance has caused schools to decrease the amount of physical activity that children get by reducing recesses and eliminating physical education classes in favor of sitting behind a desk in academic classes.

Although society advanced with improved technology our bodies did not. Studies

have shown that the human body is programmed to store body fat during periods of low physical activity (Booth et al. 2008). This suggests that nutrition alone cannot solve the overweight obesity crisis. Evolutionary adaptation is a slow process and the human body is imprinted with millions of years of evolutionary modification. When we were hunters and gathers and periods of food availability varied with season and migration, our bodies and brains evolved to store fat more efficiently and effectively. We stored fat in time of plenty for later use when food was scarce. Greater brain capacity and intelligence allowed humans to develop tools for acquiring food easier (Bellisari 2008). In the winter months when food supply was scarce and we were not able to expend a lot of energy looking for food our bodies used the fat reserves stored during food secure times to prevent illness, death, and to safe guard fertility.

Today, even though food is readily available, our bodies have not learned to be more efficient at burning calories with decreased physical activity. Despite our increasingly sedentary lifestyle our bodies have retained the trait known as the “thrifty genotype.” Because of our biologic drive to acquire food and expending less energy, with advancing technology people are gaining more weight and developing obesity-related chronic diseases, diseases that can be prevented with increased physical activity (Neel 1962, Bellisari 2008).

## CHAPTER TWO

### THE CONSEQUENCES OF CHILDHOOD OBESITY

It has been widely accepted that adult obesity increases the risk for developing chronic conditions including cardiovascular disease, type 2 diabetes, respiratory illnesses, musculoskeletal diseases, and some cancers (Freedman et al. 2004). The same complications are now affecting a growing number of obese and overweight children (Mokad et al. 2001). Children who are overweight are at an increased risk of developing obesity related illnesses in adulthood and obese children are more likely to be diagnosed with hypertension and hypercholesterolemia, diabetes, gallbladder disease, sleep apnea, and joint disorders during adolescence. In addition, these children are at greater risk for developing mental health problems due to poor self-esteem, depression, and anxiety (Estabrooks et al. 2008).

Developing chronic illness during childhood makes exercise more difficult to incorporate into an already sedentary lifestyle. Children with chronic illness tend to be physically unfit and unmotivated. A built environment that supports being physically active through activities of daily living and recreational exercise would make a positive impact on these children. Using sidewalks for walking a dog or walking to school, greenways for cycling, skate parks for roller skating or skateboarding, pools for swimming and diving are all effective ways in which children can use their built environment to increase their physical activity levels. In order to reduce the risk of illness children need to learn to be more active, more often. To help with that, the built

environment needs to be redesigned to encourage use that is safe and fun. By becoming more active children would reduce their risk of weight gain and obesity.

Treatment of overweight and obesity related illness is costly and has the potential to tax an already strained healthcare system. Wang and Dietz (2002) found that \$127 million was spent on childhood obesity from 1997-1999, compared to \$35 million from 1979-1981. This included only hospital related costs and only in patients where obesity was listed as a secondary diagnosis. The study did not examine the cost of outpatient doctor's visits, medications, or therapy sessions. The study examined obesity related illnesses including diabetes, sleep apnea, gallbladder disease, and mental illness but only included children age 6 through 17 years. Therefore, the total cost of obesity related illness is likely to be much higher than they reported.

In calculating the total costs of obesity one must include lost wages for parents who care for obese children as well as missed days of school. Children who use welfare, disability, and Medicaid resources increase the economic cost of obesity. These costs compound further as childhood obesity and overweight tracks into adulthood. For healthcare costs to be reduced the number of children gaining weight must be reduced. Creating a healthier built environment where opportunities to be physically active are attractive, safe, and accessible is an important investment that would improve the health of the population. Reducing the rate of obesity in childhood would help reduce healthcare costs, improve quality of life, and stabilize current decrease in life expectancy.

## CHAPTER THREE

### PHYSICAL ACTIVITY LEVELS ACCORDING TO AGE, RACE, AND GENDER

American children are gaining weight at a faster rate than previous generations, with one reason being that today's children are less active than their parents were 25 years ago (Hill et al. 2003, Nader et al. 2008). Changes to the built environment create challenges that reduce physical activity. Greater reliance on the automobile, more academic time dedicated to schoolwork, and digital technology promotes sedentary behaviors and lack of sports clubs and money prevent many children, especially minority children, from being physically active.

In adults, regular physical activity reduces the risk of obesity, hypertension, and diabetes. For this reason the CDC recommends that adults engage in at least 30 minutes of moderate physical activity on most days. Yet, in the United States more than half of adults do not meet these recommendations. There are also important gender and racial disparities in physical activity levels. Since 1984, the CDC has used a random telephone survey, Behavioral Risk Factor Surveillance System (BRFSS), to assess health risks in adults. Their results indicate that men are more active than women, and Caucasians are more active than ethnic minorities (MMWR 2007). From 2001 to 2005, regular physical activity increased from 43.0% to 46.7% in women and from 48.0% to 49.7% in men. In women, in 2005, non-Hispanic whites had the highest prevalence (49.6%), followed by Hispanics (40.5%), and non-Hispanic blacks (36.1%). In men, in 2005, non-Hispanic whites had the highest prevalence (52.3%), followed by non-Hispanic blacks (45.3%),

and Hispanics (41.9%). Before interventions could be developed to increase physical activity in all adults, more studies are needed to understand the causes of gender and racial discrepancies in physical activity levels.

In children, similar discrepancies in physical activity among genders and ethnic groups exist: most studies find that girls are less active than boys, and minorities less active than whites. In addition, there are discrepancies in physical activity according to socioeconomic status (SES). Children who are a minority and live in low-income neighborhoods are less active and have higher BMI scores than Caucasian children from higher income neighborhoods. Lower levels of physical activity and higher BMI scores are more prevalent in these children because they face more barriers to physical activity than their affluent counterparts (Gorden-Larsen et al. 2006, Kinra et al. 2000). Starting around age 13, girls become increasingly less active than boys. At this age, African American and Hispanic girls are the least active. By age 14 both girls and boys are less active regardless of their minority status or their place of residence. It appears that all children become more sedentary during adolescence, increasing their risk for overweight and obesity.

In an effort to assess childhood inactivity the CDC conducted a random digit phone survey of parents and guardians of children ages 9-13. The Youth Media Campaign Longitudinal Survey (YMCLS) included 3,600 homes with a total of 4,500 parent child/dyads (Duke et al. 2003). The survey assessed physical activity levels according to participation in organized sports and individual free play. They found that 61.5% of children do not participate in any organized physical activity, outside of school, and 22.6% do not engage in free play. Parents were asked how transportation, cost,

availability and variety of activities, time and neighborhood safety influenced their child's participation in physical activity. Concerns about safety were more common for girls (17.6%) than boys (14.6%) and were most common in Hispanic parents (41.2%) followed by non-Hispanic blacks (13.3%), and non-Hispanic whites (13.3%) African American and Hispanic parents reported more barriers to physical activity than Caucasian parents. In this study, minority parents were of lower socioeconomic status (SES) and lower level of education than Caucasian parents. Compared to Caucasian parents, minority parents voiced greater concerns with the number of opportunities for physical activity in their neighborhoods, the availability of transportation to and from activities, the cost of participating in physical activities. Minority parents reported more barriers to physical activity because lower income neighborhoods often lack recreation facilities of higher income neighborhoods. For example, organized sports clubs and martial arts and dance schools tend to be located in higher SES neighborhoods (Sallis et al. 2006).

In children age 9 to 13 years, the YMCLS found that the most popular organized sports were basketball, baseball, soccer, and softball. The most favored free time activities were bicycle riding, walking, running, active games like jump rope and tag, and football for boys and dance for girls. When parents reported a barrier to physical activity (due to cost, transportation, accessibility, or safety), there was low participation in physical activity by children. When these barriers were not a concern for parents, as was the case for parents of higher income and education, children's participation was greater. There are some limitations of this study: data on physical activity was self-reported and subject to error, data was collected April-June and may not reflect seasonal variations in activity, and duration of activity was not adequately measured. Despite these limitations

this study indicates that the built environment helps determine children's level of participation in physical activities.

Another large survey of physical activity level in children is The Youth Behavior Risk Surveillance System Study (YBRSS), developed by the CDC to better understand current youth behavior and risk to injury and illness and is administered to 9<sup>th</sup> through 12<sup>th</sup> grade students every two years (Eaton et al. 2008). The survey asked students if they had been active for 60 minutes 5 days a week and if the activity caused them to have labored breathing and accelerated heart rate. They found that 34.7% of students surveyed nationwide met the daily recommendation for physical activity. There were gender and ethnic disparities. More males (43.7%) than females (25.6) met recommended levels. Caucasian males met physical activity levels most often (46.1%) followed by African American males (41.3%), Hispanic males (38.6%), Caucasian females (27.9%), Hispanic females (21.9%), and African American females (21.0%). Like the YMCLS, this study is subject to reporting errors.

Unlike YMCLS and YRBSS that are subject to reporting bias, Nader et al. (2008) assessed physical activity patterns in children directly, using accelerometers worn on the waist for a seven-day period (five weekdays and two weekend days). This was a multi-center, longitudinal study of 1032 children age 9-15 years in the National Child Health and Human Development Study of Early Child Care and Youth Development Birth Cohort Study (Nader et al. 2008). Their results supported the fact that today's children are leading sedentary lives. They reported that more than 90% of the children in the 9-11 year age group met or exceeded the daily recommendation of 60 minutes of moderate to vigorous physical activity (MVPA). However, participation in MVPA began to decline

at age 13 for girls and at age 14.7 for boys. This gradual decline continued until age 15 with only 31% of participants reaching recommended levels during the week and only 17% meeting the recommended levels on weekends. Girls engaged in less MVPA than boys in each age bracket. Unlike other studies, Nader et al. did not find lower physical activity levels in children of ethnic minorities or in those who lived in low income neighborhoods.

Children today walk less, have less physically demanding hobbies and chores, and spend less time outdoors. Basset et al (2007) investigated if these factors made a difference in the overall amount of physical activity by tracking Amish children's level of physical activity using a step counter. The Amish are a religious community that prohibits the use of modern technology. Children walk to school, have long lunch and recess breaks, play for long periods outdoors, and perform manual household chores in the home and outside, regardless of temperature or weather. Entertainment is in the form of social gathering. Basset reported that Amish children walked more than mainstream American children. On average, Amish boys stepped 17,174 steps per day and Amish girls stepped 13,620 steps per day (Bassett et al. 2007). For comparison, Vincent et al. (2003) reported step counter readings in non-Amish children. In that study, American boys recorded 12,554 to 13,872 steps per day and American girls recorded 10,661 and 11,383 steps per day. Children like the Amish who rely on foot transportation and live in a safe environment that has many opportunities for physical activity are more physically active than mainstream children who rely on automobiles and live in less safe neighborhoods with fewer opportunities for physical activity. It is therefore not surprising

that lower BMI scores were seen in Amish children and that there were no cases of childhood obesity in their community.

Increasing evidence suggests that American children become less active as they mature. Boys and girls age 9 to 12 years meet and even exceed the national recommendation of 60 minutes of vigorous activity a day. However, vigorous activity begins to decline at age 13 for girls and 14 for boys. Children of lower SES have higher BMI scores and lower levels of physical activity owing in part to environmental barriers that prohibit easy access to physical activity.

To increase physical activity levels in all children, regardless of age, race, and gender, barriers in the built environment need to be removed. Children need greater access to recreation centers, organized sports, and safer neighborhoods that promote walking. The YMCLS found that the most popular sport among boys and girls ages 9-15 was basketball. Installing community basketball courts would be cost effective and benefit the entire community. Improving sidewalks and lighting to make citizens feel safe would be economically feasible and result in lower crime in that community. Changing the built environment to promote physical activity would be a cost effective way to prevent childhood obesity especially considering the \$127 million cost of overweight and obesity.

## CHAPTER FOUR

### URBAN SPRAWL, CITY DESIGN, AND MIXED LAND-USE

Any strategy for combating childhood inactivity and obesity should take into consideration how our cities and suburbs are designed. The health of any community is in part related to how well its built environment is designed and how well its citizens function within that environment. Currently, the built environment has negative effects on physical activity levels in children living in the suburbs and the inner city (Hill 2003, Cohen 2008, and Sallis et. Al. 2000). Opportunities for physical activity in the suburbs are reduced by inadequate street connectivity, low population density, poor public transportation systems, high automobile traffic, and lack of ample green spaces. In contrast, the inner city has reduced opportunities for physical activity due to physical barriers such as poor street lighting, poor sidewalk maintenance, vacant buildings, inadequate access to green spaces, and high crime. To encourage children living in both types of communities to be less sedentary and more physically active, the built environment must be redesigned.

Suburban development and redesign should encourage more mix land use. Such use of land would include a better mix of commercial, residential and recreational space. Redesign should also focus on creating more common play spaces and more sidewalks, so that children would have more opportunities for walking and playing outside. The urban environment could also benefit from redesign as well as reinvestment so that a population that has been largely ignored could be revitalized. The aim of redesigning the

inner city should be to attract new businesses, schools, and families to the area. This would restore the inner cities back to the high density, diverse, pedestrian centered environments that they were prior to 1950s. Such changes to the city and the suburbs are essential for the outside environment to become more attractive, accessible, and safe. Greater access to and increased use of outdoor areas by adults would also encourage children to play outside more, thereby increasing physical activity levels. All ethnic and socioeconomic groups would benefit from healthier children and more vibrant communities.

In many communities, the inner cities lack safe sidewalks, destination-centered places, parks, and green spaces (United States Centers for Disease Control 1999, Neckerman et al. 2009). As a result, low-income families residing in the urban built environment have become as neglected as their surroundings. Decreased investment in the inner city was caused in part by the shift in tax paying base from the city to the suburbs. As more affluent people abandoned the inner cities the families that were left behind faced increased physical and psychological barriers to good health. In particular, their built environment impeded adequate nutrition and opportunities for regular physical activity. Decreased investment in the inner city promoted social and environmental decay. Redesign of the inner city to include some attributes of the traditional (pre-1950) city is needed so that the health of the community, especially of children, is improved (Lopez et al. 2006, Harwood 2003). Hopefully, future healthcare costs related to obesity would thus be decreased.

In many inner cities streets are designed in grid like patterns, which facilitates walking, but often the sidewalks and streets are in poor condition, making walking

unsafe. Although low-income housing units promote high-density land use, few occupants leave their buildings for recreation and socializing. Budget cuts have decreased park maintenance making common spaces unsafe and prone to criminal activity. Graffiti, poor street lighting, and lack of trees compound the insecure feelings of residents in an urban community. For these residents, opportunities for employment are often located in the outlying metropolitan areas or the suburbs (Cohen 2008). Great distances between homes, jobs, and stores and inadequate public transportation make getting to work and going shopping more difficult. Physical barriers to food acquisition and physical activity serve as examples of how a built environment can adversely affect a community (Mujahid et al. 2008).

Research studies shed further light on the subject of built environment. Ross et al. reviewed data from the 1995 Survey of Community, Crime, and Health (CCH), a phone survey of Illinois residents (Ross et al. 2001). They reported that ethnic males of lower socioeconomic status (SES) walked more than their higher income neighbors. In addition, they reported that lower SES individuals lived in an environment with better street connectivity that allowed for quick, convenient, and purposeful walking trips. Men walked slightly more than women, which may be related to increased concerns about personal safety in women living in neighborhoods with higher crime. The same study reported that women were more likely to consume more calories when living in an environment with many psychological hazards. They also found that concerns over personal safety decreased the amount of walking and suggested that if the psychological hazard did not exist the amount of walking among lower SES individuals would be

higher. One weakness of the CCH study was that it relied on self-reporting and as such the destinations of the walking trips were not reviewed.

In contrast to the CCH study, other studies on the built environment, physical activity, and economic status reported that lower SES individuals are less physically active and have greater health risks (Robert et al. 2004, Shrewsbury et al. 2008).

Another issue to consider is the availability of food in lower SES neighborhoods. These neighborhoods have fewer healthy food options and more fast food restaurants and convenience stores per location compared to higher SES neighborhoods (Block et al. 2004, Black et al. 2008). High caloric density food may be more frequently consumed because of lack of healthy alternatives (Block et al. 2004). In the CCH study individuals walked more, but other studies suggest that the amount of energy expended would not offset the high caloric intake. In order to offset this imbalance and lower obesity risk people must walk more often or engage in other moderate to vigorous physical activity.

Unfortunately, for many urban poor the built environment impedes access to proper nutrition and decreases opportunities for physical activity. Without safe sidewalks, ample street lighting, and destination-centered attractions like grocery stores and parks, urban communities will remain at greater risk for obesity and overweight.

Psychological and physical barriers to physical activity have been linked to higher BMI scores and an increased prevalence of obesity among urban minority populations (Robert et al. 2004). Because the built environment lacks outdoor common spaces and safe walking conditions adults and their children stay indoors, thus reinforcing a sedentary lifestyle. Without intervention this neglected segment of society will continue to be inactive and at risk for childhood obesity.

Living in the suburbs is just as unhealthy as living in the inner city. The suburbs consist of low-density population neighborhoods where people drive long distances to areas specifically zoned for shopping, school, or work. This lifestyle creates dependence on automobiles and makes foot and bicycle travel impractical and unsafe. Such zoning and land use result not only in lower levels of physical activity among suburbanites, but also decreases social cohesion. As people spend more time alone in cars they have less time for socializing with neighbors and less time for outdoor physical activities.

Zoning and land use laws have had a great impact on how the suburbs have been designed. In the first half of the twentieth century schools and homes were zoned to be away from at risk populations that carried communicable diseases like tuberculosis and typhoid. Zoning laws also separated industrial from residential areas to eliminate exposure to hazardous materials. Although such zoning policies at one time were essential in keeping a community healthy they are no longer as necessary because the threat from biological and toxic chemicals pales in comparison to the threat from the obesity epidemic. The Center for Disease Control (CDC 1990) reported 400 cases of typhoid among travelers outside the US whereas obesity currently affects 30% of the American population. In order to improve physical activity within the built environment, zoning and land use laws must be amended.

In the suburbs, typical neighborhoods consist of low-density occupancy homes where one family occupies one or more acres of land. Developers intentionally carve up rural farmland into large subdivision plots because homes with acreage make more money for them compared to areas with walking trails, parks, or playgrounds. Low-density neighborhoods are not only bad for community socialization and for physical

activity but are also bad for the environment. The low-density occupancy and automobile dependent lifestyle uses important resources including land and oil. As rural farms are replaced by cul-de-sac subdivisions, poor community design is being promoted.

Unlike the inner-city, the suburbs lack street connectivity, grid-like street patterns, and sidewalks that encourage travel by foot. Instead, cul-de-sac street patterns are maze like and serpentine, the intertwining circular pattern discourages walking. Walking and cycling in an automobile-centered neighborhood is challenging. Destinations like shopping, work, and school are often located outside of the subdivision in specifically zoned school districts, strip malls, and industrial parks. But leaving the subdivision to enter a commercial zone without a car is also problematic. When leaving, pedestrians in subdivisions are typically required to cross a multi lane thoroughfare without crosswalks or crossing signals. Without crossing aids, walking or cycling to and from the subdivision becomes dangerous and time consuming.

Walking and cycling to school and work is an effective way to increase levels of activity for children and adults. Active commuting would reduce car dependence making for a more sustainable environment. However, active commuting by foot and bike in the suburbs is not realistic because of heavy automobile traffic and long distances between home and work. Moreover, many parents fear potential car accidents when considering if their children should walk to school. According to the National Center for Statistics and Analysis (2004) 363 children were killed and 17,000 were injured in pedestrian accidents in 2004. In the same year they reported that 130 children were killed and 12,000 were injured while cycling. These frightening statistics suggest that more should be done to make streets safer for walking and cycling. At present, suburbanites usually drive to

destinations outside of their subdivisions to areas zoned for work and for recreation. As they sit in traffic, they have less time for physical activity.

There appears to be a need for improved design of our suburbs. A redesigned suburb that uses a better mix of land to allow for nearby employment, schools, parks, and recreation would be less reliant on automobiles. By decreasing traffic congestion suburban redesign would make the subdivision safer for walking and cycling. Adults and children would be able to safely walk and bike to school and work, play in nearby parks, and visit local recreation centers. Redesign of suburban environment would encourage healthy behavior in adults and children by making physical activity an essential part of daily living.

In order to lower the rates of childhood obesity, city planners and other civic officials should be encouraged to improve the designs of our suburbs and our inner cities. Redesigning the inner cities to make them comparable to their pre-1950 layouts would encourage reinvestment in these cities. Improved lighting, better street and park maintenance, diverse housing options, local shops, schools and jobs as well as redevelopment of common green spaces would allow for inner city children to be more physically active. They would walk, bike, and play in a safer and healthier environment. Similarly, redesigning the suburbs to include sidewalks, mixed land use rather than single use land plots, green spaces like parks and trails, would reduce reliance on automobiles and encourage children to do more walking and cycling. In both city and suburbs, redesign that encourages a pedestrian centered lifestyle would result in healthier communities and healthier children. This in turn should help lower the current rate of obesity in American children.

## CHAPTER FIVE

### NEIGHBORHOOD PERCEPTION:

#### A PSYCHOLOGICAL BARRIER TO CHILDHOOD PHYSICAL ACTIVITY

To increase physical activity in children, not only should the built environment of our cities and suburbs be redesigned but such redesign should consider how psychological barriers contribute to childhood inactivity. Urban design is the physical structure and layout of the built environment. Urban design is the placement of streets, buildings, landscaping elements, and common places within a community. The social framework of the built environment is the neighborhood.

How well an environment is designed can influence how its inhabitants perceive their neighborhood. Significantly, people's perception of their neighborhood affects their perception about physical activity. For example, an attractive neighborhood can shape beliefs and behaviors related to walking, making this physical activity more appealing. Visual appeal of the built environment, its aesthetics, can make a neighborhood seem warm and inviting or cold and frightening. In particular, an ugly environment, along with high crime and high traffic volume, makes residents feel bad about their physical surroundings and this in turn can diminish their levels of physical activity (United States Centers for Disease Control 1999). Thus, people's perceptions about their built environment create psychological barriers that reduce their levels of physical activity. Such barriers could be removed by improving neighborhood aesthetics and safety, resulting in increases in physical activity (Sallis et al. 1997). When neighborhood

aesthetics improve, both adults and children will be more likely to spend time outdoors, increasing their opportunities for being physically active.

Neighborhood aesthetics is the visual attractiveness or beauty of the built environment. Aesthetic features such as attractive architecture, numerous trees and greens, good street connectivity, clean and well maintained sidewalks, mixed land use, high population density, and low automobile traffic help make neighborhoods physically and psychologically appealing. People who find their neighborhoods appealing feel safer in their neighborhoods and are more likely to engage in physical activity in their neighborhoods. For example, residents are more likely to walk and bike for recreation and for utilitarian reasons (i.e., work, school, shopping) on streets they consider aesthetically appealing. In a study of adolescent girls, Evenson et al. (2007) reported higher levels of MVPA in after school hours and lower BMI scores in subjects with positive perception of their neighborhood (i.e., good street lighting, low automobile traffic, and presence of other kids playing). Good neighborhood appeal encourages people to walk, bike, and socialize within the neighborhood. In contrast, bad neighborhood appeal due to traffic congestion, poor street connectivity, absence of green spaces and sidewalks, few people in the street, and social disorder discourages physical activity in that neighborhood.

Consequently, neighborhood perception affects the social cohesion of the community. In a study of 582 residents age 65 and older from 56 neighborhoods in Portland Oregon, Fisher et al. (2004) reported that people in neighborhoods with intact social cohesion had increased participation in physical activity. Social cohesion allows neighbors to share positive perceptions about their neighborhood with one another. When

people have positive perceptions about their neighborhoods, neighbors are more likely to empathize with others, more likely to watch out for each other's property and family members (Sampson et al. 1997). Socially disruptive behaviors, criminal and violent acts, are discouraged in such communities. When people have negative perceptions about their neighborhoods, neighbors tend to socialize less and have higher levels of fear, especially of personal crime. Fear of any neighborhood is a psychological barrier that reduces access to the outdoors and this reduces opportunities for being physically active.

In a study of New York City neighborhoods Neckerman et al. (2009) examined aesthetic attributes in neighborhoods deemed poor and non-poor. They reported that people living in lower SES neighborhoods had negative neighborhood perception due to unappealing aesthetics and fear for personal safety. Participants reported negative aesthetic appeal when one of the following attributes were present: graffiti, barking dogs, low population density at street level, vacant buildings and lots, poor sanitation, and high crime (Neckerman et al. 2009). In poor neighborhoods, these undesirable attributes made the people less likely to walk and socialize in the streets. On the other hand, in non-poor neighborhoods, study participants reported positive aesthetic appeal when attractive storefronts, trees, and sidewalk cafes as well as higher street population density were present. In that study, positive neighborhood appeal made the neighborhood more desirable for walking and outdoor socializing.

High population density and mixed land use make neighborhoods more desirable for walking and socializing. In addition, the presence of green spaces with trees is an appealing feature that attracts high population density and is associated with higher levels of physical activity in children. In a study of low-income minority residents, Coley et al.

(1997) reported that inner city public housing complexes with trees and foliage in common spaces had greater use of common areas for socializing and active play by adults as well as youths. The study also reported that people in such neighborhoods possessed a greater sense of community, bonding adults and children to the space (Coley et al. 1997). This bond created a desire to protect the space and the children in it from socially unacceptable behaviors. Natural elements (i.e., trees and greens) promoted social cohesion. People developed a positive perception of their neighborhood's safety. Thus the presence of greenery made a community that is prone to crime to feel safe, promoting greater use of outdoor space by children for socializing and active play.

In a similar study Taylor et al. (1998) reported that the presence of trees and greenery positively influenced the number of people using a common outdoor space, including children engaging in outdoor physical activity. The study reviewed the use of common outdoor spaces in relation to the number of trees and greenery present in two low-income inner city public housing neighborhoods in Chicago. The two neighborhoods had high crime and low building aesthetic. The neighborhoods had row houses and high-rise apartments with a mix of common areas made up of concrete patios, walkways, and green areas with trees and foliage. They reported that adults and children preferred areas with trees and greenery. Areas with fewer trees, more concrete, and more dirt were not as crowded as the green areas. People in the green areas exhibited a greater sense of social cohesion and greater connection to the physical space.

Sampson et al. (1997) reported that ownership of a space improves morale among neighbors. In addition, they found that neighbors are more likely to monitor their neighborhood for undesirable behavior and are more likely to intervene when socially

unacceptable behavior is observed (Sampson et al. 1997). This observation may explain why there were more children playing with each other without a parent's presence. Green spaces with trees allowed children to feel safe in the presence of adults. Greater safety allowed children to engage in more outdoor physical activities.

In a study by Taylor et al. (1998), children were observed playing in individual and group games during the week from 3 to 5 pm and on Saturdays from noon to 3 pm. These children engaged in MVPA games including jump rope, hand clapping songs, tag, and softball (Taylor et al. 1998). The results of the study suggested that the addition of trees made the play area more desirable. The areas were more used by adults and children. In a low SES minority-housing complex, known for crime and violence, residents felt more secure and exhibited socially acceptable behavior. Most importantly, children engaged in MVPA for two hours most days of the week.

Parental beliefs about neighborhood safety affect the level at which their children participate in physical activity. In a study of parent and child surveys in 1,210 Australian families of children ages 5-6 years and 919 children ages 10-12 years, Timperio et al. (2004) measured neighborhood perception and parental beliefs that prevented children from walking or biking to school. Children ages 10-12 were surveyed independently from their parents to investigate their perceptions of the neighborhood and their physical activity. Parents expressed concerns about traffic, crime, and abduction and viewed these concerns as barriers that prevented children from walking and biking to school. Parental worries were most heightened when children had to navigate poorly connected streets with dense car traffic over long distances where streets had poor lighting and low

population density. Neighborhood perception of high traffic, contact with strangers, low lighting, and low population density made parents fear for their child's safety.

People's perceptions about neighborhood aesthetics, safety, and social cohesion impact levels of physical activity. High population density of pedestrians, attractive use of architecture and landscape, well-maintained sidewalks, street lamps, and common spaces, good street connectivity, and low automobile traffic make for an environment that people perceive positively. When people have positive perception of their neighborhoods they feel more secure in their surroundings and are more likely to engage in physical activity. People who spend more time outdoors are engaged in greater amounts of physical activity compared to those who stay indoors.

In order for children to walk, bike, and play in their neighborhoods, the built environment needs to be redesigned with psychological barriers to physical activity in mind. This would increase green spaces with trees, incorporate better mixed land use, reduce crime, and reduce car traffic. Eventually, this would help families feel more secure, encourage children to become more physically active, and lower the rate of obesity among children.

## CHAPTER SIX

### PROMOTING CHILDHOOD PHYSICAL ACTIVITY: BUILDING BETTER PLACES AND SPACES TO MOVE AND PLAY

Declining physical activity levels among American children may be explained in part by barriers within the built environment. Children are spending more of their time indoors engaged in sedentary activities. In addition, an increasing number of suburban children rely on cars and buses for transportation to school and to extracurricular activities. Many automobile-centered neighborhoods lack pedestrian amenities such as parks, playgrounds, bike paths, and walking trails. Children in the inner city may be less physically active due to barriers in their built environment, in particular safety hazards in streets and other open public spaces. Consequently, both suburban and inner city children are spending less of their time outdoors engaged in MVPA. Considerable research has shown that children who spend more time outdoors are more physically active (Kleget et al. 1990). Children engage in MVPA when walking and cycling to school, participating in after-school sports, and visiting recreation centers and parks (Cooper et al. 2005). This chapter will examine the places and spaces within a community that support a physically active lifestyle for children.

Research has shown that people who are physically fit and active as children are more likely to be physically fit and active as adults (Dennison et al. 1988). Similarly, sedentary children who are overweight have an increased risk for obesity and obesity related illnesses later in life (Boreham et al. 2001). By diminishing sedentary moments

and increasing physically active moments throughout their day, children may be able to correct the energy imbalance that leads to obesity. Energy balance could be achieved through increased physical activity before school, active transportation (i.e., walking or cycling) to school, and free play at a park or playground after school. For older adolescents, participation in organized sports is a good way to increase physical activity. Increasing the number and duration of episodes of physical activity would help children maintain a healthy weight and reduce their risk of developing obesity related diseases.

Walking to school is a viable way for children to increase their daily energy expenditure. Active transport to school (ATS), includes walking and cycling, and is an effective strategy for getting children to be more active and physically fit. Children who walk and bike to school are more physically active before and after school (Cooper et al. 2005). They are also more physically fit than their passive transport (i.e., car riding) counter parts (Cooper et al. 2005).

In a study of 919 Danish children, ages 9 through 15, Cooper et al. (2006) evaluated the relationship between mode of transport to school, physical fitness, and physical activity. Mode of transport was assessed by individual survey, physical fitness by maximal cycle ergometer, and physical activity by accelerometer. Results of this study showed that children who walked were more physically active than those who cycled and those who commuted by car. However, children who cycled were more physically fit than those who walked or rode by car. Both groups that used active transport were more physically active and physically fit than those that used passive transport (Cooper et al. 2006).

In Denmark, more children cycle to school than walk to school. In fact, since the 1980's Denmark has become one of the most cycle-oriented nations. The use of car travel is discouraged and is about 40%. In the Cooper et al. (2006) study, children who cycled traveled greater distances to school than children who walked. In general, children living in close proximity to school walked while children living at a greater distance cycled. The investigators suggested that the group that cycled was more fit than the group that walked because the longer time and distance traveled resulted in greater durations of MVPA. Moreover, the study may have underestimated the physical activity in the cycling group. This is because an accelerometer measures upper and lower body movement simulated by walking whereas cycling requires little upper body movement resulting in lower physical activity measurements (Cooper et al. 2006). This study provides convincing evidence that in pedestrian-centered environments, ATS is an effective way to increase physical activity among children.

In contrast to Danish children, American children are less likely to use ATS. According to the National Personal Transportation Survey results, 42% of children walked or cycled to school in 1969 whereas only 13% of children did so in 2001 (Beschen 1972, McDonald 2007). Today most families own two cars and children live farther from the school than they did in the 1960s. Many neighborhoods are automobile-centered and great distances make walking to school time-consuming, unsafe, and inconvenient. This has caused a dramatic decrease in the number of children walking or cycling to school.

In the Philippines, where car ownership is on the rise, Tudor-Locke et al. (2003) evaluated the relationship between transport to school and physical activity in 1,518

children. Mode of transport to school was assessed by survey and physical activity levels were measured with an accelerometer worn on the upper thigh for seven-day periods. The study results showed that children who walked to school engaged in more physical activity than those who commuted by motorized vehicle. In addition, they reported an association between car ownership and use of passive transport. Children from households with a car were more likely to use passive transport to school than active transport. More importantly, children who rode in cars were less physically active than children who walked. This study found that Children who commute by car have a potential weight gain of 2-3 pounds per year (Tudor-Locke et al. 2003).

These studies suggest that car ownership and passive mode of transport to school negatively affects physical activity levels among children that in turn increases the potential for childhood obesity and weight gain. Increasing daily amounts of physical activity through active transport is one approach to increasing daily physical activity. The United States Center for Disease Control (CDC) recognizes ATS as a means by which children could become more physically active.

The CDC is promoting ATS through its Active Communities Initiative along with the National Highway Traffic Safety Administration (NHTSA) Safe Routes to School Program. This program is aimed at raising awareness and creating safe environments for children to walk and bike to school. The CDC and NHTSA recognize environmental barriers to active transport including dense car traffic and long distances to schools. The Safe Routes to School Program was developed to help overcome these environmental barriers. The program helps educate school officials, parents, and children on how to use active transport to school safely.

The concept called “the walking school bus” was initially developed by a parent and is now promoted by the CDC’s program Kids Walk to School and the NHTSA Safe Rides to School initiative as an effective way to increase ATS among children who live within a mile of school. As part of the “the walking school bus” children meet at a designated home and walk to school as a group with an accompanying adult. Since it started in 2005, more children walk to school, decreasing reliance on passive transport. When the “walking school bus” began traffic volume along the route was heavy but now traffic is much calmer allowing for a safer pedestrian environment (SRTS Website).

Walking and biking to school allows children to spend more of their time outdoors and when children do that they become more physically active (Cleland et al. 2008). The CLAN Study (Cleland et. al. 2008) in Melbourne Australia evaluated the association between time spent outdoors and level of physical activity in children living in active neighborhoods (i.e., those that promote physical activity by walking, riding, and other recreation). This was a longitudinal study that evaluated 548 children (5-6 year olds and 10-12 year olds) in 2001 and then again in 2004. This study examined physical activity during spring and summer months, in the after-school period and on weekends. Parents were asked about how many hours their children spend outside. Children wore accelerometers for eight days during waking hours. Young children and adolescent boys were most active during weekdays and weekends. Adolescent girls were less active during summer months but had elevated levels of MVPA during the spring

Results of the CLAN study (Cleland et al. 2008) provide evidence that children engage in more MVPA when they spend more time outdoors. The fact that adolescent girls in the study had lower amounts of MVPA in the summer may be an important factor

to consider when designing and refurbishing outdoor play spaces. Including shade-bearing trees to keep the play area cooler and thus more inviting may lead to increased playground utilization by girls during the warmer months.

Children who participate in free play engage in MVPA more frequently than children those who don't. Examining where children engage in free play is important in developing active communities that promote physical activity. In a study of 78 families in Melbourne Australia Veitch et al. (2006) examined popular free play spaces for children and adolescents. Because parents often decide where and when their kids play, this study assessed child play locations as well as parental and child preferences for free-play outdoors. The results of the study showed that 74% of children preferred playing in their yard or their neighbor's yards with friends. One third of children preferred playing in cul-de-sac streets. One third of parents allowed children to play supervised in public spaces like parks and playgrounds. Parents expressed safety concerns for crime activity in parks, traffic safety in streets, and limited access to public open spaces. Parents were also more likely to let children play freely outside when accompanied by friends. When safety concerns were low parents permitted children to engage in free play. Although this study was small it provided an important revelation: Children prefer to engage in free play close to home.

Research has shown that, especially for younger children, free play is associated with greater amounts of MVPA and that close proximity to public open spaces like playgrounds and parks increase childhood physical activity. Veitch et al. (2006) suggested that childhood free play would be increased if there were increased street connectivity in cul-de-sac neighborhoods. Likewise, developing more grid-like street

patterns would make it easier for children to play with other children in their neighborhood. These types of street improvements would help suburban children increase their physical activity levels.

Although time spent outdoors is an important component of increasing physical activity in children, the built environment in the inner city and suburban subdivision presents obstacles for children to spend time outdoors, and to become physically active. Many suburban subdivisions, for example, lack public open spaces such as parks, playgrounds, and walking trails. On the other hand, the inner-city environment may include common public spaces but these are often centers of criminal activity and are often poorly maintained. In order to overcome these obstacles in their built environment communities must look for ways that children and adolescents can spend more time outdoors engaged in physical activities. The outdoor spaces must be made appealing and accessible. For the inner city this usually means a rehabilitation of existing playgrounds and parks and development of new public open spaces such as greenways for walking, running, and hiking and common fountains and pools for water play. For the suburbs this usually means creating centralized green spaces, walking trails, and playgrounds as well as increasing street connectivity.

When considering redesign of the built environment, another important goal is to create play spaces that are diverse enough to appeal to children of all ages. If all children, from toddlers to adolescents, are provided with play areas that increase their physical activity levels it is likely that more children will remain physically active as adults. Free playgrounds and parks are play spaces that are generally found in many inner cities and attract users of various ages. Unfortunately, many inner city playgrounds, especially ones

in lower SES neighborhoods, lack amenities that children and parents find appealing (Cohen et al. 2006, Crawford et al. 2008). In particular, many inner city parks are poorly maintained and pose various safety hazards (Babey et al. 2007, Ellaway et al. 2007).

Previous research has shown that children of preschool age exert more MVPA during frequent short bursts of free play in outdoor play spaces like playgrounds (Hinkley et al. 2008). In contrast, older children, especially adolescents, tend to engage in MVPA mainly through organized sports. Older children often consider playgrounds as “babyish” and not fit for play. Because many public playgrounds are designed with safety in mind, most contain playground equipment that is rated for toddlers, preschoolers, or elementary school age children. Appropriate play spaces for adolescents are typically lacking in American society.

Studies have shown that park proximity and availability of various activities are important to parents, children, and adolescents (Sallis et al. 1997). In a study of eight inner-city public parks, in lower SES neighborhoods with high minority population, Cohen et al. (2006) conducted interviews of park attendees and residents living around the parks. Their results showed that people visited a park more often when that park was in close proximity to their homes. People who attended the park most often and people who lived in close proximity to the park stated they would use the park more if organized events were planned there. In this study, park attendees engaged in MVPA on park’s multi-purpose fields, soccer fields, basketball courts, volleyball courts, tennis courts, and playgrounds.

In this study, more men than women participated in organized sports such as baseball, basketball, track, and soccer. Women and children were more likely to

congregate on playgrounds. The largest group of park attendees was the adolescents who participated in organized sports. In this age group, boys were more likely than girls to engage in MVPA. This study indicates that, in the park setting, men are more active than women and this disparity appears to begin in adolescence and tracks into adulthood. Other studies have shown that adolescent girls are less physically active than boys (Nader et al. 2008). Girls less often than boys use ATS, engage in organized sports, and use public open spaces.

In a study of adolescent children in England, Alexander et al. (2005) investigated the gender-related disparity in physical activity as measured by waist worn accelerometers. They reported that adolescent girls were less physically active than boys. Boys who walked or biked to school were more active throughout the day than girls. Children who walked to school exhibited higher levels of MVPA than those who commuted by car. Although girls in the walking group had higher levels of MVPA than girls in the non-ATS group, girls had lower physical activity levels than boys. Also, for girls the episodes of MVPA did not continue throughout the day as they had for boys. Because boys were more likely than girls to participate in organized sports the investigators suggested that boys may have made plans for sports during their morning ATS with their peers. Socializing period before and after school, enabled by ATS, thus promoting increased engagement in physical activity.

In a Trial of Activity for Adolescent Girls (TAAG), a collaborative study among 36 middle schools throughout the United States, Cohen et al. (2006) investigated adolescent girls preference for physical activity in community spaces like parks and recreation centers. There were 1556 girls in the study, 45% Caucasian, 22% Hispanic,

and 21% African American. Personal surveys were used to assess physical activity and accelerometers were used to objectively measure physical activity levels. The study examined proximity, availability, and access to parks with recreation facilities. Close proximity to park, amenities at park, and ample lighting were associated with greater park use. Girls who lived within one half mile of a park were more physically active than those who lived farther away. Girls who lived in close proximity to parks exerted 24 more minutes of MVPA during the trial period compared to girls who lived farther away. Importantly, parks with playgrounds, gymnasiums, walking paths, swimming pools, or tracks were associated with elevated levels of MVPA in adolescent girls. Another appealing amenity was the presence of drinking fountains and shade trees (Cohen et al. 2006). Skate parks and lawn games (bocce ball and horse shoes) were negatively associated with physical activity. The results of this study appear to support those of Cleland et al. (2008), who reported that adolescent girls exhibit greater levels of MVPA when cooling elements such as shade trees and water features are present in parks and when the outdoor temperatures are cooler.

Within a park system, having playgrounds with attractive features encourages park attendees to participate in various physical activities including free play and organized sports. The quality of playgrounds and other park facilities is an important factor that can increase park use or decrease it. In a study of 235 Canadian parks Tucker et al. (2007) observed the use of play spaces and interviewed parents who brought children to these spaces. The study showed that parents chose a park and a playground based on the amenities available at the park, park safety, and the proximity of the park to their homes. Parents who chose parks close to home were less concerned with park

amenities while those who frequented parks farther away did so because of amenities available there. Parents reported that proper lighting; restroom availability, drinking fountains, swimming pools, quality and quantity of play equipment, and shade trees were desirable amenities that led to their traveling to far away park. When these amenities were available, parents reported that their park visits were more frequent and longer in duration. Parents reported visiting the park of choice approximately 2.5 times per week with 49% visiting their neighborhood parks and 51% visiting parks more than 4 km from their homes (Tucker et al. 2007).

It appears that children and adolescents engage in MVPA in greater amounts when they spend more of their time on outdoor play spaces. Active transport to school, either walking or cycling, increases the daily amount of MVPA and promotes after school physical activity especially for boys. In contrast, passive transport to school, using cars or buses, burns less energy and has the potential for a 2-3 pound weight gain per year. Free play outdoors especially for preschool children has shown to increase MVPA levels.

Park proximity and amenities encourage repeat visits by parents and children. The more enjoyable the experience of going to a park, the more likely is that children will return to that park to play. Developing such parks and playgrounds would encourage children of all ages to be more physically active outdoors, thus helping reduce the rates of childhood obesity and related illnesses.

## CHAPTER SEVEN

### SCHOOL PLACES, SPACES, AND PROGRAMS THAT INCREASE PHYSICAL ACTIVITY

Before and after school, children can be more physically active by using active transport to school and by spending more of their time at parks and playgrounds. Because children spend so much of their time in school, the built environment of a school is another important determinant of their level of physical activity and their risk for obesity. The school system teaches children to be more physically active through periods of physical education (PE) classes, intramural sports, and recess.

The schools should expose children to a wide variety of high quality physical activities and sports in a fun and engaging manner. When children are forced to participate in physical activities or lack appropriate knowledge and skill base to participate in these activities, they tend to shun the same activities as adults (Malina 2001, Humbert et al. 2008). In contrast, a broad and varied physical activity curriculum in school enables children to have a positive experience and results in them continuing with these physical activities as adults.

Previously, there were misconceptions that PE class takes away from serious academics and hinders learning. More recent data indicate that children who engage in MVPA during school exhibit greater concentration and greater academic performance (Coe et al. 2006, Castelli et al. 2007). Increasing levels of MVPA throughout the school

day through physical education classes, recess, and intramural sports is beneficial to children's minds as well as their bodies.

Currently, schools in the United States place lower emphasis on physical education classes than on academic classes that are evaluated yearly through the No Child Left Behind Act (NCLBA). In addition to the NCLBA, increased pressure to meet academic standards, budget cuts, and outdated school buildings and play equipment help explain why physical education and ancillary activities have a low priority for policy makers.

Prior to the NCLBA, physical education instruction time averaged 115 minutes per week and time allotted for recess averaged 184 minutes per week. Now, children average 75 minutes per week for PE classes and 144 minutes per week for recess (Center on Education Policy 2007). As such, American school children on average lost more than an hour of physical activity per week since NCLBA was signed (Center on Education Policy 2007).

In 2003 the National Institute of Child Health and Human Development Study of Early Child Care and Youth Development examined physical activity levels in 814 third graders in 4 states (Nader 2003). They conducted field observations during physical education classes using the System for Observing Fitness Instruction Time (SOFIT) scale. In addition to the physical activity scale, they measured physical activity with accelerometers and heart rate monitoring. The results of the study showed that most children attended PE class twice a week for a total of 69 minutes of which 25 minutes were considered MVPA. Waiting in line, instruction time, and teachers' administrative duties diminished the overall time available for MVPA. Similar to previous studies, this

study reported a gender discrepancy, with boys being more active than girls. This study suggests that children do not have sufficient time for MVPA during school.

The Center for Disease Control (CDC) and The National Association for Sport and Physical Education (NASPE) recognize how valuable a high quality physical education program could be in helping children become more physically active and fit. The CDC program, Healthy People 2010, hopes to reverse the current childhood obesity epidemic by encouraging children to be more physically active during the academic day. They recommend that children engage in MVPA at least 50% of a PE class period (Healthy People 2010 Mandate). To meet the CDC recommendation, the NASPE recommends that elementary schools provide 150 minutes of PE per week and middle schools and high schools provide 225 minutes (NASPE Website).

In most states, attendance is required for children age 5 through 16 years. If schools increase PE classes, recess times, and intramural sports a large number of children over a long period of time would be exposed to increased physical activity. Public schools are free and are a potential resource for increasing physical activity in children who are at greatest risk for inactivity, those who cannot afford commercial sport programs or live in unsafe neighborhoods. Regular attendance in PE classes over a nine-month school year would allow for long term repetitive exposure to MVPA, reducing the risk of childhood obesity.

Physical education classes would benefit from longer class time and lower teacher student ratios. In a study by Stephens et al. (1998) ninety-nine fourth graders from two Cleveland public schools, participated in a fitness intervention program. Prior to the start of the program children were assessed using skin-fold testing, flexibility testing, and

heart rate response to VPA. The intervention comprised of small group sessions where students met 3 times per week, performed 5 minutes stretching exercises, and 20 minutes of MVPA in the form of stair stepping. After the fifteen-week period students had greater flexibility, decreased skin fold thickness, and improved heart rate (Stephens et al. 1998). Students who participated in the study were more fit than those students who attended traditional PE class.

Although the Stephens et al. (1998) study was small, it provides several important lessons for schools hoping to increase their children's physical activity levels. First, the small class size allowed for individualized attention and encouragement from instructors. Second, although class time was short (25 minutes), 75% of class time was spent in MVPA. Third, stretching and stair stepping are activities that just about anyone with access to stairs can perform. Most importantly, the children in the study experienced beneficial health results in a relatively short period of time. Finally, stair stepping is not only an easy and economical way to increase physical activity of children in school but could just as easily do the same outside of school.

When teaching kids to be physically active, it is important to expose them to activities that are interesting and fun. Having fun has been positively associated with increased bouts of physical activity (Dishman et al. 2005). Introducing children to non-traditional sports like fitness walking and cycling can be attractive to students who are disinterested in traditional group sports like football and basketball.

A study by Carrel et al. (2005) compared the health benefits of nontraditional PE curriculum that incorporated lifestyle physical fitness with that of a traditional PE curriculum. The intervention group participated in lifestyle focused activities including

snow shoeing, bike riding, and fitness walking while the control group participated in more traditional PE classes with competitive sports including football, track, and kick ball. In the intervention group, class size was small class and students were paired together according to skill level. Immediately after student arrival children began a two-minute stretch period followed by 42-minute session of MVPA of fitness walking, snowshoeing, or cycling followed by a cool down period and heart rate check. Students did not need to change into or out of clothing and equipment or wait for lengthy instruction. This short and simple approach to starting class proved beneficial, as students were able to use 75% of class time for MVPA. On the other hand, the control group had larger class sizes with more time for instruction. Traditional lessons such as running, football and kickball were typical of class time and students averaged 25 minutes of MVPA per class resulting in approximately 50% of class time was spent during active movement (Carrel et al. 2005).

Although the control group met the CDC recommendation that 50% of class time be devoted to MVPA, the intervention group showed that class time can be better used. In the intervention group 75% of class time was devoted to MVPA in lifestyle fitness orientated activities. In order for schools to make a large impact on increasing childhood physical activity, schools must implement fitness orientated programs where children can adopt skills for everyday fitness at home or at school. Through fitness oriented activities children will develop practical experience on how to be more physically active without relying on parental support, incurring high cost, or relying on team participation.

Cycling and fitness walking are practical, low cost activities that can be performed frequently on individual basis outside of school. Snowshoeing is a unique

activity that was regional to the school. This study took place in Wisconsin where longer winters and heavy snowfalls are common. Snowshoeing has great potential because it gets students outdoors and provides an intense cardiovascular workout. Because nontraditional activities such as these are low cost and can be done independently in the child's home environment they provide schools with another opportunity to teach children how to be more physically active.

In addition to including diverse PE classes in their curricula, schools need to introduce intramural sports to students at an early age. Early adolescents are the time where girls and boys begin to be less physically active (Nader et al. 2008). Ethnic minorities and girls are especially vulnerable to physical inactivity. Around middle school years schools begin offering interscholastic competitive sports like soccer, softball, and basketball. Boys participate in organized sports more often than girls. Children who participate in intramural sports are exposed to more MVPA and are more physically fit compared to students who do not participate in organized sports (Ara et al. 2004, Wickle et al. 2007).

Wickle et al. (2007) compared levels of physical activity in boys, ages 6-12, on sport days and non-sports days. They found that boys who participated in organized sports engaged in 110 minutes of MVPA per day (with 26 minutes from organized sports) (Wickle et al. 2007). This study suggests that organized sports can have a significant impact on increasing children's physical activity levels.

Despite the health benefits from organized sports, many children are excluded from participating due to the "elitism" factor common among organized school sports teams (Stewart 2005). Coaches are pressured to develop highly skilled teams, capable of

having winning seasons. Therefore coaches accept skilled players and exclude children who may have great potential but lack the fundamental skills necessary for play.

Unlike competitive interscholastic sports teams, intramural sports teams focus on developing basic skills, allow open participation regardless of skill, and encourage sportsmanship and fun. Therefore intramural sports provide opportunities for physical activity to many children who otherwise lack the skills to participate in interscholastic sports. Intramural sports vary but often include volleyball, basketball, dance squad, swimming, and tennis. The key to increasing childhood physical activity is introducing as many children as possible to a wide variety of intramural activities. The more activities a child samples, the more likely they are to make a positive connection to that sport and thus become more physically active (Bocarro et al. 2008). Kids who participate in physical activities on their own accord are more likely to continue those activities into adulthood (Malina 2001, Humbert et al. 2008).

By offering high quality PE classes and intramural sports clubs schools could help their students, especially adolescents, increase their daily physical activity levels, and help decrease childhood obesity. Another way in which schools could help children become more physically active is to encourage recess, including use of play equipment. Good quality and quantity of play equipment such as balls, bats, jump ropes, slides, swings, and climbing equipment are factors that increase children participation in physical activity during recess. (Cardon et al. 2008, Sallis et al. 2001, Zask et al. 2001). Adult supervision and varied play equipment could increase the amount of time students engage in MVPA to at least 50% of recess time (Verstraete et al. 2006).

Although schools in the United States are required to have a mandatory PE class, they are not required to have recess. A common practice among public schools in Forsyth County is to have recess everyday of the week except on PE class day. Substitution of PE class for recess greatly diminishes the potential for improved mental and physical health of children. In order to reduce childhood inactivity and reduce obesity risk schools need to increase recess time as well as PE class time. Children who are physically active have better concentration and focus during their academic classes (Coe et al. 2006, Castelli et al. 2007).

One of the goals for the Healthy People 2010 initiative is to increase physical activity for school children by increasing the number of days children meet for PE but there are no such goals for recess. Research has shown that recess is an important time of a student's day, offering a period of rest from sedentary academic study and providing opportunity for physical activity and socializing (Morrow et al. 1994). Schools should use recess time to encourage increased physical activity in children. In that way, recess along with fitness oriented PE classes, would help reduce childhood inactivity. As a result, children would not only be more focused during their academic classes but they would also meet the minimum levels of MVPA recommended by the CDC. Not only would their academic performance improve, but children would also become more physically fit, reducing their risk for childhood obesity.

Research has shown that children who have adult supervision during play tend to behave better and tend to play more vigorously than those who lack adult supervision (Zask et al. 2001). When teachers are present and provide guidance and when children understand the rules of appropriate playground games, children tend to play more

vigorously than without such guidance. As expected, students who have hour-long recess breaks have longer periods of MVPA compared to students with shorter recess breaks (Huag et al. 2008). Without adult supervision and sufficient play equipment during recess Zask et al. (2001) and Ridgers et al. (2005) found that children spent less time in MVPA. Both studies found that less than 50% of recess time was spent in MVPA. Consistent with previous studies, gender discrepancy was present, with more boys having higher levels of MVPA than girls. Through field observation both studies found that boys predominately played ball games that require more running, resulting in more episodes of MVPA, while girls engaged in lesser active games like socializing and hopscotch (Zask et al. 2001, Ridgers et al. 2005). In order for children to better use their recess time ample playground equipment and teacher guidance is needed.

Colorful playground markings and equipment were positively associated with increased MVPA levels among English children in a study by Ridgers et al. (2007) The intervention group consisted of fifteen schools that had undergone extensive playground updates. Updates included colorful markings of play ground boundaries and play equipment that coordinated with play zones: Red zone was designated for organized sports play, blue zone for multiple activity play, and yellow zone for quiet play. In addition, play spaces received soccer goals, basketball hoops, and balls. The control group consisted of eleven schools that did not undergo playground improvements. Both groups had three recess breaks throughout the day and the longest break occurred during lunch period and all children were assessed by accelerometer. The results of the study showed that children in the intervention group were more physically active than those in the control group (Ridgers et al. 2007). Adding colorful markings and ample play

equipment to school playgrounds, in conjunction with an hour-long recess, would be a relatively inexpensive way to keep children more physically active during school.

In summary, children could become more physically active if schools develop fitness oriented PE classes, provide intramural sports, and increase recess breaks.

Children who are taught fitness-oriented lessons like stair stepping and fitness walking would acquire skills that could also be performed at home. Intramural sports programs offer an opportunity for increased physical activity to all children, regardless of ability level. Recess periods with proper teacher supervision and appropriate play equipment could easily increase the daily amounts of physical activity in children. Through these inexpensive and practical interventions schools could make significant contributions to the fight against childhood obesity.

## CONCLUSION

In summary, children today are less active than their grandparents and parents were and as a result of their inactivity, childhood obesity and related diseases are on the rise. Boys and girls between the ages of 9 and 12 meet the current CDC recommendation of 60 minutes per day of MVPA. However, by age thirteen in girls and fourteen in boys, children become much less physically active.

Current childhood inactivity may be in part related to changes made to the built environment since the 1950's. Changes like suburban sprawl and disinvestment in the inner city have altered the built environment for the worse. Disinvestment of the inner city created an environment where poorly maintained sidewalks, inadequate playgrounds, and vacant buildings created obstacles for walking, cycling, and outdoor play. Similarly, suburban subdivisions created environments that discourage physical activities. Many suburban subdivisions lack grid like street patterns and mixed-land use thus creating obstacles for walking, cycling, and outdoor play.

Negative perceptions about neighborhoods increase parental fears for childhood safety and these fears diminish opportunities for physical activity. Parents who fear heavy automobile traffic, child abduction, and other acts of violence prohibit children from walking or cycling to school and from playing in neighborhood parks. Physical barriers and mental barriers reduce opportunities for physical activity. For many American children free play outside is less common than watching TV or playing computer.

Many neighborhoods in both the inner city and the suburbs lack ample open green spaces like parks and playgrounds and adequate street lighting and sidewalks.

Development and rehabilitation of new and current parks and play grounds would increase access and quality of green spaces available. This change would be a valuable tool in assisting children to be more MVPA.

Community reinvestment in the inner city would restore population density, attract businesses, and improve public health. Through such reinvestment people could once again live, learn, and play in an environment that is people-oriented rather than automobile-oriented. In the suburbs, encouraging mixed land use where people work, shop, and go to school would allow for people to live in an environment similar to the traditional inner city. This would increase levels of daily physical activity through active transport, outdoor sports, and recreation. Increasing the number and quality of public parks and playgrounds would allow adults, teens, and children to be more physically active on a regular basis.

The CDC, using the Healthy People 2010 initiative, wants to increase childhood physical activity through active transport to school (ATS) and improved school physical education programs. Safer streets and parental involvement in programs like the walking school bus would allow children to be more physically active. In addition to ATS, fitness oriented PE classes have the potential to increase daily amounts of physical activity as much as 42 minutes per class through activities like fitness walking, cycling, and stair stepping. Fitness oriented activities require little equipment and can be done in the home environment as well as in the school. Greater exposure to intramural sports would increase children's awareness of activities that promote better health and increase their chances for lifelong participation in physical activities.

To conclude, childhood physical inactivity could be reversed through improvements to the built environment. Redesigned cities, neighborhoods, parks, and schools would enable children to meet or exceed the daily recommendation of 60 minutes of moderate to vigorous physical activity. Through increased physical activity today's children would reduce their current risk for childhood obesity, improving their quality of life as well as their life expectancy.

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## VITA

Jennifer Kristin Lenchik was born January 4, 1971 in Milford, Connecticut. She did her undergraduate work at Salem College in Winston Salem, North Carolina where she received a Bachelor of Arts in Art History in 1998. After college she continued to work as a staff nurse and enrolled in Masters of Arts in Liberal Studies (MALS) program at Wake Forest University. Although she withdrew from the program in 2000 to focus on her family, she resumed her studies in 2005 after the birth of her second child. While in the MALS program she focused on courses related to health and wellness.