THE RELATIONSHIP AMONG SCHOOL PLAYGROUND DESIGN AND CONDITIONS AND PHYSICAL ACTIVITY LEVELS IN CHILDREN

By

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ABSTRACT

Almost 20% of children aged 6 to 11 years are obese in the United States, tripling over the last ten years. The rise in childhood obesity challenges nurses in their efforts to improve community health and sustainability. A decrease in physical activity (PA) levels has been associated with an increase in obesity. Schools have been identified as a primary setting to provide children adequate amounts of daily PA, and nurses working in the area of child health promotion can work with schools to provide opportunities for children to increase PA levels. The playground is one environment where children can increase PA levels.

The effects of the environment on recreational PA are less well studied. Therefore, the purpose of this cross-sectional study was to determine which types of playground areas and Target Area conditions attract children and promote moderate to vigorous physical activity (MVPA) or sedentarism. The sample consisted of two Henderson, Nevada elementary school playgrounds which were divided into 35 Target Areas that were each scanned once in the morning during leisure time before school hours. School B offered a Jog and Walk Stars (JAWS) PA program every day of the week, except on Wednesdays, where free play was offered, and school K offered only free play every morning. Data were collected for two weeks at both schools using System for Observing Play and Leisure Activity in Youth (SOPLAY) and the jogging track portion of System for Observing Play and Recreation in Communities (SOPARC) (school B: 190 scans, 19 Target Areas; school K: 160 scans, 16 Target Areas).

SPSS version 22 was used to conduct all statistical analyses. Descriptive statistics, paired-samples *t*-tests, and independent-samples *t*-tests were used to analyze the data.

The highest populated areas for schools K and B on non-JAWS days were the general blacktops (35% of the children for both schools), and about 50% of the children in these areas were found sedentary. At school B on JAWS days, the highest populated area was the JAWS track (72%), and 99% of the children participated in MVPA.

For both schools, the highest percentages of students found in Target Areas in MVPA were in supervised areas. At school K, more children were found engaged in MVPA with loose equipment. At school B, a higher percentage of children were found sedentary in areas with loose equipment, but most of the children participated in JAWS which did not require loose equipment. In the Target Area with the organized PA program, JAWS, 99% of the children participated in MVPA.

There was a statistically significant increase in total sedentary boys and girls counted in Target Areas on non-JAWS days at school B ($M = 8.11$, $SD = 12.84$) compared to JAWS days ($M = 2.99$, $SD = 3.85$; $t\,(18) = -2.23$, $p < 0.5$, two-tailed). There was a significant difference in counts for average total sedentary children per square foot between school K ($M = 216.70$, $SD = 218.97$) compared to JAWS days at school B ($M = 80.38$, $SD = 117.01$; $t\,(22.02) = 2.24$, $p < 0.5$, two-tailed). There were no statistical differences between school K and school B on non-JAWS days in counts for the PA variables examined. At school B, 385 children were found participating in MVPA on JAWS days compared to 135 children on non-JAWS days and 135 children at school K. PA and Target Area design preferences in relation to gender differences were also discussed. A playground environment assessment to identify areas and conditions that promote MVPA, such as JAWS, may be one avenue to address the need for increasing MVPA levels in children in general, in addition to organized physical education classes.

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CHAPTER 1

INTRODUCTION

Almost 20% of children aged 6 to 11 years are obese in the United States, tripling over the last ten years (National Center for Health Statistics [NCHS], 2010). Nevada has the ninth highest prevalence of children considered either overweight or obese out of 50 states, with 34.2% of its children in one of those categories (National Initiative for Children's Healthcare Quality [NICH], 2007). Childhood obesity is a widespread health disorder that is multifactorial in nature and can have major health complications, including type 2 diabetes, high blood pressure, osteoporosis, and elevated cholesterol (Dietz, 1998). These complications affect not only the individual but also his or her family and place an economic burden on the community (Cawley, 2010).

Sustainability within a community is described as meeting "the needs of the present without compromising the ability of future generations to meet their own needs" (Dasgupta, 2007, p. 126). People have been determined to be the ultimate resource to sustainability within a community (St. Pierre Schneider et al. 2009). One-third of obese preschoolers and one-half of obese school-age children become obese adults (Cawley, 2010). In the United States, the expenditures for treating illnesses related to obesity in adults are estimated at $147 billion annually, accounting for 27% of the increased health care costs in the last several decades (Cawley, 2010). The rise in obesity and the costs to treat its complications have placed a strain on communities in their abilities to sustain resources to treat the large disease burden from obesity (Cawley, 2010). Therefore, obesity and its health consequences are commonly considered serious public health challenges (World Health Organization, 2012). An emphasis is needed to improve the

health within communities, which will allow those populations to stretch resources further because they could make better use of them (St. Pierre Schneider et al. 2009). Nursing has taken a stand to place human health at the core of urban sustainability (St. Pierre Schneider et al. 2009).

Inactivity is a risk factor for childhood obesity (Singh, Siahpush , & Kogan, 2010). Children who are physically active benefit both psychosocially and physically (Lobstein, Baur, & Uauy, 2004). Additionally, children who are physically active often carry this healthy habit into adulthood (Telama et al., 2005). Physical activity (PA) in children has been associated with better grades (Coe, Pivarnik, Womack, Reeves, & Malina, 2006) and higher academic achievement (Wittberg, Northrup, Cottrell, & Davis, 2010).

PA levels vary in intensity and include sedentary, moderate, and vigorous. The U.S. Department of Health & Human Services (USDHHS) (2008) recommends that children should participate in at least 60 daily minutes of moderate to vigorous physical activity (MVPA) to promote health and fitness. MVPA includes bone-strengthening activities, such as hopscotch; jumping; playing basketball, volleyball, or tennis; and running (USDHHS, 2008). It is especially important for children and young adolescents to participate in MVPA because the greatest gains in bone mass occur during the years just before and during puberty (USDHHS, 2008).

According to the USDHHS (2008), MVPA also includes aerobic and muscle strengthening activities. Aerobic activities require children to move their large muscles and include activities such as running, hopping, skipping, jumping rope, swimming, dancing, and bicycling. Cardiorespiratory fitness is increased during aerobic activities

(USDHHS, 2008). Muscle strengthening activities require the muscles to work harder than usual during activities of daily life (Schwager, 2010). In a school setting, muscle strengthening activities can include playing on playground equipment or playing tug-of-war (USDHHS, 2008). Muscle strength training is beneficial in reducing the potential of sports related injuries because of the increase in the strength of tendons, ligaments, and bone; improving motor performance; increasing benefits to health indices such as cardiovascular fitness, body composition, bone mineral density, blood lipids and mental health; and improving metabolic rate (Schwager, 2010).

The Patient Protection and Affordable Health Care Act (PPAHC) "has placed schools front and center in health education, Medicaid outreach, prevention, and early intervention for children," and "schools are recognized as logical partners to provide community-based services" (National Coordinating Committee on School Health and Safety [NCCSHS], 2010, p.1). Additionally, the USDHHS (2010) recommends that schools provide a significant portion of students' daily PA, which could be done during leisure time on the playground, such as during recess and before or after school. Leisure time is considered non-curriculum time allocated by schools for children to engage in leisure activity (Ridgers, Stratton, & Fairclough, 2006). Moreover, elementary school is a significant environment for providing MVPA for children because children spend many of their waking hours at school, and it is a setting that reaches a large number of children (Lounsbery, McKenzie, Morrows, Monnat, & Holt, 2013). Therefore, interventions completed at the school level to help decrease the risk of childhood obesity by increasing MVPA in children can possibly have a great health effect on many children.

Problem Statement

Since the 1800s, schools have played a central role in providing PA to American children through physical education (PE), sports, and recess (Pate et al., 2006). Additionally, students used to walk or ride their bikes to and from school (Pate et al., 2006). However, over more recent years, schools have decreased PA opportunities for children. Classroom time has been devoted instead to improving standardized test scores in reading and math, limiting time for health education and promotion during regular school hours (National Association for Sport and Physical Education and American Heart Association [NASPE & AHA], 2010).

The estimated percentage of elementary schools offering PE in all grades at least three days a week decreased from 24.9% in 2000 to 13.7% in 2006, middle schools decreased from 18% in 2000 to 15.2% in 2006, and high schools decreased from 6.9% in 2000 to 3% in 2006 (Government Accountability Office [GAO], 2012). Additionally, not all elementary schools offer recess. Approximately 70% of U.S. elementary schools offer at least 20 minutes of daily recess (Slater, Nicholson, Chriqui, Turner, & Chaloupka, 2012). Moreover, the percent of children between the ages of 5 to 14 years of age who usually walk or bike to school decreased from 48% in 1969 to 13% in 2009 (National Center for Safe Routes to School [NCSRS], 2011).

These decreasing statistics in PA opportunities in schools and transportation to and from school have occurred concurrently with other negative health trends. One in three U.S. children ages 2 through 19 years is overweight or obese (Ogden, Carroll, Kit, & Flegal, 2012). In the last 30 years, obesity has more than doubled in children ages 2 to 5 years old and in adolescents 12 to 19 years old. Additionally, rates among children ages

6 to 11 years old have tripled (Lutfiyya, Garcia, Dankwa, Young, & Lipsky, 2008; Wang & Lobstein, 2006). These disquieting health trends have raised concerns and recommendations for schools to renew and expand their role in providing and promoting PA for our nation's young citizens (Pate et al., 2006).

Fewer than half of children ages 6 to 11 meet the recommendation that children engage in at least 60 minutes daily of MVPA (Troiano et al., 2008). Leading public organizations, such as the Centers for Disease Control and Prevention (CDC) and the AHA, recognize the critical role schools have in supporting PA among children (National Association for Sport and Physical Education [NASPE], 2008; Pate et al., 2006). Moreover, the Healthy People 2020 objectives indicate that PA in schools, including daily PE and regular recess, is very important (USDHHS, 2012). Additionally, legislative efforts have been directed at schools to help decrease the childhood obesity widespread health issue with the implementation of the Women, Infant, and Children (WIC) Reauthorization Act of 2004.

In 2004, Congress passed the Child Nutrition and WIC Reauthorization Act (CNRA) (Brownell, Schwartz, Henderson, & Friedman, 2009). The CNRA mandated that all school districts receiving federal funding for their food programs create and implement a wellness policy by July 2006 (Brownell et al., 2009). Further, this act required that wellness policies be developed by a committee of stakeholders, including parents, students, the school food authority, the school board, school administrators, and the public. The policies had to include nutrition, PA, and other school-based activity goals designed to promote student wellness (Brownell et al., 2009). School wellness policies can increase access to healthful foods and increase the amount of time children

spend being physically active; thus schools will help children achieve and maintain healthy weights (Brownell et al., 2009). The mandate of school wellness policies was to be an additional method that schools could employ to decrease the childhood overweight and obesity widespread health disorder by reaching a large number of children.

Although school wellness policies were mandated, Congress provided no funds to facilitate the creation or adoption of these policies and imposed no financial penalties for school districts that fail to adopt or enforce them (The Council of State Governments [CSG], 2007). Therefore, PA policies vary widely among schools and are generally nonspecific and lack enforcement (National Association of State Boards of Education [NASBE], n.d.; Robert Wood Johnson Foundation [RWJF], 2009). PA policies that vary among schools can have a direct impact on the amount and levels of PA children receive while at school (Lounsbery et al., 2013).

In 2009, only 56.4% of students nationwide went to PE classes on one or more days in an average week of school (Eaton et al., 2010). Specifically in Nevada, Lounsbery, Bungum, and Smith (2007) examined the PA opportunities in Nevada K-12 schools. Three hundred and thirty-six elementary schools participated (45% participation) in the study. Ten percent of the reporting elementary schools did not offer PE, and more than 30% of the schools did not offer organized PA programs (Lounsbery et al., 2007).

While PA opportunities in schools have greatly decreased over the years due to the increasing pressure to increase student scores on standardized tests; nevertheless schools have been identified as a primary environment to provide children adequate amounts of daily PA to combat the recent increase in childhood obesity (Pate et al., 2006). It is not always feasible for schools to devote more time in a school day to PA

opportunities, but one approach schools can take to help counteract childhood obesity is to focus on ways to increase the levels of PA in children during leisure times on the playground (Robert Wood Johnson Foundation [RWJF], 2007).

Background and Significance to Nursing

A healthy population is the core of sustaining a community because without healthy people, the needs of the community cannot be met, and resources will be drained to care for those who are unhealthy (St. Pierre Schneider et al., 2009). Childhood obesity is a rising health problem whose cause is multifactorial in nature and the complications from this disease are many, producing unhealthy populations. Additionally, childhood obesity involves a complex set of factors from multiple contexts that interact with each other to place a child at risk for obesity (Davison & Birch, 2001). The multiple contexts include individual factors, the physical environment, social/cultural associations, and the association between policy and PA. Therefore, because of the multiple components associated with children's weight, childhood obesity is a public health concern that needs community support and involvement in developing opportunities for a healthy lifestyle, and nurses can take a leadership position within their communities to help with this public health issue (Berkowitz & Borchard, 2009).

Nurses have been called to act in helping with the prevention of childhood obesity by developing skills such as advocacy, collaborative leadership, and social marketing, which will contribute to the prevention of childhood obesity (Berkowitz & Borchard, 2009). Berkowitz and Borchard (2009) indicate that the ability to be a leader of change at the community level is an important skill of expert nurses. This collaborative leadership role of nurses within communities can be challenging because these nurses need to

collaborate with community participants and help them understand the health issue and the impact it will have on communities, while at the same time gaining their acceptance and enthusiasm in order to make a change (Berkowitz & Borchard, 2009). The student investigator (SI) utilized this collaborative leadership approach from Berkowitz and Borchard (2009) when she worked with school officials.

Additionally, nurse researchers must understand the factors that are associated with PA because this will guide interventions based on evidence (Sallis, Millstein, & Carlson, 2011). PA researchers often use social ecological models to guide their research. This approach is based on the notion that behaviors are associated with individual (biological and psychological), social/cultural, environmental, and policy factors (Sallis et al., 2011). Therefore, the interventions aimed at increasing PA levels in populations should be considered from the perspective of making change at multiple levels (Sallis et al., 2011).

This study specifically focuses on the impact of the playground environment on PA levels in children during leisure time before school hours. The playground environment can be separated into Target Areas, which are predetermined observation areas in which children may potentially engage in PA (McKenzie, 2006). Designating Target Areas provides a systematic way to evaluate the playground environment. When assessing the playground environment it is also important to evaluate descriptive characteristics of the playground, which have been described as Target Area conditions (i.e., accessible, usable, supervised, offers loose equipment, or offers an organized PA).

Leisure times are crucial opportunities for children to engage in MVPA while at school (Ridgers, Stratton, Fairclough, & Twisk, 2007). Additionally, children who participate in high levels of PA before school improve on-task behavior during academic instruction (Mahar et al., 2006). Another study found that students who are allowed at least 15 minutes of recess also showed higher rates of on-task behavior in the classroom that day (Barros, Silver, & Stein, 2009).

There are known effective strategies for increasing PA levels in children while on the playground. Verstraete, Cardon, De Clercq, and De Bourdeaudhuij (2006) examined a condition of a playground, offering loose equipment, and found that providing inexpensive equipment during recess such as flying discs, plastic hoops, jump ropes, beanbags and balls increased MVPA in children from 48% to 61%. Additionally, utilizing supervisors during recess to promote PA and to implement games increased PA levels in children (Connolly & McKenzie, 1995; McKenzie, Crespo, Baquero, & Elder, 2010). In another study, children who were provided with enjoyable games significantly increased in MVPA during recess and the total school day (Howe, Freedson, Alhassan, Feldman, & Osganian, 2012).

Studies have combined several low-cost approaches to try to increase PA levels in children during leisure time on the playground. One study altered the physical playground environment by painting activity zones and provided loose equipment, which increased PA in the experimental group over the control group (Loucaides, Jago, & Charalambous, 2009). Another study found that children accumulated more MVPA with the incorporation of staff training, activity zones, and equipment (Huberty et al., 2011b).

Stratton and Mullan (2005) found that multicolor playground markings can be a cost-effective way to increase PA levels in children during recess.

Although these three studies explored one aspect of the playground physical environment by painting activity areas, in general, the effects of the environment on recreational PA are less well studied (Sallis et al., 2011). Additionally, there is limited research on the relationship among Target Area conditions and PA levels in children on the playground during leisure time at school (McKenzie et al., 2010). Therefore, this study seeks to reduce this gap in knowledge of the effects of the playground environment on PA levels in children, specifically during leisure time before school hours. Furthermore, this study will provide information on the relationship among Target Area conditions and PA levels in children.

Purpose of Study

The purpose of this study was to determine which types of playground areas and Target Area conditions attract children and promote MVPA or sedentarism. An environmental assessment of two playgrounds and various Target Area conditions could provide insight on whether certain types of playground areas or conditions are more effective in promoting MVPA and inviting use. If they do, then a study with a larger sample could be done to see if schools should expand playground area spaces that invite use and promote MVPA and minimize areas that may not. Additionally, conditions that promote MVPA could be further studied in large sample sizes. Moreover, a playground environment assessment to identify areas and conditions that may promote MVPA may be one avenue to address the need of increasing MVPA levels in children in general in addition to the PE classes.

Definitions

Key terms are defined in the context of this study.

- Accessible: If the area is accessible to the students (e.g., not locked or rented to others).
- Children: Anyone that is enrolled in the elementary schools being observed and therefore, should be between the ages of 4-12 years.
- Coding Station: "Identified location from which scans are conducted" (McKenzie & Cohen, 2006, p. 10).
- Conditions: Descriptive characteristics (contextual variables) of a playground space (McKenzie et al., 2010). The conditions include the variables: accessible, usable, supervised, offers loose equipment, and offers an organized PA.
- Counter: A "device used to record data during school observations" (McKenzie & Cohen, 2006, p. 10).
- Leisure time: Non-curriculum time allocated by schools for children to engage in leisure activity (McKenzie et al., 2010; Ridgers et al., 2006). This study focuses on leisure time offered to children before schools hours.
- Loose equipment: "Loose equipment provided by the school or other agency is present (e.g., balls, jump ropes)" (McKenzie, 2006, p. 4).
- Organized activity: "Organized PA (i.e., scheduled, with leadership by school or agency personnel apparent) is occurring in the area (e.g., intramurals, interscholastic practices, fitness stations)" (McKenzie, 2006, p. 4).
- PA: "Any bodily movement produced by skeletal muscles that results in energy expenditure" (Ridgers, Stratton, & Fairclough, 2006, p. 361).

- PA levels: Includes three levels of intensity: sedentary, walking/moderate, and vigorous.
- Scan: A "single observation movement from left to right across a Target Area or scan space" (McKenzie, 2006, p. 6).
- Scan space: A "subdivision of a Target Area in which the assessor makes an observation scan" (McKenzie, 2006, p. 6).
- School playgrounds: The outdoor area of the school available for children to use during leisure times (Ridgers et al., 2006).
- Sedentary: "Individuals are lying down, sitting, or standing in place" (McKenzie & Cohen, 2006, p. 6).
- Supervised: Area is supervised by designated or adjunct (e.g., YMCA) personnel (e.g., teachers, playground supervisors, volunteers). The supervisor must be in or adjacent to that specific area (i.e., available to direct students and respond to emergencies), but does not have to be instructing, officiating, or organizing activities (McKenzie, 2006, p. 4).
- Target Area: "A predetermined observation area in which students may potentially engage in PA" (McKenzie, 2006, p. 6).
- Target Area design type: Target Areas that contain the same element [i.e. blacktop, grass, painted markings, tetherball poles, basketball courts, manufactured equipment, dirt, Jog and Walk Stars (JAWS), volleyball courts].
- Usable: "Area is usable for PA (e.g., is not excessively wet or windy)" (McKenzie, 2006, p. 4).

- Vigorous: “Individuals are currently engaged in an activity more vigorous than an ordinary walk (e.g., increasing heart rate causing them to sweat, such as jogging, swinging, doing cart wheels)” (McKenzie & Cohen, 2006, p. 6).
- Walking: “Individuals are walking at a casual pace” (McKenzie & Cohen, 2006, p. 6).

Assumptions

Assumptions are statements that are considered true even though they may not be scientifically tested (Burns & Grove, 2009). Additionally, assumptions influence the logic of studies (Burns & Grove, 2009). For the purpose of this study the following statements are assumed to be correct:

1. School is an optimal setting to promote PA.
2. Children do not choose their schools, and therefore, the physical environment around them may promote or hinder their desired level of PA.
3. Successful interventions to increase PA in children require a multilevel approach.
4. School is an environment that can provide PA for a large number of children.

Summary

Chapter 1 introduced the issue studied in this dissertation, which is the need to assess PA levels of children on the elementary school playground during leisure time before school hours. Background on the issue and its importance to the field of nursing were presented. The gaps that this study was intended to address in the state of the science were also discussed. The purpose of this study was given, and specific definitions were described for key terms related to this study. Finally, assumptions for this study were listed.

CHAPTER 2

REVIEW OF RELATED LITERATURE

The purpose of this literature review is to understand the childhood obesity health disorder and the relationship between the playground environment and PA levels of children. This review describes the obesity epidemic, its prevalence, and defines overweight and obesity. This review also describes health and obesity, including health and economic complications from obesity and benefits from PA.

The remainder of the review focuses on factors associated with PA in elementary schools. This section is guided by the Ecological Model of Four Domains of Active Living (Figure 1) (Sallis et al., 2006). This model suggests that multiple levels of influences interact to promote or constrain participation in PA. These levels include individual, social/cultural, physical environment, and policy (Sallis et al., 2006). The PA in Elementary Schools section has two subsections: Policies and School Playgrounds. The School Playgrounds section discusses variables associated with children's PA while on the playground, including individual, social, and physical environmental variables. The studies examined for this portion of the literature review did not identify cultural associations between PA and the playground environment. The final section for this literature review is the conclusion, a discussion on the gap in knowledge of literature, and an explanation of how this study will add to the body of knowledge in the area of PA in a school playground environment.

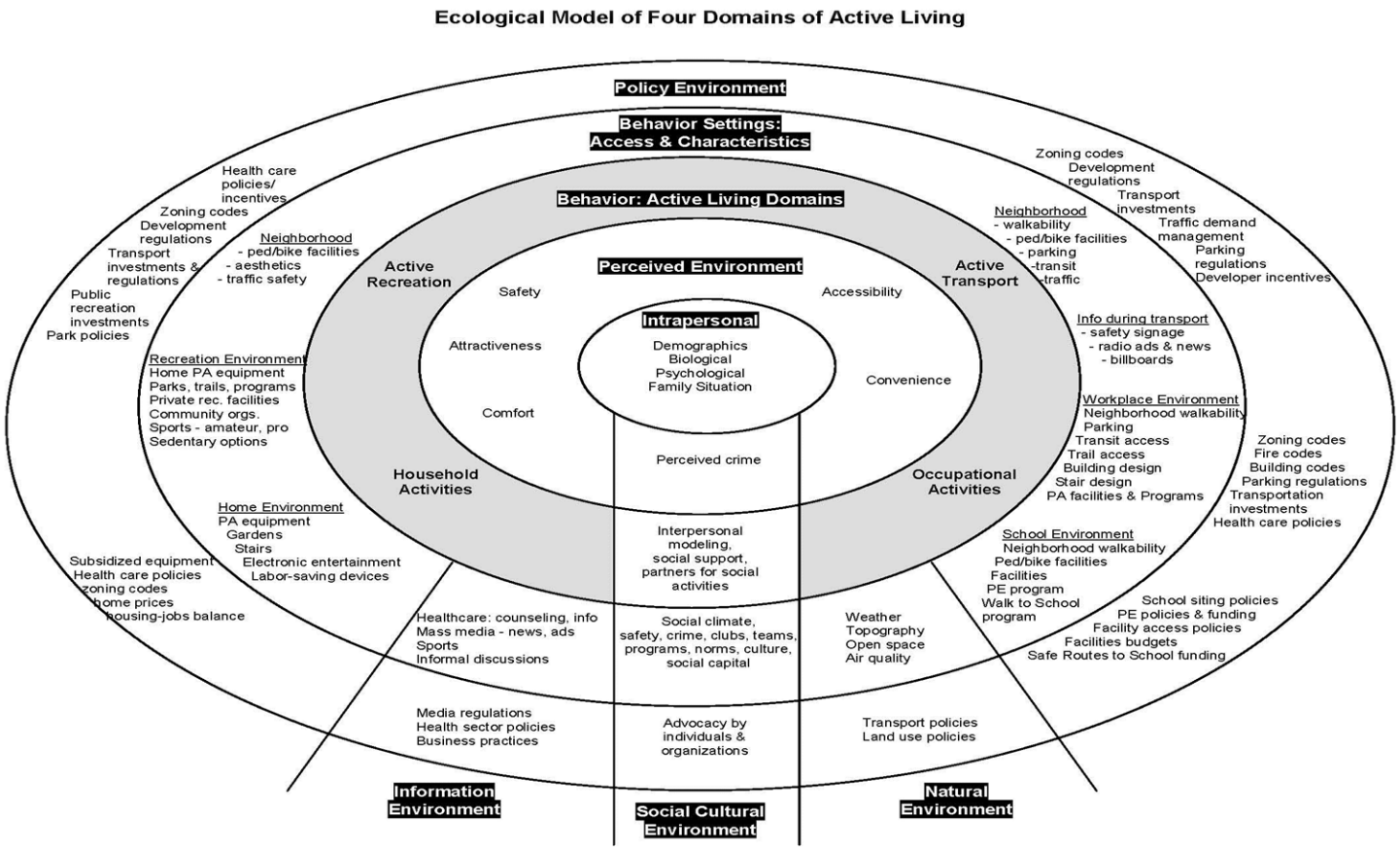


Figure 1. Adapted from "An Ecological Approach to Creating Active Living Communities," by J.F. Sallis, R.A. Millstein, and J.A. Carlson, 2006, *The Annual Review of Public Health, 27,* p. 301. Copyright 2006 by The Annual Review of Public Health. Reprinted with permission (Appendix A).

The literature review is in two sections. The first part of this review consists of all of the sections except PA in Elementary Schools. The review for the PA in Elementary Schools section was done separately and discussed in the next paragraph. For the first part of this review, over 60 articles and books from health science disciplines spanning from years 1991-2013 were reviewed. The literature encompassed children from birth through 18 years, noting specific age groups, when available. The emphasis was on elementary age children, so most of the literature review was based on this age group. The literature was searched primarily for background information on childhood obesity and the complications from it. A systematic literature search of papers was conducted in seven electronic databases [Academic Search Premier, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Cochrane, Education Resources Information Center (ERIC), SPORTDiscus, ProQuest, and Scopus]. For background information, key word searches included: childhood obesity; children AND obesity AND elementary school AND PA; economic complications of obesity; PA in children; and national guidelines for PA in children.

The second section of this review, PA in Elementary Schools, contains a review of literature related to the specific area of interest for this study and clear gaps in the literature were sought. Search strategies using the databases included key terms in three main areas: population (child, youth); school (elementary, primary); and leisure time (break time, school recess, recess, playtime, lunchtime, free play, before and after school PA programs). Inclusion criteria for articles included participants aged 4-12 years; measured PA as the outcome variable; examined PA during leisure time (morning, lunchtime, afternoon); examined an association between PA and other variables (e.g.,

contextual, physical environment); published between January 2001 and November 2013; and published in a peer-reviewed journal in English. Twenty-six articles met the inclusion criteria and were analyzed for this portion of the review. A table was created with a list of these articles, their sample sizes, limitations, and the variables examined in the studies associated with PA (Appendix B).

The Pediatric Obesity Epidemic

There has been controversy on the use of body mass index (BMI) to assess overweight and obesity in children because they are growing, but it is still used as a "reasonable measure with which to assess fatness in children and adolescents" (Dietz, 1998, p. 123S). The CDC (2002) defines overweight as a BMI for age and sex at or above the 85th percentile but lower than the 95th percentile for children. Obesity is defined as a BMI at or above the 95th percentile for children of the same age and sex. BMI is calculated as weight in kilograms divided by the square of height in meters. The Committee on Clinical Guidelines for Overweight in Adolescents Preventive Services has recommended the 95th percentile of BMI to classify adolescents as overweight (Himes & Dietz, 1994). The same recommendations for both overweight and obesity have been used with children two years and younger (Ogden, Flegal, & Carroll, 2002).

Prevalence of childhood obesity. Childhood obesity is considered a global epidemic (although it is not contagious). According to Lobstein et al. (2004), on a global scale, about 10% of the world's school-aged children are overweight or obese, with America leading at 32%, followed by Europe at 19%, near/Middle East at 16%, Asia-Pacific at 5%, and Sub-Sahara Africa at 2%. More specifically, in the United States, obesity affects approximately 12.5 million children and teens (Bell et al., 2011).

Between 1988-1994, the prevalence of obese children ages 2 through 5 years was 7.2%, 6 through 11 years old was 11.3%, and for children 12 through 19 years old it was 10.5% (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). These percentages increased for all age groups between 2009-2010 to 12.1%, 18.0%, and 18.4% respectively (Ogden et al., 2012). Although in the United States childhood obesity has increased across all age groups, racial and ethnic minorities and those from a lower socioeconomic status (SES) are at greater risk for being obese (Ball et al., 2008; Ogden et al., 2010), with the highest prevalence of childhood obesity among Hispanic boys and African American girls (Ogden et al., 2010; Wang & Lobstein, 2006). More specifically, between 2009-2010, 24.8% of non-Hispanic black adolescent females and 28.9% of Mexican-American adolescent males were obese (Ogden et al., 2012).

Childhood obesity in Nevada. In Nevada, 34.2% of children ages 10-17 are considered either overweight or obese (NICH, 2007). During the 2010-2011 school year, the Clark County School District (CCSD) collected data from a convenience sample on heights and weights of fourth, seventh, and tenth graders (Tsai, Coleman, & Middaugh, 2013). Data were collected on a sample of 3842 students out of 309,476 total enrolled students within the CCSD. Among the students sampled, 41.7% were overweight or obese (Tsai et al., 2013). Additionally, Hispanic students had the highest proportion of overweight or obese students (48%) (Tsai et al., 2013). Although these percentages are alarming, this is preliminary data on a small convenience sample, which limits generalizability to all CCSD schools.

Consistent with the other reports (Ball et al., 2008; Ogden et al., 2010), minorities in Nevada are at greatest risk for childhood obesity. According to the Kindergarten

Health Survey for Nevada, African American/Black (37.2%), Hispanic (29.4%), Native American/Alaska Native (55.3%), and children with multiple races (21.2%) have significantly higher rates of obesity compared to Caucasian (16.2%), Asian/Pacific Islander (19.3%), and children of other races (17.6%) (Nevada Institute for Children's Research & Policy [NICRP], 2011).

Health Related to Childhood Obesity

Complications. Psychosocial consequences associated with obesity in children include: discrimination, low self-esteem, increased prevalence of behavioral and learning difficulties, eating disorders, depression, unrealistic expectations by others, and bullying (Dietz, 1998). Moreover, obese girls are one and a half times more likely to be held back a grade and over two times more likely to consider themselves poor students compared to average weight girls, and obese boys are one and a half times more likely to consider themselves poor students and over two times more likely to expect to quit school (Falkner, Neumark-Sztainer, Story, Jeffery, & Resnick, 2001). Physical consequences associated with childhood and adolescent obesity includes pulmonary, orthopedic, neurological, gastroenterological, endocrine, cardiovascular, and systemic inflammation (Lobstein et al., 2004).

Economic. In 2006, an estimated $130 billion dollars was spent in the United States annually on obesity and its complications, and $337 million was spent in Nevada alone (Nevada State Health Division Bureau of Community Health, 2006). In 2010, this estimate increased to the annual cost of treating obesity-related illness in adults of $147 billion (Cawley, 2010). In 2009, the U.S. Gallop Survey looked at the cost of obesity and its complications in 187 metropolitan cities (Witters, Harter, Bell, & Ray, 2011). It was

projected that if each of these cities reduced their obesity rates to 15%, it could save the country approximately $32.6 billion in health care costs annually (Witters et al., 2011). Additionally, the direct costs of childhood obesity, including annual prescription drugs, emergency room visits, and outpatient costs, are $14.1 billion, plus inpatient costs of $237.6 million (Cawley, 2010). The rise in obesity explains 27% of the health care spending between 1987 and 2001 (Thorpe, Florence, Howard, & Joski, 2004).

Benefits of PA. An increase in PA levels can decrease the risk for obesity (Ridley, Ainsworth, & Olds, 2008). A beneficial physiologic effect of PA is that it expends energy (USDHHS, 2008b). A metabolic equivalent (MET) is a common unit used for describing the energy expenditure of a specific activity (USDHHS, 2008b). A MET is defined as "the ratio of the rate of energy expended during an activity to the rate of energy expended at rest" (USDHHS, 2008b, para. 6). The rate of energy expenditure while at rest is one MET; therefore, a four MET activity expends four times the energy used by the body at rest (USDHHS, 2008b). A person who does a 4 MET activity for 30 minutes has completed 120 MET-minutes (4x30 = 120). The same amount of energy is expended if a person completes an 8 MET activity for 15 minutes (8x15 = 120) (USDHHS, 2008b).

Therefore, although schools may be limited to times allotted for PA opportunities, children can expend the same amount of energy in15 minutes compared to 30 minutes if children participate in increased PA levels. Moderate-intensity activities include activities that expend energy at the rate similar to walking and are defined as 3.0 to 5.9 METs (USDHHS, 2008b). Vigorous-intensity activities include activities that expend energy similar to running and are defined as 6.0 METs or more (USDHHS, 2008b). If children

spend most of their leisure time at school participating in MVPA, this will help with cardiorespiratory fitness (USDHHS, 2008b). Additional benefits of PA include an association between PA and improved academic performance and brain function; healthy growth and development; lower risk of becoming overweight and developing chronic health conditions such as type 2 diabetes, heart disease, and high blood pressure; reduced stress and symptoms of depression and anxiety; and increased feelings of self-worth and self-esteem (California Department of Education [CDE], 2009).

PA in Children in Elementary Schools

In the fall of 2012, approximately 35.1 million children attended public prekindergarten through eighth grade schools in the United States (National Center for Education Statistics [NCES], 2012). Therefore, schools have access to many children, and according to the Ecological Model of Four Domains of Active Living (Sallis et al., 2006), schools can provide an environment that is convenient for promoting or hindering PA levels for children while at school. Moreover, schools play a critical role in establishing a safe and supportive environment with policies and practices that support healthy behaviors, including increased PA opportunities for children while at school (Bauer, 2011).

Policies. The 2008 PA guidelines recommend at least 60 minutes of daily MVPA for children and adolescents (USDHHS, 2008). NASPE (2008) recommends at least 150 minutes per week of PE for elementary students to help meet the national recommendations for daily PA for children. Additionally, NASPE (2006) recommends that all elementary schools provide one daily period of recess of at least 20 minutes in length. Slater et al. (2012) examined the impact of state and school district level policies

on the prevalence of PE and recess using a sample of 1761 schools from 47 states and 690 districts. The majority of states (83%) did not have a daily recess policy, but 70% of the schools in the sample offered at least 20 minutes of daily recess. Less than 50% of the states in the sample had a policy addressing the recommended 150 minutes/week of PE, and only 17.9% of the schools offered 150 minutes/week of PE. Schools were more likely to meet the NASPE PE recommendation or provide 20 minutes of daily recess if they were located in states that had policies that required NASPE recommendations and encouraged daily recess.

Moreover, Lounsbery et al. (2013) found that schools with a policy for their PE program to be evaluated annually had significantly more PE time than those that did not, but few schools or districts had this policy in place. Additionally, schools substitute one form of PA for another (i.e., PE time inversely related to recess) rather than providing the recommended levels of both PE and recess (Lounsbery et al., 2013; Slater et al., 2012). In general, district or school policies can have a positive association with school-based PA opportunities for children (Lounsbery et al., 2013; Slater et al., 2012).

CCSD policies. According to NASBE (n.d.), Nevada Revised Statutes (NRS) 389.018 mandates PE to be taught in all public schools and requires PE standards for grades second through twelfth. Additionally, the state requires the use of specific curricula for elementary, middle/junior high, and high school PE (NASPE & AHA, 2010b). There are no policies in the CCSD for the required number of minutes per week of PE (NASPE & AHA, 2010b). Additionally, a student may be exempt from participation in PE for up to one credit by participating in interscholastic athletics, a drill team, a marching band, a dance group, or a cheerleading squad if it is school sponsored

and the student participates for at least 120 hours. Moreover, students can earn required PE credits through online PE courses (NASPE & AHA, 2010b). The CCSD requires schools to collect students' BMI (height and weight) for a representative sample of students enrolled in fourth, seventh, and tenth grades (NASPE & AHA, 2010b). Although there is no state policy requiring recess, the Statewide Wellness Policy requires that there be at least 30 minutes of PA per day, which is not consistent across schools (Nevada State Health Division Bureau of Community Health, 2006).

School playgrounds. This section examines 26 articles, published between 2001-2013, in the body of literature related to PA levels of children on the playground. Six articles were published between 2001-2008. The remaining 20 articles were published between 2009-2013. This is one indicator that research in the area of PA levels of children on the playground is a newer concept being explored. The samples from the studies were from six different areas (Table 1), and several tools were used to evaluate PA levels in the 26 studies (Table 2).

Table 1

PA on School Playgrounds: Origin of Samples

Areas where samples were drawn	Studies
Australia	Dyment et al. (2009); Kelly et al. (2012); Martin, Bremner, Salmon, Rosenberg, and Giles-Corti (2012); Parrish et al. (2009); Parrish, Russell, Yeatman, and Iverson (2009b); Ridgers, Timperio, Crawford, and Salmon (2012); Willenberg et al. (2010); Zask, Van Beurden, Barnett, Brooks, and Dietrich (2001)
Belgium	Verstraete, Cardon, De Clercq, and De Bourdeaudhuij (2006)
Britain (Wales, England)	Jones et al. (2010); Ridgers et al. (2007); Ridgers, Fairclough, and Stratton (2010); Ridgers, Fairclough, and Stratton (2010b); Ridgers et al. (2010c); Ridgers and Stratton (2005); Ridgers, Stratton, Clark, Fairclough, and Richardson (2006b); Stratton and Mullan (2005)
Canada	Dyment, Bell, and Lucas (2009)
Cyprus	Loucaides et al. (2009)
United States	Chin and Ludwige (2013); Efrat (2013); Erwin et al. (2012); Howe et al. (2012); Huberty, Beets, Beighle, and Welk (2011); McKenzie, Crespo, Baquero, and Elder, (2010); Ridgers, Saint-Maurice, Welk, Siahpush, and Huberty (2011); Stellino, Sinclair, Partridge, and King (2010)

Note. The Dyment et al. (2009) study used two areas for their sample, so the study is listed more than once in the table.

Table 2

Tools Used to Evaluate PA Levels in the 26 Studies

Tools	Studies
Accelerometers	Efrat (2013); Howe et al. (2012); Huberty et al. (2011); Jones et al. (2010); Kelly et al. (2012); Martin et al. (2012); Ridgers et al. (2007); Ridgers et al. (2010b); Ridgers et al. (2011); Ridgers et al. (2012); Verstraete et al. (2006)
Heart rate telemetry	Ridgers and Stratton (2005); Ridgers et al. (2006b); Ridgers et al. (2010b); Stratton and Mullan (2005)
Pedometers	Erwin et al. (2012); Loucaides et al. (2009); Stellino et al. (2010)
Direct observation: Children's Activity Scanning Tool (CAST)	Kelly et al. (2012); Zask et al. (2001)
Direct observation: CAST 2 (revised version of CAST)	Parrish et al. (2009); Parrish et al. (2009b)
Direct observation: System for Observing Children's Activity and Relationships during Play (*SOCARP*)	Ridgers et al. (2010); Ridgers et al. (2010c)
Direct observation: The System for Observing Play and Leisure Activities (SOPLAY)	Chin and Ludwige (2013); Dyment et al. (2009); McKenzie et al. (2010); Willenberg et al. (2010)

Note. Some studies used more than one tool to measure PA, so these studies are listed more than once in the table.

The 26 articles were reviewed in depth for variables examined with the outcome variable of PA levels of children on the playground environment. The variables that were examined in these research articles were placed under three categories according to the Ecological Model of Four Domains of Active Living: individual, social, and physical environment.

Individual. Gender, age, and ethnicity were three variables identified in the studies. Gender was the most frequently studied variable, with boys consistently found to be more active than girls on the playground (Dyment et al., 2009; Jones et al., 2010; McKenzie et al., 2010; Parrish et al., 2009; Ridgers & Stratton, 2005; Ridgers et al., 2007; Ridgers et al., 2010; Ridgers et al., 2011; Stellino et al., 2010; Verstraete et al., 2006; Willenberg et al., 2010; Zask et al., 2001). Only one study found no gender difference among PA levels on the playground (Erwin et al., 2012). This study had a sample size of 160 third through fifth grade students from two elementary schools. The sample size was a limitation to this study, and a larger sample size may have altered the results. One longitudinal study examined PA levels in children at school recess over a five year period (Ridgers et al., 2012). This study found that both boys and girls (N = 2782 at baseline and N = 634 at five years) decreased in PA levels over the five years. Therefore, as age increased in children, PA levels decreased. Ridgers et al. (2011) found no association between ethnicity and PA levels.

In summary, some studies recommended further research on how the playground physical environment could be altered to increase PA levels in both boys and girls (Dyment et al., 2009; Parrish et al., 2009). An additional recommendation is to examine the types of activities available on the playground to ensure they attract both boys and girls and older children (Stellino et al., 2010). Moreover, the activity type should be considered because boys often engaged in more sports related activities than girls, and girls are more active during recess if games are involved (Ridgers et al., 2010c).

Social. Five social variables were identified from the studies: SES, providing an organized PA program, supervision, social prompting, and modeling games that increase

PA. Parrish et al. (2009) found no association between PA levels and SES. Only two articles of the 26 discussed an organized activity in their study (Howe et al., 2012; McKenzie et al., 2010). Howe et al. (2012) examined the effect of a 30 minute structured recess using 22 games of known energy expenditure on MVPA when compared to free play. The study used a sample of third grade students from two elementary schools over nine weeks. Results from the study showed that MVPA increased significantly in the intervention school compared to the control school.

McKenzie et al. (2010) found that out of 137 Target Areas in 13 elementary schools, only 16.5% of the observations had documented areas that provided organized activities. Additionally, McKenzie et al. (2010) found that boys had similar PA levels in areas with or without organized activities, but girls tended to engage in more walking and MVPA in areas without organized activities. In the Stellino et al. (2010) study, 65 children from a Midwest elementary school were provided three separate recess activities to examine if these activities had any association with PA levels. These activities were not considered organized because they were not scheduled or led by a supervisor. For example, during one of the weeks, an obstacle course was offered to the children. The children were able to participate in the obstacle course sometime during recess if they wanted to, but there was not a person in charge of the obstacle course. In general, there is minimal research on organized activities during recess and its association on PA levels in children. Additionally, offered organized activities should include both large and small groups because Ridgers et al. (2010c) found that girls often socialized in smaller groups and boys preferred larger groups.

The association between adult supervision and PA levels in children is unclear. Willenberg et al. (2010), Huberty et al. (2011), and Chin and Ludwig (2013) found a positive association between adult supervision and PA levels in children. In contrast, McKenzie et al. (2010) found that children were engaged in less MVPA with supervision. McKenzie et al. (2010) indicate that this probably occurred because playground supervisors are trained to ensure that children are safe, and this often means suppressing PA instead of promoting it.

Efrat (2013) examined in a quasi-experimental study 161 fourth-grade children from three demographically matched schools in a suburban area of Los Angeles County. Students were randomly assigned to three groups: social prompting, modeling, and comparison. Social prompting by teachers had a significant impact on the amount of MVPA the child accumulated during recess, but the increase was not significantly greater than the increase observed among participants of the comparison group. The small sample size was a limitation for this study and may have influenced these findings. Modeling of active recess-time games during curriculum time did not have an association with MVPA on the playground environment. Efrat (2013) believed that teaching in the classroom environment did not transfer to the playground. A recommendation for future studies is to model active recess games during recess. The sample for this study was drawn from the same area in Los Angeles, limiting generalizability.

Physical environment. Seven physical environmental variables were identified from the studies: weather, size of playground space, accessibility of playground space, usability of playground space, loose equipment, fixed equipment, and paint markings. It is undetermined whether weather and/or seasonal differences have an association with

PA. Zask et al. (2001) found that hot temperatures did not have an association with PA levels in children, but a limitation to the study was that although 18 schools were examined, each school was visited only once. Therefore, the results may have varied with additional visits. Ridgers et al. (2006b) also found no significant difference in children's PA levels across days and seasons, but this study contained a small sample of 15 boys and 19 girls. In contrast to previous research in this area, Ridgers et al. (2010) found the temperature to have a negative association with vigorous activity in children.

Ridgers et al, (2010) found that as play space per child increased, vigorous PA increased. In contrast, Parrish et al. (2009b) found that the total area available for play did not have a significant association with PA levels in children. Dyment et al. (2009) focused on how children used the playground spaces. Dyment et al. (2009) examined the physical environment of two elementary schools during recess: one in Australia and one in Canada. The playgrounds were split into Target Areas, and PA levels were examined in each area. The researchers were particularly interested in the association between the "green" school ground design and PA levels. These "green" areas included a variety of natural elements such as trees, butterfly gardens, ponds, and vegetable patches. The researchers found that the highest percentage of girls and boys engaged in MVPA was found on the manufactured equipment and green areas (Dyment et al., 2009). The researchers indicated that girls are less active on conventional school grounds comprised of asphalt and open playing fields and recommend further research on playground spaces that will engage more girls in MPVA (Dyment et al., 2009). This study used a small sample size of two playground environments split into a total of 13 Target Areas;

therefore, more information is needed to examine relationships among physical environments and PA levels in children.

McKenzie et al. (2010) observed 137 Target Areas in 13 elementary schools over 18 months and found that activity areas were typically accessible (99.4%) and usable (98.5%). Loucaides et al. (2009) found that allocating playground space (e.g., for team games, playground markings, and jump roping) had a positive but not significant effect on children's activity levels during recess. Children in this study used pedometers to measure PA levels and recorded their own steps, which may have influenced the results of this study.

Martin et al. (2012) found that nearly 40% of variability in recess MVPA was explained by the school environment. Children participated in higher daily MVPA during recess in newer schools and schools with a higher number of grassed surfaces per child and fewer shaded grassed surfaces. Additionally, children participated in higher levels of MVPA when the PE coordinator met Australian PA guidelines (Martin et al., 2012). A limitation of this study is the sample consisted of only sixth grade students enrolled in government-funded metropolitan elementary schools, which limits generalizability to all elementary schools.

The association among fixed equipment and markings on the playground and PA levels in children is unclear. Zask et al. (2001) found a nonsignificant association between fixed equipment and PA levels in children. A limitation to the study was that the 18 schools in the study were each visited on one day. Visits to each school on multiple days would have provided a more representative sample of the environment during recess. Willenberg et al. (2010) found that fixed equipment and asphalt with court/play-

line markings were inviting to children for active play but had the greatest impact only on moderate activity. This study did not discuss the measures taken to ensure reliability during data collection using SOPLAY. In contrast, Dyment et al. (2009) found that the highest percent of children in their study (42%) participated in vigorous PA on manufactured fixed equipment. A limitation in the Dyment et al. (2009) study is the small sample size (two schools playground physical environments split into 13 Target Areas).

Stratton and Mullan (2005) found that painting multicolored markings on playgrounds increased the percent of recess time children spent in MVPA. Limitations to this study are that the school playground was painted with new markings for this study, and data were collected for four weeks after the intervention. Because the playground markings were new, the children may have increased MVPA levels due to the novelty effect of the change in the playground setting. Ridgers et al. (2010b) also examined the effect of playground markings and PA levels in children but over one year. The playground markings also had a positive effect on MVPA during recess, but this effect was strongest at six months post-intervention and decreased between six months and twelve months. In contrast, Ridgers et al. (2007) did not find a significant difference in MVPA in children after the playground environment was redesigned with multicolor playground markings. Additionally, Kelly et al. (2012) found that playground markings did not increase PA levels in children.

Studies have consistently shown associations between loose or unfixed equipment (e.g., balls, skipping rope) and PA levels to be predominately positive (Huberty et al., 2011; Ridgers et al., 2010; Ridgers et al., 2010c; Verstraete et al., 2006; Willenberg et al., 2010). Loucaides et al. (2009) found that the use of jump ropes had a positive but not

significant association with PA levels during recess. In contrast, Zask et al. (2001) found that equipment availability (other than balls) did not have a significant association with PA levels in children during recess, but balls-to-child ratio was a one-tailed significant predictor of increased vigorous PA in children. McKenzie et al. (2010) examined 137 Target Areas in elementary schools and found that about one-third of the areas had loose equipment available for use during recess. Both boys and girls participated in more MVPA in areas that provided loose equipment. A study limitation was that the data collectors did not record how much equipment was available or whether a boy or girl was using it (McKenzie et al., 2010).

Summary

Increasing prevalence of overweight and obesity in children (Ogden, Carroll, Kit, & Flegal, 2012), along with the rise in inactivity in children (USDHHS, 2008), have resulted in the promotion of PA being a public health concern (Ridgers et al., 2011). PA has been positively associated with improving attention skills during school (Bates, 2006; Evans & Pellegrini, 1997; Pellegrini & Bohn, 2005) and obtaining higher grades (Coe et al., 2006). Moreover, PA gained from school outside of classroom time can also help socially (sharing, cooperation, communication, and problem solving), emotionally (stress relief, self-esteem, and character development), and cognitively (creativity, problem-solving skills, and vocabulary development) (Kahan, 2008; Ramstetter, Murray, & Garner, 2010).

Because of the decreasing trend in PA opportunities in elementary schools, it is important that children engage in MVPA during leisure times for its overall health benefits. With the exception of home, children spend more time in school than any other

location (Pate et al., 2006). Non-curricular times, such as school recess periods and before and after school leisure times, are great opportunities for children to be physically active at school (Erwin et al., 2012). Even a 15 minute leisure time, if spent predominately in MVPA, can make a valuable contribution to a child's daily recommended PA (Erwin et al., 2012).

Current literature indicates that boys spend more time in MVPA than girls, but it is important to provide playground environments that are inviting for increased PA levels for both boys and girls (Ridgers et al., 2011). Because the association between weather and PA levels is unclear, it is important to consider the weather during data collection, especially in the Las Vegas heat. The association between playground markings and PA levels is undetermined. The association between fixed equipment and PA levels is undetermined as well. There is minimal research on organized activities during leisure time and PA levels in children (Howe et al., 2012; McKenzie et al., 2010). The relationship between supervision during leisure time and PA levels is inconclusive. Loose equipment provided for use on the playground predominately had a positive relationship with PA levels in children (Huberty et al., 2011; Ridgers et al., 2010; Ridgers et al., 2010c; Verstraete et al., 2006; Willenberg et al., 2010).

In general, there is minimal research on the playground physical environment and its association to PA levels in children. Dyment et al. (2009) conducted a study examining the playground environment by dividing it into Target Areas. This study was conducted using an elementary school from Australia and one from Canada. The playground physical environments may differ greatly from elementary schools in the United States. McKenzie et al. (2010) also separated playgrounds from 13 San Diego

Elementary schools into Target Areas. McKenzie et al. (2010) observed the Target Areas during leisure times, including before school, at recess, and during active lunchtime. They found that MVPA in children were higher during lunch and recess than before school. They also found that organized activities during recess are hardly offered. Additional research is needed to examine PA levels in children during leisure times at school, especially when an organized PA program is offered.

The proposed study can add to this growing area of research by providing information on the relationship among two elementary school environments and PA levels in children. Additionally, one school offers an organized PA program before school hours in one Target Area. Examining this Target Area will also provide information on the association between an organized PA program and PA levels in children before school hours. This area is also supervised, which will provide more information on the association between supervision and PA levels in children. The two schools differ in playground marking, which will provide additional data on the relationship among playground markings and PA levels in children. Ultimately, increasing PA levels in children during all leisure times at school will benefit the overall health of children and add towards the USDHHS (2008) PA recommendation of at least 60 daily minutes of MVPA.

CHAPTER 3

CONCEPTUAL FRAMEWORK

The theoretical basis for this study is presented in this chapter, and research questions based upon this theory are also described.

Ecological Model of Four Domains of Active Living

Ecological models are used to provide a framework to understand the various factors and behaviors that promote or act as barriers to PA participation. Active living is a broad concept that includes exercise; recreational, household and occupational activities; and active transportation (Sallis et al., 2006). Ecological models suggest that active living requires the targeting of four levels: individual, social/cultural environment, physical environment, and policy to effectively bring change. The information environment can facilitate change as well. Interventions related to PA require a strategy, program, or policy designed to have an impact on PA participation. Ecological models are helpful for creating appropriate PA interventions, implementing these interventions, and evaluating the desired outcome. Further, ecological models require the implementation of multilevel interventions to achieve change in behavior that is most likely to be successful and sustained (Sallis et al., 2006). Based on the concept of active living and past ecological models, Sallis et al. (2006) created the Ecological Model of Four Domains of Active Living (Figure 1). This model was created to identify potential environmental and policy influences on four domains of active living: recreation, transport, occupation, and household.

In this model, broad categories of intrapersonal variables are shown at the center to represent the individual. Individuals' perceptions of the environment are represented

by the area just outside the intrapersonal circle. An individual's perception of the environment is separated from the objective aspects of the environment but both are likely to be associated with active living. The behavioral level represents the interaction of the person and the environment and is highlighted because this is the outcome of interest. Behavior settings are actual places where PA may occur. The policy environment can have an association with active living differently depending on the policy. The social/cultural environment cuts across all levels. The natural environment includes variables such as the weather and air quality. Finally, the information environment includes the media.

According to Sallis et al. (2006), ecological models are well suited for research in PA because PA is done in particular places. When the characteristics of places that promote or hinder PA are studied, priority interventions could be created based on the findings. Moreover, Sallis et al. (2006) indicate that the most powerful interventions should a) "ensure safe, attractive, and convenient places for PA, b) implement motivational and educational programs to encourage use of those places, and c) use mass media and community organization to change social norms and culture" (p. 299).

This study seeks to determine which types of playground areas promote MVPA. The behavior setting for this study is the school environment. The first part of a powerful intervention per Sallis et al. (2006) is to "ensure safe, attractive, and convenient places for PA" (p.299). Schools provide a safe and convenient environment because many children have to attend school. The playground physical environment needs to be examined first to identify playground areas that may attract students for use and promote

MVPA. Therefore, this study seeks to identify physically "attractive" areas that promote MVPA on the playground.

Focusing on the physical environment is an antecedent before educational or community awareness (Sallis & Glanz, 2006). Once the areas that promote or hinder PA are identified within the physical environment of the playground, this information can be brought to the attention of school officials who may incorporate policy change that will help increase PA levels in children while at school. An example of a PA policy change would be the amount of time spent in recess or what activities are conducted during recess or before or after school. The outcome of interest is in the behavioral level on the model and is entitled "occupational activities." The occupation is considered the student. The outcome is that the change in the environment could possibly lead to policy change and both could have a positive association with PA levels in the student.

Research Questions

Based on the Ecological Model of Four Domains of Active Living, the following research questions were used to guide the direction for the study:

- Research Question 1: Where on the playground are children, boys, and girls spending their time during leisure period before school hours?
- Research Question 2: How do the PA levels of children, boys, and girls differ within each school in each Target Area design type?
- Research Question 3: What are the top six populated Target Area design types by gender for the two schools combined?
- Research Question 4: What are the average number of children and activity level in the top six Target Area design types for the two schools combined?

- Research Question 5: How are the Target Area conditions associated with PA levels?

Research questions 6 through 8 are an extension from question 5, and they are intended to provide further insight on the association between the condition of offering an organized PA program and PA levels in children.

- Research Question 6: Are there statistically significant differences in PA levels of children, boys, and girls before school hours at school B on JAWS versus non-JAWS days?
- Research Question 7: Are there statistically significant differences in PA levels of children, boys, and girls between a school that offers free play and one that offers an organized PA program before school hours?
- Research Question 8: Are there statistically significant differences in PA levels of children, boys, and girls before school hours between school K and school B on non-JAWS days?

CHAPTER FOUR

METHODOLOGY

This chapter presents the methods utilized for this cross-sectional study.

Design

This study used a cross-sectional design in which the SI observed, described, and documented aspects of the two playground environments as they naturally occurred, a step that is often a prerequisite to any intervention (Burns & Grove, 2009). A cross-sectional design fits this study because the SI sought to determine the frequencies of PA levels of children in different playground areas as they naturally occurred (Burns & Grove, 2009). Additionally, the tools used in this study, SOPLAY and System for Observing Play and Recreation in Communities (SOPARC), allow for data collection at one specific point in time, which is required for cross-sectional studies.

Strengths of design. Cross-sectional designs collect data at a single point in time (Burns & Grove, 2009). Cross sectional designs are economical in regards to both time and cost (Polit & Beck, 2004). This cross-sectional design provides an estimate of the prevalence of PA levels of children in different playground spaces at a specific point in time. The results from this study can assist with planning interventions related to PA levels in children during leisure time before school hours. Attrition is not a problem with cross-sectional studies because data are collected at one single point in time (Polit & Beck, 2004). A cross-sectional design allowed for this study to be completed in the timeframe given by the University of Nevada, Las Vegas' (UNLV's) School of Nursing Doctoral Program.

Weaknesses of design. PA levels of children can change over time. Descriptive designs describe how phenomena are interrelated and do not infer causality (Polit & Beck, 2004). Cross-sectional designs are less rigorous than true-experimental designs. Generalizability is limited due to a lack of randomization in subject selection (i.e., schools) or assignment (Hale, 2011).

Variables

The variables in this study include gender (boys and girls); PA levels of girls and boys (sedentary, walking/moderate, and vigorous); Target Area conditions (accessible, usable, supervised, offers an organized PA, and offers loose equipment); the predominant activity of boys and girls in each Target Area; the temperature; Target Area design type (blacktop, grass, painted markings, tetherball, basketball, manufactured equipment, dirt, or JAWS), and school (K or B).

Operational Definitions

The following operational definitions were used for the variables in this study.

- Accessible, usable, supervised, offers an organized PA, offers loose equipment: Assessed via direct observation in each Target Area and circled "Y" for yes or "N" for no on the SOPLAY data collection form. An area may be accessible (e.g., tetherball pole or volleyball court), but no equipment is provided (e.g., tetherball or net). This would be coded as "Yes" for accessible and "Yes" for usable because children could still use these areas for PA, but "No" for equipment.
- Counter: This study used an application for the iPhone called Tally Counter for Four by Takagi (2013).

- Gender: Boy or a girl. The SOPLAY data collection sheet has separate columns for each gender (Appendix C). The appropriate number of children for each PA level for each Target Area was placed under the appropriate gender column on the data collection sheet. In this study, one observer always observed girls, and the second observer always observed boys.
- Predominant activity of boys and girls in each Target Area: activity codes were written on the bottom of the SOPLAY data collection form. The appropriate code was placed under the girls and boys columns for the predominate activity in that Target Area. For younger children the activity codes were: 0 = no specific activity (sit, stand, walk), 1 = aerobics/dance/gymnastics, 2 = baseball/softball/kickball/dodgeball, 3 = basketball/volleyball, 4 = tetherball, 5 = football/soccer, 6 = climbing/sliding, 7 = jumping games/four-square/jump rope/hopscotch, 8 = racquet sports/manipulative games, 9 = sedentary activities, 10 = none of the other ten categories, 11 = tag/chasing games, 12 = JAWS. These codes are from the SOPLAY procedures manual (McKenzie, 2006). They were altered slightly to fit this study. Code 1 was fitness/aerobics on the SOPLAY data collection sheet, but because there were no children participating in this type of activity, it was altered to aerobics/dance/gymnastics. Kickball and dodgeball were added to code 2 because several children at the two schools used the baseball diamond area to play either kickball or dodgeball. McKenzie (2006) had dance/gymnastics for code 4, but this was moved to code 1 on our form and tetherball was added because both school had tetherballs. JAWS was added as code 12 because one of the schools had this program.

- Scan: “During a sweep, each individual student in the area is counted and coded as being Sedentary (S), Walking (W), or Very Active (V)” (McKenzie, 2006, p. 6).
- Scan space: “Target Areas are subdivided into Scan Spaces when the number of students is large and they are engaged actively” (McKenzie, 2006, p. 6).
- Sedentary, walking/moderate, vigorous: Assessed via direct observation as a count and written on the SOPLAY data collection form under the appropriate gender.
- Target Area design type: This was based on direct observation and was coded on the SOPLAY data collection form as 1 = blacktop, 2 = grass, 3 = painted markings, 4 = tetherball, 5 = basketball, 6 = manufactured equipment, 7 = dirt, 8 = JAWS track.
- Target Areas: The playground physical environment at each school was separated into a number of Target Areas based on the SOPLAY/ SOPARC mapping strategies given by McKenzie (2005) (Appendix D).
- Temperature: Written in degrees Fahrenheit on the top of the SOPLAY data collection form.
- School: This was coded as either KES for school K or BAR for school B on the top of each SOPLAY data collection form.
- Walking: For this study, the “walking” code was considered moderate PA and assessed by “activities equivalent in intensity to brisk walking” (California School Boards Association [CSBA], 2009, p. 1).

Sample and Settings

This study is an environmental assessment consisting of a purposive sample of two CCSD elementary school playgrounds. The CCSD is the nation's fifth-largest school district (Milliard, 2012). Purposive sampling is a nonprobability sampling method used by researchers based on personal judgment about which ones will be most representative or informative (Polit & Beck, 2004). Two Henderson schools were selected with similar student demographics (Table 3). No studies were found that examined PA levels in children on the playground environment in Henderson. Additionally, some of the larger studies observing PA levels of children on the playground have been completed with the Latino population (McKenzie et al., 2010) or in Australia (Parrish et al., 2009; Parrish et al., 2009b; Willenberg et al., 2010; Zask et al., 2001). Therefore, this study will provide additional information on PA levels of children on the playground environment from two middle to upper class Henderson, NV elementary schools.

Table 3

Student Demographics

	B Elementary	K Elementary
Total number of students	687	657
Males	341	361
Females	346	296
American Indian/Alaskan Native	0%	0%
Asian	7.42%	6.24%
Hispanic	20.67%	28.01%
Black/African American	3.49%	4.87%
White	57.79%	51.14%
Pacific Islander	1.75%	1.67%
Multi-race	8.44%	7.91%
Free or reduced lunch	19.07%	28.31%

Note. Based on the 2012-2013 CCSD Accountability Report (CCSD, 2013)

Moreover, of the 26 studies examined in the literature related to PA levels of children on the playground, 10 used a direct observational tool for data collection (Table 2). From these studies, the sample sizes for the schools used ranged from 2 to 23 elementary school playgrounds observed. The children observed at the playgrounds ranged from 114 to 12,000 (Appendix B). Direct observational studies often use smaller school sample sizes because of the expense (McKenzie & Lounsbery, 2012). The biggest expense is time. Time is needed to train observers. Additionally, time is needed from observers during data collection. Therefore, the sample size is restricted by feasibility and funding.

Additionally, school B was chosen because it offers free play in the morning and has an organized jogging and walking program, JAWS, that is supervised. This will allow for further evaluation among Target Area conditions and PA levels in children. The

association between offering an organized PA program that is supervised and PA levels in children was not clearly determined in the literate. Therefore, observing the PA levels of children at a school with this type of program will provide more information in this area. School K was chosen because it offers free play in the morning, does not have an organized PA program, and has diverse play areas that allow for an evaluation between design and PA. Therefore, the sample for this study includes two Henderson elementary school playgrounds separated into 35 Target Areas (19 for school B and 16 for school K) with approximately 660 children at each school.

Procedures

Facility authorization was received from the two elementary schools to conduct this study (Appendix E). Mary E. Pike, Director for K-12 Science, Health, PE, Foreign Language, and Driver Education, sponsored this study. Approval to conduct this study was received from UNLV's Institutional Review Board (IRB) (Appendix F). The SOPLAY Description and Procedures Manual (McKenzie, 2006) was used to guide the procedures for this study (Appendix G).

Training. Three observers were initially trained to use the SOPLAY tool using the SOPLAY digital video disc (DVD) provided by McKenzie (2006b) through the Active Living Research website. Each observer received her own copy of the DVD. Each observer was asked to download a tally counter application for the iPhone called Tally Counter for Four by Takagi (2013). This application was chosen over a manual counter on a clipboard because these clipboards were heavy, bulky, and required manual twisting of a knob to reset the counter, which took precious scan time away. The iPhone application required only a tap of an icon to reset the counter. The observers used the

tally counter application to practice with the SOPLAY DVD. Additionally, the SI contacted Dr. McKenzie, creator of SOPLAY, via email to confirm that the iPhone application could be used with his tool.

The SOPLAY DVD provided a practice assessment portion using video scenarios. The "Gold Standard" for this assessment portion is to receive an 80% or higher on this assessment when performing the scans by watching the video. The "Gold Standard" answers are not on the DVD, but the SI was able to obtain the answers from Dr. McKenzie after ensuring him that the answers would not be shared with anyone outside the study. Each observer completed the practice assessment and submitted the answers to the SI on an excel spreadsheet. The SI compared the answers to the "Gold Standard" answers. Each observer retook the assessment until she received an 80% or higher compared to the "Gold Standard."

All three observers reviewed the maps of the playgrounds and the Target Areas. Additionally, all three observers walked both playgrounds and discussed various aspects of the SOPLAY tool. Approximately 10 hours were spent in training, and two of the three trained observers spent an additional 6 hours understanding the tool during pilot data collection.

Maps. An on-line map creation tool called Scribble Maps Pro was used to create maps of the school playgrounds for both school B and school K(Scribble Maps Pro, 2013). This website is considered an advanced geographic information system (GIS) and annotation tool, which allows for the creation of custom maps (Scribble Maps Pro, 2013). Satellite aerial views of both of the playgrounds were used to create Target Areas for the two playgrounds (Figures 2 and 4) and to calculate the size of each area (Figures 3 and

5). The SI could not move the labels for the size of each area using the Scribble Maps Pro tool, but clearer pictures of the maps can be viewed on-line. Figure 2 can be seen at http://www.scribblemaps.com/maps/view/TX3XMKGTBt. Figure 3 can be seen at http://www.scribblemaps.com/maps/view/0yFcMizIT5. Figure 4 can be seen at http://www.scribblemaps.com/maps/view/FuF8Nev7ya, Figure 5 can be seen at http://www.scribblemaps.com/maps/view/rfdYh1UW1Q. Pictures of each of the Target Areas and coding stations can be viewed on the website by clicking on the appropriate numbers.

Figure 2. Map of Target Areas and coding stations for B Elementary. Adapted from "B Elementary School with JAWS," by I.E. Black, 2013, http://www.scribblemaps.com/maps/view/TX3XMKGTBt.

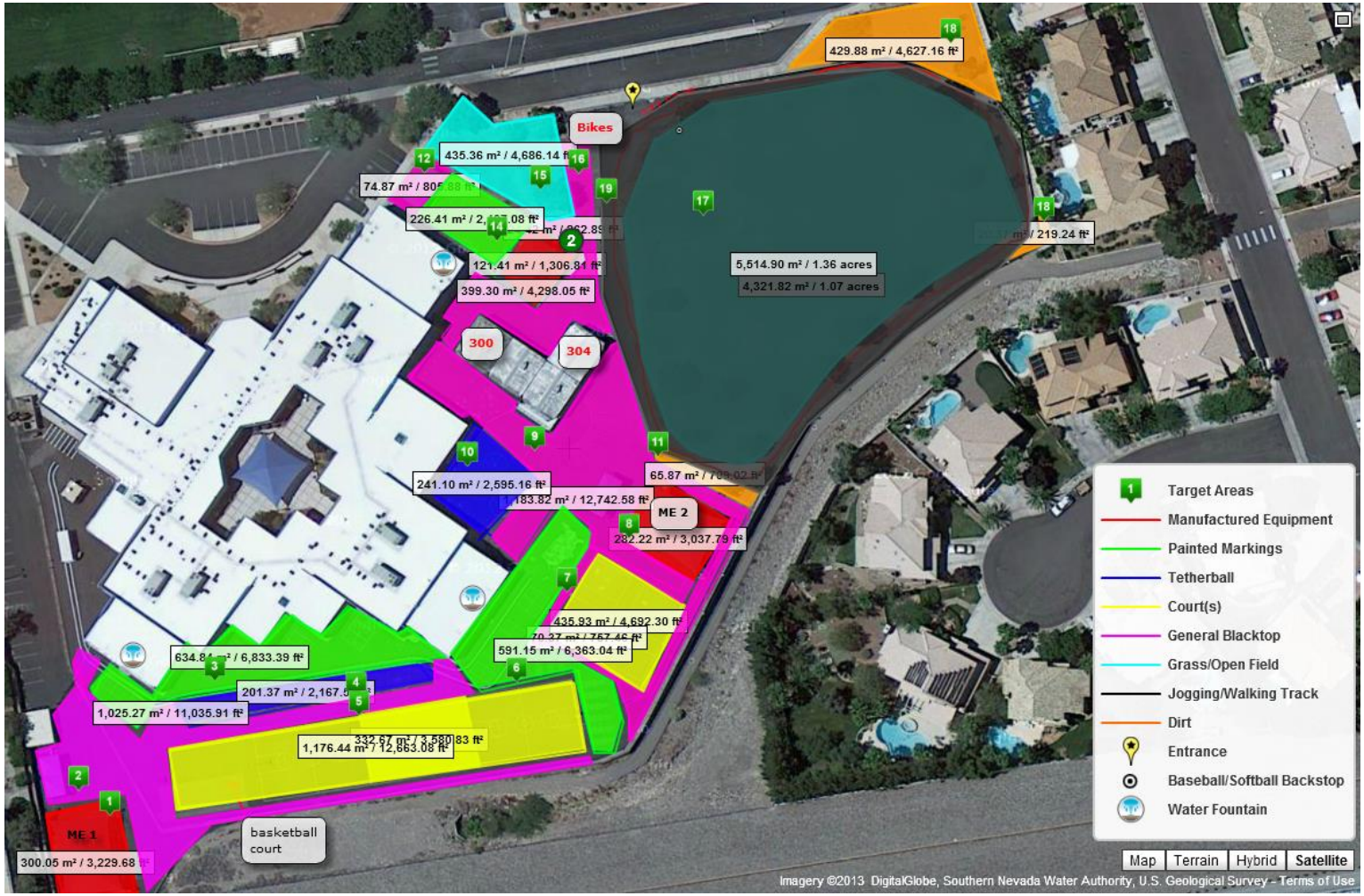


Figure 3. Map of Target Area size for B Elementary. Adapted from "B Elementary School with JAWS," by I.E. Black, 2013, http://www.scribblemaps.com/maps/view/0yFcMizIT5.

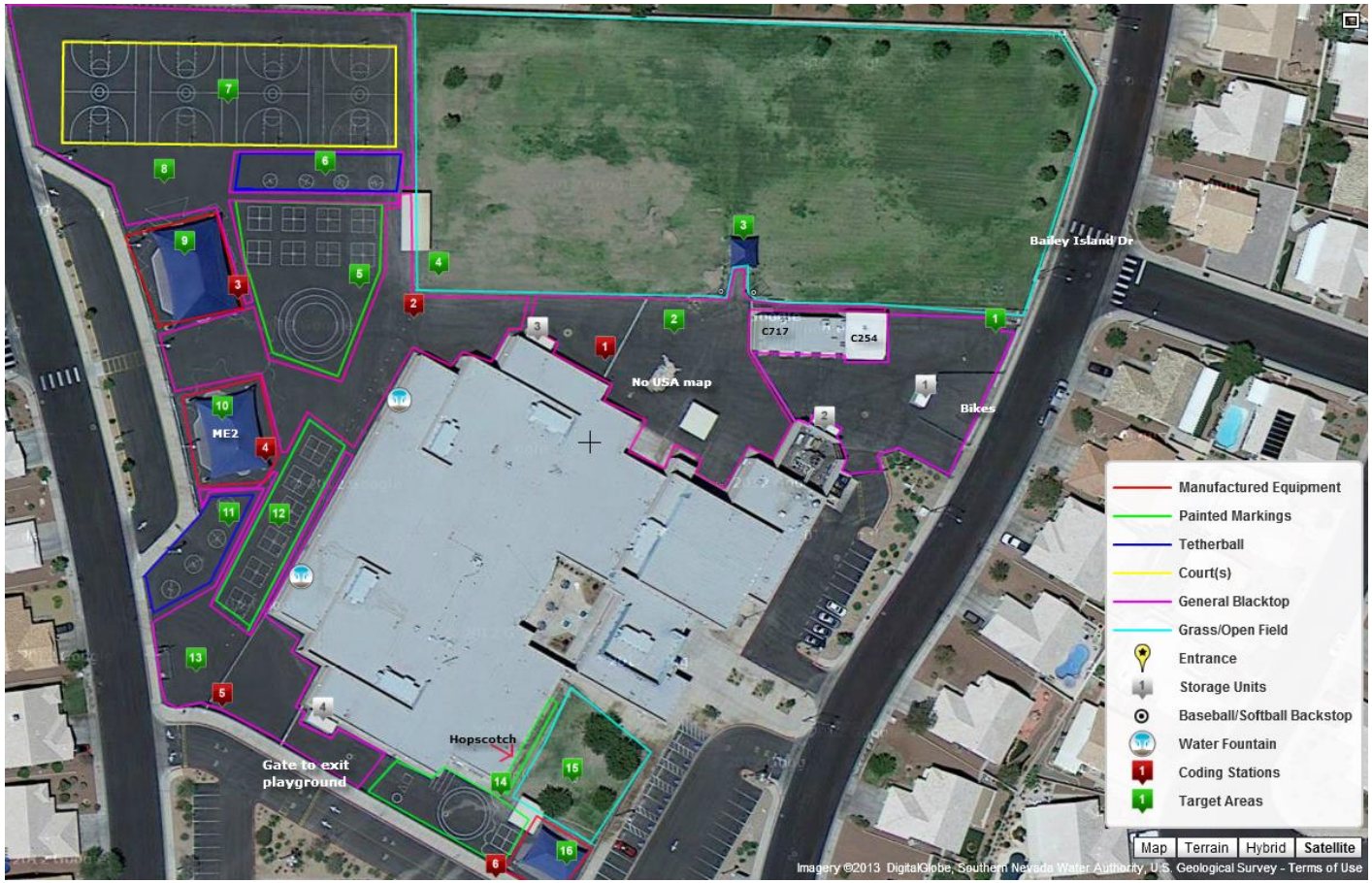


Figure 4. Map of Target Areas and coding stations for K Elementary. Adapted from "K Elementary Offers Free Play Before School Hours," by I.E. Black, 2013, http://www.scribblemaps.com/maps/view/FuF8Nev7ya.

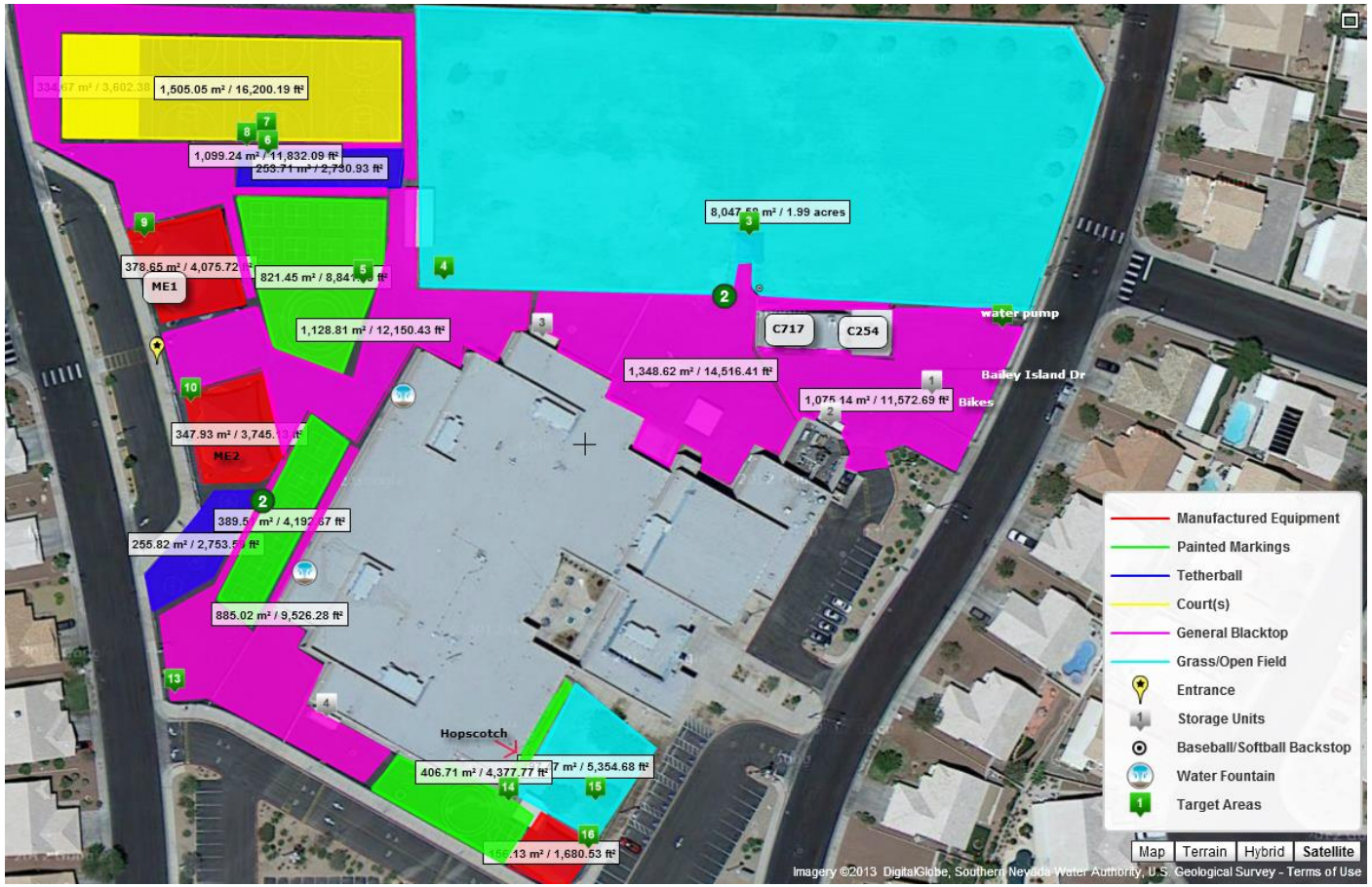


Figure 5. Map of Target Area size for K Elementary. Adapted from "K Elementary Offers Free Play Before School Hours," by I.E. Black, 2013, http://www.scribblemaps.com/maps/view/rfdYh1UW1Q.

All trained observers reviewed the maps as they walked the school grounds when children were not present at school. Several revisions were made to the maps after each school visit. The final maps are presented in these figures. During the school visits, the Mapping Variables Data Collection Sheet was completed for each school independently by two observers. The results were compared and any discrepancies were discussed. After all discrepancies were resolved, the final Mapping Variables Data Collection Sheet was created for each school (Appendix H), and Target Areas were clearly defined (Appendix I).

Pilot data collection. Approval from UNLV's IRB was obtained before proceeding with pilot data collection. The principals of each of the schools were notified in advance of the exact pilot data collection days. Pilot data collection occurred at the beginning of September for school K and at the end of September through the beginning of October for school B. School B's JAWS program did not start until the end of September. Therefore, pilot data collection did not take place until the program started. The temperatures were similar at both of the schools during pilot data collection (school K, 71-73 degrees Fahrenheit; school B, 68-73 degrees Fahrenheit).

Data were collected for five days at each of the schools. Three of the days were used to complete scans of the playground in which observer T scanned for girls and the SI scanned for boys. Two of the days were used for inter-rater reliability. On these days, the two observers scanned each Target Area together scanning first for girls at the same time followed by scanning for boys. The inter-rater reliability data were analyzed and will be discussed later in this paper.

Purpose of pilot data collection. Pilot data collection was completed prior to actual data collection for this study to assess whether two observers were sufficient for data collection, to have a better understanding of the location and order of each Target Area, to assess how much time was needed to scan each Target Area, to determine whether the Target Areas could be clearly seen from each coding station, to decide whether the number of coding stations were sufficient or needed to be condensed, for inter-rater reliability, and to discuss any discrepancies. Adjustments were made to Target Areas and coding stations from the pilot data collection. Although three observers were trained to collect data, the pilot data collection determined that two observers were sufficient for data collection.

School K began with nine coding stations. During pilot data collection, the SI realized that it was not feasible to walk to that many coding stations in the amount of time allowed for free play, and several of the Target Areas could be viewed clearly from fewer coding stations. The coding stations were adjusted leaving six coding stations (Appendix I). School B began with eight coding stations. After adjustments, the coding stations were condensed to four (Appendix I). No adjustments were made to the Target Areas during the pilot data collection at school K. During pilot data collection at school B, it was found that the order of the Target Areas seemed to transition smoother when the Target Area containing the JAWS program was observed last. Therefore, the last three Target Areas were adjusted so that the JAWS track became Target Area 19 (Appendix I).

All of the Target Areas at school B could be viewed within the main playground gate entrance (yellow symbol with a black dot in the center on Figure 2). During pilot data collection at school K, it was found that the entire kindergarten area could not be

viewed after entering the main playground gate (yellow symbol with a black dot on Figure 4). The SI found that the best way to view the kindergarten area without losing too much time was to exit out of the gates labeled "gate to exit playground" in white on Figure 4. The kindergarten area was then viewed from coding station 6 (red symbol with a white 6 on Figure 4). During trial data collection it was also found that the playgrounds could only be viewed once during the 15 minutes of leisure time before school hours using two trained observers. The observers also spoke out loud to discuss any discrepancies (e.g., gender identification or the coding of various unusual physical activities).

Data collection. The two playground environments were observed during morning leisure time. Morning leisure time was chosen to assess PA levels in children because according to Pirrie and Lodewyk (2012), the cognitive process of planning is enhanced in children after participating in MVPA. The child's ability to problem-solve and self-regulate his behavior is associated with planning (Pirrie & Lodewyk, 2012). Therefore, children who participate in MVPA before school will not only benefit physically but also cognitively.

Additionally, data collection occurred before school hours because the two elementary schools in this study offered at least 15 minutes of leisure time before school. Moreover, an organized PA program occurred during this time at one of the schools, school B. Both schools only offered one daily recess for 10 minutes. According to school officials at both schools, the students do not even receive the full 10 minutes. Recess is offered right after lunch, and both schools have a five-lunch rotation schedule, which

requires moving children from the cafeteria to the playground and from the playground to classrooms. This process uses most of the 10 minutes of daily recess.

The playground gates opened 10 minutes earlier for children to participate in the JAWS program on the days that JAWS took place. If children came to school at 8:30 am, they would have to participate in JAWS until 8:40 am. They could then play on other areas of the playground from 8:40 am – 8:55 am. Data were collected between 8:40 am – 8:55 am to be consistent with data collection at school K. During JAWS, children would grab their punch cards and walk or jog around the track and get their cards punched each time they completed a lap around the track. The PE teacher and several parent volunteers would use hole punches with various designs to punch the cards at a designated spot near the entrance of the playground.

Observer T and the SI were the two data collectors for this study. After resolving any discrepancies from the pilot data collection, the two data collectors collected data using the SOPLAY procedures manual and the SOPLAY data collection sheet. Data were collected for 10 days at each of the schools during morning leisure time for 15 minutes prior to the first bell signaling the children to line up for instruction time. At both schools, it took the entire 15 minutes to scan each Target Area once at each school. Therefore, each Target Area was observed once each data collection day.

The two observers arrived to each playground prior to the gates opening to record the temperature, school ID, and observer ID. During data collection, the two observers stood next to each other at each coding station with a light clipboard, data collection sheets, a pen, and their iPhones with the tally counter application open. They scanned each Target Area from left to right in order as directed per the SOPLAY procedures

manual, except for the JAWS area, which will be discussed in the next paragraph. At the same start and end time, observer T scanned only for girls while the SI scanned for boys at both schools. Three icons were tapped on the application depending on the child's PA level (i.e., sedentary, moderate, vigorous) (Appendix J). The total sedentary, moderate, and vigorous counts for boys were recorded on the data collection sheet by the SI, and the counts for girls were recorded by observer T. Activity codes were documented on the SOPLAY data collection sheet next to the PA counts for boys and girls. The area conditions were circled as "yes" or "no" for each Target Area by both observers on their individual data collection sheets. At the end of each data collection day, the two observers discussed the conditions to ensure that their answers were the same, and any discrepancies were corrected.

SOPLAY requires scanning each Target Area from left to right. This cannot be done with a Target Area that contains a track. Therefore for Target Area 16 at school B, the SOPARC tool was used to scan this area (Appendix K). Dr. McKenzie is the creator of both SOPLAY and SOPARC, so the tools are similar. Both tools require direct observation to identify PA levels. With SOPARC, instead of scanning a Target Area from left to right as in SOPLAY, SOPARC requires observers to use one designated spot, called a coding station, to scan joggers/walkers as they pass the coding station. The coding station for JAWS is shown as a red 4 icon in Figure 2.

According to SOPARC, prior to scanning a walking/jogging track, "a research team member will walk the path/track and record the length of time, in minutes, it took to complete one full lap around it" (McKenzie & Cohen, 2006, p. 8). Both observers walked the track several times and watched several children circle the track on the pilot data

collection days. On average, it took four minutes to complete one full lap around the track. Therefore, the track Target Area was observed for four minutes each time a scan of the area was conducted. Observers "may count some people more than once (e.g., runners), and some (e.g., slow walkers) may not pass by the area and will not be counted" (McKenzie & Cohen, 2006, p. 8). This is a limitation for this study. Observer T scanned for girls and the SI scanned only for boys in this Target Area as well.

Instrumentation

The SOPLAY tool and the walking/jogging track instructions for data collection from the SOPARC tool were used for this study. Both tools are standard instruments designed for measuring macro-population data and based on observing split second intervals or snap-shots of PA levels in children in pre-determined settings (McKenzie, 2006). The SOPARC tool uses the same PA level coding for direct observation as the SOPLAY tool (sedentary, walking, and vigorous).

Validity. Validity refers "to the degree to which an instrument measures what it is purported to measure" (McKenzie, 1991, p. 224). Construct validity for levels of PA used in both SOPLAY and SOPARC was completed on a sample of 19 children, 4 to 9 years old, who wore heart rate monitors while they participated in a variety of specified activities (McKenzie, Sallis, & Nader, 1991). The average heart rates for this sample ranged from 99 beats per minute lying down to 153 beats per minute when very active (McKenzie et al., 1991). Heart rates increased with each activity category, thus supporting the validity of the levels of PA coding categories.

Rowe, Schuldheisz, and Van der Mars (1997) also validated the coding of PA levels used in SOPLAY and SOPARC. This study consisted of 173 students (92 boys and

81 girls) from Grades 1-8. Heart rate monitors were used for concurrent validity as the children completed a standardized protocol that included lying, sitting, standing, walking, running, curl-ups, and push-ups. The results confirmed the validity of the PA coding used in SOPLAY and SOPARC for elementary and middle school children (Rowe et al., 1997).

As part of a thesis, SOPLAY was validated using an accelerometry-based activity monitor in a sample of 160 children between the ages of 9-12 years old (De Saint-Maurice Maduro, 2009). Data were collected using the SOPLAY tool and activity monitors to assess PA levels in the sample on two different occasions. The results indicated that SOPLAY is a valid tool to assess PA levels in children and more frequent scans can improve the validity of the estimations.

Reliability. Reliability "in systematic observation typically refers to the degree two or more persons simultaneously viewing an activity using the same behavior definitions and coding conventions record the same codes" (McKenzie, 1991, p. 226). Data were collected using SOPLAY during 14 days of field assessments in middle schools (McKenzie, Marshall, Sallis, & Conway, 2000). One hundred and eighty-six Target Areas were used in the reliability analysis. The conditions (area accessibility, usability, presence of supervision, presence of organized activity, and provision of loose equipment) had inter-rater reliability of greater than 88%. Inter-rater reliability for activity counts met acceptable criteria for reliable assessment as well (inter-rater reliability of at least 80%) (McKenzie, 2006).

Data were collected for reliability of the SOPARC tool by observing 16,244 individuals in 165 park areas (McKenzie, Cohen, Sehgal, Williamson, & Golinelli, 2006).

Data from 472 simultaneous measures by individual observers were used in the reliability analysis. Three different levels were assessed for agreements of pairs of assessors: characteristics of Target Areas; gender in Target Areas; and the age, race, and PA levels of females and males in Target Areas. Observers correlated on the number of area participants at .99 for female and male park users. Additionally, reliabilities for age (89% for females; 85% for males), race/ethnic (80% for females; 82% males), activity level (80% for females, 88% for males), and conditions (i.e., usable, accessible, supervised, organized, equipped) (94%) coding met acceptable criteria of greater than 80%.

Validity and Reliability for This Study

Validity. According to Burns and Grove (2009), there are four aspects of a study's validity: statistical conclusion validity, internal validity, construct validity, and external validity. Statistical conclusion validity refers to "the degree to which conclusions about relationships and differences from a statistical analysis of the data are legitimate" (Polit & Beck, 2004, p. 733). This study is examining the relationship among Target Areas and PA levels in children. The number of students in each Target Area will be considered for power during the analysis because a low sample size could result in a type II error (e.g., concluding that there is no significance relationship between PA levels and offering an organized PA programs when there really is). Data will be examined prior to statistical analysis for violations of assumptions (e.g., normality). This study will use valid and reliable instruments for data collection, SOPLAY and the walking/jogging track protocol portion of SOPARC.

Internal validity refers to the degree to which it can be inferred that the effects observed in the study are a true reflection of reality rather than being the result of the

effects of extraneous variables (Burns & Grove, 2009). Internal validity is addressed more commonly in studies that try to establish a causal relationship (Burns & Grove, 2009). Because this study did not use a true experimental design, it must be accepted that there are competing explanations for obtained results (Polit & Beck, 2004). To help eliminate bias in observing PA levels, each data collector in the study was trained using the SOPLAY/SOPARC DVD (McKenzie, 2006b).

Construct validity refers to whether the instrument actually measures the theoretical construct it purports to measure (Burns & Grove, 2009). The validity of the activity codes used by SOPLAY/SOPARC have been established through heart rate monitoring (McKenzie, 2006). Construct validity of the activity levels used in SOPLAY/SOPARC is discussed in more detail in the instrumentation section of this paper.

External validity refers to the extent to which study findings can be generalized beyond the sample used in the study (Burns & Grove, 2009). Generalizability is more narrow for a single study (Burns & Grove, 2009), like this study, but this study can be replicated using different samples from different populations in different settings, which would provide more information on generalizability. This study adds to the body of literature on the relationship among physical playground environments and activity levels in children. It also provides information on the relationship among conditions (i.e., supervised, organized, usable, accessible, and loose equipment) on the playground and PA levels in children.

Reliability. Two measures were taken to ensure inter-rater reliability. First, the

SI had the two trained observer watch and practice scanning Target Areas using the SOPLAY DVD provided by McKenzie (2006b) through the Active Living Research website. The SOPLAY DVD provides a practice assessment portion using video scenarios. As indicated earlier in this paper, the "Gold Standard" for this assessment portion is receiving an 80% or higher on this assessment when performing the scans by watching the video. Each time the trained observers completed the assessment, the answers were placed on an excel spreadsheet and turned submitted to the SI, who checked the answers against the key. All trained observers repeated the practice assessment until they received an 80% or higher, which is acceptable per McKenzie (2006).

Secondly, the SI and the second observer visited each playground for five separate mornings prior to the first day of data collection. Three of the days were used for pilot data collection. The SI and the second observer scanned each Target Area at the same time for first girls and then boys while standing adjacent to one another using separate counters and data sheets for the other two of the days. The data from the scans were analyzed for inter-rater reliability. Pearson bivariate correlations ranged from r = .87 to .99 (Table 4), which was higher than the acceptable .80 or greater per McKenzie (2006).

Table 4

Bivariate Pearson Correlations Between Two Raters

	B Elementary	K Elementary
Sedentary Girls	.99	.99
Walking/Moderate Girls	.98	.99
Vigorous Girls	.96	.95
Sedentary Boys	.99	.99
Walking/Moderate Boys	.98	.99
Vigorous Boys	.92	.87
Total Girls	.99	.99
Total Boys	.99	.99

Data Analysis

SPSS version 22 was used to conduct statistical analysis (International Business Machines Corporation [IBM], 2013). A statistician confirmed data analysis procedures during the analysis process and guided the SI.

The data collected from the SOPLAY data collection sheets (Appendix C) were inputted into SPSS 22. The sample consisted of the Target Areas, which were 35 (the rea ID 1-16 was for school K and 17-35 was for school B). The area type was the next variable coded. The following codes were used for the area type: 1 = blacktop, 2 = grass, 3 = painted markings, 4 = tetherball, 5 = basketball courts, 6 = manufactured equipment, 7 = dirt, 8 = JAWS, 9 = volleyball courts. Each Target Area size in square feet was inputted based off the data collected from the Mapping Variables Data Collection sheets (Appendix H). The next variable inputted was the school variable and coded 1 = school K and 2 = school B. Data for 12 variables were inputted for each day data was collected (10 days): temperature, supervised, loose equipment, organized activity, sedentary girls, walking/moderate girls, vigorous girls, girls activity, sedentary boys, walking/moderate boys, vigorous boys, and boys activity. For supervised, loose equipment, and organized

activity, the following codes were used: 0 = no supervision, loose equipment, or organized activity; 1 = supervision present, loose equipment present, or organized activity present. For the boys or girls activities, the following codes were used: 0 = no identifiable activity, 1 = aerobics/dance/gymnastics, 2 = kickball/dodgeball, 3 = basketball/volleyball, 4 = tetherball, 5 = soccer, 6 = climbing/sliding, 7 = jumping games/four-square/jump rope/hopscotch, 8 = racquet sports/manipulative games, 9 = sedentary activities, 10 = none of the other categories, and 11 = tag/chasing games.

The PA data counts for each Target Area were screened for any outliers for each area. There were no extreme outliers, and all of the data from the 10 days was used to compute average PA counts on a "typical" day for school B for JAWS and non-JAWS days and for school K. From the data inputted over 10 days, new variables were computed and created for school B on JAWS days and non-JAWS days and for school K: average sedentary girl, average walking/moderate girl, average vigorous girl, average sedentary boy, average walking/moderate boy, and average vigorous boy. The total counts for each PA level for each day were summed and divided by 10 for school K, divided by 8 for school B on JAWS days, and divided by 2 for school B on non-JAWS days.

The total average PA counts for girls and boys were each summed separately and the following variables were computed and created for each Target Area: average total girl and average total boy. These two variables were added together to create the total children variable. The average sedentary girl and average sedentary boy was summed to create the total sedentary children variable, and the same procedure took place for the walking/moderate and vigorous variables. The average walking/moderate PA and the

average vigorous PA were summed for each gender to obtain the total boy and total girl MVPA. The total boy and girl MVPA were summed to create the total children MVPA variable. For the average supervised and loose equipment variables, the ten days of data for these variables were summed and divided by ten. If the Target Area had an average of .5 or greater, this Target Area was changed to a 1 for offering supervision or loose equipment. If the Target Area had an average of .49 or less, this Target Area was changed to a 0 for not offering supervision or loose equipment. There was only one Target Area that offered an organized PA program, so this was the only Target Area that was coded with a 1 (Target Area 35 when the Target Areas are combined in SPSS between the two schools).

The average sedentary girl and boy and average MVPA girl and boy were divided by the area size in square feet and multiplied by 100,000 to obtain the average sedentary girl and boys and average MVPA girl and boy by area size. This was done to be able to compare the two schools based on PA level per square foot, which was needed to answer research questions 7 and 8. The number was multiplied by 100,000 to create large enough numbers to interpret easily over really small numbers with many leading zeros after a decimal. The variables for the total sedentary activity and MVPA based on square feet were created by summing the boy and girl variables for each PA levels. This procedure was done for school K and for school B on JAWS and non-JAWS days.

Research Question 1: Where on the playground are children, boys, and girls spending their time during leisure period before school hours? For this question, descriptive information was drawn from a report conducted using case summaries. The grouping variable used was the area type. A report was created for school K and school B

on JAWS and non-JAWS days. From the reports, Tables 7-9 in Chapter 5 were created. The percentages of the total students, girls, and boys were calculated for each Target Area design type by dividing the number of children found in each Target Area design type by the total found on the playground for total students, boys, and girls.

Research Question 2: How do the PA levels of children, boys, and girls differ within each school in each Target Area design type? For this question, descriptive information was also drawn on total students, girls, and boys using the average sedentary, walking/moderate, vigorous, and MVPA variables created in SPSS from a report conducted using case summaries. The grouping variable was the area type, like in question 1. Tables 10-12 were created to answer this question and can be found in Chapter 5. The percentages were calculated by summing the students in sedentary, walking/moderate, and vigorous PA in each design type and dividing it by three to get the percent of student found in that PA compared to the total students found in that design type. This was done for total students, boys, and girls.

Research Question 3: What are the top six populated Target Area design types by gender for the two schools combined? The girls and boys were summed for school K (Table 7 in Chapter 5) and on JAWS days at school B (Table 8 in Chapter 5) by Target Area design type. This process was repeated for school K (Table 7) and non-JAWS days at school B (Table 9 in Chapter 5). The average boys, and girls for each design type were divided by the average total boys and girls found on the playground. This provided the percentage of children present from both schools per Target Area design type. The top six populated Target Area design types were presented using bar

graphs to show the percent of children found in the areas in relation to the total boys and girls found on the playground on a "typical" day (Figures 6 and 7 in Chapter 5).

Research Question 4: What are the average number of children and activity level in the top six Target Area design types for the two schools combined? Data from Tables 10-12 (Chapter 5) were used to answer this question. The sedentary and MVPA of the children were summed based on Target Area design type. This was completed separately for school K (Table 10) and school B on JAWS days (Table 11) and for school K (Table 10) and school B on non-JAWS days (Table 12). The average counts of total children in MVPA or sedentary were illustrated in a bar graph format (Figures 8 and 9 in Chapter 5).

Research Question 5: How are the Target Area conditions associated with PA levels? The conditions usable, accessible, supervised, loose equipment offered, and organized activity offered were examined in the question. In SPSS, each Target Area was coded for each condition as 1 for "yes" for having the condition or 2 for "no" for not having the condition. The condition numbers (either 1 or 0) were summed with the 10 days of data for each Target Area. This was divided by 10 to get an average of each condition in a Target Area. The Target Areas with 0.5 or higher received a 1 for the final code and the Target Areas with 0.49 or less received a 0 for the final code. The Target Areas with the code 1 were summed and divided by the total number of Target Areas for each school. This provided the percent of each condition observed in the Target Areas at each school. This data was displayed in a bar graph format (Figure 10 in Chapter 5).

The three conditions that were further explored were supervised, equipment offered, and organized activity offered. For these three conditions, the average sedentary,

walking/moderate, vigorous, MVPA for the following variables: total students, girls, and boys were examined with each condition. Within each variable, all the Target Areas with a 0 for the condition were summed, and all the Target Areas with a 1 for the condition were summed. The total number for with or without the condition were divided by the total number of students found in each activity level for total students, girls, and boys. This was completed for school K and school B separately (Tables 13-17 in Chapter 5). The condition of offering an organized PA program was only examined at school B and over eight days of data collection because two of the days JAWS was not offered (Table 17). Questions 6 – 8 below further expand on the condition of offering an organized PA program.

Research Question 6: Are there statistically significant differences in PA levels of children, boys, and girls before school hours at school B on JAWS versus non-JAWS days? Multiple paired-samples *t*-tests were conducted to evaluate whether there were statistical differences in the mean counts for the two conditions (JAWS and non-JAWS days) for the following variables: sedentary girls, MVPA girls, sedentary boys, MVPA boys, total sedentary students, and total MVPA students.

Research Question 7: Are there statistically significant differences in PA levels of children, boys, and girls between a school that offers free play and one that offers an organized PA program before school hours? As indicated previously, the counts found in each Target Area for school K and school B were changed to the average number of students found in the area divided by the area size and multiplied by 100,000 square feet. Multiple independent-samples *t*-tests were conducted to identify whether there were statistical differences in mean counts between the total children, boys, and

girls at school B on JAWS days and at school K for the following variables: average sedentary girls per square foot, average MVPA girls per square foot, average sedentary boys per square foot, average MVPA boys per square foot, average total sedentary students per square foot, and average total MVPA students per square foot.

Research Question 8: Are there statistically significant differences in PA levels of children, boys, and girls before school hours between school K and school B on non-JAWS days? Multiple independent-samples *t*-tests were conducted to identify whether there were statistical differences in mean counts between the total students, boys, and girls at school B on non-JAWS days and at school K for the following variables: average sedentary girls per square foot, average MVPA girls per square foot, average sedentary boys per square foot, average MVPA boys per square foot, average total sedentary students per square foot, and average total MVPA students per square foot.

Ethical Considerations

UNLV IRB and CCSD Research Department approvals were obtained prior to conducting this study. Additionally, all researchers participating in this study completed the Collaborative Institutional Training Initiative (CITI) tutorial for the protection of human subjects prior to conducting the study. Because the tools utilized in this study, SOPLAY/SOPARC, do not collect data at the individual level, individual consent/assent was not needed. No individual identifiable data was obtained, and the children participated in regular school days. Additionally, this study did not alter the child's school schedule at all.

Observational studies are relatively low-risk (Ministry of Health, 2012). The principals of the two schools in this study were given information on the study per UNLV

IRB guidelines and facility authorizations were obtained. There was no discrimination when observing the children. All children on the playgrounds during leisure time before school hours were observed. Children could have felt uncomfortable when being observed. The trained observers stood at a distance at specified viewing areas (i.e., coding stations). The observers only observed each Target Area for the amount of time needed to scan the areas. The observers checked in and out of the front office every day they observed and wore name tags provided by the office.

Summary

In summary, this study used a cross-sectional design to evaluate two playground environments and gained further information on whether certain types of playground areas or conditions are more effective in promoting MVPA in children and inviting use for boys or girls. This chapter addressed the study design and the procedures for this study using the SOPLAY/SOPARC tools. Operational definitions, statistical analysis, validity, reliability, and ethical considerations were also discussed.

CHAPTER FIVE

RESULTS

This study examined which types of playground areas promote MVPA. This chapter presents descriptive information on the sample of students observed, the temperatures during data collection, and results for each of the study's eight research questions.

Description of Sample

Data were collected over 10 days at each of the schools. There were no extreme outliers for PA levels in children over the 10 days at school K. Therefore, at school K the 10 days of data were averaged to obtain PA levels of children on a "typical" day. On a typical day at school K, 329 students (approximately 50% of the total student population) were observed [153 girls (approximately 52% of the total girls at the school) and 176 boys (approximately 49% of the total boys at the school)] (Table 3). School K had approximately 200,235.84 ft^2 of playground space available for PA. This space was separated into 16 Target Areas based on design type that were observed over ten days. Each Target Area was scanned once in a day giving school K a total of 160 scans.

There were no extreme outliers in PA levels in each of the Target Areas over the 10 days at school B (data for non-JAWS and JAWS days were examined separately). School B offers its JAWS program every school day except for Wednesdays. Therefore, data were averaged for every day except for Wednesdays to represent a "typical" morning of leisure time at school B on JAWS days. Data were averaged for Wednesdays separately to represent a "typical" non-JAWS day morning at school B. On a typical JAWS morning, 442 children (approximately 64% of the total student population) were

counted [212 girls (approximately 61% of the total girls at the school) and 230 boys (approximately 67% of the total boys at the school)] (Table 3). On a typical non-Jaws morning, 289 children (approximately 42% of the total student population) were counted [141 girls (approximately 41% of the total girls at the school) and 148 boys (approximately 43% of the total boys at the school)] (Table 3). School B had approximately 144,711.80 ft^2 of playground space available for PA. This space was separated into 19 Target Areas based on design type that were observed over 10 days. Each Target Area was scanned once in a day giving school B a total of 190 scans. Further information on the children present, total playground area, numbers of scans, and Target Areas for each of the schools is listed in Table 5.

Table 5

Playground Demographics

	B Elementary	K Elementary
Total Children	442 (64%) 289 W (42%)	329 (50%)
Boys	230 (67%) 148 W (43%)	176 (49%)
Girls	212 (61%) 141 W (41%)	153 (52%)
Playground Area Size	144,711.80 ft^2	200,235.84 ft^2
Number of Scans	190	160
Number of Target Areas	19	16

Note. "W" is for on Wednesdays and refers only to school B. The percentage of children, boys, and girls were calculated as percentages of the total children and by gender for each school from the data in Table 3.

Temperatures during data collection at both of the schools were mostly between 60-79 degrees (school K $N = 9$ days, school B $N = 8$ days) (Table 6). School K had one day that was 83 degrees, and school B had one day at 50 degrees and one at 52 degrees. Paired-samples *t*-tests were conducted to compare the PA level counts for school B on

day 4 (temperature 50 degrees Fahrenheit) and day 10 (temperature 70 degrees Fahrenheit) and for school K on day 2 (temperature 83 degrees Fahrenheit) and day 10 (temperature 61 degrees Fahrenheit). No analysis was completed for school B on non-JAWS days because the temperature was similar (64 degrees Fahrenheit on day 3 and 60 degrees Fahrenheit on day 8).

There were no significant differences in any of the variables studied at school B on non-JAWS days: sedentary girls for day 4 (M = 1.95, SD = 4.01) and day 10 (M = 1.42, SD = 2.61; t (18) = 0.83, p = 0.42, two-tailed), walking/moderate girls for day 4 (M = 7.37, SD = 28.27) and day 10 (M = 5.42, SD = 19.89; t (18) = 0.98, p = 0.34, two-tailed), vigorous girls for day 4 (M = 2.05, SD = 7.76) and day 10 (M = 2.32, SD = 7.96; t (18) = -1.32, p = 0.21, two-tailed), sedentary boys for day 4 (M = 1.53, SD = 2.44) and day 10 (M = 1.16, SD = 2.27; t (18) = 0.75, p = 0.46, two-tailed), walking/moderate boys for day 4 (M = 6.05, SD = 20.90) and day 10 (M = 5.32, SD = 19.41; t (18) = 1.57, p = 0.14, two-tailed), and vigorous boys for day 4 (M = 4.84, SD = 18.70) and day 10 (M = 3.84, SD = 15.31; t (18) = 1.24, p = 0.23, two-tailed).

At school B for day 4 compared to 10, the magnitude of the differences in the means for both girls and boys for each variable examined was small except for walking/moderate boys, which was moderate (sedentary mean difference girls = 0.53, 95% CI: -0.80 to 1.86, eta squared = 0.02; walking/moderate mean difference girls = 1.95, 95% CI: -2.23 to 6.12, eta squared = 0.03; vigorous mean difference girls = -0.263, 95% CI: -0.68 to 0.16, eta squared = 0.05; sedentary mean difference boys = 0.37, 95% CI: -0.66 to 1.40, eta squared = 0.02; walking/moderate mean difference boys = 0.74,

95% CI: -0.25 to 1.73, eta squared = 0.06; vigorous mean difference boys = 1.00, 95% CI: -0.70 to 2.7, eta squared = 0.04).

There were no significant differences in any of the variables studied at school K: sedentary girls for day 2 (M = 5.38, SD = 6.85) and day 10 (M = 5.38, SD = 5.39; t (15) = 0.00, p = 1.00, two-tailed), walking/moderate girls for day 2 (M = 3.56, SD = 3.61) and day 10 (M = 2.88, SD = 3.88; t (15) = 1.02, p = 0.33, two-tailed), vigorous girls for day 2 (M = 0.56, SD = 0.81) and day 10 (M = 0.69, SD = 1.25; t (15) = -0.46, p = 0.65, two-tailed), sedentary boys for day 2 (M = 7.38, SD = 6.74) and day 10 (M = 5.31, SD = 5.35; t (15) = 1.32, p = 0.65, two-tailed), walking/moderate boys for day 2 (M = 2.94, SD = 3.38) and day 10 (M = 4.56, SD = 5.83; t (15) = -1.32, p = 0.21, two-tailed), and vigorous boys for day 2 (M = 1.06, SD = 1.48) and day 10 (M = 2.56, SD = 3.92; t (15) = -1.89, p = 0.08, two-tailed).

At school K for day 2 compared to 10, the magnitude of the differences in the means for girls were small and for boys they were moderate for each variable examined (sedentary mean difference girls = 0.00, 95% CI: -2.64 to 2.64, eta squared = 0.00; walking/moderate mean difference girls = 0.69, 95% CI: -0.75 to 2.13, eta squared = 0.04; vigorous mean difference girls = -0.13, 95% CI: -0.71 to 0.46, eta squared = 0.01; sedentary mean difference boys = 2.06, 95% CI: -1.27 to 5.39, eta squared = 0.06; walking/moderate mean difference boys = -1.625, 95% CI: -4.26 to 1.01, eta squared = 0.06; vigorous mean difference boys = -1.50, 95% CI: -3.20 to 0.20, eta squared = 0.11).

Table 6

Temperature and Total Daily Physical Activity Levels

	B Elementary							K Elementary						
	T	SG	WG	VG	SB	WB	VB	**T**	SG	WG	VG	SB	WB	VB
Day 1	60	17	84	58	14	102	82	77	103	38	10	102	47	13
Day 2	63	20	149	57	17	150	71	83	86	57	9	118	47	17
Day 3 (W)	64	79	37	25	74	52	23	75	109	44	8	96	55	16
Day 4	50	37	140	39	29	115	92	77	105	35	9	98	48	23
Day 5	52	39	123	56	35	122	75	72	90	40	12	88	48	18
Day 6	60	29	158	33	30	150	63	73	91	54	12	105	46	18
Day 7	60	43	161	64	31	146	83	66	80	60	19	107	59	22
Day 8 (W)	60	84	34	23	71	52	23	75	112	35	13	99	64	23
Day 9	60	28	147	43	36	139	59	63	88	45	23	97	59	30
Day 10	70	27	103	44	22	101	73	61	86	46	11	85	73	41

Note. "W" = Wednesday. "**T**" = Temperature. "SG" = Sedentary Girls. "WG" = Walking Girls. "VG" = Vigorous Girls. "SB" = Sedentary Boys. "WB" = Walking Boys. "VB" = Vigorous Boys.

Research Questions Results

Research Question 1: Where on the playground are children, boys, and girls spending their time during leisure period before school hours? Tables 7, 8, and 9 describe how many children, girls, and boys on average were found in each Target Area design type during a "typical" day. The tables also show the standard deviation (SD) based on the number of Target Areas within a Target Area design type. Additionally, the tables provide the percentage of children, girls, and boys found in each Target Area design type as a function of the total number of students found on the playground.

Table 7

School K: Average Number of Students, by Gender, on a Typical Day per Target Area Design Type Across 10 Scans (N = 10 scans/Playground Design Type) and Percentage of Total

Target Area design type	Target Area(s)	Total students *M (SD)*	Girls *M (SD)*	Boys *M (SD)*
Blacktop	1,2,4,8,13	115.80 (26.58)	60.60 (13.93)	55.20 (12.65)
		35%	40%	31%
Grass	3,15	46.40 (7.64)	17.20 (0.28)	29.20 (7.35)
		14%	11%	17%
Painted Markings	5,12,14	56.90 (10.10)	28.10 (3.40)	28.80 (8.39)
		17%	18%	16%
Tetherball	6,11	8.80 (2.97)	2.00 (0.57)	6.80 (3.54)
		3%	1%	4%
Basketball	7	17.70	0.50	17.20
		5%	0.3%	10%
Manufactured Equipment	9,10,16	83.60 (11.94)	44.60 (7.18)	39.00 (4.84)
		25%	29%	22%
Totals	16	329.20 (16.59)	153.00 (9.13)	176.20 (8.53)

Note. The kindergarten area includes Target Areas 14-16.

Table 8

School B on JAWS Days: Average Number of Students, by Gender, on a Typical Day per Target Area Design Type Across 8 Scans (N = 8 scans/Playground Design Type) and Percentage of Total

Target Area design type	Target Area(s)	Total students *M (SD)*	Girls *M (SD)*	Boys *M (SD)*
Blacktop	2,9,12,16	60.88 (13.82)	36.00 (8.67)	24.88 (5.19)
		14%	17%	11%
Grass	15,17	27.75 (7.07)	9.63 (3.27)	18.13 (3.80)
		6%	5%	8%
Painted	3,6,14	7.25 (3.87)	3.63 (2.09)	3.63 (1.78)
Markings		2%	2%	2%
Tetherball	4,10	0	0	0
Basketball	5	4.25	0	4.25
		0.9%		2%
Manufactured	1,8,13	20.75 (6.32)	10.00 (3.31)	10.75 (3.13)
Equipment		5%	5%	5%
Dirt	11,18	3.63 (2.21)	1.13 (.80)	2.50 (1.41)
		0.8%	0.5%	1%
JAWS	19	316.75	152.00	164.75
		72%	72%	72%
Volleyball	7	0.75	0	0.75
Courts		0.2%		0.3%
Totals	19	442.00 (71.60)	212.38 (34.49)	229.63 (37.17)

Note. The kindergarten area includes Target Areas 12-15.

Table 9

School B non-Jaws Days (Wednesdays): Average Number of Students, by Gender, on a Typical Day per Target Area Design Type Across 2 Scans (N = 2 Scans/Playground Design Type) and Percentage of Total

Target Area design type	Target Area(s)	Total students *M (SD)*	Girls *M (SD)*	Boys *M (SD)*
Blacktop	2,9,12,16	101.00 (20.37)	54.00 (13.30)	47.00 (7.40)
		35%	38%	32%
Grass	15,17	96.50 (52.68)	51.00 (29.0)	45.50 (23.69)
		33%	36%	31%
Painted Markings	3,6,14	14.50 (4.37)	11.50 (4.01)	3.00 (1.32)
		5%	8%	2%
Tetherball	4,10	3.50 (2.48)	3.50 (2.48)	0
		1%	2%	
Basketball	5	15.00	0	15.00
		5%		10%
Manufactured Equipment	1,8,13	40.00 (13.25)	19.00 (7.09)	21.00 (6.38)
		14%	13%	14%
Dirt	11,18	10.50 (1.06)	2.00 (0)	8.50 (1.06)
		4%	0.7%	6%
JAWS	19	5.50	0	5.50
		2%		4%
Volleyball Courts	7	2.00	0	2.00
		0.3%		1%
Totals	19	288.50 (21.30)	141.00 (12.17)	147.50 (9.72)

Note. The kindergarten area includes Target Areas 12-15.

For school K and school B on non-JAWS days, the highest percentage of children at each school was found on the blacktop (35%). On days that the JAWS program took place at school B, the findings differed, and most of the children were found on the JAWS track (72%). When looking specifically by gender, the blacktop contained the highest percentage of both boys and girls for both school K and school B on non-JAWS days (girls at school K 40%, boys at school K 31%, girls at school B 38%, boys at school B 32%). On days that the JAWS program took place at school B, the highest percentage of boys and girls were found on the JAWS track (72% for both boys and girls).

Areas that contained tetherballs attracted low percentages of children for both school K and school B regardless of the JAWS program (total students: school K 3%, school B JAWS days 0%, school B non-Jaws days 1%). School B had volleyball courts and school K did not. This area was hardly used (<1%) on both JAWS and non-JAWS days, but during data collection, the nets were never put up for the children to use the courts properly. On non-JAWS days, although the JAWS track was available for children to use, it was only used 2% of the time. On JAWS days, all of the other playground design types had decreased percentages of children (Table 8).

The basketball courts attracted the least percentage of girls at both schools regardless of the JAWS program (school K 0.3%, school B for JAWS and non-JAWS days 0%). The tetherball areas consistently attracted a low percentage of girls at both of the schools (school K 1%, school B with JAWS 0%, school B without JAWS 2%). Although the percentage is low, girls did play tetherball at school B on non-JAWS days. Additionally at school B, girls did not play on the dirt or volleyball courts on both JAWS and non-JAWS days. No girls used the JAWS track on non-JAWS days. For boys, the tetherball areas were used the least at both schools regardless of the JAWS program (school K 4%, school B with or without JAWS 0%). At school B, regardless of the JAWS program, the painted markings (2% for both JAWS and non-JAWS days) and the volleyball courts attracted a low percentage of boys (<1%). At school B, on JAWS days, the dirt attracted only 1% of boys compared to 6% on non-JAWS days. Although the percentage is low, boys did use the JAWS track on non-JAWS days (4%).

Research Question 2: How do the PA levels of children, boys, and girls differ within each school in each Target Area design type? Tables 10, 11, and 12 describe

the number and percentage of students on average in sedentary, moderate, and vigorous activity on a “typical” day, by gender in all Target Area design types. The tables also show the standard deviation (SD) based on the number of Target Areas within a Target Area design type.

Table 10. School K: Number and Percentage of Students on Average in Sedentary, Moderate, and Vigorous Activity on a Typical Day, by Gender, in all Target Area Design Types (N = 10 Scans/Design Type)

	Total students *M (SD)*				Girls *M (SD)*				Boys *M (SD)*			
Design Type	S	M	V	MVPA	S	M	V	MVPA	S	M	V	MVPA
Blacktop	58.80	51.50	5.50	57	33.00	24.90	2.70	27.60	25.80	26.60	2.80	29.40
	(15.78)	(9.64)	(1.43)	(10.95)	(8.95)	(4.54)	(0.63)	(5.10)	(6.85)	(5.13)	(0.84)	(5.87)
	51%	44%	5%	49%	54%	41%	4%	46%	47%	48%	5%	53%
Grass	25.30	12.30	8.80	21.10	9.70	4.50	3.00	7.50	15.60	7.80	5.80	13.60
	(4.45)	(4.88)	(1.70)	(3.18)	(0.64)	(0.92)	(1.27)	(0.35)	(3.82)	(3.96)	(0.42)	(3.54)
	55%	27%	19%	45%	56%	26%	17%	44%	53%	27%	20%	47%
Painted	45.20	8.60	3.10	11.70	22.30	4.60	1.20	5.80	22.90	4.00	1.90	5.90
Markings	(8.33)	(1.32)	(1.14)	(2.34)	(3.56)	(0.45)	(0.35)	(0.59)	(6.67)	(0.87)	(0.92)	(1.78)
	79%	15%	5%	21%	79%	16%	4%	21%	80%	14%	7%	20%
Tetherball	4.10	2.70	2.00	4.70	0.60	0.30	1.10	1.40	3.50	2.40	0.90	3.30
	(2.05)	(0.92)	(0)	(0.92)	(0.28)	(0.07)	(0.21)	(0.28)	(2.33)	(0.99)	(0.21)	(1.20)
	47%	31%	23%	53%	30%	15%	55%	70%	51%	35%	13%	49%
Basketball	5.90	5.40	6.40	11.80	0.30	0.20	0	0.20	5.60	5.20	6.40	11.60
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
	33%	31%	36%	67%	60%	40%	0%	40%	33%	30%	37%	67%
Manufactured	55.20	19.50	8.90	28.40	29.10	10.90	4.60	15.50	26.10	8.60	4.30	12.90
Equipment	(7.78)	(2.72)	(1.50)	(4.19)	(5.05)	(1.69)	(0.55)	(2.14)	(2.74)	(1.20)	(0.96)	(2.15)
	66%	23%	11%	34%	65%	24%	10%	35%	67%	22%	11%	33%
Totals	194.50	100	34.70	134.70	95.00	45.40	12.60	58.00	99.50	54.60	22.10	76.70
	(10.54)	(6.22)	(2.00)	(7.02)	(6.04)	(3.07)	(0.74)	(3.43)	(5.08)	(3.38)	(1.70)	(4.26)
	59%	30%	11%	41%	62%	30%	8%	38%	56%	31%	13%	44%

Table 11. School B JAWS Days: Number and Percentage of Students on Average in Sedentary, Moderate, and Vigorous Activity on a Typical Day, by Gender, in all Target Area Design Types (N = 8 Scans/Design Type).

	Total students *M (SD)*				Girls *M (SD)*				Boys *M (SD)*			
Design Type	S	M	V	MVPA	S	M	V	MVPA	S	M	V	MVPA
Blacktop	22.63	31.00	7.25	38.25	15.75	14.75	5.50	20.25	6.88	16.25	1.75	18.00
	(6.31)	(7.10)	(1.83)	(7.54)	(4.33)	(3.96)	(1.81)	(4.41)	(2.00)	(3.15)	(.33)	(3.24)
	37%	51%	12%	63%	44%	41%	15%	56%	28%	65%	7%	72%
Grass	14.63	8.00	5.13	13.13	5.50	2.50	1.63	4.13	9.13	5.50	3.50	9.00
	(4.33)	(2.65)	(0.08)	(2.74)	(2.30)	(1.06)	(0.09)	(0.97)	(2.03)	(1.59)	(0.18)	(1.77)
	53%	29%	18%	47%	57%	26%	17%	43%	50%	30%	19%	50%
Painted	2.88	3.12	1.25	4.38	1.63	1.25	0.75	2.00	1.25	1.88	0.50	2.38
Markings	(1.66)	(1.49)	(0.72)	(2.21)	(0.94)	(0.72)	(0.43)	(1.15)	(0.72)	(0.78)	(0.29)	(1.06)
	40%	42%	18%	60%	44%	36%	21%	55%	35%	51%	14%	65%
Tetherball	0	0	0	0	0	0	0	0	0	0	0	0
Basketball	1.88	1.38	1.00	2.38	0	0	0	0	1.88	1.38	1.00	2.38
Courts	44%	33%	23%	56%					44%	33%	23%	56%
Manufactured	8.13	6.88	5.75	12.63	3.50	2.99	3.63	6.50	4.63	4.00	2.13	6.13
Equipment	(2.35)	(2.06)	(2.08)	(4.07)	(1.04)	(0.89)	(1.49)	(2.32)	(1.33)	(1.18)	(0.64)	(1.82)
	39%	33%	28%	61%	35%	29%	36%	65%	43%	37%	20%	57%
Dirt	3.38	0.25	0	0.25	1.00	0.13	0	0.13	2.38	0.13	0	0.13
	(2.03)	(0.18)		(0.18)	(0.71)	(0.09)		(0.09)	(1.33)	(0.09)		(0.09)
	93%	7%		7%	88%	12%		12%	96%	4%		4%
JAWS	3.00	210.13	103.63	313.75	2.63	111.63	37.75	149.38	0.38	98.50	65.88	164.38
	0.9%	66%	33%	99%	2%	73%	25%	98%	0.2%	60%	40%	100%
Volleyball	0.25	0.50	0	0.50	0	0	0	0	0.25	0.50	0	0.50
Courts	38%	63%		63%					38%	63%		63%
Totals	56.75	261.25	124.00	385.25	30.00	133.13	49.25	182.38	26.75	128.13	74.75	202.88
	(3.85)	(47.7)	(23.6)	(71.2)	(2.45)	(25.43)	(8.58)	(33.96)	(1.71)	(22.32)	(15.01)	(37.30)
	13%	59%	28%	87%	14%	63%	23%	86%	12%	56%	33%	88%

Table 12. School B non-JAWS Days: Number and Percentage of Students on Average in Sedentary, Moderate, and Vigorous Activity on a Typical Day, by Gender, in all Target Area Design Types (N = 2 Scans/Design Type).

	Total students *M (SD)*				Girls *M (SD)*				Boys *M (SD)*			
Design Type	S	M	V	MVPA	S	M	V	MVPA	S	M	V	MVPA
Blacktop	44.50	43.00	13.50	56.5	29.50	16.50	8.0	24.50	15.00	26.50	5.50	32.00
	(13.05)	(9.85)	(2.36)	(11.12)	(9.32)	(4.27)	(1.78)	(5.95)	(3.77)	(5.72)	(1.38)	(5.24)
	44%	43%	13%	56%	55%	31%	15%	45%	32%	56%	12%	68%
Grass	56.00	24.50	16.00	40.50	29.50	13.00	8.50	21.50	26.50	11.50	7.50	19.00
	(33.94)	(10.25)	(8.49)	(18.74)	(18.74)	(5.66)	(4.60)	(10.25)	(15.2)	(4.60)	(3.89)	(8.48)
	58%	25%	17%	42%	58%	25%	17%	42%	58%	25%	16%	42%
Painted	8.00	3.50	3.00	6.50	7.50	2.00	2.00	4.00	0.50	1.50	1.00	2.50
Markings	(4.62)	(1.61)	(1.73)	(3.33)	(4.33)	(0.76)	(1.15)	(1.89)	(0.29)	(0.87)	(0.58)	(1.44)
	55%	24%	21%	45%	65%	17%	17%	35%	17%	50%	33%	83%
Tetherball	1.50	0.50	1.50	2.00	1.50	0.50	1.50	2.00	0	0	0	0
	(1.06)	(0.35)	(1.06)	(1.41)	(1.06)	(0.35)	(1.06)	(1.41)				
	43%	14%	43%	57%	43%	14%	43%	57%				
Basketball	7.50	4.00	3.50	7.50	0	0	0	0	7.50	4.00	3.50	7.50
Courts	50%	27%	23%	50%					50%	27%	23%	50%
Manufactured	23.50	9.00	7.50	16.50	12.00	3.00	4.00	7.00	11.50	6.00	3.50	9.50
Equipment	(8.01)	(2.78)	(2.50)	(5.27)	(4.92)	(0.87)	(1.53)	(2.25)	(3.40)	(2.00)	(1.04)	(3.01)
	59%	23%	19%	41%	63%	16%	21%	37%	55%	29%	17%	45%
Dirt	9.00	1.50	0	1.50	1.50	0.50	0	0.50	7.50	1.00	0	1.00
	(2.12)	(1.06)		(1.06)	(0.35)	(0.35)		(0.35)	(1.77)	(0.71)		(0.71)
	86%	14%		14%	75%	25%		25%	88%	12%		12%
JAWS	2.50	1.00	2.00	3.00	0	0	0	0	2.50	1.00	2.00	3.00
	45%	18%	36%	55%					45%	18%	36%	55%
Volleyball	1.50	0.50	0	0.50	0	0	0	0	1.50	0.50	0	0.50
Courts	75%	25%		25%					75%	25%		25%
Totals	154.00	87.50	47.00	134.50	81.50	35.50	24.00	59.50	72.50	52.00	23.00	75.00
	(12.84)	(6.78)	(3.37)	(9.55)	(7.71)	(3.17)	(1.95)	(5.00)	(5.62)	(3.79)	(1.70)	(4.81)
	53%	30%	16%	47%	58%	25%	17%	42%	49%	35%	16%	51%

Vigorous. When examining the intensity of PA as a function of Target Area design types, the highest percentage of children in a Target Area design type engaged in vigorous PA at school K was on the basketball courts (36%). However, the basketball courts attracted only 5% of the total number of students scanned on the school ground (Table 7). At school B on non-JAWS days, the highest percentage of children in a Target Area design type engaged in vigorous PA was at the tetherball areas (57%). However, the tetherball areas attracted only 1% of the total number of students scanned on the school ground (Table 9). On JAWS days at school B, the JAWS area had the highest percentage of children engaged in vigorous PA (33%). The JAWS area attracted 72 % of the total children scanned on the school ground.

When examining gender differences, the highest percentage of girls found vigorously active by Target Area design type was in the tetherball areas for both school K (55%) and school B on non-JAWS days (43%). However, the tetherball areas attracted only 1% at school K (Table 7) and 2% at school B on non-JAWS days (Table 9) of the total number of students scanned on the school ground. At school K, the basketball courts contained the highest percentage of vigorously active boys (37%) per design type compared to the other Target Area designs. However, the basketball courts attracted only 2% of the boys counted on the playground (Table 7). On non-Jaws days at school B, the highest percentage of boys found vigorously active per design type was on the JAWS track (36%), but this area attracted only 4% of the total boys found on the playground (Table 9). On JAWS days at school B, the highest percentage of girls found vigorously active per design type was on the manufactured equipment (36%), but this area attracted only 5% of the girls found on the playground (Table 8). On JAWS days at school B, the

highest percentage of boys found vigorously active per design type was on the JAWS track (40%), and this area attracted 72% of the boys counted on the playground.

MVPA. When examining MVPA as a function of Target Area design types, the findings for the highest percentage of children in a Target Area design type engaged in MVPA were the same as the findings for vigorous PA in children, except the percentages were slightly higher for the basketball courts and JAWS areas but the same for tetherball areas (school K basketball area 67%, school B non-JAWS days tetherball areas 57%, school B JAWS days JAWS 99%). When examining gender differences and MVPA as a function of Target Area design types, the findings change slightly compared to the findings for vigorous PA.

At school K and school B on non-JAWS days, the findings for the girls for MVPA were the same for vigorous PA (tetherball area), except the percentages were higher (school K 70%, school B on non-JAWS days 57%) (Tables 10 and 12). At school K, the MVPA findings for the boys were the same for vigorous PA (basketball), except the percentage was higher (67%). On non-JAWS days at school B, the highest percentage of boys participating in MVPA per Target Area design type was found on the painted markings (83%), but this area attracted only 2% of the children counted on the playground (Table 9). At school B on JAWS days, the highest percentage of children participating in MVPA per Target Area design type was found in the JAWS area for both boys and girls (boys 100%, girls 98%), and this area contained 72% of the girls and boys counted on the playground (Table 8).

Sedentary. When examining the intensity of PA as a function of Target Area design type, the highest percentage of children in a Target Area design type engaged in

sedentary PA at school K was on the painted markings areas (79%), and 17% of the children were found in these areas (Table 7). At school B on non-JAWS days, the highest percentage of children in a Target Area design type engaged in sedentary PA were in the dirt areas (86%), but only 4% of the children who were counted were found in these areas. The findings were the same on JAWS days at school B with 93% of the children found in the dirt areas participating in sedentary activities, but less than 1% of the children who were counted were found in these areas (Table 8).

When examining gender differences, the highest percentages of sedentary girls and boys at school K were found in painted markings areas (girls 79%, boys 80%) compared to the other areas, and 18% of the girls and 16% of the boys who were counted on the playground were found in these areas (Table 7). At school B, on JAWS and non-JAWS days, the highest percentages of sedentary girls and boys at school B were found on dirt areas (school B JAWS days girls 88%, boys 96%; school B non-JAWS days girls 75%, boys 88%) compared to the other areas, but less than 1% of the girls were found in this area on JAWS and non-JAWS days, 1% of boys on JAWS days, and 4% of boys on non-JAWS days (Tables 8 and 9).

Highest populated areas. When examining the highest populated areas in relation to the intensity of PA as a function of Target Area design types, the highest populated areas for school K and school B on non-JAWS days were the general blacktops (school K and school B non-JAWS days 35%). At both school K and school B on non-Jaws days, about 50% of the children were sedentary, and the other 50% participated in MVPA (school K sedentary 51% and MVPA 49%, non-JAWS school B sedentary 44% and MVPA 56%) (Tables 10 and 12). At school B on JAWS days, the highest populated

area was the JAWS track (72%) (Table 8). In the JAWS area, 99% of the children participated in MVPA and less than 1% participated in sedentary activity (Table 11).

When examining the highest populated areas by gender in relation to the intensity of PA as a function of Target Area design types, the highest populated areas for school K and school B on non-JAWS days for both boys and girls were the general blacktops (school K girls 40% and boys 31%, school B non-JAWS days girls 38% and boys 32%). For both boys and girls at school K and for only girls at school B, about 50% of the children found in these areas were sedentary and 50% were participating in MVPA (school K sedentary girls 54%, school K MVPA girls 46%, school K sedentary boys 47%, school K MVPA boys 53%, non-JAWS school B sedentary girls 55%, non-JAWS school B MVPA girls 45%) (Tables 10 and 12). At school B on non-JAWS days, boys were more physically active with 68% participating in MVPA and 32% sedentary (Table 12). On JAWS days at school B almost 100% of the children found in this area regardless of gender participated in MVPA, with boys being slightly more active than girls (sedentary girls 2%, MVPA girls 98%, sedentary boys 0.2%, MVPA boys 100%).

Overall there was no general activity on the blacktop at both school B and school K. Most of the children in walking/moderate PA were just getting to their next destination. At school K, approximately five girls and five boys used the jump ropes on the blacktop. At school B, there were five to seven girls dancing to the music played on JAWS days. The kindergarten children would occasionally play tag on the blacktop or in the grass at both of the schools and with both genders. There were approximately 5 to 10 children playing tag at either school at any given time in the kindergarten Target Areas.

Research Question 3: What are the top six populated Target Area design types by gender for the two schools combined? Figure 6 shows the top six Target Area design types by gender for the two schools on the days the JAWS program is present. Figure 7 shows the top six Target Area design types by gender for the two schools on the days when there was no JAWS program.

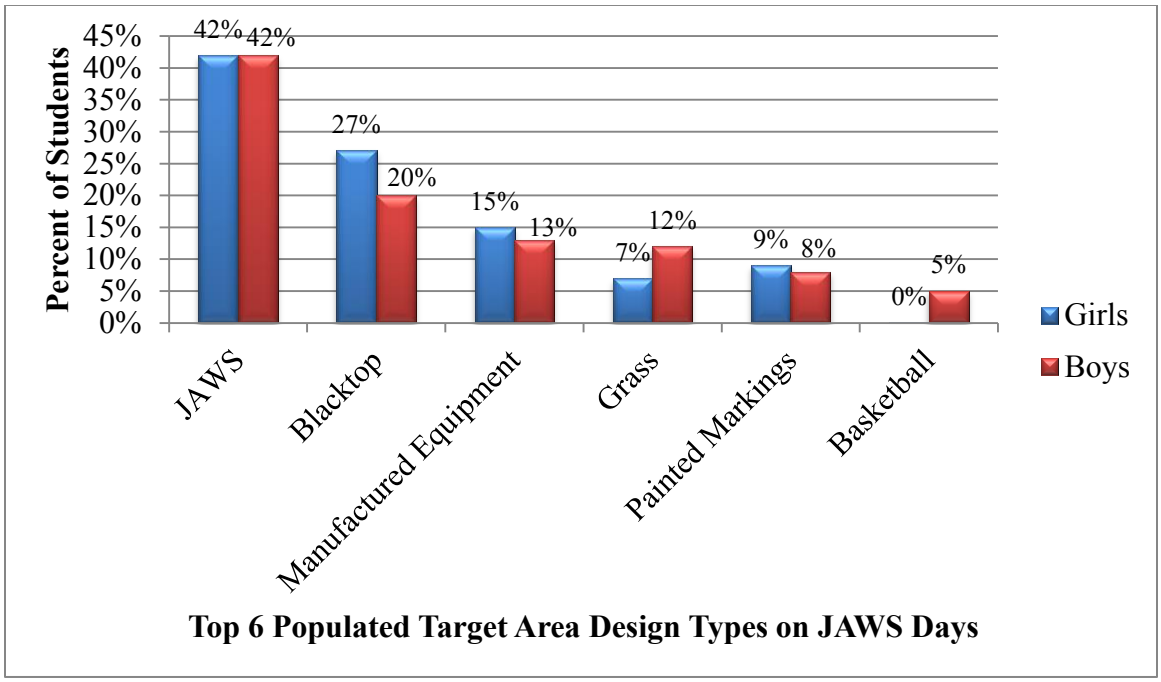


Figure 6. The top six populated Target Area design types for school K and school B combined on days where JAWS was present (based on 362 girls and 396 boys counted in these areas from both of the schools).

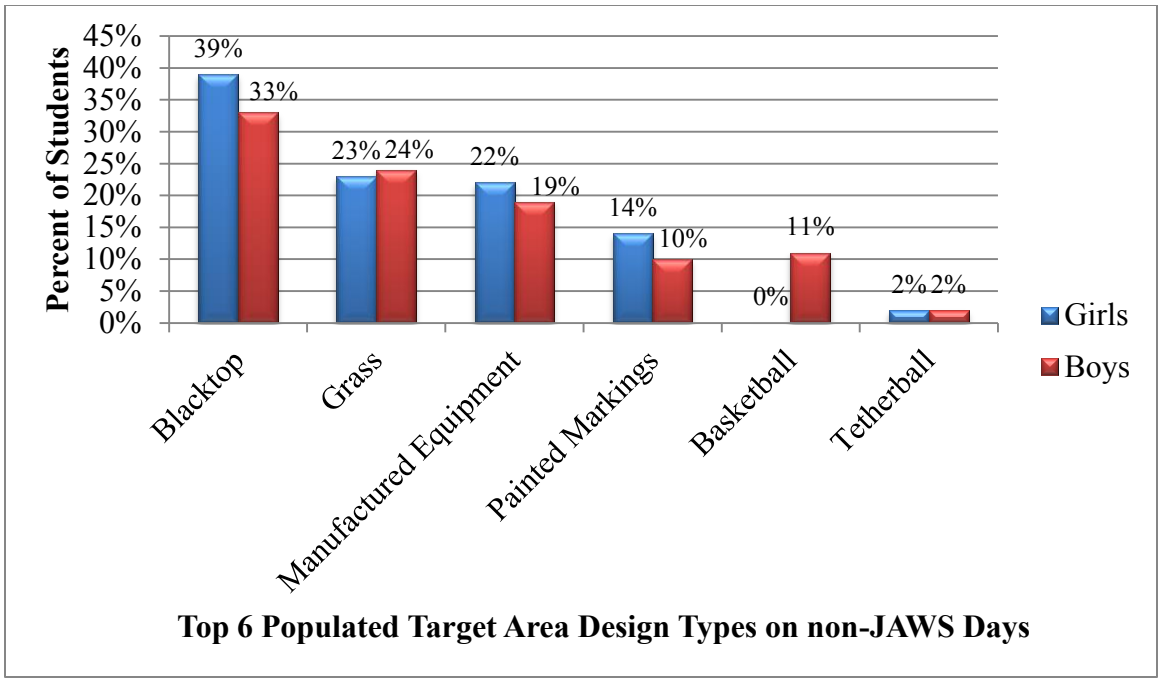


Figure 7. The top six populated Target Area design types for school K and school B combined on days where JAWS was not present (based on 292 girls and 308 boys counted in these areas from both of the schools).

When looking at the Target Areas combined based on design types at both of the schools, if the JAWS program was present, the highest populated Target Area design type was the JAWS program (42% for both boys and girls), followed by the blacktop (girls 27% and boys 20%), and the manufactured equipment (girls 15% and boys 13%) . Basketball areas were not used by girls (0%) and boys used this area the least (5%). When looking at the Target Areas combined based on design types when the JAWS program was not present, the highest populated Target Area design type was the blacktop (girls 39% and boys 33%), followed by the grass (girls 23% and boys 24%), and then the manufactured equipment (girls 22% and boys 19%). Again, the basketball area was not used by girls without the JAWS program (0%), and the tetherball area was used minimally for both genders (girls and boys 2%).

Research Question 4: What is the average number of children and activity level in the top six Target Area design types for the two schools combined? Figure 8 shows the average number of children and activity level in top six Target Area design types for the two schools combined on JAWS days. Figure 9 shows the average number of children and activity level in top six Target Area design types for the two schools combined on non-JAWS days.

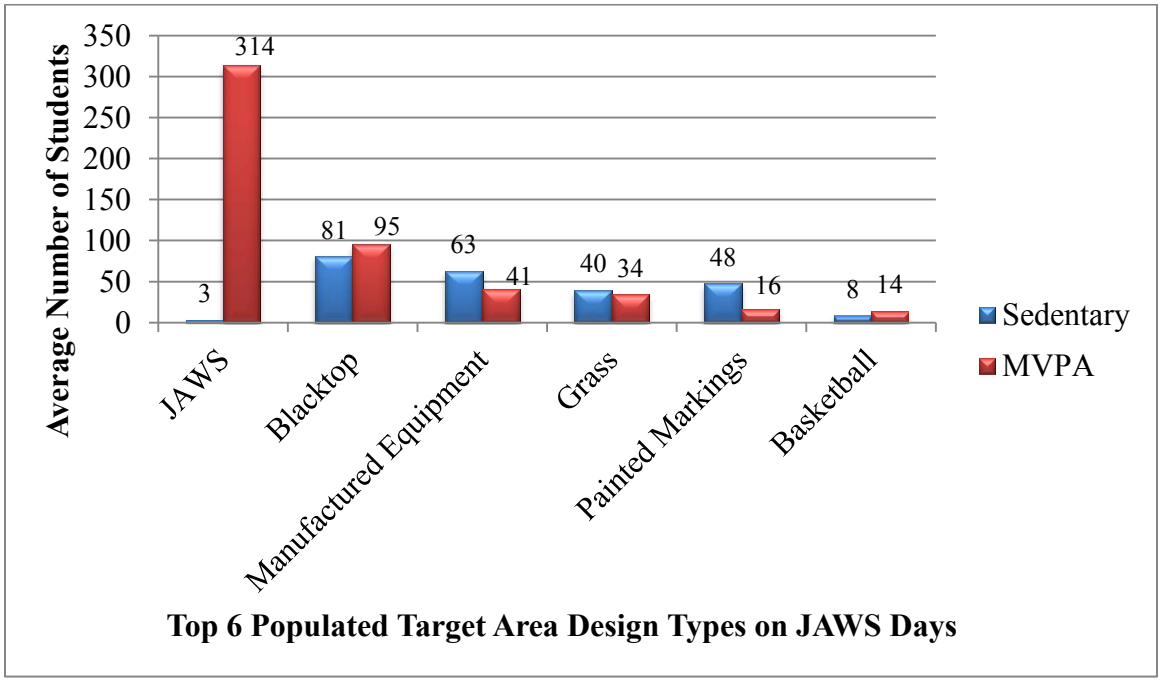


Figure 8. The average number of students and activity level by the top six populated Target Area design types for school K and school B combined on days where JAWS was present.

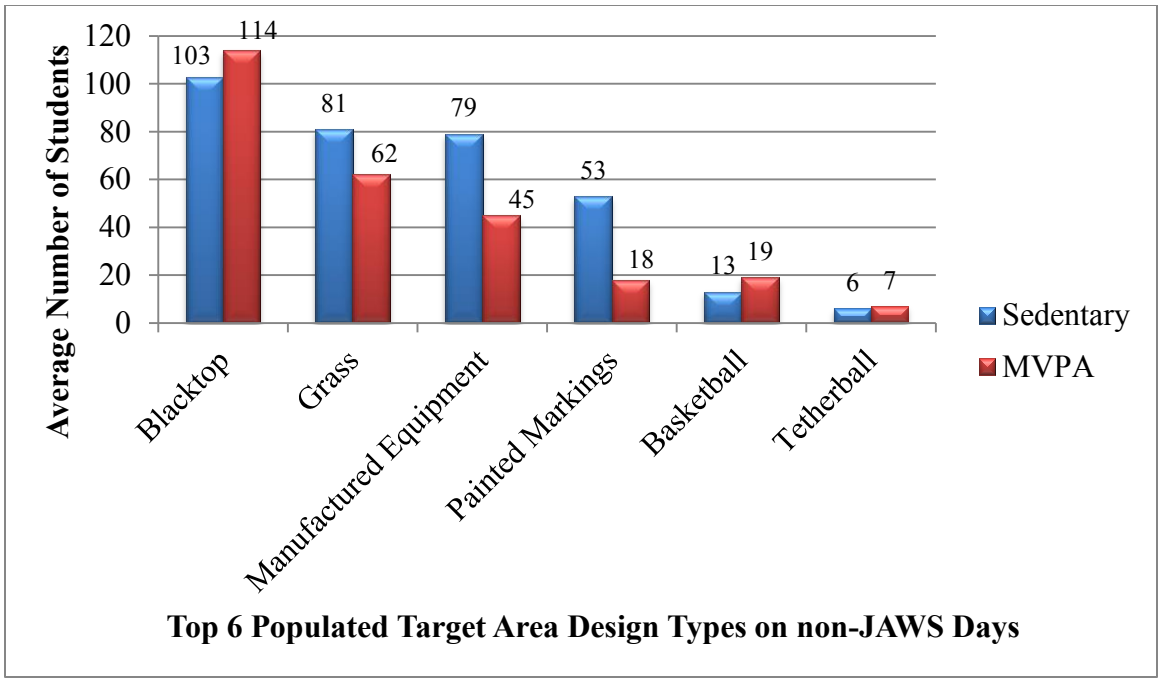


Figure 9. The average number of students and activity level by the top six populated Target Area design types for school K and school B combined on days where JAWS was not present.

Based on the information from figure 9, on average, the highest number of children who were found participating in MVPA on JAWS days was found in the JAWS area ($N = 314$). On JAWS days, on average, the highest number of children who were sedentary at both schools were found on the blacktop ($N = 95$). On non-JAWS days the highest number of children who were found participating in MVPA was on the blacktop areas ($N = 114$), but this was also the area where the highest number of children were found in sedentary activities ($N = 103$).

Research Question 5: How are the Target Area conditions associated with PA levels? Figure 10 provides information on the Target Area conditions for both schools. At both schools, 100% of the Target Areas were usable. At school K, 100% of the Target Areas were accessible. At school B, 4 of the 16 Target Areas (Target Areas 1-4) were not accessible. The SI was informed that the students were not allowed to play in

these areas in the morning because they are difficult to supervise due to their location behind the school building (Figure 2). Therefore, 75% of the Target Areas at school B were accessible. At school K, 7 of the 16 Target Areas generally had direct supervision (44%). At school B, 5 of the 15 accessible Target Areas generally were directly supervised (33%). At school K, 7 of the 16 Target Areas offered loose equipment (44%). At school B, 2 of the 19 Target Areas offered loose equipment (11%). Although Target Area 4 (Figure 2) at school B was not accessible to the students, tetherballs were hung on Wednesdays (non-JAWS days). School K did not offer any organized PA programs before school hours on the playground, and school B had one Target Area out of 19 that offered an organized PA program (5%).

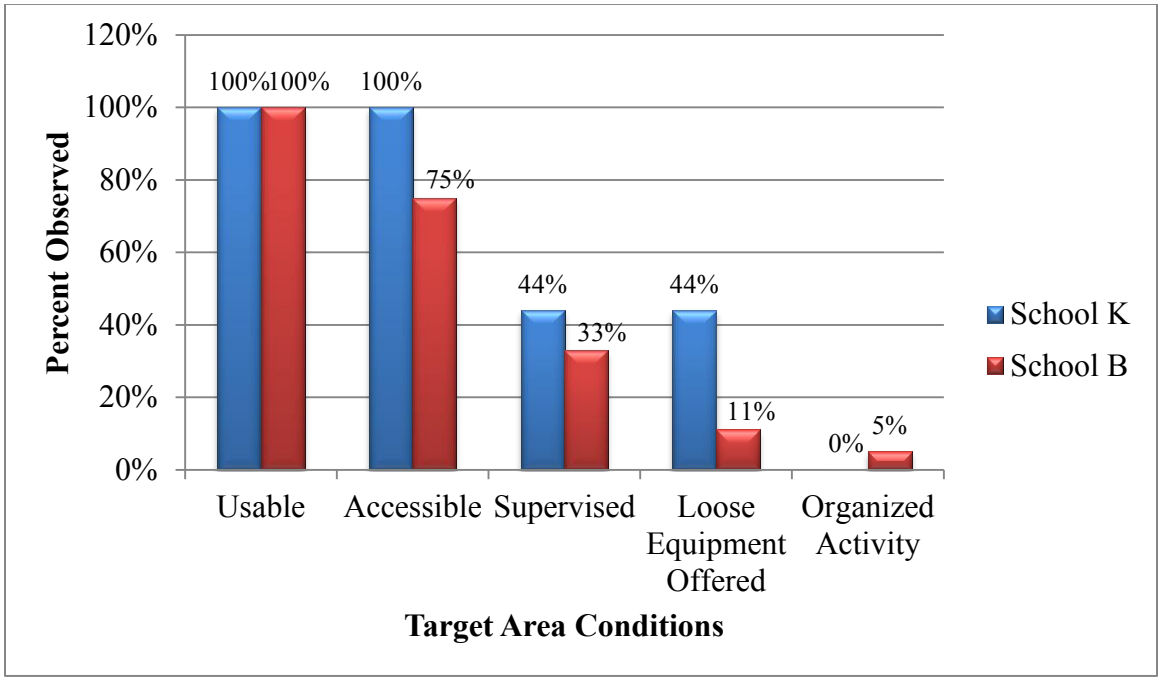


Figure 10. Target Area conditions observed for school K and school B.

Tables 13 and 14 provide on average the number and percentage of children, girls, and boys in different levels of PA under supervised and unsupervised conditions. Based

on the information from Tables 13 and 14, a higher percentage of children were found to be sedentary in areas without supervision at both school K (sedentary unsupervised 61% and sedentary supervised 58%) and school B (sedentary unsupervised 49% and sedentary supervised 24%). Additionally at both schools, a higher percentage of children were found participating in MVPA in areas that were supervised over areas that were not supervised (school K MVPA unsupervised 39% and school K MVPA supervised 42%; school B MVPA unsupervised 51% and school B MVPA supervised 76%). The same findings were present when specifically looking at gender at both of the schools, except the boys at school K PA levels were minimally affected with the condition of supervised and unsupervised (sedentary supervised 56%, sedentary unsupervised 57%, MVPA supervised 44%, MVPA unsupervised 43%). Figure 11 provides the information in a bar graph form for the total students observed in areas on a "typical" day at both schools. Tables 15 and 16 provide on average the number and percentage of total children, girls, and boys in different levels of PA in Target Areas that were provided loose equipment and areas that did not have loose equipment.

Table 13. School K: Average Number and Percentage of Students, by Gender, and Level of PA with Supervised/Unsupervised Conditions across 10 Days (N = Total Students per Condition/10 Days).

	Total students *M (%)*				Girls *M (%)*				Boys *M (%)*			
Condition	S	M	V	MVPA	S	M	V	MVPA	S	M	V	MVPA
Supervised	128.50	71.90	20.40	92.30	70.50	37.00	10.00	47.00	58.00	34.90	10.40	45.30
	58%	33%	9%	42%	60%	31%	9%	40%	56%	34%	10%	44%
Unsupervised	66.00 61%	28.10	14.30	42.40	24.50	8.4.00	2.60	11.00	41.50	19.70	11.70	31.40
		26%	13%	39%	69%	24%	7%	31%	57%	27%	16%	43%

Table 14. School B: Average Number and Percentage of Students, by Gender, and Level of PA with Supervised/Unsupervised Conditions across 10 Days (N = Total Students per Condition/10 Days).

	Total students *M (%)*				Girls *M (%)*				Boys *M (%)*			
Condition	S	M	V	MVPA	S	M	V	MVPA	S	M	V	MVPA
Supervised	40.50	32.10	97.50	129.60	23.50	103.90	37.80	141.70	17.00	96.50	59.70	156.20
	24%	19%	57%	76%	14%	63%	23%	86%	10%	56%	34%	90%
Unsupervised	35.70	26.10	11.10	37.20	16.80	9.70	6.40	16.10	18.90	16.40	4.70	21.10
	49%	36%	15%	51%	51%	29%	19%	49%	47%	41%	12%	53%

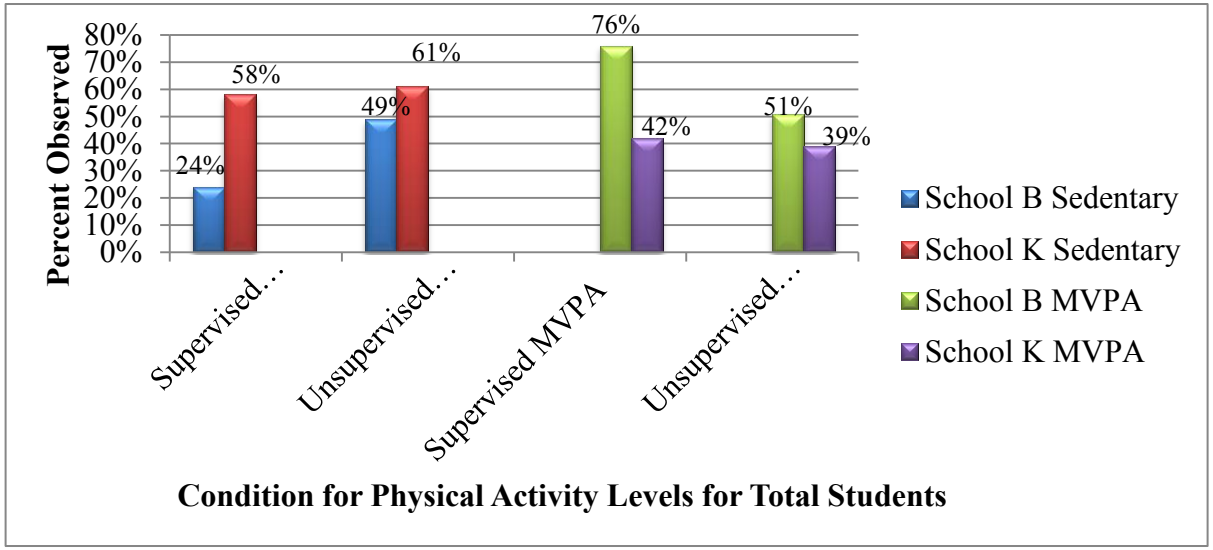


Figure 11. The percentage of total students observed on average in a typical day in sedentary or MVPA under supervised and unsupervised conditions at schools K and B.

Table 15. School K: Average Number and Percentage of Students, by Gender, and Level of PA with Loose Equipment/No Loose Equipment Conditions across 10 Days (N = Total Students per Condition/10 Days).

	Total students *M (%)*				Girls *M (%)*				Boys *M (%)*			
Condition	S	M	V	MVPA	S	M	V	MVPA	S	M	V	MVPA
Loose	78.90	43.80	17.30	61.10	31.40	15.50	3.70	19.20	47.50	28.30	13.60	41.90
Equipment	56%	31%	12%	44%	62%	31%	7%	38%	53%	32%	15%	47%
No Loose	115.60	56.20	17.40	73.60	63.60	29.90	8.90	38.80	520	26.30	8.50	34.80
Equipment	61%	30%	9%	39%	62%	29%	9%	38%	60%	30%	10%	40%

Table 16. School B: Average Number and Percentage of Students, by Gender, and Level of PA with Loose Equipment/No Loose Equipment Conditions Across 10 days (N = Total Students per Condition/10 Days).

	Total students *M (%)*				Girls *M (%)*				Boys *M (%)*			
Condition	S	M	V	MVPA	S	M	V	MVPA	S	M	V	MVPA
Loose	3.00	1.90	1.50	3.40	0	0	0	0	3.00	1.90	1.50	3.40
Equipment	47%	30%	23%	53%					47%	30%	23%	53%
No Loose	73.20	56.30	107.10	163.40	40.30	113.60	44.20	157.80	32.90	111.00	62.90	173.90
Equipment	31%	24%	45%	69%	20%	57%	22%	80%	16%	54%	30%	84%

At school K, children had access to balls, jump ropes, and tetherballs every day of the week. At school K, a higher percentage of children were found to be sedentary in areas without loose equipment (61%) compared to areas with loose equipment (56%). Additionally at school K, a higher percentage of children were found to participate in MVPA with loose equipment (44%) compared to areas without loose equipment (39%). There was no association between the intensity of PA for girls and loose equipment in Target Areas (sedentary 62% for both and MVPA 38% for both). It was observed that the girls rarely used the loose equipment. A few girls played with a ball at four-square, jump roped, and played tetherball. Boys were found to be more sedentary in areas without loose equipment (60%) compared to areas with loose equipment (53%), and a higher percentage of boys participating in MVPA were found in areas with loose (47%) compared to areas without loose equipment (40%). The boys were observed to use loose balls more than the girls. The three items that were used by both boys and girls were balls for four-square, jump ropes, and tetherballs. Boys also used loose balls to play soccer, kickball, and basketball.

At school B, there was a minimal amount of loose equipment provided. Children had access to balls on JAWS and non-JAWS days, but they had access only to the tetherballs on non-JAWS days. The nets for the volleyball courts were never put up during data collection. The nets were put up during a trial data collection day, but the children still did not use this area. Occasionally, a few boys used the volleyball courts when no net was present to play dodgeball. The tetherballs were rarely used even with the balls present. No jump ropes were provided at this school. On JAWS days, music was played and there were usually five to seven girls dancing on the blacktop to the music,

but this did not require loose equipment. Overall at school B, students were observed to participate in sedentary activities in areas with loose equipment (47%) compared to areas with no loose equipment (31%), and students were observed to participate in MVPA in areas with no loose equipment (69%) compared to areas with loose equipment (53%).

Table 17 provides on average the number and percentage of children, girls, and boys in different levels of PA in Target Areas that offered an organized PA program and areas that did not offer one. An organized PA program, JAWS, was offered only in one Target Area at school B on every day of the week except for Wednesdays. Therefore, Table 17 provides the average number of children and by gender across 8 days because data were collected over 10 days but two of those days did not offer an organized PA program. School K did not offer an organized PA program in the morning before school hours.

Table 17. School B: Average Number and Percentage of Students, by Gender, and Level of PA with Organized/No Organized PA Program Conditions across 8 Days (N = Total Students per Condition/8 Days) (No Wednesdays).

	Total students *M (%)*				Girls *M (%)*				Boys *M (%)*			
Condition	S	M	V	MVPA	S	M	V	MVPA	S	M	V	MVPA
Organized Activity	3.00 0.9%	210.13 66%	103.63 33%	313.75 99%	2.63 2%	111.63 73%	37.5 25%	149.38 98%	0.38 0.2%	98.50 60%	65.88 40%	164.38 100%
No Organized Activity	53.75 43%	51.12 41%	20.37 16%	71.50 57%	27.37 45%	21.50 36%	11.75 19%	33.00 55%	26.37 41%	29.63 46%	8.87 14%	38.50 59%

At school B on JAWS days, hardly any children were found to be sedentary in the area with the JAWS program (0.9%) compared to areas without the program (43%). Additionally, 99% of the children found in the JAWS area participated in MVPA compared to 57% found to participate in MVPA in the other areas. These findings were similar regardless of gender.

Research Question 6: Are there statistically significant differences in PA levels of children, boys, and girls before school hours at school B on JAWS versus non-JAWS days? Multiple paired-samples *t*-tests were conducted to evaluate whether there were statistical differences in the mean counts for the two conditions (JAWS days versus non-JAWS days) for the following variables: sedentary girls, MVPA girls, sedentary boys, MVPA boys, total sedentary children, and total MVPA children. There were statistically significant findings in the means scores between average sedentary boys counted in a Target Area on JAWS days and non-JAWS days and total sedentary boys and girls counted in a Target Area on JAWS days and non-JAWS days.

There was a statistically significant finding between average sedentary boys on JAWS days and non-JAWS days, with a statistically significant increase in the number of boys found in sedentary activities in Target Areas on Wednesdays (non-JAWS days) (M = 3.82, SD = 5.62) compared to JAWS days (M = 1.41, SD = 1.71; t (18) = -2.45, p < 0.05, two-tailed). The mean increase in sedentary boys per Target Area was -2.41 with a 95% confidence interval ranging from -4.47 to -0.34. The eta squared statistic (0.25) indicated a large effect size. The guidelines used for interpreting effect size or eta squared values are: 0.01 = small effect, 0.06 = moderate effect, and 0.14 = large effect (Cohen, 1988).

There was a statistically significant finding between total sedentary boys and girls counted in a Target Area on JAWS days and non-JAWS days, with a statistically significant increase in the number of boys found in sedentary activities in Target Areas on Wednesdays (non-JAWS days) (M = 8.11, SD = 12.84) compared to JAWS days (M = 2.99, SD = 3.85; t (18) = -2.23, p < 0.05, two-tailed). The mean increase in the number of sedentary boys and girls found per Target Area was -5.12 with a 95% confidence interval ranging from -9.94 to -0.30. The eta squared statistic (0.22) indicated a large effect size.

The paired-samples t-test requires the assumption of normality. The sample size for school B consisted of 19 Target Areas. In examining the data for skewness, all of the variables in this section had a value of less than three except for girls MVPA on JAWS days, boys MVPA on JAWS days, and total children MVPA on JAWS days, which all had values greater than 3. Therefore, these data were positively skewed. In examining the

data for kurtosis, all of the values were greater than 3 except for sedentary boys on JAWS days, boys MVPA on non-JAWS days, and total children MVPA on non-JAWS days. Therefore, the data for the other variables showed positive kurtosis, indicating that the distribution was peaked with long thin tails (Pallant, 2010). It is difficult to find a normal distribution in direct observational studies examining PA levels at different playgrounds because children can cluster in a Target Area and be scant in other areas.

The JAWS Target Area on JAWS days had 72% of the boys and girls counted on the playground in this area and 149 of the 182 total girls and 164 of the 203 total boys found in MVPA were counted in the JAWS area. This area is causing the kurtosis in the data. Although paired-samples *t*-tests did not identify significant differences in MVPA between children, boys, and girls on JAWS versus non-JAWS days at school B (probably due to the kurtosis in the data), 385 children were found to participate in MVPA on JAWS days compared to 135 children on non-JAWS days. Additionally, 182 girls and 203 boys were found to participate in MVPA on JAWS days compared to 60 girls and 75 boys on non-JAWS days (Tables 11 and 12). Figure 12 provides a bar graph showing the total children, girls, and boys in sedentary or MVPA at school B on JAWS and non-JAWS days.

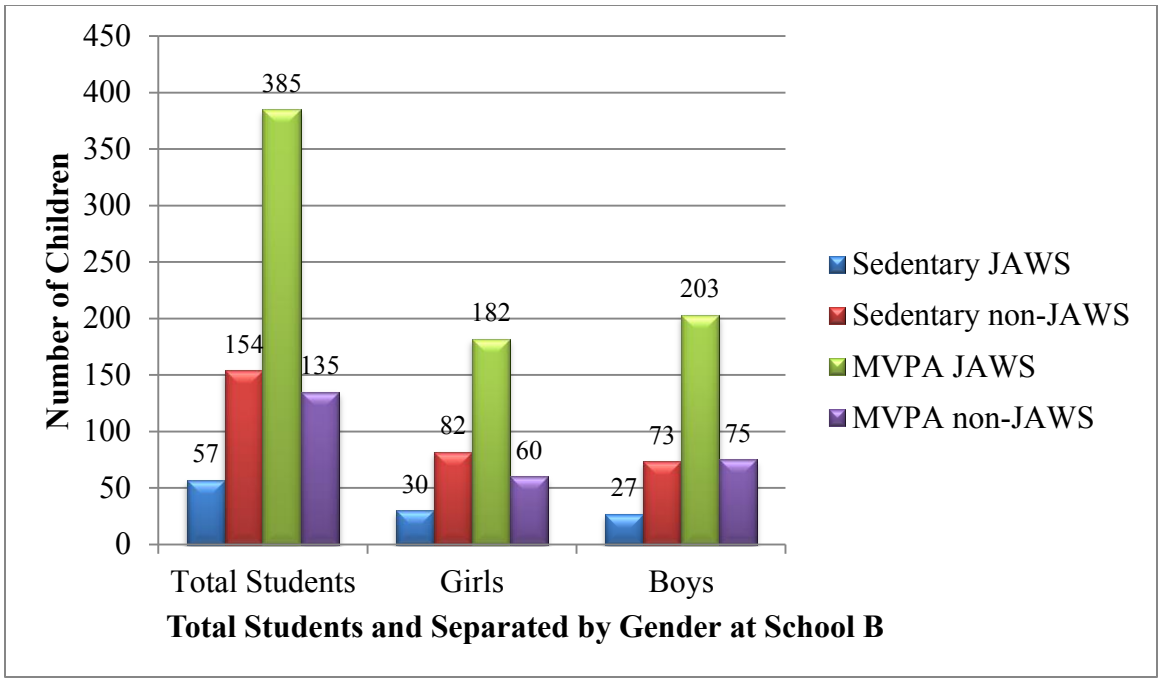


Figure 12. The number of children, girls, and boys in sedentary or MVPA on JAWS compared to non-JAWS days at school B. Based on data from Tables 11-12.

Research Question 7: Are there statistically significant differences in PA levels of children, boys, and girls between a school that offers free play and one that offers an organized PA program before school hours? In order to answer research questions 7 and 8, it was necessary to change the counts found in each Target Area to the average number of students found in the area divided by the area size and multiplied by 100,000 square feet. This was done so that the two playgrounds could be compared based on PA count per square foot, and the activity count divided by the square footage of the area was multiplied by 100,000 to have a number large enough to easily interpret during the analysis. Table 18 shows the average number of students at school K per area size in square feet multiplied by 100,000, by gender, in each Target Area on a "typical" morning before school hours. Table 19 shows the average number of students at school B on

JAWS days per area size in square feet multiplied by 100,000 square feet, by gender, in each Target Area on a "typical" morning before school hours.

Table 18. Average Number of Students at School K per Area Size x 100,000 square feet, by Gender, in each Target Area on a Typical Morning before School Hours.

	Total Students		Girls		Boys	
Target Area	S	MVPA	S	MVPA	S	MVPA
1	0.86	25.92	0.86	12.10	0	13.83
2	2.76	49.60	1.38	27.56	1.38	22.04
3	18.23	14.77	6.11	4.04	12.11	10.73
4	261.72	207.40	152.26	94.65	109.46	112.75
5	240.90	74.64	75.77	29.41	165.12	45.24
6	21.97	62.25	18.31	32.96	3.66	29.29
7	36.42	72.84	1.85	1.23	34.57	71.60
8	4.23	6.76	1.69	3.38	2.54	3.38
9	534.87	262.53	296.88	154.57	237.99	107.96
10	638.16	344.45	349.79	173.56	288.37	170.89
11	127.11	108.95	3.63	18.16	123.48	90.79
12	436.48	64.40	269.52	35.78	166.96	28.62
13	272.92	218.34	146.96	108.12	125.96	110.22
14	127.92	54.82	98.22	38.83	29.70	15.99
15	177.41	155.00	82.17	74.70	95.24	80.30
16	565.30	285.62	232.07	160.66	333.23	124.96

Note: S = sedentary, MVPA = moderate to vigorous physical activity

Table 19. Average Number of Students at School B on JAWS Days per Area Size x 100,000 square feet, by Gender, in each Target Area on a Typical Morning before School Hours.

	Total Students		Girls		Boys	
Target Area	S	MVPA	S	MVPA	S	MVPA
1	0	0	0	0	0	0
2	9.06	44.17	9.06	20.39	0	23.79
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	14.81	18.76	0	0	14.81	18.76
6	0	5.89	0	0	0	5.89
7	5.33	10.66	0	0	5.33	10.66
8	139.90	267.46	65.84	152.25	74.07	115.22
9	107.41	147.22	75.00	78.70	32.41	68.52
10	0	0	0	0	0	0
11	440.75	35.26	141.04	17.63	299.71	17.63
12	116.96	292.39	81.87	81.87	35.09	210.52
13	296.52	344.35	114.78	143.48	181.74	200.87
14	117.97	164.13	66.68	82.07	51.29	82.07
15	90.69	98.70	24.01	29.34	66.69	69.35
16	136.69	241.39	87.25	151.23	49.44	90.16
17	22.26	18.24	9.39	5.90	12.87	12.34
18	5.16	0	0	0	5.16	0
19	23.75	2483.69	20.78	1182.48	2.97	1301.22

Note: S = sedentary, MVPA = moderate to vigorous physical activity

In examining normality, the skewness and kurtosis for the variables examined at school K were close to zero. At school B, the kurtosis for any of the variables related to MVPA were close to 17, which may have an influence on the results for these variables as indicated in question 6. Multiple independent-samples *t*-tests were conducted to identify whether there were statistical differences in mean counts between the children, boys, and girls at school B on JAWS days and at school K for the following variables: average sedentary girls per square foot, average MVPA girls per square foot, average sedentary boys per square foot, average MVPA boys per square foot, average total sedentary children per square foot, and average total MVPA children per square foot. There were statistically differences between the schools in counts for average sedentary

girls per square foot, average sedentary boys per square foot, and average total sedentary children per square foot.

There was a statistically significant difference in counts for average sedentary girls per square foot between school K (M = 108.59, SD = 119.90) and school B on JAWS days (M = 36.62, SD = 45.64; t (18.65) = 2.27, $p < 0.05$, two-tailed), with school K having higher average sedentary girls per square foot count compared to school B. The magnitude of the differences in the means (mean difference = 71.98, 95% *CI*: 5.44 to 138.51) was moderate (approaching large) (eta squared = 0.13). There was a significant difference in counts for average sedentary boys per square foot between school K (M = 108.11, SD = 107.51) and school B on JAWS days (M = 43.77, SD = 76.08; t (33) = 2.07, $p < 0.05$, two-tailed), with school K having higher average sedentary boys per square foot count compared to school B. The magnitude of the differences in the means (mean difference = 64.34, 95% *CI*: 1.03 to 127.66) was moderate (eta squared = 0.11). There was a significant difference in counts for average total sedentary children per square foot between school K (M = 216.70, SD = 218.97) and school B on JAWS days (M = 80.38, SD = 117.01; t (22.02) = 2.24, $p < 0.05$, two-tailed), with school K having higher average total sedentary children per square foot count compared to school B. The magnitude of the differences in the means (mean difference = 136.32, 95% *CI*: 9.88 to 262.76) was moderate (approaching large) (eta squared = 0.13).

As discussed in Research Question 6, although paired-samples t-tests did not identify significant differences in MVPA between children, girls, and boys on JAWS days at school B compared to school K (probably due to the kurtosis in the data), 385 children were found to participate in MVPA on JAWS days at school B compared to 135

children at school K (Tables 10-11). Additionally, 182 girls and 203 boys were found to participate in MVPA on JAWS days at school B compared to 58 girls and 77 boys at school K (Tables 10-11). Figure 13 provides a bar graph showing the total children, girls, and boys in sedentary or MVPA at school B on JAWS days compared to school K.

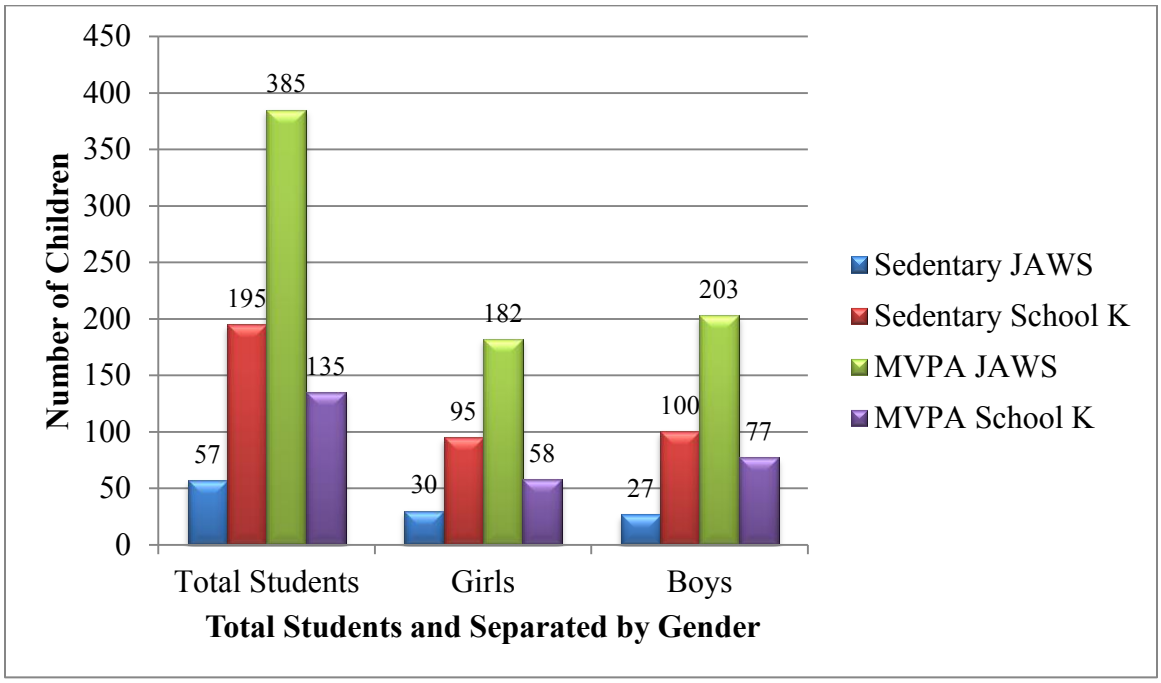


Figure 13. The number of children, girls, and boys in sedentary or MVPA on JAWS days at school B compared to school K. Based on the data from Tables 10-11.

Research Question 8: Are there statistically significant differences in PA levels of children, boys, and girls before school hours between school K and school B on non-JAWS days? Table 20 shows the average number of students at school B on non-JAWS days per area size in square feet multiplied by 100,000 square feet, by gender, in each Target Area on a "typical" morning before school hours. This data were compared to the data from Table 18 using multiple independent-samples *t*-tests.

Table 20. Average Number of Students at School B on non-JAWS Days per Area Size x 100,000 square feet, by Gender, in each Target Area on a Typical Morning before School Hours.

	Total Students		Girls		Boys	
Target Area	S	MVPA	S	MVPA	S	MVPA
1	0	0	0	0	0	0
2	0	31.71	0	0	0	31.71
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	59.23	59.23	0	0	59.23	59.23
6	125.73	7.86	117.87	7.86	7.86	0
7	31.97	10.66	0	0	31.97	10.66
8	526.70	345.65	312.73	148.13	213.97	197.51
9	222.22	133.33	155.56	66.67	66.67	66.67
10	57.80	77.07	57.80	77.07	0	0
11	423.12	211.56	70.52	70.52	352.60	141.04
12	608.18	654.96	327.48	233.91	280.70	421.04
13	573.92	459.13	191.31	191.31	382.61	267.83
14	0	246.20	0	143.61	0	102.58
15	85.36	149.38	32.01	74.69	53.35	74.69
16	186.13	651.46	116.33	302.46	69.80	349.00
17	111.57	71.87	60.07	38.62	51.49	33.26
18	123.80	0	20.63	0	103.17	0
19	19.79	23.75	0	0	19.79	23.75

Note: S = sedentary, MVPA = moderate to vigorous physical activity

In examining normality, the skewness and kurtosis for the variables examined at both schools were less than 1.7 for all variables. Multiple independent-samples *t*-tests were conducted to identify whether there were statistical differences in mean counts between the children, boys, and girls at school B on non-JAWS days and at school K for the following variables: average sedentary girls per square foot, average MVPA girls per square foot, average sedentary boys per square foot, average MVPA boys per square foot, average total sedentary children per square foot, and average total MVPA children per square foot. There was no statistically significant difference between the schools in counts for any of the variables examined: average sedentary girls per square foot (school

K *M* = 108.59, *SD* = 119.90; school B non-JAWS days *M* = 76.96, *SD* = 103.84; *t* (33) = 0.84, *p* = 0.41, two-tailed), average MVPA girls per square foot (school K *M* = 60.61, *SD* = 59.60; school B non-JAWS days *M* = 71.31, *SD* = 91.66; *t* (33) = -0.40, *p* = 0.69, two-tailed), average sedentary boys per square foot (school K *M* = 108.11, *SD* = 107.51; school B non-JAWS days *M* = 89.12, *SD* = 123.57; *t* (33) = 0.48, *p* = 0.63, two-tailed), average MVPA boys per square foot (school K *M* = 64.91, *SD* = 50.67; school B non-JAWS days *M* = 93.63, *SD* = 126.93; *t* (33) = -0.85, *p* = 0.40, two-tailed), average total sedentary children per square foot (school K *M* = 216.70, *SD* = 218.97; school B non-JAWS days *M* = 166.08, *SD* = 207.47; *t* (24.41) = -0.90, *p* = 0.38, two-tailed), and average total MVPA children per square foot (school K *M* = 125.52, *SD* = 106.13; school B non-JAWS days *M* = 164.94, *SD* = 214.55; *t* (27.22) = -0.71, *p* = 0.49, two-tailed).

The magnitude of the differences in the means for average sedentary girls per square foot (mean difference = 31.63, 95% *CI*: -45.29 to 108.55) was small (eta squared = 0.02). The magnitude of the differences in the means for average MVPA girls per square foot (mean difference = -10.70, 95% *CI*: -65.05 to 43.65) was small (eta squared = 0.01). The magnitude of the differences in the means for average sedentary boys per square foot (mean difference = 19.00, 95% *CI*: -61.46 to 99.45) was small (eta squared = 0.01). The magnitude of the differences in the means average MVPA boys per square foot (mean difference = -28.72, 95% *CI*: -94.20 to 36.77) was small (eta squared = 0.02). The magnitude of the differences in the means average total sedentary children per square foot (mean difference = 50.62, 95% *CI*: -96.26 to 197.51) was small (eta squared = 0.02). The magnitude of the differences in the means average total MVPA children per square foot (mean difference = -39.42, 95% *CI*: -154.11 to 75.27) was small (eta squared =

0.01). Figure 14 shows the number of children, girls, and boys in sedentary or MVPA on non-JAWS days at school B compared to school K based on the data from Tables 10 and 12.

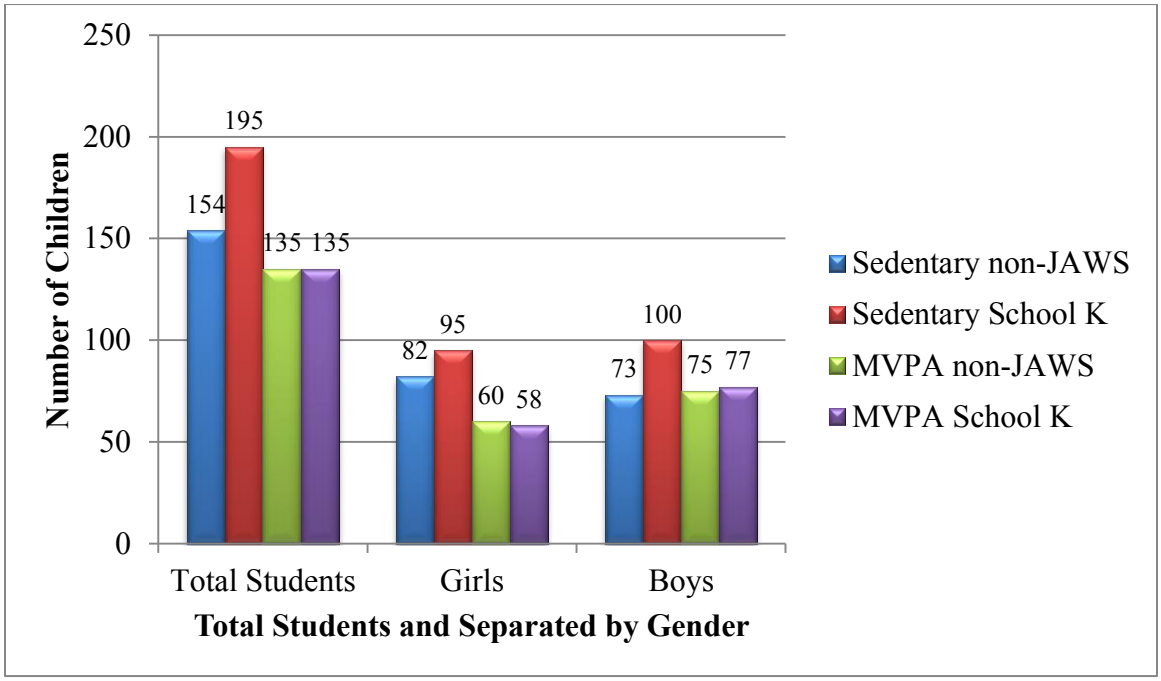


Figure 14. The number of children, girls, and boys in sedentary or MVPA on non-JAWS days at school B compared to school K. Based on the data from Tables 10 and 12.

Chapter Summary

The data collected from school K and school B were analyzed using SPSS 22 (IBM, 2013). This chapter presented the pilot data collection results, description of the sample, and the results of the statistical analyses guided by the eight research questions.

CHAPTER SIX

DISCUSSION

The purpose of this chapter is to discuss the results of this study in the context of existing literature. More specifically, this chapter provides a discussion on the findings, implications for nursing, recommendations for future research, and a conclusion.

Discussion of the Findings

As discussed in Chapter 3 of this paper, the Ecological Model of Four Domains of Active Living (Sallis et al., 2006) was used to guide this study. This model provides a framework to understanding the various factors and behaviors that promote or act as barriers to PA participation. This ecological model suggests that active living requires the targeting of four levels: individual, social/cultural environment, physical environment, and policy to effectively bring change. This study examined several variables related to PA levels of children on the playground within the context of the individual, social, and physical environment. This section will discuss these findings in the context of current literature.

Individual. As discussed in Chapter 2, the individual variables that were found in the literature included gender, age, and ethnicity. The variable examined in this study from the three was gender. Gender has frequently been studied in the literature, with boys consistently shown to be more active than girls (Dyment et al., 2009; Jones et al., 2010; McKenzie et al., 2010; Parrish et al., 2009; Ridgers & Stratton, 2005; Ridgers et al., 2007; Ridgers et al., 2010; Ridgers et al., 2011; Stellino et al., 2010; Verstraete et al., 2006; Willenberg et al., 2010; Zask et al., 2001). This study found the same finding at school K and at school B regardless of the JAWS program. However, this study did find

that the difference in MVPA between boys and girls was the least on JAWS days (MVPA boys 88%, MVPA girls 86%) compared to non-JAWS days (MVPA boys 51%, MVPA girls 42%) and school K (MVPA boys 44%, MVPA girls 38%) (Tables 10-12). Additionally, it was interesting to see that because students were observed over 10 days, the observers started to recognize the same children in many of the same Target Areas. For example, there were two boys who consistently sat on the same bench every day at school K.

Studies have recommended further research on identifying playground areas and activities that attract and increase PA levels in both boys and girls (Dyment et al., 2009; Parrish et al., 2009; Stellino et al., 2010). This study found that at school K and school B on non-JAWS days the blacktop, grass, and manufactured equipment attracted the most boys and girls (Figure 9). In this study, there was no particular activity on the blacktop that generally occurred. Approximately 50% of the children were sedentary in these areas. Often children were waiting next to their backpacks for the bell to ring to start school. Many children who participated in MVPA were just passing over the blacktop to get to their destinations. At school K, girls were found participating in MVPA on the blacktop using jump ropes in approximate equal numbers as boys. The problem was that there were only 5-10 children found using the jump ropes. There were jump ropes left over in the basket of loose equipment. Therefore, there was an issue of attracting more children to use the jump ropes. At school B, a few girls would participate in MVPA by dancing to the music played only on JAWS days. As found on the blacktop, 50% of the boys and girls were sedentary in the grass at school B on non-JAWS days and at school K

(Tables 10 and 12). There was no particular activity on the grass at school B. At school K, boys consistently played soccer and kickball on the grass.

On JAWS days at school B, 72% of boys and girls who were counted on the playground on a "typical" day were found in the JAWS area (Table 8). The JAWS program also encouraged 98% of the girls to participate in MVPA and 100% of the boys. Therefore, for this school, this is one program attracted both boys and girls equally and encouraged MVPA for both genders.

Social. From the literature reviewed in this study, five variables were examined: SES, providing an organized PA program, supervision, social prompting, and role modeling games that increase PA. This study further explored providing an organized PA program and supervision. In the literature, Willenberg et al. (2010), Huberty et al. (2011), and Chin and Ludwig (2013) found a positive association between adult supervision and PA levels in children, but McKenzie et al. (2010) found that children were engaged in less MVPA with supervision.

This study found both schools had a higher percentage of children found sedentary in areas without supervision compared to areas with supervision. Additionally, at both schools, a higher percentage of children were found participating in MVPA in areas that were supervised over areas that were not supervised (Tables 13 and 14). At school B, the JAWS program is directly supervised by the PE teacher. This area attracts the highest percentage of students, and most of these students participated in MVPA. Additionally, at school K, 44% of the Target Areas were directly supervised and at school B, 33% were. School B used less supervision, especially on JAWS days because most of

the children were populated on the JAWS track. A couple of teachers were able to watch this entire area.

Howe et al. (2012) found that providing a structured recess using games compared to offering only free play increased MVPA in children. McKenzie et al. (2010) found similar findings with girls in that they tended to engage in more MVPA in areas with organized physical activities, but boys had similar PA levels in areas with or without organized activities. This study found that more girls were found sedentary than boys with or without an organized activity, and boys were found participating in MVPA more often than girls with or without an organized PA program (Table 17). This supports the current literature that in general boys are more active than girls.

Additionally, this study found that both girls and boys were found less sedentary and participated in increased MVPA in the Target Area that offered an organized PA program over areas that did not offer this program. Boys participated in MVPA 100% of the time with the organized PA program compared to 59% without the program, and girls participated in 98% MVPA with the program compared to 55% without the program (Table 17). Additionally, 45% of girls compared to 2% and 41% of boys compared to 0.2% were found sedentary in areas without the organized PA program compared to the area with the program (Table 17). The JAWS area attracted 72% of the boys and girls counted on the playground in a “typical” day. One possible reason for this is that the gates are open at school B on JAWS days 10 minutes earlier then they are on non-JAWS days to allow the students to participate in JAWS. The children who arrive on the playground early to school must participate in JAWS. After the 10 minutes, the children can participate in any other activity on the playground, but on JAWS days, minimal loose

equipment is provided for the children. Therefore, children may have stayed on the JAWS track because they already started there and did not want to change to a new activity.

Research questions 6-8 were asked to further explore activity levels with an organized program compared to without one. Statistically significant differences were found in mean counts for students on JAWS versus non-JAWS days at school B for sedentary boys and total sedentary students. Statistically significant differences were found in mean counts for students on JAWS days at school B and school K for average sedentary girls per square foot, average sedentary boys per square foot, and average total sedentary students per square foot. No significant difference was found in counts for any of the PA variables examined between school K and school B on non-JAWS days. Therefore, this study does indicate that supervision and offering an organized PA program such as JAWS may have a positive influence on increasing MVPA for both boys and girls. No statistical differences were found in the *t*-tests analyses for MVPA, but the data showed high kurtosis (>18) because the children at school B on JAWS days were highly populated in the JAWS Target Area.

Physical Environment. In Chapter 2, seven physical environmental variables were discussed from the studies examined: weather, size of playground space, accessibility of playground space, usability of playground space, loose equipment, fixed equipment, and paint markings. The variables further explored in this study were weather, accessibility of playground space, usability of playground space, loose equipment, fixed equipment, and paint markings.

Zask et al. (2001) and Ridgers et al. (2010) found no significant difference in children's PA in relation to the temperature. In contrast, Ridgers et al. (2010) found the temperature to have a negative association with vigorous activity in children. Although this study was not seeking to explore the relationship between temperature and PA levels, the temperature was documented each day for data collection because Henderson could have extreme heat temperatures. This study found no significant differences in PA level counts for school B when the temperature was 50 degrees Fahrenheit compared to when the temperature was 70 degrees Fahrenheit. Additionally, there were no significant differences in PA level counts for school K when the temperature was 83 degrees Fahrenheit compared to when the temperature was 70 degrees Fahrenheit. Therefore, this study found similar findings to Zask et al. (2001) and Ridgers et al. (2010), where there were no significant differences in mean counts of PA levels of children on the playground in relation to the temperature at these two schools.

McKenzie et al. (2010) observed 137 Target Areas in 13 elementary schools and found that the Target Areas were typically accessible (99.4%) and usable (98.5%). This study had similar findings in which 35 Target Areas in 2 elementary schools were observed and 100% of the areas were usable, 100% of the areas were accessible at school K, and 75% of the areas were accessible at school B (Figure 10). The SI was informed that Target Areas 1-4 at school B (Figure 2) were not accessible to the students because more supervision was needed to cover these areas. It was interesting that although these areas were not accessible, the tetherballs were placed in the morning in Target Area 4 on non-JAWS days. This will be discussed further under loose equipment. Additionally, resources were used to create a new paint marking in Target Area 2 during data

collection, but the students did not have access to this area before school hours. This will be discussed further under paint markings. It would be beneficial to know if these areas were used during another break at school.

Studies have shown a positive association between offering loose equipment (e.g., balls, jump rope) and PA levels in children (Huberty et al., 2011; Ridgers et al., 2010; Ridgers et al., 2010c; Verstraete et al., 2006; Willenberg et al., 2010). Similar findings were seen at school K. School K provided loose equipment (balls, jump ropes, and tetherballs) for the children every day during data collection. A higher percentage of students were found sedentary in areas without loose equipment (61%) compared to areas with loose equipment (56%). Additionally, at school K, a higher percentage of children were found to participate in MVPA with loose equipment (44%) compared to areas without loose equipment (39%) (Table 15).

When gender was specifically examined, it was found that the intensity of PA for girls at school K was not associated with loose equipment (62% of the girls were sedentary and 38% participated in MVPA in areas with or without loose equipment). Girls were observed to rarely use the loose balls. Zask et al. (2001) found that the balls-to-child ratio was a one-tailed significant predictor to increased vigorous physical activity, but this study did not discuss gender differences related to this. McKenzie et al. (2010) indicated that both boys and girls participated in more MVPA in areas that provided loose equipment, but it was not documented during data collection how much equipment was available or whether a boy or girl was using it. In this study, the exact amount of loose equipment was not documented, but there was always loose equipment left over in a basket that was brought out every day for the students to use at school K.

Therefore, there was loose equipment available for use if the students wanted to use it. In this study, boys used the loose balls and girls did not. As in previous research studies, the boys at school K were found to be more sedentary in areas without loose equipment (53%), and a higher percentage of boys participating in MVPA were found in areas with loose (47%) compared to areas without loose equipment(40%).

Previous studies have recommended identifying ways that the playground physical environment could be altered to increase PA levels in both boys and girls (Dyment et al., 2009; Parrish et al., 2009; Stellino et al., 2010). This study did find that both boys and girls used the jump ropes equally at school K, but about only 10 total children used the jump ropes and there were extras in the loose equipment basket. School B did not offer jump ropes. The girls predominately were not attracted to balls, but the balls were used for competitive activities such as kickball and basketball. According to Blatchford, Baines, and Pellegrini (2003), boys are more active than girls in those areas that promote sport based, rule bound PA. Moreover, Pellegrini (1995) found that girls tend to choose social interaction rather than competitive activities on the playground. The findings from this study support the literature because using the jump ropes is not a competitive sport based activity, and it offers open play. Additionally, most girls stayed away from any competitive activities with the balls.

The only competitive activity that the girls and boys both participated in was the tetherballs. The tetherballs were used by both boys and girls at both schools. However, the tetherball areas did not attract many children (Tables 7-9). Ridgers et al. (2010c) found that girls often socialized in smaller groups and boys preferred larger groups. This may be one reason why the girls preferred the tetherballs because it requires only two

children to play (or the child can play alone) compared to basketball, dodgeball, or soccer, where more children are needed to play. School K always had all the tetherballs placed on poles during data collection. At school B, the tetherballs were placed on poles only on non-JAWS days, which was once a week. The children had access only to the tetherballs in Target Area 10 (Figure 2). They did not have access to the tetherballs in Target Area 4. The children may have not used the tetherballs because they had access only to a limited number of them and once a week.

The manufactured equipment attracted 25% of the children at school K and 14% of the children on non-JAWS days at school B. On JAWS days, only 5% of the children counted on the playground were found on the manufactured equipment (Tables 7-9). At school B, the manufactured equipment attracted approximately equal percentages of girls and boys. At school K, more girls (29%) were found on the manufactured equipment than boys (22%). According to Dyment et al. (2009), the manufactured equipment is another area that promotes open ended play and is not centered on rules or sport based activity. Therefore, this may be one explanation as to why more girls were found on the manufactured equipment than boys at school K.

Dyment et al. (2009) found that approximately 40% of the girls and boys found on the manufactured equipment were participating in vigorous PA. In this study, at school K, about only 10% of the boys and girls found on the manufactured equipment were participating in vigorous activity. At school B on non-JAWS days, close to 20% of boys and girls participated in vigorous PA, and on JAWS days 36% of girls and 20% of boys participated in vigorous PA. The percentages were lower overall compared to the Dyment et al. (2009) study, and at school K (66%) and at school B on non-JAWS days

(59%) of the children were found sedentary on the manufactured equipment. There may be a couple reasons for this. First, the designs of the manufactured equipment may promote or hinder PA. Secondly, in these particular areas, supervision always took place. The observers frequently heard the supervisors ask the children in these areas to walk or slow down. This was similar to the finding by McKenzie et al. (2010), where children engaged in less MVPA with supervision because supervisors are trained to ensure that children are safe, which often suppresses PA instead or promoting it. However, overall this study found that children participated in increased MVPA in supervised areas (Tables 13-14), this may not have been the case in the areas with manufactured equipment in this study.

Studies have found that painted playground marking had a positive influence on MVPA for children (Stratton & Mullan, 2005; Ridgers et al. 2010b), but studies have also shown no significant difference in MVPA in children after the playground environment was painted (Ridgers et al., 2007; Kelly et al., 2012). This study found that 17% of the children at school K used the playground markings, and this was about equal for both genders (Table 7). At school K, the hopscotch was only in the kindergarten area and it was rarely used. The most commonly used painted marking was the four-square at school K. The kindergarten area had most of the blacktop area painted, but the children rarely used it. There was no loose equipment given to the children to use on the painted marking, except for four-square areas. At school K, approximately 80% of the children were sedentary on the painted marking, regardless of gender (Table 10).

Most of the playground markings at both schools were white. School K had multicolor markings for letters and numbers only in the kindergarten area (Figure 15). On

a “typical” day at school K, eight children were found on these playground markings in the kindergarten area. Out of these eight children, approximately six were found sedentary and two were involved in MVPA. Therefore, 75% of the children even in the kindergarten area at school K with multicolor markings were sedentary.

Figure 15. School K. Kindergarten playground markings with color.

At school B on JAWS days, 2% of the children used the painted marking and on non-JAWS days, 5% of the children used the painted markings. On JAWS days, the area was used equally by boys and girls, but on non-JAWS days, more girls (8%) used the painted markings than the boys (2%) (Tables 8-9). On JAWS days, 55% of the girls and 65% of the boys participated in MVPA, and non-JAWS days, 35% of the girls and 84% of the boys participated in MVPA (Tables 10-11). Although children were found to

participate in MVPA in these areas, it attracted only a small percentage of children. Moreover, 65% of the girls on non-JAWS days were sedentary in painted marking areas.

This study was not intended to specifically examine the association among new painted markings and PA levels of children or if this would attract children, but during data collection at school B, an unexpected event occurred. All of the painted markings on the playground were repainted. Pictures were taken in August 2013 to assist with creating the maps. This was before the markings were repainted (Figure 16). Pictures were retaken at the end of September before data collection because the observers noticed that the markings had been repainted (Figure 17). The painted marking areas attracted only a few children even with the new paint.

Figure 16. Painted markings taken at school B in August 2013.

Figure 17. Painted markings taken at school B in September 2013.

It was also observed that in August 2013, there were no painted markings on the blacktop near the manufactured equipment in Target Area 1 (Figure 18). In September 2013, a new painted marking was created in this area on the blacktop when the rest of the playground was repainted (Figure 19). Although this new painted marking was created, the children were not allowed to play in this area during leisure time before school hours. The SI was not sure whether or not the new painted marking ever got used during school. The new painted marking was never used in the morning before school during data collection.

Figure 18. School B. Blacktop near Target Area 1. Photo taken August 2013.

Figure 19. School B. Blacktop near Target Area 1. Photo taken September 2013.

Overall, the findings from this study were similar to what Ridgers et al. (2007) and Kelly et al. (2012) found in that the children in this study were not attracted to the playground markings as much as there were to other Target Areas and many of the children in these areas were found sedentary. School B had eight four-square painted markings and nine hopscotches that were never used.

Limitations

Limitations are restrictions in a study that can decrease the generalizability of the findings (Burns & Grove, 2009). This study contained the following limitations:

1. This study had a small sample size of two school playground environments with a total of 35 Target Areas. The schools were located in one city, Henderson, Nevada and contained a combined student population of approximately 1300.
2. The identification of gender was subjective.
3. Children may have been counted twice or missed during a scan.
4. The schools were selected using purposive sampling.
5. Data were collected for only two days on non-JAWS days, Wednesdays, during the two weeks of data collection.
6. Not all of the children were on the playground in the morning. Children trickled in. Neither school provided a mandatory breakfast, but both offered breakfast during morning leisure time before school hours. Children could be in the cafeteria or on the playground during this time. The school buses were supposed to arrive at the schools by the time the children were allowed on the playground, but the buses could run late.

Implications for Nursing

Childhood obesity is a serious public health challenge which needs community support and engagement in developing opportunities for healthy lifestyles (WHO, 2012). Healthy individuals are needed to sustain communities. Schools have been recognized as places that can reach many children (Pate et al., 2006). Providing school environments that can increase PA levels in children can decrease the risk of childhood obesity and provide opportunities for healthy lifestyles (Pate et al., 2006). Nurses working in the area of child health promotion and research can work with schools to establish environments for children that promote healthy lifestyles, such as providing opportunities for children to increase PA levels.

It is important for nurses working in the area of child health promotion to understand the factors associated with PA because this will guide interventions based on evidence (Sallis et al., 2011) and will provide evidence for nurses to use in advocating for school resources. This study adds to the growing body of research in the area of the role of school playgrounds and conditions during leisure time in promoting PA in children (Dyment et al., 2009; Jones et al., 2010; McKenzie et al., 2010; Parrish et al., 2009; Ridgers & Stratton, 2005; Ridgers et al., 2007; Ridgers et al., 2010; Ridgers et al., 2011; Stellino et al., 2010; Verstraete et al., 2006; Willenberg et al., 2010; Zask et al., 2001). More specifically, this study adds information on conditions of Target Areas and PA levels of children, playground areas that attract children, and PA levels of children by Target Area design type.

This study found that an organized PA program, JAWS, attracted both boys and girls equally. This program attracted 72% of the boys and 72% of the girls found on the

playground on a day that JAWS took place. It is important to find PA programs that attract both boys and girls (McKenzie et al., 2010). This may be one program that does. Boys may be attracted to the area because it allows for competitiveness when competing for the next colored card (the punch cards for the number of laps completed change colors as the child advances in miles). According to Pellegrini (1995), boys enjoy competitive activities on the playground. Girls enjoy social interaction (Pellegrini, 1995) and small groups (Ridgers et al., 2010c), and the JAWS program allows for the children to walk or jog at their own pace. The children could walk alone, in small groups, or in large groups. Children could run or walk and socialize. This may be a reason that girls are attracted to the JAWS track as well. Participating in JAWS does not have to be competitive, and there is opportunity to socialize. Additionally, the children are able to participate in 25 minutes of PA in the morning in which they are predominately in MVPA. With this type of program, the children can receive almost half of the recommended 60 minutes daily of MVPA (Troiano et al., 2008) in just one morning leisure period. School nurses or nurse researchers could advocate for programs such as JAWS to be offered at elementary schools to assist with increasing MVPA in children outside of PE.

This study also supported current research which found a positive association between adult supervision and PA levels in children (Willenberg et al., 2010; Huberty et al., 2011; Chin & Ludwig, 2013). In this study, the highest percentages of students at both schools participating in MVPA were found in Target Areas that were supervised, and the highest percentages of students found sedentary were in unsupervised Target Areas. Additionally, at school B, there was less supervision compared to school K. This

is probably because the children were predominately populated in the JAWS area. This may be helpful information for school nurses or nurse researchers to inform school faculty members if they are finding it difficult to provide supervision on the playground. If an organized PA program is offered in which many children are participating in MVPA in a specific area, this could assist with supervision because the supervisors are not spread across large playground spaces to supervise children.

This study did not find differences in PA levels between the temperatures of 50 degrees and 70 degrees Fahrenheit at school B and between 70 and 83 degrees at school K. This is helpful to know that children participated in PA if it was 50 degrees Fahrenheit or 83 degrees Fahrenheit. School faculty may bring the children inside or not allow a PA program to take place depending on the temperature outside. School faculty may consider allowing children to participate in PA on the playground either in free play or with a PA program even in cooler or warmer temperatures as long as it is safe for the children.

This study examined gender differences in attraction to areas and types of activities that may interest either gender. This is important to understand when school nurses or researchers are working with school faculty in identifying playground areas or activities that promote MVPA for each gender. Besides the JAWS program, both boys and girls used the painted markings, jump rope, four square, and tetherball. It would be beneficial to identify ways to attract a larger percentage of children to these areas. In this study, boys tended to play in competitive sport activities with larger groups of children (dodgeball, soccer, basketball, kickball). Girls also participated in dancing at school B during JAWS days. Besides the JAWS area, the blacktop, manufactured equipment, and the grass attracted the largest number of children. About 50% of the children found in

these areas were sedentary for schools K and school B on non-JAWS days. Therefore, it is important to identify ways to increase MVPA in these areas. Additionally, because not all activities and areas attracted both genders, it is important for playgrounds to provide areas and offer activities that allow both genders to be physically active.

This study also found that repainting markings did not attract more children to these areas. Although a new painted marking was added during this study to school B, this study was not able to identify if this would have attracted children because children were not allowed to play in this area before school. If the repainting of markings is not successful in attracting children to these areas or increasing MVPA in these areas, this school could possibly use the future resources allocated to repainting the playground in other areas that may attract and increase MVPA in children. Other schools can identify the best ways to use any resources related to the playground to ensure that it will attract children and increase PA levels of boys and girls. Additionally, if schools are trying new painted markings, this should be placed in areas where children are highly populated. This may be a better use of this resource because the painted markings would be easily accessible to a large number of children.

Recommendations for Future Research

This study examined only one school that offered a jogging and walking program. This program was very successful in attracting a large percentage of both boys and girls from the playground into this area. Additionally, this program was very successful in having almost 100% of both boys and girls participate in MVPA during this program. It is recommended to conduct a study with a larger sample size of elementary schools that offer a jogging and walking program to see if the success of attracting both genders and

increasing PA levels of children is similar to the findings from this study. Another recommendation is to evaluate the incentives offered at each school to run such a program and examine if the incentives have an influence on the amount of participation from students in these programs. It would be interesting to see if there were any correlations between the children who participate in the JAWS program and positive academic achievements.

Further research is needed in the influence of painted markings and PA levels of children. Additional research is recommended with the influence of the temperature and PA levels of children. Research with different types of manufactured equipment and gender differences could be further explored. Research in the area of the conditions identified by Dr. McKenzie et al. (2010) is still growing. This study added to this area, but further research is needed with larger sample sizes on offering loose equipment, providing an organized PA program, and supervision.

Conclusion

This study used a cross-sectional design to determine which types of playground areas and Target Area conditions attract children and promote MVPA or sedentarism. Purposive sampling was used to select two CCSD elementary school playgrounds (school B offered an organized PA program and school K offered free play) to observe. A total of 35 Target Areas between the two schools were observed over 20 days using SOPLAY. The data were compared for school K, school B on JAWS days, and school B on non-JAWS days. On JAWS days at school B, the JAWS area attracted 72% of the children found on the playground and nearly 100% of the children participated in MVPA. On non-JAWS days at school B and at school K, the basketball courts and the tetherball areas had

the greatest percentages of total students found in vigorous or MVPA by Target Area design type, but these areas attracted only less than 8% of the children found on the playground.

The highest populated areas for school K and school B on non-JAWS days were the general blacktop areas and approximately 50% of the children in these areas were sedentary. Gender differences in each Target Area were examined. At both schools, 100% of the Target Areas were usable. At school K, 100% of the Target Areas were accessible and 75% were at school B. At school K, 44% of the Target Areas were directly supervised and 33% were at school B. The highest percentages of students found in Target Areas in MVPA were in supervised areas. At school K, loose equipment did not have an association with PA levels for girls, but had a positive association with boys. At school B, more children were found participating in MVPA in areas without loose equipment (e.g., the JAWS area).

There was a statistically significant increase between total sedentary boys and girls counted in a Target Area on JAWS days compared to non-JAWS days with an increase in the number of students found in sedentary activities in Target Areas on Wednesdays, non-JAWS days, compared to JAWS days. Statistically significant differences were found in counts for average sedentary girls per square foot, average sedentary boys per square foot, and average total sedentary children per square foot at school K compared to school B on JAWS days, with school K having higher average sedentary children per square foot than school B on JAWS days . There were no statistical differences in mean counts between children, boys, and girls at school B on non-JAWS days compared to school K for any of the PA levels examined per square foot.

The number of minutes offered for PE has decreased across the nation in elementary schools, and the number of obese children has risen concurrently, making it difficult for communities to sustain healthy populations. Therefore, it is imperative for schools to identify ways to increase MVPA in children outside of PE, which may decrease the risk of childhood obesity. One way to increase MVPA in children outside of PE is to examine ways to increase PA levels on the playground during leisure time offered at school. It is also important to be sensitive to gender differences in relation to attraction of playground designs, activities, and conditions. This study adds to the growing body of literature on the relationship among playground designs and conditions and the influence they may have on attracting children to areas of the playground that promote MVPA. This study specifically added information on gender differences in relation to PA levels and the playground environment. Offering a jogging and walking type organized PA program may be beneficial for increasing PA levels and attracting both boys and girls to this area. It does not require loose equipment and may decrease the need for supervising larger areas. Additionally, this type of program may be one way to provide healthy lifestyle choices while at school, which may help sustain healthy populations. Further research is needed in this area.

APPENDIX A: INSTRUMENT PERMISSIONS

Gmail by Google

Ipuna Black [redacted]

PhD Nursing Student

Sallis, Jim [redacted]
To: Ipuna Black [redacted]

Wed, Mar 20, 2013 at 5:05 PM

Hello

Thanks for your interest in the model. Yes, you may use the model in your dissertation. The attached is a better quality version.

jim

James F. Sallis, Ph.D.

Distinguished Professor of Family and Preventive Medicine

Chief, Division of Behavioral Medicine

University of California, San Diego, mail code 0824

Director, Active Living Research

[redacted]

[redacted]

www.activelivingresearch.org

Re: PhD Nursing Student- Permission SOPARC
2 messages

Thomas McKenzie [redacted] Fri, Apr 5, 2013 at 6:04 AM

To: Ipuna Black [redacted]

Cc: Monica Lounsbery [redacted]

Greetings.

Am now back in San Diego.

Thanks for your interest in our instruments.

Please feel free to use the SOPLAY/SOPARC instrumentation for your study.

Cheers,

THOM

APPENDIX B: VARIABLES IN THE LITERATURE REVIEW EXAMINED WITH PA

Study	Sample Size	Limitations	Variables		
			Individual	Social	Physical Environment
Chin & Ludwig (2013)	25 N.Y. city public elementary schools [15 with Recess Enhancement Program (REP) & 10 without]	Cross-sectional (not possible to determine that the REP intervention caused increases in vigorous PA).		**Coach** guides children through age-appropriates games aimed at increasing PA levels. + influence on PA levels	
Dyment et al. (2009)	Purposive sampling: Two elementary schools: One in Australia and one in Canada. Australia: School had approximately 400 students from middle-upper class neighborhood. Canada: School had approximately 700 students from upper class neighborhood.	Sample size. Data collected over 11 days in Australia and over 7 days in Canada. Only descriptive analysis used.	**Gender**: Boys + more active than girls.		**Fixed equipment and play space**: Highest percent of boys and girls engaged in MVPA was on manufactured equipment and green areas. Girls ↓ PA on conventional school grounds comprised of asphalt and open playing fields. Most popular area for boys was the paved sporting courts and just over half of the boys were sedentary.

(continued)

Study	Sample Size	Limitations	Variables		
			Individual	Social	Physical Environment
Efrat (2013)	Children from 3 demographically matched schools (*N* = 161) and fourth-grade classrooms in a suburban area of Los Angeles County. Social prompting group *N* = 59, comparison group *N* = 51, and modeling group *N* = 51.	Small sample size from one area. Could not control for the amount of playground equipment at each school, the quantity and quality of role modeling, classroom teacher's enthusiasm for PA, and school recess-time practices. Did not measure impact of either modeling or social prompting on overall PA.		**Social prompting** by teachers: Had a significant impact on the amount of MVPA the child accumulated during recess (p = .0009). Increase was not significantly greater than the increase observed among participants of the comparison group. **Modeling** of active recess-time games by an adult: No association with MVPA.	
Erwin et al. (2012)	Third through fifth grade students from two elementary schools in a midsize city in the southeastern United States (*N* = 160).	Sample drawn from two elementary schools. No descriptive information on the social and physical environments on the playground.	**Gender**: No gender difference among PA levels on the playground.		
Howe et al. (2012)	Children from two schools in Springfield, MA. 81% Hispanic and 50% overweight/obese (*N* = 27).	Non-randomized. Small sample.		**Organized Activity**: ↑ MVPA.	

(continued)

Study	Sample Size	Limitations	Variables		
			Individual	Social	Physical Environment
Huberty et al. (2011)	Third-sixth grade children from four elementary schools in a Midwestern Metropolitan area in the United States (*N* = 257).	Effectiveness of interventions could be due to influences from confounding variables such as staff motivation and willingness to implement interventions. Four conditions were used in the study and each school had one condition.		**Supervised**: + association with ↑ PA.	**Loose equipment**: + association with ↑ PA.
Jones et al. (2010)	9-10 year old children from 92 elementary schools in Norfolk, England (*N* = 1868).	Data collected in the summer. Schools were made aware of the environmental audit prior to data collection, so some work could have been done to improve the grounds prior to each audit.	**Gender**: Boys + more active than girls.		

(continued)

Study	Sample Size	Limitations	Variables		
			Individual	Social	Physical Environment
Kelly et al. (2012)	Students from four elementary schools located in the Fairfield Local Government Area (*N* = 126).	Small sample size. Children had a short time to learn and play the games. There was ongoing construction to the school building during the intervention.			**Playground markings**: No increase in PA levels.
Loucaides et al. (2009)	Children from Cyprus in fifth and sixth grades from three inner city schools (*N* = 247).	Children recorded their own pedometer steps. Sample taken from the same area.			**Play space**: Allocating space for specific physical activities had + but not significant effect on PA levels. **Loose equipment**: + but nonsignificant association on PA levels.
Martin et al. (2012)	Sixth grade students (*N* = 408) attending 27 government-funded metropolitan elementary schools in Perth, Western Australia.	Use of staff self-report for measuring perceptions and behavior. Limited to children in sixth grade.			**Age of school**: Newer schools = ↑ MVPA. **Play space**: ↑ grassed surfaces per child and fewer shaded grassed surfaces = ↑ MVPA.

(continued)

Study	Sample Size	Limitations	Variables		
			Individual	Social	Physical Environment
McKenzie et al. (2010)	13 elementary schools. Approximately 6000 girls and 6000 boys observed.	The amount of equipment available or whether a boy or girl was using the loose equipment was not recoded. Schools in the sample are all located in Southern California. Student population was highly Latino. Convenience sample.	**Gender**: Boys + more active than girls.	**Organized Activity**: No association with PA for boys; ↓ PA girls. **Supervised**: ↓ PA.	**Accessible**: 99.4% of 137 Target Areas. **Usable**: 98.5% of 137 Target Areas. **Loose equipment**: 1/3 of 137 Target Areas provided loose equipment. + association with ↑ PA for both boys and girls.
Parrish et al. (2009)	13 regional Australian public primary schools. Total of 2946 children observed in the schools.	With direct observation, children can be missed in counting or children could be counted twice.	**Gender**: Boys + more active than girls.	**SES**: No association between SES and PA levels.	Parrish et al. (2009)
Parrish et al. (2009b)	13 regional Australian public primary schools. Total of 2946 children observed in the schools.	With direct observation, children can be missed in counting or children could be counted twice. Small number of data including the number of teachers encouraging children.	**Gender**: Boys + more active than girls.	**Social prompting**: No significant relationship found with PA.	**Play space**: Total area available for play did not have a significant association with PA levels. Availability or number of fixed equipment had no significant relationship with PA. **Loose equipment**: + association with ↑ PA.

(continued)

Study	Sample Size	Limitations	Variables		
			Individual	Social	Physical Environment
Ridgers et al. (2006b)	15 boys and 19 girls randomly selected from 2 elementary schools in northwest England located in the same geographical area of high social and economic deprivation in a large urban city. Only 10 boys and 10 girls had complete data sets, so the data from a sample of 20 were analyzed.	Monitored 5 consecutive days in the summer and 5 consecutive days in the winter. Small sample from one area. Due to children being absent, only three complete consecutive days were analyzed for the winter and summer.			**Weather**: No association with PA
Ridgers & Stratton (2005)	Children between the ages of 6-11 years from 18 schools in England (*N* = 270).	Children had their heart rates monitored on 1 school day.	**Gender**: Boys + more active than girls.		
Ridgers et al. (2007)	150 boys and 147 girls randomly selected from 26 elementary schools in North West of England.	Did not control the amount of equipment that was available to children. Staff may have actively prompted students to engage in PA.	**Gender**: Boys + more active than girls.		**Playground markings**: Nonsignificant difference in MVPA.

(continued)

Study	Sample Size	Limitations	Variables		
			Individual	Social	Physical Environment
Ridgers et al. (2010)	128 children (39% boys) aged 9-10 years from 8 elementary schools observed.	Sample size at the school level is small. Playground areas were not broken down in to specific areas (e.g., fixed equipment, soccer pitches), influencing comparability across studies. Each school visited 3 consecutive days for data collection.	**Gender**: Boys + more active than girls.		**Weather**: ↑ temperature = ↓ vigorous activity. **Play space**: ↑ = ↑ vigorous PA. **Loose equipment**: + association with ↑ PA.
Ridgers et al. (2010b)	470 children (*N* = 232 boys, N = 238 girls) from 26 elementary schools.	Attrition at 6 months and 12 months, used multilevel modeling to account for missing data.			**Playground markings**: ↑ MVPA, but effect strongest at six months post-intervention and ↓ between six and twelve months.
Ridgers et al. (2010c)	114 (48 boys, 66 girls, 42% overweight) from 8 elementary schools in a large city in the North West of England observed. 99 children wore uni-axial accelerometers during observation.	The amount and type of equipment not provided. Adult supervisors were included in the count for group size.	**Gender/social**: Boys preferred large groups, and girls preferred small groups on the playground environment.		**Loose equipment**: + association with ↑ PA.

(continued)

Study	Sample Size	Limitations	Variables		
			Individual	Social	Physical Environment
Ridgers et al. (2012)	*N* = 2782 at baseline and *N* = 634 at five years.	High attrition. Not known whether the different grades had their recess and lunch periods together or separately. Specific activities children engaged in were not known.	**Age**: Boys and girls PA ↓ as they grew older.		
Ridgers et al. (2011)	Children grades 3 to 6 in 4 elementary schools (*N* = 210, 45% boys).	Small sample size for several ethnic groups.	**Gender**: Boys + more active than girls. **Ethnicity**: No association with PA.	Ridgers et al. (2011)	Children grades 3 to 6 in 4 elementary schools (*N* = 210, 45% boys).
Stellino et al. (2010)	Children from a Midwest elementary school (*N* = 65: 30 boys, 35 girls; 32 first and second graders; 33 third and fourth graders; 45 healthy BMI, 20 overweight BMI).	One school examined. Each intervention (3 total) was offered only for 1 week.	**Gender**: Boys + more active than girls but not significant. Boys preferred activities such as an obstacle course. **Age**: Children in grades 3 and 4 preferred playing Frisbee over younger children.		

(continued)

Study	Sample Size	Limitations	Variables		
			Individual	Social	Physical Environment
Stratton and Mullan (2005)	8 schools. Two early elementary (4-7 years) and two late primary (7-11 years) from areas of deprivation in Northeast Wales = intervention. Two early elementary and two late primary from Northwest England = control. (*N* = 120 children)	New markings painted for the study, and data collected four weeks after intervention. MVPA could have ↑ due to novelty effect of the change in playground setting.			**Playground markings**: Painting multicolored markings on playgrounds ↑ percent of recess time children spent in MVPA.
Verstraete et al. (2006)	Random sample of 7 elementary schools. Fifth and sixth grade children (*N* = 235).	The influence of teacher's encouragement to actively participate with game equipment was not explored.	**Gender**: Boys + more active than girls.		**Loose equipment**: + association with ↑ PA.
Willenberg et al. (2010)	23 elementary schools from predominantly low socio-economic area of Melbourne, Australia. 3006 children observed. Child focus groups: (*N* = 91 children).	Did not discuss measures taken to ensure reliability during data collection using SOPLAY. Small focus group sample size.	**Gender**: Boys + more active than girls.	**Supervised**: + association with PA.	**Fixed equipment**: ↑ moderate activity. **Playground markings**: ↑ moderate activity. **Loose equipment**: + association with ↑ PA.

(continued)

Study	Sample Size	Limitations	Variables		
			Individual	Social	Physical Environment
Zask et al. (2001)	Children grades K-6 (*N* = 3912) from 18 rural Australian elementary schools observed.	Each school visited twice on the same day. School sizes ranged from 18-575, which influences how the data was analyzed. Complexity of school playgrounds and children's activities were chaotic during breaks.	**Gender**: Boys + more active than girls.		**Weather**: No association with PA. **Fixed equipment**: Nonsignificant association with PA. **Loose equipment**: Nonsignificant association with PA levels other than balls.

Note. SES= Socioeconomic status; + = positive association; - = negative association with PA; ↓ = decreased; ↑ = increased; BMI= Body Mass Index.

APPENDIX C: SOPLAY DATA COLLECTION SHEET

School ID : ___ ___
Date:__ __/__ __/__ __
D8 D9 D10 D11

SOPLAY

(System for Observing Play and Leisure Activity in Youth)

Obs. ID #: ___ ___ Reliability: 0. No 1. Yes Temp: ___ ___F Period: 1. BS 2. L1s1 L1s2 3. L2s1 L2s2 4. L3s1 L3s2 5. AS1 6. AS2 7. AS3

START TIME	AREA	CONDITION					GIRLS				BOYS			
		A	U	S	O	E	S	W	V	Act.	S	W	V	Act.
__ __:__ __	1	0. N 1. Y	0. N 1. Y	0. N 1. Y	0. N 1. Y	0. N 1. Y	____	____	____	____	____	____	____	____
__ __:__ __	2	0. N 1. Y	0. N 1. Y	0. N 1. Y	0. N 1. Y	0. N 1. Y	____	____	____	____	____	____	____	____
__ __:__ __	3	0. N 1. Y	0. N 1. Y	0. N 1. Y	0. N 1. Y	0. N 1. Y	____	____	____	____	____	____	____	____
__ __:__ __	4	0. N 1. Y	0. N 1. Y	0. N 1. Y	0. N 1. Y	0. N 1. Y	____	____	____	____	____	____	____	____
__ __:__ __	5	0. N 1. Y	0. N 1. Y	0. N 1. Y	0. N 1. Y	0. N 1. Y	____	____	____	____	____	____	____	____
__ __:__ __	6	0. N 1. Y	0. N 1. Y	0. N 1. Y	0. N 1. Y	0. N 1. Y	____	____	____	____	____	____	____	____
__ __:__ __	7	0. N 1. Y	0. N 1. Y	0. N 1. Y	0. N 1. Y	0. N 1. Y	____	____	____	____	____	____	____	____
__ __:__ __	8	0. N 1. Y	0. N 1. Y	0. N 1. Y	0. N 1. Y	0. N 1. Y								

Activity Codes: 0=No identifiable activity 1=Aerobics 2=Baseball/Softball 3=Basketball 4=Dance 5=Football 6=Gymnastics 7=Martial Arts 8=Racquet sports 9=Soccer 10=Swimming 11=Volleyball 12=Weight Training 13=Other playground games 14=None of the above

SOPLAY Recording Form: 1/10/06 KSM

APPENDIX D: MAPPING STRATEGIES

SAMPLE SOPLAY/SOPARC MAPPING STRAGEGIES

This document provides examples for the initial mapping of Target Areas.

Procedures for Describing Target Areas

1. Obtain a detailed map from school (PARK) officials.
2. Walk throughout the entire school campus.
3. Indicate precisely (draw) on the map each area that is available for physical activity anytime (e.g., before school, during lunch, and after school. Include areas that are used for physical education classes too.
4. Be sure to include all Target Areas, including: (a) basketball, volleyball, tennis, handball, and wall ball courts; (b) tracks, baseball, hockey, soccer, and other playing fields; (c) gymnasiums, weight training and multipurpose rooms; (d) grass, dirt, cement, matted, tiled or carpeted areas specifically available for users (e.g., students) to be physically active.
5. Number the Target Areas sequentially--in the specific order they will be observed during each rotation rotation. Establish a logical route (e.g., The first Target Area is the one closest to the main cafeteria door).
6. Store the finalized map of Target Areas in a specific "records" office.
7. Occasionally it may be necessary to add or delete a Target Area (e.g., campus/park construction). Designate only ONE person to add/delete Target Areas (e.g., the leader of the field observation team). This person makes the changes on the master map and provides revised copies to field observation team members.

Sample Operational Definitions of Environmental Variables (for Schools)

This section provides definitions and instructions to be used in completing mapping variables identified on the data collection sheet (see attached).

I. Fixed Setting:

Code Target Area as either (1) Indoors or (2) Outdoors.

II. Location of Target Area:

On School Campus: Area within the designated school boundaries.
Adjacent to Campus = Area, typically within an adjacent park or community center, used by students for school-related activities.

III. Area Type:

Assign each Area one of these codes. If not sure of the correct code, complete the comments box at bottom of data form.

1. Court Space: area marked for basketball, tennis, volleyball, and/or other court games. Contains permanent markings specifically for court games.
2. Play space: Self-contained outdoor area designated for physical activity.
3. Field. Large open area designed for activity. It may or may not have goals, backstops, etc.; cannot be described as a Court space.
4. Pool: consists of a wading or swimming pool and the surrounding enclosed space.
5. Weight room: specifically designated room that is equipped with strength/endurance machines (e.g., weight machines (e.g., nautilus), free-weights, bench press) and/or aerobic machines such as stair-steppers and stationary bikes.
6. Gymnasium: large indoor space primarily for physical activity and game play. It may or may not have seating for spectators.
7 and 8. Multipurpose room/Auditorium: designated indoor spaces that can be used for multiple functions, including physical activity, plays, and eating.

IV. Area Improvements:
Improvements are permanent modifications to areas such as lines painted on courts (e.g., basketball, tennis, and four-square courts); cuts in grass or field areas (e.g., baseball diamonds); poles or holes in the cement/blacktop for poles or standards (e.g., basketball hoops; tether-ball and volleyball poles, tennis standards, football goal-posts).

Do not record for temporary improvements (e.g., temporary chalk lines for field games, portable nets for tennis and volleyball, portable soccer goals).

CODING CONVENTIONS:

An improvement identifies what the area is primarily designed for, regardless of how it is used at a particular time. For example, a tennis court is recorded as a tennis court—even if children are playing soccer on it.

- Two erect poles are often used for football and soccer goals. Two posts = one goal.
- A basketball court consist of a hoop plus permanent lines painted on the Surface Area
- Each half of a basketball court is counted as one. Each hoop is counted as one.
- When there is a basketball hoop without a painted court, or if there is only a shooting key or foul line painted, record only the hoop. The numbers for hoops and for half-courts are not always equal.
- The number of diamonds and backstops may not always be equal.
- A wallball court is a single erected wall. It could be the back of racquetball courts if a court is also specifically painted for wallball.
- A racquetball court must have walls on at least three sides.
- A volleyball court has two tall permanent poles separating areas about 30' by 30' (one court).
- A tennis court has two short poles and equal amount of play space on both sides of poles (one court).
- All climbing apparatus within 50 feet of each other and in the same Target Area are counted as one. If the items are widely separated (i.e., beyond 50 feet), count each group of climbing apparatus as a separate area.
- Record a baseball/softball diamond only if the diamond is a dirt area surrounded by grass, and places for the bases (home, first, second, third) are permanently marked. Do not record partial cut-outs (e.g., for home-base only) or temporary bases thrown on a "field" to make a diamond.

V. Improvement Overlap:
Record yes (1) to identify Target Area has multiple improvements that overlap within the same space but cannot be used simultaneously. For instance, record 1 if the court space has poles and/or painted lines that could be used to identify games for basketball, tennis, and volleyball (but not simultaneously).

VI. Surface Area:

sand: particles smaller than gravel, but coarser than silt (i.e., beach).

dirt: earth, soil; dusty when dry and not impacted.

gravel: loose, broken small fragments of rock.

mats: rubber or plastic coverings of floor or ground (e.g., for tumbling, etc).

cement

grass

carpet

tile

water

wood

other (specify, e.g., tarmac).

Sample Data Collection:

Procedures for Environmental Assessments

Before going to map Target Areas be sure to have data collection forms, 2 pencils with erasers, and a school map. Make certain to record/number the proper Target Area sequence on the data collection form.
Enter School ID number, Date, Observer ID number, and whether or not the form is a reliability assessment. Under Reliabilities circle "0" for primary observer and "1" for the reliability observer.

Complete the following variables for each Target Area. If an Area is locked or under construction, schedule an additional appointment.

Fixed Setting: Identify as either indoors or outdoors.

Location: Record whether Target Area is part of the school campus or adjacent to it.

Area Type: Select only one code. If none are appropriate, enter code 9 and describe the type.

Area Improvements: Count the number of improvements and record in the appropriate box(s)
For example, walk around the entire Target Area #1, count the number of basketball half courts, record this number in the space under the column for Target Area 1 and across the row for basketball courts (half courts). Count and record the quantity for each Improvement type in each different Target Area.

Improvement Overlap: Code 1= Yes if any of the improvements overlap each other or are dual-use improvements in the same Target Area (i.e., Target Area has both basketball court markings and tennis court poles and markings, but the two games cannot be played simultaneously). If different games can be played at the same time they are not considered overlapping, therefore code 0 = No.

Area surface: (surface codes are listed near the bottom of the data collection form):
Primary = Most dominant ground surface within each Target Area (i.e., 51% or greater).
Secondary = Second most prominent surface area (if there is one). (E.g., dirt track surrounds a grassy field). Record "0" if there is no secondary surface.

Area Size: Use a standard measuring wheel. Enter the square footage/meters for each Target Area.

Mapping Training and Reliability

Training for mapping should include:

1. Explanation of variables and the coding conventions (rules).
2. Demonstration of how to complete Mapping Variables on the data collection forms (use pictures of actual school Target Areas).
3. Presentation of pictures of different variables on the data collection form. Observers will record responses to the pictures on Mapping Variable data collection forms. Inter-observer agreements will be tallied and percentage agreement recorded. Observers will train until 90% agreement is achieved.
4. Discuss discrepancies, refinement of definitions, and protocol recommendations. Note discrepancies (inter-observer disagreements), tally, and discuss until 100% agreement is reached.
5. Trained mappers should go to schools/parks in teams of two (a Primary and a Reliability assessor). Each observer should individually assess and record for Fixed Setting, Location, Area Type, Area Improvements, Area Overlap, and Surface Area for each Target Area. They should then resolve any differences before leaving the location.

Mapping Variables Data Collection Sheet

Park ID:	**Date**	**Observer ID:**		**Reliability? 1. Yes;**			**0 No;**		
		1	2	3	4	5	6	7	8
Fixed Setting:									
1= indoor, 2= outdoor									
Location:									
1=school campus 2= adjacent to campus									
Area Type:									
1=Court Space 2=Play Space 3=Field 4=Pool 5=Weight Room 6=Gymnasium 7=Multipurpose 8=Auditorium 9=Other _____									
Area Improvements: (code total #)		1	2	3	4	5	6	7	8
a. Basketball Hoops									
b. Basketball Half Courts									
c. Wall-ball Courts									
d. Racquet ball Courts									
e. Volleyball Courts									
f. Tennis Courts									
g. Four-square									
h. Tetherball poles									
I Track									
j. Climbing Apparatus									
k Baseball/Softball Diamond									
l. Baseball/Softball Backstop									
m. Exercise Stations									
n. Long-jump Pits									
o. Football Goal (each goal post)									
p. Soccer Goal (each goal post)									
q. Other (specify)									
Improvement Overlap: Yes =1 No =0									
Surface Area: A. Primary									
B. Secondary									
1 = black top 3 = cement 5 = carpet 7 = wood 9 = gravel 11 = water 2 = dirt 4 = grass 6 = mats 8 = tile									
Area Size: (square footage)									
Comments:									

APPENDIX E: UNLV IRB APPROVAL

UNLV
UNIVERSITY OF NEVADA LAS VEGAS

Biomedical IRB
Notice of Excluded Activity

DATE: June 3, 2013

TO: **Dr. Nancy Menzel,** Nursing

FROM: Office of Research Integrity – Human Subjects

RE: Notification of IRB Action
Protocol Title: **The Relationship Among School Playground Design and Conditions and Physical Activity Levels in Children**
Protocol# 1305-4469

This memorandum is notification that the project referenced above has been reviewed as indicated in Federal regulatory statutes 45CFR46.

The protocol has been reviewed and deemed excluded from IRB review. It is not in need of further review or approval by the IRB.

Any changes to the excluded activity may cause this project to require a different level of IRB review. Should any changes need to be made, please submit a Modification Form.

If you have questions or require any assistance, please contact the Office of Research Integrity – Human Subjects at IRB@unlv.edu or call[redacted]

Office of Research Integrity – Human Subjects
4505 Maryland Parkway • Box 451047 • Las Vegas, Nevada 89154-1047
[redacted]

APPENDIX F: FACILITY AUTHORIZATION FORMS

Lorna J. Kesterson Elementary School

Home of **THE COYOTES**

Jacqueline Walker, Principal

Brett Campbell, Ph.D.
Coordinator III
Research Department
Assessment, Accountability, Research, and School Improvement Division
Clark County School District
4260 Eucalyptus Avenue, Annex C
Las Vegas, NV 89121-5207

Subject: Letter of Acknowledgement of a Research Project at a CCSD Facility

Dear Dr. Campbell:

This letter will acknowledge that I have reviewed a request by Ipuna Black, UNLV PhD Nursing student and Dr. Nancy Menzel to conduct a research project entitled, The Relationship Among School Playground Design and Conditions and Physical Activity in Children at Lorna J. Kesterson Elementary.

When the research project has received approval from the University of Nevada Las Vegas Institutional Review Board and the Department of Research of the Clark County School District, and upon presentation of the approval letter to me by the approved researcher, as site administrator for Lorna J. Kesterson Elementary at 231 Bailey Island Drive, Henderson, NV 89074. I agree to allow access for the approved research project.

If we have any concerns or need additional information, the project researcher will be contacted or we will contact the Department of Research a[redacted]

Sincerely

[redacted]

Signature of Principal/Division/Department Head

8-2-13
Date

JACQUELINE WALKER, PRINCIPAL
Print Name and Title

CCSD
CLARK COUNTY SCHOOL DISTRICT
5100 W. Sahara Avenue
Las Vegas, Nevada 89146

231 Bailey Island Drive • Henderson, Nevada 89074 • PHONE: [redacted]

SELMA F. BARTLETT ELEMENTARY SCHOOL

1961 WIGWAM PARKWAY • HENDERSON, NV 89074 • (702) 799-5750

Brett Campbell, Ph.D.
Coordinator III
Research Department
Assessment, Accountability, Research, and School Improvement Division
Clark County School District
4260 Eucalyptus Avenue, Annex C
Las Vegas, NV 89121-5207

Subject: Letter of Acknowledgement of a Research Project at a CCSD Facility

Dear Dr. Campbell:

This letter will acknowledge that I have reviewed a request by Ipuna Black, UNLV PhD Nursing student and Dr. Nancy Menzel to conduct a research project entitled, The Relationship Among School Playground Design and Conditions and Physical Activity in Children at Selma F. Bartlett Elementary.

When the research project has received approval from the University of Nevada Las Vegas Institutional Review Board and the Department of Research of the Clark County School District, and upon presentation of the approval letter to me by the approved researcher, as site administrator for Selma F. Bartlett Elementary at 1961 Wigwam Parkway, Henderson, NV 89074. I agree to allow access for the approved research project.

If we have any concerns or need additional information, the project researcher will be contacted or we will contact the Department of Research at: [redacted]

Sincerely,

[redacted]

8/5/13
Date

Wendy Lee Phelps, principal
Print Name and Title

CCSD
CLARK COUNTY
SCHOOL DISTRICT
5100 West Sahara Ave
Las Vegas, NV 89146

APPENDIX G: SYSTEM FOR OBSERVING PLAY AND LEISURE ACTIVITY IN YOUTH- DESCRIPTION AND PROCEDURES MANUAL

SOPLAY

System for Observing Play and Leisure Activity in Youth

Description and Procedures Manual

Thomas L. McKenzie, Ph.D.

Professor, Department of Exercise and Nutritional Sciences
San Diego State University
San Diego, CA 92182

[redacted]

January 10, 2006

SOPLAY
(System for Observing Play and Leisure Activity in Youth)

RATIONALE

Investigations of physical activity have been hampered by the lack of an objective tool for quantifying physical activity in "open" environments, such as recreational and leisure settings. Measuring activity in these environments is complicated because both the number of participants and their activity levels change frequently.

SUMMARY

The System for Observing Play and Leisure Activity in Youth (SOPLAY) is based on momentary time sampling techniques in which systematic and periodic scans of individuals and contextual factors within pre-determined target areas are made. During a scan the activity of each individual is mechanically or electronically coded as Sedentary (lying down, sitting, or standing), Walking, or Very Active. Separate scans are made for females and males, and simultaneous entries are also made for time of day, temperature, area accessibility, area usability, presence of supervision, presence and classification of organized activity, and equipment availability. Summary counts describe the number of males and females in any given setting and their activity levels. The instrument permits physical activity level comparisons to be made among different environments or within the same environment over different time periods. Energy expenditure rates (Kcal/kg/min) can also be calculated based on previously validated constants for each level of activity.

PURPOSE

SOPLAY was designed to obtain observational data on the number of students and their physical activity levels during play and leisure opportunities in a specified activity area.

During the M-SPAN study, SOPLAY observations were be made before school (BS), during each lunch period (L), and after school (AS).

VALIDITY & RELIABILITY

Validity

Although no field-based validity study of the SOPLAY measure has been conducted, validity of the activity codes used by SOPLAY have been established through heart rate monitoring (McKenzie et al., 1991; Rowe, Schuldheism, & van der Mars, 1997). These provide support for the initial construct validity of SOPLAY. Providing measures of persistent behaviors (i.e., physical activity) are taken frequently and at random, momentary time sampling techniques have shown to yield valid behavioral samples (Ref). Because only brief episodes are recorded, response and recording occur simultaneously with observations occurring at an approximate rate of one child per second.

Reliability

Reliability data for SOPLAY were collected during 14 days of field assessment. A pair of assessors would simultaneously and independently make counts of boys and girls in each

activity category in selected target areas. Activity counts from a total of 186 target areas were used in the reliability analysis. Interobserver agreements for the five contextual variables were 95%, 97%, 93%, 96%, and 88%, for area accessibility, usability, presence of supervision, presence of organized activity, and provision of equipment, respectively. To examine the reliability of activity counts made by different assessors, a series of intraclass correlations were computed. Correlations were high for sedentary girls (R=.98) and walking girls (.95), although lower for counts of very active girls (.76). For boys, correlations were high for sedentary (.98), walking (.98), and very active (.97) behavior. It was concluded that all interobserver agreements and intraclass correlations met acceptable criteria (IOA=80%, R=.75) for reliable assessment.

OBSERVATION AREAS

1. Direct observations will be made in designated Target Areas that represent all standard locations likely to provide opportunities for students to be physically active. These Areas will be predetermined and identified for observations prior to baseline assessments. A map will be provided to identify areas and a standard observation order established for each school. Additional target areas may be added by observers on site and then documented.

2. During occasions of high student density, Target Areas will be subdivided into smaller Scan Spaces so that accurate measures can be obtained. Observers will use standard court or field markings to determine appropriate Scan Spaces within each Target Area. Data from these smaller spaces will be summed to provide an overall measure for each Target Area.

   NOTE: A decision to subdivide a Target Area depends upon the (1) number of students in the area and (2) the type of student activity. Fast moving activities with students clustered together and moving in diverse directions (e.g., during soccer and basketball), require smaller scan spaces.

OBSERVATION PREPARATION

1. Prior to leaving for the school, prepare observation materials including: synchronized wristwatch, counter, clipboard, sufficient SOPLAY recording forms, and pencils.
2. Arrive at the school site at least 60 minutes prior to the official start of school. Review the sequence for observing Target Areas. Visit each Target Area in order and plan how to sub-divided it into Scan Spaces if necessary. Prepare mentally by scanning each area a few times.

SOPLAY CODES and RECORDING

Reliability Circle 'NO" unless you are the second observer and your data will serve as a reliability measure.

Temp. Enter Fahrenheit temperature at the start of the observation period.

Period Circle a number to designate whether observations were made before school (BS), at lunch time (L), or after school (AS).

Start time Enter the start time (2400 hours) of the sweep for that designated area.

Area Refers to the number of a previously designated School Target Area (see school map). If necessary, add an additional area, describe it, and give it a new number.

Condition Circle N or Y to describe specific conditions for each designated observation area. If a Target Area is inaccessible (A=N), do not code the other four conditions.

A = Area is accessible (e.g., not locked or rented to others)

U = Area is usable for physical activity (e.g., is not excessively wet or windy).

S = Area is supervised by designated school or adjunct (e.g., YMCA) personnel (e.g., teachers, playground supervisors, volunteers). The supervisor must be in or adjacent to that specific area (i.e., available to direct students and respond to emergencies), but does not have to be instructing, officiating, or organizing activities.

O = Organized physical activity (i.e., scheduled, with leadership by school or agency personnel apparent) is occurring in the area (e.g., intramurals, interscholastic practices, fitness stations).

E = Equipment provided by the school or other agency is present (e.g., balls, jump ropes). Do not code 'YES' if the only equipment is permanent (e.g., basketball hoops) or is owned by students themselves.

S W V S = Sedentary; W = Walking; V = Very Active

Act. Enter the activity code (or name) for the most prominent physical activity that girls and boys are participating in within designated area.

Physical activity codes for secondary schools:

0. no specific activity (sit, stand, walk)
1. aerobics (dance, step aerobics)
2. baseball/softball
3. basketball
4. dance (ballet, country, line)
5. football
6. gymnastics
7. martial arts (judo, karate)
8. racquet sports (tennis, badminton)
9. soccer
10. swimming
11. volleyball
12. weight training/lifting
13. playground games (e.g., tetherball, 4-square)
14. none of the activities above (e.g., track)

Comments. Describe any events or features that may help explain any of the above data.

Alternative physical activity codes for young children:

0. no specific activity (sit, stand, walk)
1. fitness/aerobics (dance/step aerobics)
2. baseball/softball
3. basketball/volleyball
4. dance/gymnastics
5. soccer/football
6. climbing/sliding
7. jumping games
8. manipulative games/racquet activities
9. sedentary games/activities
10. none of the other ten categories
11. tag/chasing games

RECORDING PROCEDURES

1. On the observation form, enter the **School ID**, the **Date**, **Observer ID**, if it was a **Reliability** assessment, the **Temperature**, and the **Period** of assessment. Enter the **Start Time** for each **Area** scan (or scan space).

2. Record the contextual variables for each area (see SOPLAY codes).

3. Scan each entire target area for **Girls**, using the mechanical counter to record the number of **Sedentary**, **Walking**, and **Very Active** observations. Classify the predominant type of **Activity** occurring using the codes at the bottom of the SOPLAY Observation Form. Transfer these data to the SOPLAY Observation Form and reset the counter. Repeat for Boys. Record empty Target Areas by entering 0 (zero) into the SAV columns.

4. Always scan from LEFT to RIGHT. Observe each student in the area once. If an observed student reappears in the scan area, do not record a second time. Do not back-track to count new children entering the scan area.

BEFORE SCHOOL OBSERVATIONS

The objective is to obtain an accurate measure of the number of students engaged in physical activity before school starts. The last scan should begin 15 minutes before the school starts. Begin at School Start minus 40 minutes (with 6 Target Areas), minus 30 minutes (with 4 Target Areas), or minus 25 minutes (with 3 Target Areas).

LUNCHTIME OBSERVATIONS

The objective is to obtain an accurate measure of the number of students engaged in physical activity at lunchtime (outside of required physical education). There are two complete rotations of scans during lunchtime. The first rotation begins at Lunch Start plus 15 minutes. Always begin at Area 1 at start time. If a physical education class is occurring in a target area, record the area "accessible=No." The second rotation of scans begins at Lunch Start plus 25 minutes.

AFTER SCHOOL OBSERVATIONS

The objective is to obtain an accurate measure of the number of students engaged in physical activity beginning at School End plus 15, 45, and 75 minutes. Start at Area 1 at specified start time; then walk directly to subsequent Areas in designated rotation.

Sample Schedule (9:00 School Start; 4 target areas; 3 lunch periods)

8:00-8:20am	check Target areas, prepare data forms
8:25 am	initiate SCAN in Target Area 1 (following established sequence)
8:30 am	initiate SCAN in Target Area 2 (continue established sequence)
8:55 am	first school (warning) bell rings
9:00 am	school start
11:30	Lunch one (initiate SCAN 1 in Target Area 1 at 11:45) (initiate SCAN 2 in Target Area 1 at 11:55)
12:00	Lunch two (initiate SCAN in Target Area 1 at 12:15) (initiate SCAN 2 in Target Area 1 at 12:25)
12:30	Lunch three (initiate SCAN in Target Area 1 at 12:45) (initiate SCAN 2 in Target Area 1 at 12:55)
15:00	School Ends
15:15	initiate SCAN in Target Area 1, continue
15:45	initiate SCAN in Target Area 1, continue
16:15	initiate SCAN in Target Area 1, continue

SCORING

1. Depending on the unit of analysis (gender, area, period, school, etc.), raw counts in each activity level are aggregated (sums or means) according to the variables of interest.

Example: To calculate the most active areas for boys and girls at a school during a given day

Steps:

a. Reduce lunchtime data. Calculate mean activity counts from the double-scan data to provide a single count for each activity level of boys and girls for each lunch period. For multiple lunches, sum these counts across periods to compute a single lunch count for boys and girls for each level of student activity.

b. Sum across school day. Aggregating by area, calculate a mean for each activity level (boys and girls separately) across all periods observed (i.e., before school, lunchtime, after school) to arrive at single counts for boys and girls at each level of activity in each area.

c. Calculate energy expenditure rates. To estimate kilocalories/kg expended, the number of children counted in the sedentary, walking, and very active categories are multiplied by the constants .051kcal/kg/min, .096kcal/kg/min, and .144kcal/kg/min, respectively. Kilocalories/kg from each category can be summed to provide a measure of the total kilocalories/kg expended by children in a given area. These values can be interpreted as the number of kilocalories per kg of body weight per minute expended in each area during the school day. These energy expenditure rates are dependent on the number of children observed. Arrange means in descending order.

KEY WORDS

Target Area - A predetermined observation area in which students may potentially engage in physical activity. A number of Target Areas will be established for each school.

Scan Space - A subdivision of a Target Area in which the assessor makes an observation scan. Target Areas are subdivided into Scan Spaces when the number of students is large and they are engaged actively.

Scan - A single observation movement from left to right across a Target Area or Scan space. During a sweep, each individual student in the area is counted and coded as being Sedentary (S), Walking (W), or Very Active (V).

REFERENCES

1. McKenzie, T. L., Marshall, S. J., Sallis, J. F., & Conway, T. L. (2000). Leisure-time physical activity in school environments: An observational study using SOPLAY. Preventive Medicine, 30, 70-77.
2. McKenzie, T. L., Sallis, & Nader, P. R. (1991). SOFIT: System for observing fitness instruction time. Journal of Teaching in Physical Education, 11, 195-205.
3. Rowe, P.J., Schuldheisz, J.M., & van der Mars, H. (1997). Measuring physical activity in physical education: Validation of the SOFIT direct observation instrument for use with first to eighth grade students. Pediatric Exercise Science, 9(2), 136-149.
4. Sallis, J. F., Conway, T. L., Prochaska, J. J., McKenzie, T. L., Marshall, S. & Brown, M. (2001). School environments are associated with youth physical activity. American Journal of Public Health, 91, 618-620.

5. McKenzie, T. L. (2005, November). *Systematic Observation: SOPLAY/SOPARC Introduction, Practice, and Assessment*. (27 minute DVD). San Diego State University, San Diego, California. (T. McKenzie, author, producer, narrator; D. Graves, editor). Available from Active Living Research, San Diego State University, 3900 Fifth Avenue, Suite 310, San Diego, CA 92103 (www.activelivingresearch.org) or the author.

APPENDIX H: SCHOOL B AND K MAPPING VARIABLES DATA COLLECTION SHEETS

T. McKenzie 11.15.05 SOPLAY/SOPARC MAPPING 4

Mapping Variables Data Collection Sheet

Park ID: BAR Date 8-18-13 Observer ID: JB/TM Reliability? 1. Yes; 0. No; Final

	1	2	3	4	5	6	7	8
Fixed Setting: 1= indoor, 2= outdoor	2	2	2	2	2	2	2	2
Location: 1=school campus 2= adjacent to campus	1	1	1	1	1	1	1	1
Area Type: 1=Court Space 2=Play Space 3=Field ~~4=Pool~~ ~~5=Weight Room~~ ~~6=Gymnasium~~ ~~7=Multipurpose~~ 8=Auditorium 9=Other JAWS track manufactured equipment, General blacktop, painted markings, tetherball poles, dirt	2	2	2	2	1	2	1	2
Area Improvements: (code total #)	1	2	3	4	5	6	7	8
a. Basketball Hoops					8			
b. Basketball Half Courts					8			
c. Wall-ball Courts								
d. Racquet ball Courts								
e. Volleyball Courts							2	
f. Tennis Courts								
g. Four-square			5			3		
h. Tetherball poles				8				
I Track								
j. Climbing Apparatus	1							1
k Baseball/Softball Diamond								
l. Baseball/Softball Backstop								
m. Exercise Stations								
n. Long-jump Pits								
o. Football Goal (each goal post)								
p. Soccer Goal (each goal post)								
q. Other (specify) Hopscotch						9		
other painted markings						1 not map		
Improvement Overlap: Yes =1 No =0	0	0	0	0	0	0	0	0
Surface Area: A. Primary	6	1	1	1	1	1	1	6
B. Secondary	1							1
1 = black top 3 = cement 5 = carpet 7 = wood 9 = gravel 11 = water 2 = dirt 4 = grass 6 = ~~mats~~ rubber 8 = tile								
Area Size: (square footage)	3,229	11,035	6,833	2,167	12,663	6,363	4,182	3,037

Comments:

Mapping Variables Data Collection Sheet

Park ID: BAR	Date 8-18-13	Observer ID: TB/JM Reliability? 1. Yes; 0 No; Final							
		9	10	11	12	13	14	15	16
Fixed Setting:		2	2	2	2	2	2	2	2
1= indoor, 2= outdoor									
Location:		1	1	1	1	1	1	1	1
1=school campus 2= adjacent to campus									
Area Type:		2	2	2	2	2	2	3	2
1=Court Space 2=Play Space 3=Field 4=Pool 5=Weight Room 6=Gymnasium 7=Multipurpose 8=Auditorium 9=Other JAUS track (manufactured equipment, fences, bleachers, painted markings, tetherball poles, DIRT)									
Area Improvements: (code total #)		9	10	11	12	13	14	15	16
a. Basketball Hoops									
b. Basketball Half Courts									
c. Wall-ball Courts									
d. Racquet ball Courts									
e. Volleyball Courts									
f. Tennis Courts									
g. Four-square									
h. Tetherball poles			3						
I Track									
j. Climbing Apparatus						1			
k Baseball/Softball Diamond									
l. Baseball/Softball Backstop									
m. Exercise Stations									
n. Long-jump Pits									
o. Football Goal (each goal post)									
p. Soccer Goal (each goal post)									
q. Other (specify) Hopscotch							1		
other painted markings							3		
Improvement Overlap: Yes =1 No =0		0	0	0	0	0	0	0	0
Surface Area: A. Primary		1	1	2	1	6	1	4	1
B. Secondary						1			
1 = black top 3 = cement 5 = carpet 7 = wood 9 = gravel 11 = water 2 = dirt 4 = grass 6 = ~~mats~~ rubber 8 = tile									
Area Size: (square footage)		13,500	2,595	709	1,068	1,306	2,437	4,686	4,298
Comments:									

Mapping Variables Data Collection Sheet

Park ID: BAK	Date 8-18-13	Observer ID: JB/JM	Reliability? 1. Yes; 0 No;							
	Target Area	17	18	19						
Fixed Setting:		2	2	2						
1= indoor, 2= outdoor										
Location:		1	1	1						
1=school campus 2= adjacent to campus										
Area Type:		3	2	9						
1=Court Space 2=Play Space 3=Field ~~4=Pool~~ 5=Weight Room ~~6=Gymnasium~~ ~~7=Multipurpose~~ ~~8=Auditorium~~ 9=Other Jews / track manufactered equipment, general blacktop, painted markings, tetherball poles, DIRT										
Area Improvements: (code total #)		17	18	19						
a. Basketball Hoops										
b. Basketball Half Courts										
c. Wall-ball Courts										
d. Racquet ball Courts										
e. Volleyball Courts										
f. Tennis Courts										
g. Four-square										
h. Tetherball poles										
I Track				1						
j. Climbing Apparatus										
k Baseball/Softball Diamond										
l. Baseball/Softball Backstop										
m. Exercise Stations										
n. Long-jump Pits										
o. Football Goal (each goal post)										
p. Soccer Goal (each goal post)										
q. Other (specify) Hopscotch other painted markings										
Improvement Overlap: Yes =1 No =0		0	0	0						
Surface Area: A. Primary		4	2	1						
B. Secondary										
1 = black top 3 = cement 5 = carpet 7 = wood 9 = gravel 11 = water 2 = dirt 4 = grass 6 = mats rubber 8 = tile										
Area Size: (square footage)		46,609	484	12,632						
Comments:										

Mapping Variables Data Collection Sheet

Final

Park ID: KES **Date** 8-18-13 **Observer ID:** TM/IG **Reliability? 1. Yes; 0 No;**

	1	2	3	4	5	6	7	8
Fixed Setting: 1= indoor, 2= outdoor	2	2	2	2	2	2	2	2
Location: 1=school campus 2= adjacent to campus	1	1	1	1	1	1	1	1
Area Type: 1=Court Space 2=Play Space 3=Field ~~4=Pool~~ ~~5=Weight Room~~ ~~6=Gymnasium~~ ~~7=Multipurpose~~ ~~8=Auditorium~~ 9=Other _____ manufactured equipment, general blacktop, painted markings, tetherball poles	2	2	3	2	2	2	1	2
Area Improvements: (code total #)	1	2	3	4	5	6	7	8
a. Basketball Hoops							8	
b. Basketball Half Courts							8	
c. Wall-ball Courts								
d. Racquet ball Courts								
e. Volleyball Courts								
f. Tennis Courts								
g. Four-square					8			
h. Tetherball poles						4		
I Track								
j. Climbing Apparatus								
k Baseball/Softball Diamond								
l. Baseball/Softball Backstop			2					
m. Exercise Stations								
n. Long-jump Pits								
o. Football Goal (each goal post)								
p. Soccer Goal (each goal post)								
q. Other (specify) Hopscotch								
Other painted markings					3 circles			
Improvement Overlap: Yes =1 No =0	0	0	0	0	0	0	0	0
Surface Area: A. Primary	1	1	4	1	1	1	1	1
B. Secondary								
Area Size: (square footage)	11,572	14,516	~~86,684~~ 86,684	12,150	8,841	2,730	16,260	11,832

1 = black top 3 = cement 5 = carpet 7 = wood 9 = gravel 11 = water
2 = dirt 4 = grass 6 = mats 8 = tile

Comments:

Mapping Variables Data Collection Sheet

Park ID: KES	Date 8-18-13	Observer ID: JB/TM	Reliability? 1. Yes; (0 No); Final						
	Target Area	9	10	11	12	13	14	15	16
Fixed Setting:		2	2	2	2	2	2	2	2
1= indoor, 2= outdoor									
Location:		1	1	1	1	1	1	1	1
1=school campus 2= adjacent to campus									
Area Type:		2	2	2	2	2	2	3	2
1=Court Space 2=Play Space 3=Field 4=Pool ~~5=Weight Room~~ ~~6=Gymnasium~~ 7=Multipurpose ~~8=Auditorium~~ 9=Other _____ → manufactured equipment, general blacktop, painted markings, tetherball poles									
Area Improvements: (code total #)		9	10	11	12	13	14	15	16
a. Basketball Hoops									
b. Basketball Half Courts									
c. Wall-ball Courts									
d. Racquet ball Courts									
e. Volleyball Courts									
f. Tennis Courts									
g. Four-square					6		1		
h. Tetherball poles				4					
I Track									
j. Climbing Apparatus		1	1						1
k Baseball/Softball Diamond									
l. Baseball/Softball Backstop									
m. Exercise Stations									
n. Long-jump Pits									
o. Football Goal (each goal post)									
p. Soccer Goal (each goal post)									
q. Other (specify) hopscotch							2		
other painted markings							3		
Improvement Overlap: Yes =1 No =0		0	0	0	0	0	0	0	0
Surface Area: A. Primary		6	6	1	1	1	1	4	6
B. Secondary		1	1				3		1
1 = black top 3 = cement 5 = carpet 7 = wood 9 = gravel 11 = water 2 = dirt 4 = grass 6 = mats (rubber) 8 = tile									
Area Size: (square footage)		4,075	3,745	2,753	4,192	9,526	4,317	5,354	1,180
Comments:									

APPENDIX I: DEFINED TARGET AREAS

School B

1. Manufactured Equipment (ME) #1: ME #1. Back of the school. Area size: 300.05 m^2/ 3,229.68 ft^2
2. General Blacktop: Back of the school. Includes the area in front of the ME in Target Area 1, in between the tetherballs and the basketball courts, and to the south of the basketball courts. Ends at the four-squares located at the southeast part of the playground and the hopscotches. Area size: 1,025.27 m^2/11,035.91 ft^2
3. Painted Markings: Includes four-square x 5. Area size: 634.84 m2/6,833.39 ft2
4. Tetherball poles: Includes 8. Back of the school. Area size: 201.37 m2 / 2,167.54 ft2
5. Basketball Courts: Back of the school. Includes 8 half courts, 8 hoops, 5 poles. Area size: 1,176.44 m2 / 12,663.08 ft^2 (Each court approximately 332.67 m^2/3,580.83 ft^2)
6. Painted Marking: Includes four- square x 3, hopscotch x 9, map of USA. Area size: 591.15 m^2/6,363.04 ft^2
7. Volleyball Courts: Includes 2 courts. Area size: 435.93 m^2/4,692.30 ft^2
8. ME #2: Main one children use. East side of school. Area size: 282.22 m^2/ 3,037.79 ft^2
9. General Blacktop: Includes general blacktop around the ME #2, around the volleyball courts, outside the hopscotches, in between the tetherball poles and the USA map, and the morning sun line- up area until the end of portables 304 and 300. Area size: 1,183.82 + 70.37 = 1,254.19 m^2/12,742.58 + 757.46 = 13,500.04 ft^2
10. Tetherball: East side of school. Includes 3 poles. Area size: 241.10 m^2/2,595.16 ft^2
11. Dirt: Includes the dirt in between the ME #2 and the jogging and walking track. Area size: 65.87 m^2/709.02 ft^2
12. Kindergarten Area: general blacktop. Area size: 24.42 + 74.87 = 99.29 m^2/262.89 + 805.88 = 1,068.77 ft^2
13. Kindergarten Area: ME. Area size: 121.41 m^2/ 1,306.81 ft^2
14. Kindergarten Area: playground markings. Includes 1 hopscotch, 1 two-square, 1 ladder, and 2 squiggly lines around the painted markings. Area size: 226.41 m^2/2,437.08 ft^2
15. Kindergarten Area: grass. Area size: 435.36 m^2/4,686.14 ft^2
16. General Blacktop: Includes area to the northwest portion of the portables, in between the portables and the Kindergarten area, in front of portable 304, and to

the third pole from the west side of the bike fence. Area size: 399.30 m^2/4,298.05 ft^2

17. Grass: Includes the entire grass. Open field. Area size: 4,321.82 m^2/1.07 acres (46,609.20 ft^2)
18. Dirt: Two dirt areas around the JAWS track (2 areas shown as #16 on the map). Coding station is shown as a red tack on the map. Area size: 429.88 + 20.37 = 450.25 m^2/4,627.16 + 219.24 = 4,846.40 ft^2
19. JAWS Track: View the JAWS track at the same location for 4 minutes. Area size: 5,514.90- 4,321.82 = 1,193.08 m^2/1.36-1.07 = 0.29 acres (12,632.40 ft^2) ((Once around the track is approximately 277.63 meters.)

Coding Stations

1. Stand at the south region of the playground at the corner of the school building near the four-squares. View Target Areas 1-6. View Target Areas 1-6.
2. Stand near the pole located in the middle of the courts on the side closest to the USA map. View Target Area 7.
3. Stand at the southwest area of the ME. View Target Areas 8-11.
4. Stand outside the kindergarten gate near the northeast corner of the ME. View Target Areas 12-15 and turn around to view Target Areas 16-19 from the same spot.

School K

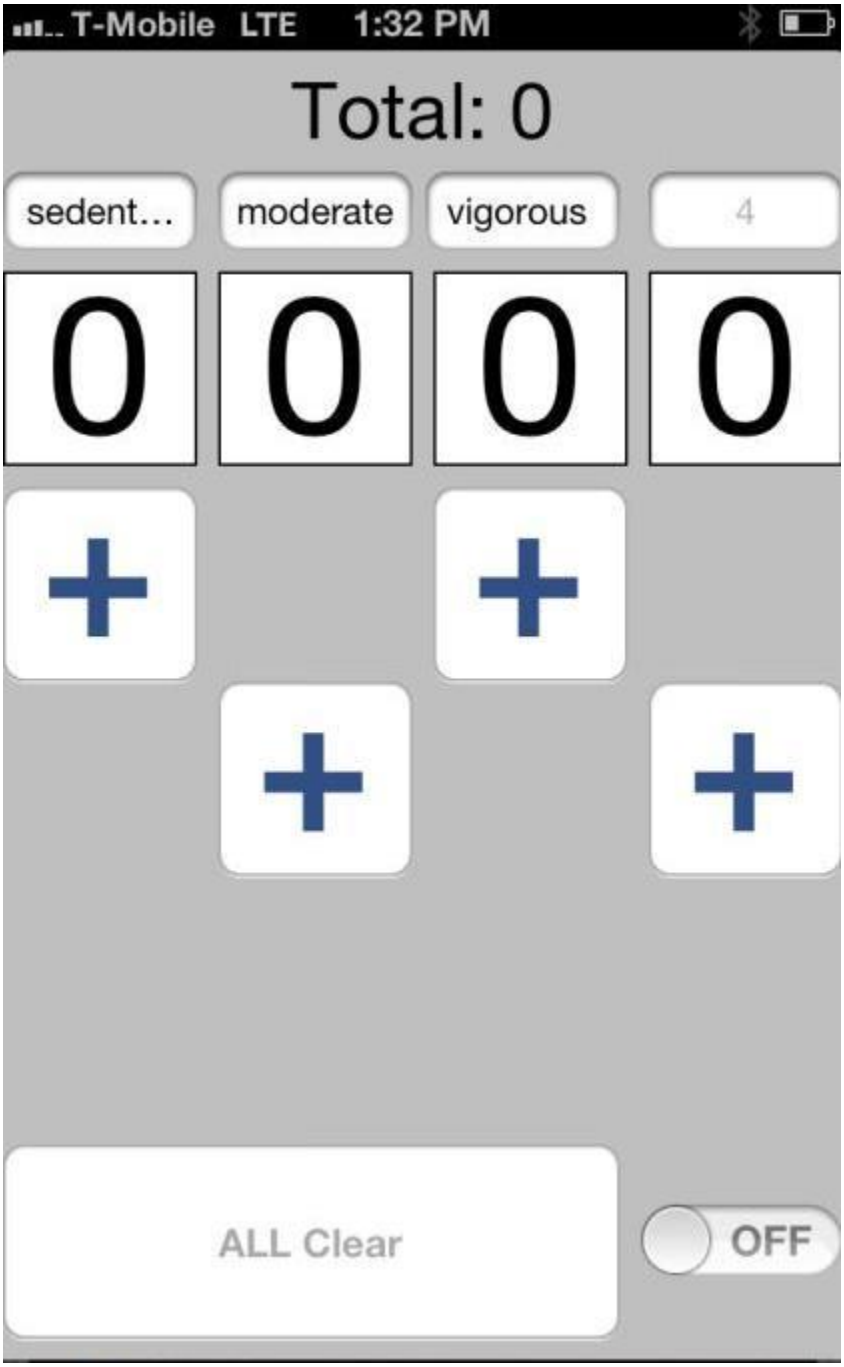
1. General Blacktop: Area closest to Bailey Island Drive. Includes the area in front of the grass, stops at the portable C254, around storage unit #1, around the bike area, and up to the white line from the corner of the building near storage unit #2 to the corner of portable C717. Area size: 1,075.14 m^2/11,572.69 ft^2
2. General Blacktop: Includes the area in between the backstops and under the blue shade, in between the back of portables C717 and C254 and the grass, to west of the white line of Target Area #1, to the Kesterson school building, and to the end of storage unit #3. Area size: 1,348.62 m^2/14,516.41 ft^2
3. Grass: View all of the grass. Area size: 8,047.58 m^2/1.99 acres
4. General Blacktop: Includes the area between the grass, the end of storage unit #3, the school building, the dots where children line up to enter the classrooms, outside the four-squares near the water fountain, in between the two manufactured equipment, to the end of ME 2, to the south of the three circles painted markings, and to the end of the covered shade located at the west are of the grass. Area size: 1,128.81 m^2/ 12,150.43 ft^2
5. Painted Markings: Includes the three circles and four-square x 8. Area size: 821.45 m^2/8,841.99 ft^2
6. Tetherball poles: Tetherballs near grass and basketball courts. X4. Area size: 253.71 m^2 / 2,730.93 ft^2
7. Basketball Courts: Includes 8 half courts, 8 hoops, 8 poles. Area size (square footage): 1,505.05 m^2 / 16,200.19 ft^2 (Each court approximately 334.67 m^2/3,602.38 ft^2)
8. General Blacktop: Includes area around the basketball courts, around the tetherballs, to the north of four-squares, to the end of ME #1, and in between ME#1 and the basketball courts. Area size: 1,099.24 m^2/11,832.09 ft^2
9. Manufactured Equipment (ME) #1: ME near four-squares and basketball courts. Area size: 378.65 m^2/ 4,075.72 ft^2
10. Manufactured Equipment #2: Near tetherball and four-squares at the southwest region of the playground. Area size: 347.93 m^2/ 3,745.13 ft^2
11. Tetherball poles: At the southwest region of the playground. X4 tetherballs. Area size: 255.82 m^2 / 2,753.59 ^{ft2}
12. Painted Markings: At the southwest region of the playground. Four-squares x 6. Area size: 389.51 m^2/4,192.67 ft^2
13. General Blacktop: Includes the area outside four-squares, tetherballs, up to the southeast corner of ME #2, and up to the Kindergarten area. Area size: 885.02 m^2/9,526.28 ft^2

14. Kindergarten Area: playground markings. Includes 2 hopscotches, 1 circle, 1 triangle, 1 square, 1 small circle with a larger one around it, squiggly lines, and 1 one four-square. Area size: 406.71 m^2/4,377.77 ft^2
15. Kindergarten Area: grass. Area size: 497.47 m^2/5,354.68 ft^2
16. Kindergarten Area: ME. Area size: 156.13 m^2/ 1,680.53 ft^2

Coding Stations

1. Stand east of storage unit 3, on the general blacktop, in between the grass and the school building. View Target Areas 1-3.
2. Stand at the southwest corner of the grass. View Target Areas 4-8.
3. Stand at the southeast region of ME#1. View Target Area #9.
4. Stand at the southeast region of ME #2. View Target Areas 10-12.
5. Stand on the white line at the south end of the playground. View Target Area 13.
6. Stand outside of the Kindergarten gate in between the painted markings and the manufactured equipment. View Target Areas 14-16.

APPENDIX J: TALLY COUNTER



APPENDIX K: SOPARC WALKING/JOGGING TRACKS PROTOCOL

RECORDING PROCEDURES FOR WALKING/JOGGING TRACKS

1. Prior to observing in the park, a research team member will walk the path/track and record the length of time, in minutes, it took to complete one full lap around it (e.g., seven minutes). The Target Area will be observed for this length of each time a scan of the area is conducted.

2. A standard location from which all scans will be made will be identified. This location is referred to as the ***Coding Station*** and will easily identifiable.

3. On the SOPARC Observation Form, enter the **Date**, **Park ID**, **Observer ID**, **Period,** and **Target Area.**

    - If possible, complete this section prior to the start of the observation period.

4. Enter the **Start Time** for the area scan on the SOPARC Observation Form.

5. Record the conditions for each area (Accessible, Usable, Supervised, Organized, Equipped, Dark, and Empty).

    - If the area is "dark" or "empty," complete the conditions and then move to the next Target Area. If one or more people are in the area, continue with action #6.

6. Enter the **Start Time** and **End Time** on the Path Coding Form.

7. Count ALL people as they walk by the *coding station* and record their characteristics on the Path Coding Form. You may count some people more than once (e.g., runners), and some (e.g. slow walkers) may not pass by the area and will not be counted.

    - When two observers with counters are present during the scan, one counts for females and the other for males.

    - When recording data on the Path Coding Form, place a one (1) in each column that represents the individual characteristics (e.g., male, adult, Latino, walking).

8. Once time has expired, transfer the data from the Path Coding Form to the SOPARC Observation Form.

    - Use CAUTION when transferring data onto the SOPARC Observation Form. If time permits after the park scans are completed, check the form for errors.

    - Attach the Path Coding Form to the SOPARC Observation Form before submitting the data.

9. Move to next Target Area.

References

Anderson, P. M., Butcher, K. F., & Levine, P. B. (2003). Maternal employment and overweight children. *Journal of Health Economics*, *22*, 477-504.

Ball, G. D., Lenk, J. M., Barbarich, B. N., Plotnikoff, R. C., Fishburne, G. J., Mackenzie, K. A., & Willows, N. D. (2008). Overweight children and adolescents referred for weight management: Are they meeting lifestyle behavior recommendations? *Applied Physiology Nutrition and Metabolism*, *33*(5), 936-945.

Barros, R. M., Silver, E. J., & Stein, R. E. (2009). School recess and group classroom behavior. *Pediatrics*, *123*, 431-436.

Bates, H. (2006). Daily physical activity for children and youth. Retrieved from http://www.eric.ed.gov/PDFS/ED498257.pdf

Bauer, U. E. (2011). School health guidelines to promote healthy eating and physical activity. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6005a1.htm

Bell, J., Rogers, V. W., Dietz, W. H., Ogden, C. L., Schuler, C., & Popovic, T. (2011). CDC grand rounds: Childhood obesity in the United States. *Morbidity and Mortality Weekly Report*, *60*(2), 42-46.

Berkowitz, B., & Borchard, M. (2009). Advocating for the prevention of childhood obesity: A call to action for nursing. *OJIN: The Online Journal of Issues in Nursing*. Retrieved from http://www.nursingworld.org/MainMenuCategories/ANAMarketplace/ANAPeriodicals/OJIN/TableofContents/Vol142009/No1Jan09/Prevention-of-Childhood-Obesity_1.aspx

Blatchford, P., Baines, E., & Pellegrini, A.D. (2003). The social context of school playground games: Sex and ethnic differences, and changes over time after entry to junior school. *British Journal of Developmental Psychology, 21*, 481–505.

Brownell, K. D., Schwartz, M. B., Henderson, K. E., & Friedman, R. R. (2009). School wellness policies [Policy Brief]. Retrieved from http://www.yaleruddcenter.org/resources/upload/docs/what/reports/RuddReportSchoolWellnessPolicies2009.pdf

Burns, N., & Grove, S. K. (2009). *The practice of nursing research* (6th ed.). St. Louis, MO: Saunders Elsevier.

California Department of Education. (2009). California after school physical activity guidelines. Retrieved from http://www.cde.ca.gov/ls/ba/as/documents/paguidelines.pdf

California School Boards Association. (2009). Moderate to vigorous physical activity in physical education to improve health and academic outcomes. Retrieved from http://www.californiaprojectlean.org/docuserfiles//200911_MVPA_FactSheet%5B1%5D.pdf

Cawley, J. (2010). The economics of childhood obesity. *Health Affairs*, *29*(3), 364-371. doi:10.1377/hlthaff.2009.0721

Centers for Disease Control and Prevention. (2002). 2000 CDC growth charts for the United States: Methods and development. *Vital and Health Statistics*, *11*(246), 1-190.

Chin, J. J., & Ludwig, D. (2013). Increasing children's physical activity during school recess periods. *American Journal of Public Health*, *103*(7), 1229-1234. doi:10.2105/AJPH.2012.301132

Clark County School District. (2013). Clark County School District Accountability Reports [Annual report]. Retrieved from http://www.nevadareportcard.com/di/

Coe, S. P., Pivarnik, J. M., Womack, C. J., Reeves, M. J., & Malina, R. M. (2006). Effect of physical education and activity levels on academic achievement in children: A meta-analytic study. *Psychological Science*, *14*, 125-130.

Cohen, J. W. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Connolly, P., & McKenzie, T. (1995). Effects of a game intervention on the physical activity levels of children at recess. *Research Quarterly for Exercise and Sport*, *66*, 60-66.

Dasgupta, P. (2007). *Economics a very short introduction*. Oxford, New York: Oxford University Press Inc.

Davison, K. K., & Birch, L. L. (2001). Childhood overweight: A contextual model and recommendations for future research. *Obesity Reviews*, 2, 159-171.

De Saint-Maurice Maduro, P. D. (2009). Validation of the SOPLAY direct observation tool with an objective accelerometry-based physical activity monitor (Doctoral dissertation, Iowa State University). Retrieved from http://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1881&context=etd

Dietz, W. H. (1998). Health consequences of obesity in youth: Childhood predictors of adult disease. *Pediatrics*, *101*, 518-525.

Dyment, J. E., Bell, A. C., & Lucas, A. J. (2009). The relationship between school ground design and intensity of physical activity. *Children's Geographics*, *7*(3), 261-276. doi:10.1080/J4733280903024423

Eaton, D. K., Kann, L., Kinchen, S., Shanklin, S., Ross, J., Hawkins, J., ... Wechsler, H. (2010). Youth risk behavior surveillance- United States, 2009 [Fact sheet]. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5905a1.htm

Efrat, M. W. (2013). Exploring effective strategies for increasing the amount of moderate-to-vigorous physical activity children accumulate during recess: A quasi-experimental intervention study. *Journal of School Health*, *83*(4), 265-272.

Erwin, H., Abel, M., Beighle, A., Noland, M. P., Worley, B., & Riggs, R. (2012). The contribution of recess to children's school-day physical activity. *Journal of Physical Activity and Health*, *9*(3), 442-448.

Evans, J., & Pellegrini, A. (1997). Surplus energy theory: An enduring but inadequate justification for school breaktime. *Educational Review*, *49*(3), 229–236.

Falkner, N. H., Neumark-Sztainer, D., Story, M., Jeffery, R. W., & Resnick, M. D. (2001). Social, educational, and psychological correlates of weight status in adolescents. *Obesity Reviews*, *9*(1), 32-42.

Government Accountability Office. (2012). *K-12 Education school-based physical education and sports programs* (GAO-12-350). Washington, DC: Government Printing Office.

Hale, C. D. (2011). Evaluation research design: Options. In *Evaluating education and training services: A primer* (2nd ed.) (pp. 354-398). Retrieved from

http://www.charlesdennishale.com/books/eets_ap2/8%20Evlauation%20Research%20Design%20Options%202.1.pdf

Himes, J. H., & Dietz, W. H. (1994). Guidelines for overweight in adolescent preventive services: Recommendations from an expert committee. The Expert Committee on Clinical Guidelines for Overweight in Adolescent Preventive Services. *American Journal of Clinical Nutrition*, *59*, 307-316. Retrieved from http://www.ajcn.org/content/59/2/307.full.pdf+html

Howe, C. A., Freedson, P. S., Alhassan, S., Feldman, H. A., & Osganian, S. K. (2012). A recess intervention to promote moderate-to-vigorous physical activity. *Pediatric Obesity*, *7*(1), 82-88. doi:10.1111/j.2047-6310.2011.00007.x

Huberty, J. L., Beets, M. W., Beighle, A., & Welk, G. (2011). Environmental modifications to increase physical activity during recess: Preliminary findings from Ready for Recess. *Journal of Physical Activity and Health*, *8*(Suppl 2), S249-S256.

Huberty, J., Siahpush, M., Beighle, A., Fuhrmeister, E., Silva, P., & Welk, G. (2011b). Ready for recess: A pilot study to increase the physical activity in elementary school children. *Journal of School Health*, *81*(5), 251-257. doi:10.1111/j.1746-1561.2011.00591.x

International Business Machines Corporation. (2013). IBM SPSS Statistics Standard GradPack 22 for Windows. Retrieved from http://estore.onthehub.com/WebStore/OfferingDetails.aspx?o=b726a469-0005-e311-93f3-b8ca3a5db7a1

Jones, N. R., Jones, A., Van Sluijs, E. M., Panter, J., Harrison, F., & Griffin, S. J. (2010). School environments and physical activity: The development of an audit tool. *Health & Place*, *16*, 776-783. doi:10.1016/j.healthplace.2010.04.002

Kahan, D. (2008). Recess, extracurricular activities, and active classrooms: Means for increasing elementary school students' physical activity. *Journal of Physical Education, Recreation & Dance*, *79*(2), 26-31.

Kelly, A., Arjunan, P., Van der Ploeg, H. P., Rissel, C., Borg, J., & Wen, L. M. (2012). The implementation of a pilot playground markings project in four Australian primary schools. *Health Promotion Journal of Australia*, *23*(3), 183-187. doi.org/10.1071/HE12183

Lobstein, T., Baur, L., & Uauy, R. (2004). Obesity in children and young people: A crisis in public health. *Obesity Reviews*, *5*(1), 4-85.

Loucaides, C. A., Jago, R., & Charalambous, I. (2009). Promoting physical activity during school break times: Piloting a simple, low cost intervention. *Preventive Medicine*, *48*(4), 332-334. doi:10.1016/j.ypmed.2009.02.005

Lounsbery, M. A., McKenzie, T. L., Morrows, J. R., Monnat, S. M., & Holt, K. A. (2013). District and school physical education policies: Implications for physical education and recess time. *Annals of Behavioral Medicine*. doi:10.1007/s12160-012-9427-9

Lounsbery, M., Bungum, T., & Smith, N. (2007). Physical activity opportunity in K-12 public school settings: Nevada. *Journal of Physical Activity and Health*, *4*, 30-38.

Lutfiyya, M. N., Garcia, R., Dankwa, C. M., Young, T., & Lipsky, M. S. (2008). Overweight and obese prevalence rates in African American and Hispanic

children: An analysis of data from the 2003-2004 National Survey of Children's Health. *Journal of American Board of Family Medicine*, *21*(3), 191-199. doi:10.3122/jabfm.2008.03.070207

Mahar, M. T., Murphy, S. K., Rowe, D. A., Golden, J., Shields, A. T., & Raedeke, T. D. (2006). Effects of a classroom-based program on physical activity and on-task behavior. *Medicine and Science in Sports and Exercise*, *38*(12), 2086-2094. Retrieved from http://www.medscape.com/viewarticle/551022

Martin, K., Bremner, A., Salmon, J., Rosenberg, M., & Giles-Corti, B. (2012). School and individual-level characteristics are associated with children's moderate to vigorous-intensity physical activity during school recess. *Australian and New Zealand Journal of Public Health*, *36*(5), 469-477. doi:10.1111/j.1753-6405.2012.00914.x

McKenzie, T. (2005). Sample SOPLAY/SOPARC mapping strategies. Retrieved from http://www.activelivingresearch.org/files/SOPARC-SOPLAY_MappingStrategies_0.pdf

McKenzie, T. L. (1991). Observational measures of children's physical activity. *Journal of School Health*, *61*(5), 224-227.

McKenzie, T. L. (2006). SOPLAY: System for Observing Play and Leisure Activity in Youth description and procedures manual. Retrieved from http://www.activelivingresearch.org/files/SOPLAY_Protocols.pdf

McKenzie, T. L. (2006b). SOPLAY: System for Observing Play and Leisure Activity in Youth DVD. Retrieved from http://www.activelivingresearch.org/node/10642

McKenzie, T. L., & Cohen, D. A. (2006). *System for Observing Play and Recreation in Communities (SOPARC)* [Description and procedures manual]. Retrieved from http://www.activelivingresearch.org/files/SOPARC_Protocols.pdf

McKenzie, T., & Lounsbery, M. (2012). Systematic observation of physical activity and its contexts [Lecture notes]. Retrieved from http://www.activelivingresearch.org/files/2012_SOPARC_McKenzie-Lounsbery.pdf

McKenzie, T. L., Cohen, D. A., Sehgal, A., Williamson, S., & Golinelli, D. (2006). System for Observing Play and Recreation in Communities (SOPARC): Reliability and feasibility measures. *Journal of Physical Activity and Health*, *3*(Suppl 1), S208–S222. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2957838/

McKenzie, T. L., Crespo, N. C., Baquero, B., & Elder, J. P. (2010). Leisure-time physical activity in elementary schools: Analysis of contextual conditions. *Journal of School Health*, *80*(10), 470-477. doi:10.1111/j.1746-1561.2010.00530.x

McKenzie, T. L., Marshall, S. J., Sallis, J. F., & Conway, T. L. (2000). Leisure-time physical activity in school environments: An observational study using SOPLAY. *Preventive Medicine*, *30*, 70-77. doi:10.1006/pmed.1999.0591

McKenzie, T. L., Sallis, J. F., & Nader, P. R. (1991). SOFIT: System for Observing Fitness Instruction Time. *Journal of Teaching in Physical Education*, *11*, 195-205.

Milliard, T. (2012). Clark County School District's enrollment grows. Retrieved from http://www.lvrj.com/news/clark-county-school-district-s-enrollment-grows-171077941.html

Ministry of Health. (2012). Ethical guidelines for observational studies: Observational research, audits and related activities. Retrieved from http://www.waikatodhb.govt.nz/file/fileid/44571

National Association for Sport and Physical Education and American Heart Association. (2010). Shape of the nation report: Status of physical education in the USA. Retrieved from http://www.aahperd.org/naspe/publications/upload/shape-of-the-nation-2010-final.pdf

National Association for Sport and Physical Education and American Heart Association. (2010b). State profiles: Nevada. Retrieved from http://www.aahperd.org/naspe/publications/upload/Nevada-profile.pdf

National Association for Sport and Physical Education. (2006). Recess for elementary school student [Position Statement]. Retrieved from http://www.aahperd.org/naspe/standards/upload/recess-for-elementary-school-students-2006.pdf

National Association for Sport and Physical Education. (2008). Comprehensive school physical activity programs: Position statement. Retrieved from http://www.aahperd.org/naspe/standards/upload/Comprehensive-School-Physical-Activity-Programs2-2008.pdf

National Association of State Boards of Education. (n.d.). State school healthy policy database. Retrieved from http://nasbe.org/healthy_schools/hs/state.php?state=Nevada

National Center for Education Statistics. (2012). Back to school statistics. Retrieved from http://nces.ed.gov/fastfacts/display.asp?id=372

National Center for Health Statistics. (2010). Prevalence of obesity among children and adolescents: United States, trends 1963-1965 through 2007-2008 [NCHS Health E-Stat]. Retrieved from http://www.cdc.gov/nchs/data/hestat/obesity_child_07_08/obesity_child_07_08.htm

National Center for Safe Routes to School. (2011). How children get to school: School travel patterns from 1969 to 2009. Retrieved from http://saferoutesinfo.org/sites/default/files/resources/NHTS_school_travel_report_2011_0.pdf

National Coordinating Committee on School Health and Safety. (2010). How is health care reform changing school health? Retrieved from http://csmh.umaryland.edu/resources/CSMH/NCCSHS%20health%20care%20reform.pdf

National Initiative for Children's Healthcare Quality. (2007). 2007 childhood obesity state report card. Retrieved from http://www.nschdata.org/Content/07ObesityReportCards.aspx

Nevada Institute for Children's Research & Policy. (2011). Results of the 2010-2011 (year three) Nevada Kindergarten Health Survey. Retrieved from

http://nic.unlv.edu/files/KHS%20Year%203%20Summary%20of%20Findings%206.21.11.pdf

Nevada State Health Division Bureau of Community Health. (2006). Strategic plan for the prevention of obesity in Nevada. Retrieved from http://health.nv.gov/PDFs/obeseplan.pdf

Ogden, C. L., Carroll, M. D., Curtin, L. R., Lamb, M. M., & Flegal, K. M. (2010). Prevalence of high body mass index in US children and adolescents, 2007-2008. *The Journal of the American Medical Association*, *303*(3), 242-249.

Ogden, C. L., Carroll, M. D., Kit, B. K., & Flegal, K. M. (2012). Prevalence of obesity and trends in body mass index among US children and adolescents, 1999-2010. *The Journal of the American Medical Association*, *307*(5), 483-490. doi:10.1001/jama.2012.40

Ogden, C. L., Flegal, K. M., & Carroll, M. D. (2002). Prevalence and trends in overweight among US children and adolescents, 1999-2000. *Journal of American Medical Associates, 291*, 2847-2850.

Pallant, J. (2010). *SPSS survival manual* (4th ed.). New York, NY: McGraw-Hill Companies.

Parrish, A. M., Iverson, D., Russell, K., & Yeatman, H. (2009). Observing children's playground activity levels at 13 Illawarra primary schools using CAST2. *Journal of Physical Activity and Health*, *8*(Suppl 1), S89-S96.

Parrish, A. M., Russell, K., Yeatman, H., & Iverson, D. (2009b). What factors influence children's activity? *British Journal of School Nursing*, *4*(1), 6-9.

Pate, R. R., Davis, M. G., Robinson, T. N., Stone, E. J., McKenzie, T. L., & Young, J. C. (2006). Promoting physical activity in children and youth: A leadership role for schools: A scientific statement from the American Heart Association Council on nutrition, physical activity, and metabolism (Physical Activity Committee) in collaboration with the Councils on Cardiovascular Disease in the Young and Cardiovascular Nursing. *Circulation*, *114*, 1214-1224. doi:10.1161/CIRCULATIONAHA.106.177052

Pellegrini, A.D. (1995). *School recess and playground behavior: Educational & developmental roles*. Albany, NY: State University of New York Press.

Pellegrini, A. D., & Bohn, C. M. (2005). The role of recess in children's cognitive performance and school adjustment. *American Educational Research Association*, *34*(1), 13-19. doi:10.3102/0013189X034001013

Pirrie, A. M., & Lodewyk, K. R. (2012). Investigating links between moderate-to-vigorous physical activity and cognitive performance in elementary school students. *Mental Health and Physical Activity*, *5*, 93-98. doi:10.1016/j.mhpa.2012.04.001

Polit, D. F., & Beck, C. T. (2004). *Nursing research: Principles and methods* (7th ed.). Philadelphia, PA: Lippincott Williams & Wilkins.

Ramstetter, C. L., Murray, R., & Garner, A. S. (2010). The crucial role of recess in schools. *Journal of School Health*, *80*, 517-526. doi:10.1111/j.1746-1561.2010.00537.x

Raosoft, Inc. (2004). Sample size calculator. Retrieved from http://www.raosoft.com/samplesize.html

Ridgers, N. D., & Stratton, G. (2005). Physical activity during school recess: The liverpool sporting playgrounds project. *Pediatric Exercise Science*, *17*, 281-290.

Ridgers, N. D., Fairclough, S. J., & Stratton, G. (2010). Variables associated with children's physical activity levels during recess: The A-CLASS project. *International Journal of Behavioral Nutrition and Physical Activity*, *7*(74). doi:10.1186/1479-5868-7-74

Ridgers, N. D., Fairclough, S. J., & Stratton, G. (2010b). Twelve-month effects of a playground intervention on children's morning and lunchtime recess physical activity levels. *Journal of Physical Activity and Health*, *7*(2), 167-175.

Ridgers, N. D., Saint-Maurice, P. F., Welk, G. J., Siahpush, M., & Huberty, J. (2011). Differences in physical activity during school recess. *Journal of School Health*, *81*(9), 545-551. doi:10.1111/j.1746-1561.2011.00625.x

Ridgers, N. D., Stratton, G., & Fairclough, S. J. (2006a). Physical activity levels of children during school playtime. *Sports Medicine*, *36*(4), 359-371.

Ridgers, N. D., Stratton, G., Clark, E., Fairclough, S. J., & Richardson, D. J. (2006b). Day-to-day and seasonal variability of physical activity during school recess. *Preventive Medicine*, *42*(5), 372-374. doi:10.1016/j.ypmed.2006.01.017

Ridgers, N. D., Stratton, G., & McKenzie, T. L. (2010c). Reliability and validity of the System for Observing Children's Activity and Relationships during Play (SOCARP). *Journal of Physical Activity and Health*, *7*(1), 17-25.

Ridgers, N. D., Stratton, G., Fairclough, S. J., & Twisk, J. W. (2007). Children's physical activity levels during recess: A quasi-experimental intervention study. *Preventive Medicine*, *44*(5), 393-397. doi:10.1186/1479-5868-4-19

Ridgers, N. D., Timperio, A., Crawford, D., & Salmon, J. (2012). Five-year changes in school recess and lunchtime and the contribution to children's daily physical activity. *British Journal of Sports Medicine*, *46*(10), 741-746. doi:10.1136/bjsm.2011.084921

Ridley, K., Ainsworth, B. E., & Olds, T. S. (2008). Development of a compendium of energy expenditures for youth. *International Journal of Behavioral Nutrition and Physical Activity*, *5*(45). doi:10.1186/1479-5868-5-45

Robert Wood Johnson Foundation. (2007). Recess rules: Why the undervalued playtime may be America's best investment for healthy kids and healthy schools. Retrieved from http://www.playworks.org/files/rwjf_sports4kids_recess_report.pdf

Robert Wood Johnson Foundation. (2009). Local school wellness policies: How are schools implementing the congressional mandate? Retrieved from http://www.rwjf.org/content/dam/farm/reports/issue_briefs/2009/rwjf42306

Rowe, P. J., Schuldheisz, J. M., & Van der Mars, H. (1997). Measuring physical activity in physical education: Validation of the SOFIT direct observation instrument for use with first to eighth grade students. *Pediatric Exercise Science*, *9*, 136-149.

Sallis, J. F., & Glanz, K. (2006). The role of built environments in physical activity, eating, and obesity in childhood. *Future Child*, *16*(1), 89-108.

Sallis, J. F., Cervero, R. B., Ascher, W., Henderson, K. A., Kraft, M. K., & Kerr, J. (2006). An ecological approach to creating active living communities. *The Annual Review of Public Health*, *27*, 297-322.

Sallis, J. F., Millstein, R. A., & Carlson, J. A. (2011). Community design for physical activity. In A. Dannenberg, H. Frumkin, & R. Jackson (Eds.), *Making healthy*

places: Designing and building for health, well-being, and sustainability (pp. 33-49). doi:10.5822/978-1-61091-036-1_2

Schwager, T. (2010). Strength training for kids. *American Fitness*, *28*(5), 20-23.

Scribble Maps Pro. (2013). http://pro.scribblemaps.com/

Singh, G. K., Siahpush, M., & Kogan, M. D. (2010). Neighborhood socioeconomic conditions, built environments, and childhood obesity. *Health Affairs*, *29,* 503-512. doi:10.1377/hlthaff.2009.0730

Slater, S. J., Nicholson, L., Chriqui, J., Turner, L., & Chaloupka, F. (2012). The impact of state laws and district policies on physical education and recess practices in a nationally representative sample of US public elementary schools. *Archives of Pediatrics & Adolescent Medicine*, *166*(4), 311-316. doi:10.1001/archpediatrics.2011.1133

St. Pierre Schneider, B., Menzel, N., Clark, M., York, N., Candela, L., & Xu, Y. (2009). Nursing's leadership in positioning human health at the core of urban sustainability. *Nursing Outlook*, *57*(5), 281-288. doi:10.1016/j.outlook.2009.07.003

Stellino, M. B., Sinclair, C. D., Partridge, J. A., & King, K. M. (2010). Differences in children's recess physical activity: Recess activity of the week intervention. *Journal of School Health*, *80*(9), 436-444. doi:10.1111/j.1746-1561.2010.00525.x

Stratton, G., & Mullan, E. (2005). The effect of multicolor playground markings on children's physical activity level during recess. *Preventive Medicine*, *41*(5-6), 828-833.

Takagi, S. (2013). Tally counter for four. Retrieved from https://itunes.apple.com/us/app/tally-counter-for-four/id648100406?mt=8&ls=1

Takahashi, P. (2012, February 23). Clark County School District announces rankings of top- and lowest- performing elementary, middle schools. *Las Vegas Sun*. Retrieved from http://www.lasvegassun.com/news/2012/feb/23/clark-county-school-district-names-top-performing-/

Telama, R., Yang, X., Viikari, J., Valimaki, I., Wanne, O., & Raitakari, O. (2005). Physical activity from childhood to adulthood: A 21-year tracking study. *American Journal of Preventive Medicine*, *28*(3), 267-273.

The Council of State Governments. (2007). School wellness policies [Legislator Policy Brief]. Retrieved from http://www.healthystates.csg.org/NR/rdonlyres/C87EB28D-B2F6-4399-B1BD-BC5617940019/0/SchoolWellnessPoliciesFINAL.pdf

The Nevada Department of Education. (2005). Statewide school wellness policy. Retrieved from http://wellness4you.nv.gov/WellnessPolicies/FinalWellnessPolicy_2_.pdf

The University of Nebraska-Lincoln. (n.d.). Cohen's kappa. Retrieved from http://psych.unl.edu/psycrs/handcomp/hckappa.PDF

Thorpe, K. E., Florence, C. S., Howard, D. H., & Joski, P. (2004). The impact of obesity on rising medical spending. *Health Affairs*, *Suppl Web Exclusives (W4),* 480-486. doi:10.1377/hlthaff.w4.480

Troiano, R. P., Berrigan, D., Dodd, K. W., Masse, L. C., Tilert, T., & McDowell, M. (2008). Physical activity in the United States measured by accelerometer.

Medicine & Science in Sports & Exercise, *40*(1), 181-188. doi:10.1249/mss.0b013e31815a51b3

Tsai, M., Coleman, T. R., & Middaugh, J. P. (2013). A review of the Clark County School District height and weight data collection, 2010-2011 school year. Retrieved from http://www.southernnevadahealthdistrict.org/download/stats-reports/ccsd-height-weight-report-2013.pdf

University of Pennsylvania. (2008). Tutorial: Pearson's Chi-square test for independence. Retrieved from http://www.ling.upenn.edu/~clight/chisquared.htm

U.S. Department of Health & Human Services. (2008). Physical activity guidelines for Americans. Retrieved from http://www.health.gov/paguidelines/guidelines/chapter3.aspx

U.S. Department of Health & Human Services. (2008b). Translating scientific evidence about total amount and intensity of physical activity into guidelines. Retrieved from http://www.health.gov/paguidelines/guidelines/appendix1.aspx

U.S. Department of Health and Human Services. (2010). *The association between school based physical activity, including physical education, and academic performance* (200 2002-00800). Washington, DC: U.S. Government Printing Office.

U.S. Department of Health and Human Services. (2012). 2020 topic and objectives: Physical activity [Report]. Retrieved from http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=33

Verstraete, S. J., Cardon, G. M., De Clercq, D. L., & De Bourdeaudhuij, I. M. (2006). Increasing children's physical activity levels during recess periods in elementary

schools: The effects of providing game equipment. *European Journal of Public Health*, *16*(4), 415-419. doi:10.1093/eurpub/ckl008

Wang, Y., & Lobstein, T. (2006). Worldwide trends in childhood overweight and obesity. *International Journal of Pediatric Obesity*, *1*(1), 11-25. doi:10.1080/17477160600586747

Willenberg, L. S., Ashbolt, R., Holland, D., Gibbs, L., MacDougall, C., Garrard, J., ... Waters, E. (2010). Increasing school playground physical activity: A mixed methods study combining environmental measures and children's perspectives. *Journal of Science and Medicine in Sport*, *13*(2), 210-216. doi:10.1016/j.jsams.2009.02.011

Wittberg, R., Northrup, K., Cottrell, L. A., & Davis, C. L. (2010). Aerobic fitness thresholds associated with fifth grade academic achievement. *American Journal of Health Education*, *41*, 284-291.

Witters, D., Harter, J., Bell, K., & Ray, J. (2011, January 27). The cost of obesity to U.S. cities. *Gallup Management Journal*. Retrieved from http://gmj.gallup.com/content/145778/cost-obesity-cities.aspx?version=print

World Health Organization. (2012). What is a health promoting school? Retrieved from http://www.who.int/school_youth_health/gshi/hps/en/index.html#

Zask, A., Van Beurden, E., Barnett, L., Brooks, L. O., & Dietrich, U. C. (2001). Active school playgrounds- Myth or reality? Results of the "Move It Groove It" project. *Preventive Medicine*, *33*, 402-408. doi:10.1006/pmed.2001.0905

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