

January 01, 2010

Healthy kids, healthy futures open gym observations

Jordan Elizabeth Thomas
Northeastern University

Recommended Citation

Thomas, Jordan Elizabeth, "Healthy kids, healthy futures open gym observations" (2010). *Clinical Exercise Physiology Master's Theses*. Paper 5. <http://hdl.handle.net/2047/d20000273>

This work is available open access, hosted by Northeastern University.

Healthy Kids, Healthy Futures Open Gym Observations

A Thesis Presented

by

Jordan Elizabeth Thomas

to

Bouvé College of Health Sciences

In partial fulfillment of the requirement
for the degree of

Master of Science

in

Clinical Exercise Physiology

Northeastern University
Boston, Massachusetts 02115

May, 2010

Approval Form

**NORTHEASTERN UNIVERSITY
Bouvé College of Health Sciences
Graduate School**

Thesis Title: Healthy Kids, Healthy Futures Open Gym Observations

Author: Jordan Elizabeth Thomas

Department: Health Sciences

Approved for Thesis Requirement of Master of Science Degree

Thesis Advisor Signature

Date

Consultant Signature

Date

Consultant Signature

Date

Program Advisor Signature

Date

Signature Graduate School Director,
Bouvé College of Health Sciences

Date

Table of Contents

Approval Form.....	ii
Table of Contents	iii
List of Tables	v
List of Figures.....	vi
Abstract.....	vii
Chapter I Introduction.....	1
Purpose of the Study	4
Scope of the Study	4
Research Questions.....	4
Hypotheses	5
Limitations	6
Definition of Terms.....	6
Chapter II Review of the Literature	9
Preschool aged children	9
Overweight/obesity in preschool aged children.....	12
Physical activity to prevent childhood obesity	14
Approaches to increasing physical activity.....	16
Chapter III Methods and Procedures.....	25
Participants.....	25
Procedures.....	33
Assessment.....	39
Implementation of Activities	45

Statistical Analysis Plan.....	45
Chapter IV Results and Discussion.....	47
Results.....	47
Discussion.....	58
Chapter V Summary, Conclusions, and Recommendations for Future Research ..	64
Summary.....	64
Conclusions.....	65
Recommendations for Future Research.....	66
APPENDIX A. Healthy Kids, Healthy Futures Open Gym Waiver	67
APPENDIX B. Family Informed Consent Form	69
APPENDIX C. Caregiver Questionnaire.....	71
APPENDIX D. Script for Obtaining Child Assent	73
APPENDIX E. Student Informed Consent Form	74
APPENDIX F. Modified SOFIT Data Collection Form.....	76
APPENDIX G. Activity Debriefing List	78
References.....	79

List of Tables

TABLE

1.	Inter-observer reliability for child behaviors	51
2.	Inter-observer reliability for caregiver behaviors	51
3.	Inter-observer reliability for student activity leader behaviors.....	51
4.	Association between attendance rates at Open Gym and physical activity participation during a typical week.	57
5.	Association between attendance rates at Open Gym and physical activity participation during the previous seven days.	57

List of Figures

FIGURE

1. Number of intervals children engaged in activity levels (1-5) for all Open Gym sessions. 48
2. Number of intervals caregivers engaged in activity levels (1-6) for all Open Gym sessions. 49
3. Number of intervals student activity leaders engaged in each behavior for all Open Gym sessions. 50
4. Relationship between children engaged in VPA while student activity leaders managed the Open Gym space, $r=0.81$, $p=0.03$ 53
5. Relationship between children engaged in VPA while student activity leaders demonstrated activities at Open Gym, $r=0.65$, $p=0.11$ 53
6. Relationship between children engaged in VPA while student activity leaders instructed during activities at Open Gym, $r=0.57$, $p=0.18$ 54
7. Relationship between caregivers engaged in VPA while student activity leaders engaged in observing the Open Gym space, $r=0.9$, $p=0.01$ 54
8. Number of days caregivers self-reported engaging in at least 60 minutes of physical activity during a typical week pre- and post-Open Gym. 56
9. Number of days caregivers self-reported engaging in at least 60 minutes of physical activity during the previous seven days pre- and post-Open Gym. 56

Abstract

Thomas, J. Healthy Kids, Healthy Futures Open Gym Observations. M.S. in Clinical Exercise Physiology, 2010, 84p. (C.Sceppa)

Childhood obesity is growing at an alarming rate. To date there is a very limited availability of age-appropriate, family-oriented, community-based physical activity (PA) promotion programs for families with preschool aged children. Healthy Kids, Healthy Futures Open Gym (OG) is a community-based PA initiative created for families with 3-8 year old children to provide access to and promotion of PA. Ten families and 17 student activity leaders (SAL) were enrolled and structured observations across nearly 1,100 intervals were carried out during seven OG sessions. A modified systematic direct observation (SOFIT) tool was used to assess child, caregiver and SAL behaviors. Ten caregivers and 15 children were enrolled. Results showed that children engaged in walking or vigorous PA during 55% of OG intervals observed. By contrast, caregivers engaged in walking or vigorous PA during only 24% of the intervals. SAL engaged in instructing, demonstrating and promoting fitness during 64% of OG intervals observed. Despite the small sample size ($n=10$), statistically significant correlations were observed between increased child and caregiver PA levels when SAL were less engaged with families. Healthy Kids, Healthy Futures Open Gym is a promising model to promote and support an active lifestyle for families of young children.

Chapter I Introduction

The prevalence of overweight and obesity in the United States is increasing at an alarming rate. The 2003-2004 National Health and Nutrition Examination Survey (NHANES) estimated that 66% of adults in the U.S. are overweight or obese (Centers for Disease Control and Prevention [CDC], 2006). This steady increase in overweight and obesity in the U.S. is largely a result of an increased consumption of more energy-dense foods containing high levels of saturated fats and sugars and a reduction in physical activity (World Health Organization [WHO], 2010).

Overweight and obesity is not limited to adults. The 2003-2004 NHANES found that 31.9% of children and adolescents are overweight and 16.3% are obese. The NHANES observed an increase in overweight for two to five year olds from 7.2% in 1988-1994 to 13.9% in 2003-2004. An increase from 11 to 19% was also seen in six to 11 year olds during the same time periods (CDC, 2008). The CDC reports that one in seven preschool aged children from low-income families are obese. In 2008, 14.6% of low-income two to four year-olds were obese (CDC, 2010). A recent study found that nearly one in five (18.4%) four year old children was obese (Anderson & Whitaker, 2009).

Weight gain is a result of energy imbalance within the body. When a person takes in more calories than his/her body is using, the body will store the extra calories, resulting in weight gain. The food that a person consumes and the amount of physical activity s/he participates in affect his/her weight. In order for a person to lose weight, s/he must use more calories than s/he is consuming. A caloric deficit (using more calories than consuming) of 3,500 calories will allow a person to lose one pound. Inversely, the

addition of an extra 3,500 calories will cause a person to gain one pound. A person is able to create a caloric deficit by eating fewer calories, burning more calories, or a combination of the two (CDC, 2009a). The CDC recommends that adults participate in at least 150 minutes of moderate-intensity aerobic exercise and two or more days of strength-training exercises every week to help maintain a healthy weight. For individuals who need to lose weight, the CDC recommends increasing the length and/or duration of exercise in order to increase the amount of calories burned. The CDC also recommends that children are physically active for at least 60 minutes each day (CDC, 2009b).

Overweight and obesity do not affect all people equally. The prevalence of overweight and obesity in minority groups is significantly higher compared to non-Hispanic whites. Data from the 2006-2008 Behavioral Risk Factor Surveillance System (BRFSS) surveys found that non-Hispanic blacks had the highest rate of obesity at 35.7%, followed by Hispanics at 28.7% and non-Hispanic whites at 23.7% (Morbidity and Mortality Weekly Report [MMWR], 2009). Socioeconomic status also plays an important role in the obesity epidemic in the U.S. Researchers found that individuals in low-income communities are disproportionately overweight and obese compared to higher-income individuals (Zhang & Wang, 2004).

The WHO recommends the establishment and implementation of a population-based approach to long-term weight management for individuals and groups who are at risk of developing obesity. Obesity prevention, weight management, and weight loss should all be included aspects to prevent and treat obesity, as well as environmental support for healthy diets and physical activity. Programs should also focus on increasing physical

activity levels to at least 30 minutes per day (WHO, 2010). Currently, there are very few programs available to families that address both nutrition and physical activity levels.

In February 2010, First Lady Michelle Obama announced a new campaign to help fight childhood obesity. The campaign, “Let’s Move” recommends that children participate in at least 60 minutes of physical activity each day. The campaign also places emphasis on families making healthier decisions at home and improving the nutritional quality of school lunch programs (<http://www.letsmove.gov>).

Healthy Kids, Healthy Futures (HKHF) was a pilot program that started in February, 2009 and was funded by Children’s Hospital Boston, Boston Red Sox, and Northeastern University in Boston, Massachusetts. HKHF was developed in partnership with community-based organizations including: The Boston Public Health Commission (BPHC), Action for Boston Community Development, Inc. (ABCD) Head Start, and Boston Centers for Youth & Families (BCYF). HKHF was designed to provide opportunities for caregivers to improve their health knowledge, attitudes and behaviors related to nutrition and physical activity and for Head Start providers to self-evaluate their nutrition and physical activity environments and use this information to set and implement goals. An additional component of HKHF, Open Gym, was designed as a community-based initiative to provide an environment for caregivers and their children three to eight years old to be physically active together. Currently, there is very limited physical activity programming for children in this age group. Open Gym is unique because it not only offers programming to children three to eight years old but also programming for their caregivers with the intent of having physical activity family participation.

Purpose of the Study

The purpose of this study was to determine if children and caregivers were engaged in moderate-to-vigorous physical activity (MVPA) during the Open Gym. In addition, caregiver physical activity changes were monitored.

Scope of the Study

Participants of this study were children three to eight years old, their caregivers, and student activity leaders. This study focused on child, caregiver, and student activity leader behavior at Open Gym conducted at Madison Park Community Center, Roxbury, MA between September and December of 2009. All procedures for this study were approved by the Institutional Review Board at Northeastern University. Child, caregiver, and student activity leader behavior was determined using direct observation during the Open Gym. Activities offered at Open Gym include catching and throwing, tag games, parachute, obstacle courses, and dance. Children, caregivers, and student activity leaders who have previously attended the Open Gym pilot prior to September 2009 were excluded from participation in this study.

Research Questions

For the purpose of this study, the following research questions were addressed:

1. How physically engaged are children during Open Gym?
2. How physically engaged are caregivers during Open Gym?
3. What behaviors are the student activity leaders engaged in during Open Gym?
4. Does participation in Open Gym increase overall physical activity participation in caregivers outside of Open Gym?

Hypotheses

For the purposes of this study the following hypotheses were put forth:

1. Children will engage in moderate-to-vigorous physical activity (MVPA) for a majority of the time they are at Open Gym as assessed by direct observation using a modified System for Observing Fitness Instruction Time (SOFIT) tool based on combined code level 4 (walking) and code level 5 (vigorous) (McKenzie, 2009; McKenzie, Sallis, & Nader, 1991).
2. Caregivers will engage in MVPA for a majority of the time they are at Open Gym as assessed by direct observation using a modified SOFIT tool based on a combined code level 4 (walking) and code level 5 (vigorous) (McKenzie, 2009; McKenzie et al., 1991).
3. Activity leaders will promote fitness, demonstrate fitness, or instruct children and caregivers for a majority of the time during Open Gym as assessed by direct observation using a modified SOFIT tool based on the codes; promotes fitness, demonstrates fitness, or instructs (McKenzie, 2009; McKenzie et al., 1991).
4. After participation in Open Gym caregivers will significantly increase the amount of physical activity that they engage in outside of Open Gym as measured by the Patient-Centered Assessment and Counseling for Exercise Plus Nutrition (PACE+) Adolescent Physical Activity Measure (Prochaska, Sallis, & Long, 2001).

Limitations

Limitations of this study include the following. Participants in this study were all minorities. This study took place in a community center located in a lower-socioeconomic inner-city community. All activities were implemented and monitored by student activity leaders from Northeastern University, some with little or no previous experience working with young children. All children participating in this study were between the ages of three and eight years old. Caregivers with children this age may be more inclined to participate in activities with their children compared to caregivers with older children who may be more independent. Activities offered at Open Gym were adapted from evidenced based curriculum as well as I am Moving, I am Learning (IMIL), a program used in Head Start programs. Activities were selected and implemented to include caregivers. Participation in Open Gym, regardless of enrollment in this study, was voluntary and attendance was not mandatory. All activities offered were instructed in English only. Therefore, results of this study may not be generalizable beyond the scope of this study.

Definition of Terms

For the purposes of this study the following terms are defined:

Caregiver: Any person 18 years old or older responsible for a child(ren) attending the Open Gym.

Families: At least one caregiver and one child between the ages of three to eight years from the Boston or surrounding community.

Healthy Kids, Healthy Futures project manager: Full-time staff member who is responsible for overseeing all aspects of Healthy Kids, Healthy Futures.

Moderate-to-vigorous physical activity (MVPA): Any type of activity or exercise that requires more energy expenditure than is required for normal walking and increases heart rate from rest. For the purpose of this study MVPA will be defined as combined code level 4 (walking) and code level 5 (vigorous).

Observed families: A caregiver-child dyad from the same family.

Open Gym coordinators: Graduate students responsible for organizing the Open Gym space, monitoring activities, monitoring family registration, and communicating with student activity leader, student observers, and student research assistant.

Physical activity: Any bodily movement that increases energy expenditure above resting level.

Physical exercise: A type of physical activity that has been planned and is structured (intensity, duration, frequency) for the purpose of increasing physical fitness.

Sedentary behavior: Any type of exercise or physical activity that does not increase energy expenditure above resting levels.

Student activity leaders: Trained university students responsible for implementing activities at the Open Gym, registering and signing-in families, and engaging children and caregivers at activity stations.

Student observers: Trained graduate students responsible for observing families, activity leaders and the overall use of activity stations by using a predetermined coding system.

Student research assistant: Undergraduate student responsible for enrolling families at Open Gym and data entry.

Vigorous physical activity (VPA): Any type of activity or exercise that requires more energy expenditure than is required for normal walking and significantly increases heart rate from rest (i.e., running).

Chapter II Review of the Literature

This chapter represents a review of current published data related to preschool aged children and physical activity. The review of the literature was conducted using computer searches (EBSCOhost, Elsevier, MEDLINE, Medscape, and PubMed). Searches identified 80 published articles. Inclusion criteria included published peer-reviewed articles in the English language between 1990 and 2010. School and community setting physical activity interventions were included. Age criterion for children was 2-12 years. Review of eligible articles yielded 43 studies. Exclusion criteria included studies that did not report measurement tool and abstracts whose full-published article was not available. Keywords and search terms included “exercise,” “physical,” “activity,” “preschool,” “children,” “community,” “family,” “school,” “overweight,” “obesity,” “prevention,” and “development” singly and in combination.

Preschool aged children

The time at which children are of preschool age (three to five years old) is a critical period of rapid growth and acquisition of knowledge and skills. During this time children are exposed to a variety of new environments and experiences that influence their physical, mental, and social development.

Skill development. During the first years of life, children acquire basic voluntary movements. As children grow they learn new motor development skills such as running, skipping, turning, and throwing. Once they have learned a new movement they must continue to repeat learned skills many times before they are able to perfect them

(Haywood, 1993). Not all children of the same age group progress with skill development at the same rate so a wide range of skill levels within the same age group can be seen (Haywood, 1993). The development of both gross and fine motor skills in young children is necessary for proper physical advancement. Gross motor development is needed in order for children to move, stabilize, and control their bodies and objects. Fine motor skills are needed for children to be able to perform everyday tasks such as tying shoes (Cools, De Martelaer, Samaey, & Andries, 2009). Young children should develop fundamental movement patterns such as locomotor activities (i.e., running and jumping), manipulative activities (i.e., throwing and catching), and stability activities (i.e., balancing on one foot; Gallahue & Ozmun, 2002). The rate at which children develop these skills is influenced by several factors. Maturation, opportunities to practice new skills, instruction, encouragement, and the environment in which they are exposed to these factors play a role in the acquisition of these fundamental movement patterns (Gallahue & Ozmun, 2002).

Equipment and play environment. The more opportunities that young children have to engage in movement, the more opportunities they will have to acquire and practice motor development skills. Hannon and Brown (2008) found that the addition of age-appropriate playground equipment selected specifically to supporting locomotor and manipulative activities decreased sedentary physical activity levels in three to five year olds (57.17% to 41.18%) and increased light (from 30.6 to 34.13%), moderate physical activity (MPA; from 9.84% to 17.60%), and VPA (from 2.31% to 6.97%) levels (Hannon & Brown, 2008). Researchers from this same study found that three year olds participated in more MPA compared to five year olds who participated in more VPA. One

explanation for this is the ability of older children to move around equipment at a faster pace due to advanced motor skills, allowing for the higher amount of VPA (Hannon & Brown, 2008). This emphasizes the need to have age-appropriate equipment and activities available for children to maximize their participation in physical activity.

Along with having age-appropriate equipment, the type of equipment that is offered at a play space may also determine the amount of physical activity preschool aged children engage in. Bower et al. (2008) suggest that fixed playground equipment pieces (i.e., climbing structures, balancing surfaces, and indoor play space) are associated with lower levels of physical activity (Bower, 2008). Dowda et al. (2009) found that children had fewer sedentary minutes per hour (measured using accelerometers) when the preschool they were attending had at least one piece of portable playground equipment (i.e., balls and tricycles) resulting in $36.7 + 1.5$ minutes compared to $33.4 + 0.8$ minutes of physical activity at preschools with no portable playground equipment. Additionally, in this study children spent more minutes engaged in moderate-to-vigorous physical activity (MVPA) per hour when their preschool offered at least one piece of portable playground equipment ($7.4 + 0.3$ compared to $6.2 + 0.4$ minutes) and less fixed playground equipment (i.e., swings and slides; $7.6 + 0.3$ compared to $6.4 + 0.4$ minutes; Dowda et al., 2009). The increase in sedentary behavior in children at preschools with less portable equipment may be a result of the tendency for children to congregate around fixed equipment (i.e., waiting in line for their turn; Dowda et al., 2009). Having portable equipment decreases the tendency for children to congregate due to the necessity of the child(ren) to move with the equipment in order to play with it (i.e., jump ropes and balls).

Another important factor to consider when designing a play space for preschool aged children is caregiver influence. For young children parents and caregivers possess most, if not all, decision making control about attendance at play spaces outside of the home and day-care settings. Sallis, McKenzie, Elder, Broyles, and Nader (1997) found that safety was the most important factor parents considered when deciding on a play space for their children. Offering a safe space that caregivers would want to access with their children could greatly increase their attendance to spaces that promote physical activity.

Overweight/obesity in preschool aged children

The CDC describes obesity in children as a Body Mass Index (BMI)-for-age $\geq 95^{\text{th}}$ percentile on the sex specific BMI-age-for-growth-charts for the United States. Overweight in children is described as a BMI-for-age between the 85^{th} and 95^{th} percentile (CDC, 2009c).

Epidemiology. Overweight and obesity affect one in five children in the U.S. and is the most common form of nutritional disease in children in the U.S. (Dietz, 1998). According to the American Academy of Pediatrics (AAP), the number of obese children has doubled over the past two decades (AAP). The CDC's Pediatric Nutrition Surveillance System (PedNSS) reported an increase in childhood obesity among low-income, preschool aged children from 12.4% in 1998 to 14.5% in 2003 (MMWR, 2009). Overweight and obesity trends in the preschool aged population are important to document and follow because trends seen in this age group can forecast trends seen in older populations.

Living a sedentary lifestyle has been shown to positively correlate with becoming overweight. Currently 25% of children in the U.S. are classified as being completely

sedentary (Miller, Rosenbloom, & Silverstein, 2004). Sedentary behavior includes screen time (time spent at a computer screen or watching television). Time spent watching television has been linked with becoming overweight in children. Children who watch five hours or more of television per day have an obesity rate of 8.3 times higher when compared to children who watch two hours or less of television per day (Proctor et al., 2003).

Health consequences. Being overweight or obese as a child can have serious health consequences. Type 2 diabetes, high blood pressure, high cholesterol, sleep apnea, menstrual abnormalities, orthopedic problems, depression, and low self-esteem have all been shown to affect young children who are overweight or obese (AAP; American Heart Association [AHA], 2009; Dietz, 1998). In addition, research has shown that people who are overweight as children are frequently overweight as adults (Serdula et al., 1993; Krassas, 2004). According to the U.S. Surgeon General, 70% of overweight adolescents have a chance of becoming overweight or obese adults. For children with at least one parent that is overweight or obese that rate increases to 80% (U.S. Surgeon General, 2007). Coronary heart disease, type 2 diabetes, cancer, stroke, and osteoarthritis have been linked to being overweight as an adult (CDC, 2009b).

A review of electronic medical record (EMR) data obtained from primary care practices found that in two to five year old children, systolic blood pressure (SBP) and diastolic blood pressure (DBP) increased with increasing age- and sex-specific BMI for both boys and girls. Boys and girls two to five years old under the 85th percentile age-sex-BMI group had SBP of 89.1 ± 11.1 and 87.5 ± 10.3 , respectively. Boys and girls from the same age group who fell in the $\geq 95^{\text{th}}$ percentile age-sex-BMI had SBP of 93.1 ± 11.4 and

92.7± 11.9, respectively. Similar increases were also seen in DBP in the same age group and BMI percentiles; boys DBP increased from 52.3 ± 8.6 (< 85th percentile) to 55.6 ± 8.9 (≥ 95th percentile) while girls DBP increased from 51.8 ± 8.0 (< 85th percentile) to 55.2 ± 8.3 (≥ 95th percentile; Falkner et al., 2006).

A study conducted by Weiss et al. (2004) found that metabolic syndrome was seen in 38.7% of moderately obese (a threshold BMI z score of 2.0 to 2.5) children and adolescents (four to 20 year olds) and 49.7% of severely obese (BMI z score greater than 2.5) children and adolescents. The data are significant because they show that increasing BMI can have an effect on blood pressure and metabolic abnormalities in children as young as two to five years old.

Physical activity to prevent childhood obesity

An increase in physical activity can be linked to an increase in life expectancy, a decrease in cardiovascular disease and blood pressure, the reduction of diabetes risk factors and some cancers, as well as improved psychological well-being (AHA, 2009). To date, limited studies have been conducted showing the long-term effects of physical activity intervention with young children to prevent decreases in overweight or obesity. However, research has shown that the amount of physical activity parents or caregivers engage in plays a significant role in the amount of physical activity that their children will engage in (Golan & Crow, 2004).

Physical activity levels in preschool aged children. A literature review of 49 studies that measured physical activity levels in preschool aged children conducted by Oliver, Schofield, and Kolt (2007) found that preschool aged children participate in low levels of VPA and high levels of sedentary behavior. A common misconception by

parents and caregivers is the amount of physical activity that their child(ren) is/are engaged in while attending preschool. Irwin, He, Bouck, Tucker, and Pollett (2005) found that parents reported their preschooler engaged in three to four hours of daily physical activity, while the actual time that the child was engaged in physical activity was much less (Irwin et al., 2005). A study conducted by Pate, McIver, Dowda, Brown, & Addy (2008) found that children were physically inactive for the most of the time they spent at preschool. A study looking at three to five year olds attending a preschool program found that the children were sedentary for 89% of their time at the program (Brown et al., 2009). If parents believe that their children are engaging in enough physical activity during preschool, they may be less inclined to incorporate physical activity in the home.

Recommendations for physical activity in preschool aged children. Preschool aged children need to be exposed to a variety of movement skills. The National Association for Sport & Physical Education (NASPE) recommends that preschool aged children engage in at least 60 minutes of structured physical activity and at least 60 minutes of unstructured physical activity daily (Seal & Yurkovich, 2009). Structured and unstructured play allows children to develop and practice basic motor skills and increase their cardiovascular endurance and muscular strength. The AAP recommends that preschool aged children should engage in free play with emphasis placed on having fun, exploration, and experimentation. The AAP also recommends that screen time (television, computer, etc.) be limited to less than two hours each day (AAP, 2006).

Parental correlations to physical activity in children. Parental participation in physical activity has been shown to correlate directly to the amount of daily physical

activity children participate in. A review of published research conducted by Sallis, Prochaska, and Taylor (2000) found a positive association between children and parents' physical activity in 38% (11 of 29) of reviewed studies. Young children learn new behaviors by modeling the behavior of their parents and caregivers (Golan & Crow, 2004). Children imitate behaviors they observe starting at a very early age and healthy lifestyle behaviors are learned early on. Parents who are involved in physical activity and provide a healthy environment can serve as a role model for healthy eating and activity lifestyles for their children (Golan & Crow, 2004).

Early intervention. Prevention of obesity in preschool aged children is important due to the lack of success in reversing obesity once it has been established. However, there is very limited information about physical activity programs and obesity interventions for preschool aged children. The section below describes some of the approaches to increasing physical activity in children.

Approaches to increasing physical activity

School based approaches. Sports, Play, and Active Recreation for Kids (SPARK) was designed as a research-based program to increase physical activity levels and physical fitness in elementary school aged children during physical education classes in schools (McKenzie, Sallis, & Rosengard, 2009). In addition to increasing physical activity levels during physical education classes, SPARK aimed to improve children's participation in physical activity outside of physical education classes. The initial SPARK program included a variety of different physical education activities and curriculum to promote physical activity outside of physical education classes, in addition to training and support for teachers who would be implementing the SPARK program. The

curriculum was designed so that both classroom teachers and physical education teachers would be able to use the program (McKenzie et al., 2009). Dowda, Sallis, McKenzie, Rosengard, and Kohl (2005) found that SPARK programs were sustained at elementary schools for at least four years after implementation in 80% of the elementary schools where the program was initially implemented.

In a study by Marcoux et al. (1998) 24 teachers conducted SPARK self-management workshops with 549 students in the fourth and fifth grades (mean age of students at baseline was 9.25 years). Workshops were held for 30 minutes once a week for a total of 31 sessions in addition to the students' regular physical education classes. SPARK workshops focused on promoting physical activity outside of school by teaching the children healthy behavior skills. Each week students set three physical activity goals designed to help increase cardiovascular fitness (e.g., jogging, swimming, cycling). Students were provided with a chart on which they could record the amount of time spent in physical activities and would receive points based upon the amount of physical activity they participated in. Students were given rewards (e.g., stickers, water bottles, pencils) based upon the number of points they accumulated. During the three years that the study was conducted, 148 workshops were observed. Teachers were observed implementing 65% of the SPARK workshop curriculum during observations. Student participation was measured using the points that they acquired for participating in physical activity outside of school. Boys' participation in the workshops was significantly correlated with changes in BMI ($r = -0.15$; Marcoux et al., 1998).

In another study of the SPARK curriculum Sallis et al. (1997) randomly assigned seven elementary schools to one of three groups. The first group was taught the SPARK

curriculum by a certified physical education specialist. The second group was led by classroom teachers trained to implement the SPARK curriculum. The third group served as a control. All students were in the fourth grade. The mean age across all three groups was 9.49 to 9.62 years. Participation in after school physical activity was self-reported by students using a one-day recall checklist. Out-of-school physical activity was monitored one weekday per semester and one weekend per school year. Physical fitness and anthropometric measurements were assessed. Cardiovascular endurance was measured using the mile-run test. Muscular strength and endurance were measured by the number of bent knee sit-ups completed in 60 seconds. Upper body strength was measured by the number of completed pull-ups. Hamstring flexibility was measured with the sit-and-reach test. Calf and triceps skinfolds were taken three times using calibrated Lange calipers. Physical education classes were directly observed using the SOFIT tool (McKenzie, 2009; McKenzie et al., 1991). During each year that the study was conducted, physical education classes were observed for two full weeks. Inter-observer agreement was 91% for all observations. Researchers found that students in the specialist-led and teacher-led classes spent more minutes per week (40 minutes and 33 minutes, respectively) being physical active in physical education classes when compared to the control classes (18 minutes). Researchers also found that girls in the specialist-led group had better cardiorespiratory endurance and abdominal strength compared to girls in the control group (Sallis et al., 1997). With the successful implementation of SPARK at elementary schools, researchers have developed additional curricula to be used with younger children.

SPARK Early Childhood (Kimbrell, Rosengard, Richey, & McKenzie, 2003) was developed to engage preschool aged children in physical activity. The design of the curriculum addresses the short attention spans of children at this age. The activities were developed to be quickly explained and implemented and allow for the teacher to introduce a variety of activities to the children. Activities for this curriculum have been divided into separate units (i.e., Beanbag Bonanza, Hoop Hoopla, and Perpetual Parachute). Individual activities are found within the units and progress in a lesson format. The units begin with “Exploration Time,” which allows the children to play and familiarize themselves with the object and serves as a warm-up to an activity. “Exploration Time” is followed by a “Challenge,” wherein the instructor provides specific actions for the children to attempt. Next, the “Motor Task” section of the unit is a chance for the children to take a brief rest from physical activity and practice non-locomotor skills (i.e., balancing) and activities that promote children to say and do the actions that they are performing (i.e., touch their heads, knees, toes, etc. while saying the body part out loud). The “Games and Activities” section of the unit allows children the opportunity to apply and practice new skills. The activities in this section place a large emphasis on repetition to increase the acquisition of the skill. The last section in the unit is dedicated to the “Wrap-up” of the activities. This is a chance for instructors to review with the children any important new concepts and also allows the chance for social interaction among the children (Kimbrell et al., 2003). No information on the effectiveness of the SPARK Early Childhood program has been published.

SPARK Physical Education Grades K-2 (Rosengard, Baranowski, Williston, McKenzie, & Short, 2008) was developed for instructors to implement activities with a

large emphasis placed on movement basics. The introduction and practice of locomotor skills such as walking, jumping, galloping, hopping, side-slides, running, leaping, and skipping are included in the activities. Emphasis is also placed on movement concepts such as levels, pathways, tempo, directions, and relationships. Non-locomotor skills such as bending and stretching, twisting and turning, raising and lowering are also included in the curriculum. All activities have been divided into units (i.e., Balance, Stunts, and Tumbling, Jumping, and Catching and Throwing). Each activity has been assigned a grouping (i.e., individual, pair or group activity). All activities have been divided into three sections: “Ready,” “Set,” and “Go!” “Ready” details the equipment needed for the activity. “Set” gives instructions for setting up the activity. “Go!” provides directions and word cues for the instructor as well as variations of the activity. Activities also include a “Wrap It Up” section allowing instructors an opportunity to review important lessons covered during the activity with the children (Rosengard et al., 2008). No information on the effectiveness of the SPARK Physical Education Grades K-12 program has been published.

I am Moving, I am Learning (IMIL) was developed for use at Head Start programs as a way to address the increasing number of overweight children attending Head Start. Head Start is a nationally run school readiness program for preschool aged children from low-income families. IMIL was initially piloted in 2005 in Virginia and West Virginia. IMIL was designed by incorporating established recommendations and policies regarding physical activity for children and obesity prevention including the CDC’s BMI-for-Age/Gender Screening Guidelines, the AAP Policy Statements & Task Force on Obesity, and Active Start: A Statement of Physical Activity Guidelines for

Children Birth to Five Years from the NASPE (Region III Administration for Children with Families [ACF], 2006). The goals of IMIL were to increase the amount of time children at Head Start were engaged in MVPA, to improve the quality of structured physical activities and movement, and to improve the nutritional choices provided to the children. Head Start staff members attended a two and a half day intensive training to learn how to implement IMIL in the classroom. IMIL curriculum was designed to be flexible, allowing staff to make the activities work with their individual program needs. Follow-up support for Head Start staff is provided by the Region III Head Start Technical Assistance System (Region III ACF, 2006). An assessment of implementation of IMIL was conducted on 53 Head Start centers that underwent IMIL training. Follow-up questionnaires were mailed to each Head Start center that had participated in the training one year after completing the training. 94% of programs reported enhancements made at their center that focused on physical activity goals, 85% reported the use of equipment and/or vocabulary for teaching structured movement, 77% reported the addition of new play equipment, and 56% reported making changes to or enhancing space used for physical activity. 44% reported all of the previously mentioned changes had been implemented at their center (Office of Planning, Research and Evaluation [OPRE]). No information on the effectiveness of the program has been published.

In contrast to the published school-based physical activity approaches described above, the use of community-based approaches to increasing physical activity in children and their families has been under-investigated, especially approaches targeting families with preschool aged children. Young children do not make decisions regarding opportunities to participate in physical activity. Therefore, opportunities for physical

activity strategies aimed at increasing physical activity participation in preschool aged children should also target their caregivers.

Behavioral and social approaches to increasing physical activity. Behavioral and social approaches to increase physical activity aim at teaching behavior management skills while structuring the social environment to support the learned behavior skills (Guide to Community Preventive Services, 2009). The Task Force on Community Preventive Services (Task Force) is an independent nonfederal group that reports on the effectiveness of interventions that aim at increasing physical activity. Evaluations and recommendations are given based on findings from systemic literature reviews (Task Force, 2002). The Task Force strongly recommends social support interventions within a community setting that focus on the formation, strengthening, and maintenance of social networks that provide supportive physical activity behavior changes. Programs like these have been shown to be successful in increasing physical activity in adults (Task Force, 2002) and adolescents (Luepker et al, 1996). For example, The Child and Adolescent Trial for Cardiovascular Health (CATCH) program was designed as a school-based health promotion study for elementary school aged children. CATCH involved modifications in school food services, improved physical education, and health curricula in the classroom. The goal for CATCH was for students to be engaged in MVPA for at least 50% of class time. Activities for CATCH were designed to make it possible for all students to participate and focused on practicing physical fitness, movement skills and sports skills (Child Trends, 2007). CATCH also aimed to offer more nutritious meals to students and to teach students about healthy eating habits, risks of smoking, and the importance of physical activity.

Evaluation of the CATCH program was conducted at 96 elementary (56 intervention, 40 control) schools throughout four states (Luepker et al., 1996). As part of the CATCH program, food service staff underwent training to improve the nutritional value of school meals, teacher training was provided to increase the amount of MVPA offered during physical education classes, and health curricula included physical activity, risk, of smoking, and healthy eating habits. Outcomes showed a significant decrease in the fat content of school lunches from 38.7% to 31.9% in intervention school lunches compared to a decrease of 38.9% to 36.2% in control school lunches. Students in the study self-reported daily energy intake. Students from intervention schools significantly reduced fat intake from 32.7% to 30.3% compared to control schools (32.6% to 32.2%). Students in intervention schools self-reported more time spent on MVPA (58.6 minutes) compared to students in control schools (46.5 minutes). Blood pressure, cholesterol, and body size were also measured, with no significant changes seen between the two groups (Luepker et al., 1996). Findings from this study show the success that these types of interventions can have on increasing participation in physical activity but more research is needed in this area for preschool aged children.

Environmental and community approaches to increasing physical activity.

The Task Force recommends creating or enhancing public access to places within the community for physical activity. These recommendations include creating walking/biking trails, constructing exercise facilities, or providing access to appropriate facilities within the community (Guide to Community Preventative Services, 2009). Sallis et al. (2000) reported that access to programs and facilities correlated with the amount of physical activity children (three to eight years old) participated in. Data on

community-based approaches to increase physical activity in preschool aged children is scarce. Environmental interventions for children tend to focus on elementary or high school aged children and most do not include preschool aged children (Van Sluijs, McMinn, & Griffin, 2007). More research needs to be conducted on community-based approaches for families with young children and the effects on physical activity participation.

Chapter III Methods and Procedures

This chapter presents the methods and procedures employed in this study including subject selection, Open Gym activities, test instruments, and data analysis.

Participants

Families (Caregivers and Children). For the purpose of this study, a family consisted of at least one caregiver and one child between the ages of three to eight. Families attending Open Gym were recruited for participation in this study. Only families that had not previously participated in Open Gym were eligible for this study. Families were from Boston and the surrounding communities. Caregivers were black ($n=5$) and Hispanic ($n=4$). The average age of caregivers was 38 years old. Eight caregivers were female and one caregiver was male.

Student Activity Leaders. Seventeen Northeastern University students served as student activity leaders. Sixteen students were recruited through the Northeastern University Service-Learning Program to become Open Gym student activity leaders and one student was a volunteer recruited by word-of-mouth. Trained student activity leaders were also given the opportunity to participate in this study. Only students who had not previously participated in Open Gym were eligible to participate. Student activity leaders were black ($n=1$), Caucasian ($n=11$), Hispanic ($n=2$), Lebanese ($n=1$) and multi-racial ($n=2$). Two student activity leaders were male and 15 were female.

Setting

Open Gym. Activities offered at Open Gym were adapted from several research and non-research based physical activity curricula. Activities selected for use in Open Gym primarily came from the SPARK Early Childhood (Kimbrell et al., 2003) curriculum, and SPARK K-6 (Rosengard et al., 2008) curriculum, and the IMIL Head Start activities. The activities from these curricula were specifically designed for young children. Activities at Open Gym had to be adapted to allow for the participation of children and their caregivers. For many of the activities, caregivers served as additional participants and role models for children to observe the proper way to execute an activity or skill.

Open Gym took place at a community center in an urban neighborhood in Boston, MA for a period of 90 minutes on Saturday mornings. Currently there are a very limited number of programs available for preschool aged children and their caregivers. Open Gym provided a unique opportunity for caregivers and children to come together in a safe space to increase their knowledge and participation in physical activity.

At the community center, the space provided for Open Gym was sectioned into three separate basketball courts, all within the same open space. At each court student activity leaders set-up, implemented and monitored the activities. After signing in, families were able to freely move throughout the different activity stations that were set up. Allowing families to freely move through each activity at their own pace helped address the short attention span that many young children have and permitted quick transitions between activities.

Activities at Open Gym ran continuously for 90 minutes. All activities offered had been adapted so that children and caregivers could join or leave an activity at their own pace. In order to do this, several different versions of the same activity were being led at the same activity station. For example, if the activity station was Catching and Throwing, one student activity leader would encourage children and caregivers who had just entered the station to explore the objects available (e.g., a bean bag). During this same time an additional student activity leader would be instructing a child and caregiver to throw the bean bag to each other. This set-up allowed for the progression of the activity and the acquisition and practice of a skill by the participating child(ren). Physical ability can vary greatly between children, even those of the same age. Therefore, allowing the activity to run with a small group or with just one family ensured that children could progress through the activity at their own pace without getting frustrated. Maturity levels also vary among children and with the guidance of student activity leaders, children and caregivers were able to adapt the activity being offered to the varying developmental stages of the child(ren).

The activities that were offered during Open Gym had also been designed for repetition of lessons. Activity stations had the same themes each week, focusing on the same types of motor skills. Repeating lessons allowed children to practice skills and gave them time to improve these skills over time (Kimbrell et al., 2003).

Open Gym Activities. Open Gym coordinators assigned student activity leaders to a station prior to the beginning of Open Gym and provided them with different activities that they chose to implement. Each activity station was designed for different types of

activities, allowing for the most variety possible. Each activity station focused on a different stage of learning and motor development.

Free play area. An area where children and caregivers could use a variety of equipment together in an unstructured manner. Hula-hoops, mini-basketball hoop, mini-soccer net and ball, jump ropes, ball and scoop, parachutes, and a balance beam are examples of equipment that was available in the free play area. Student activity leaders were responsible for showing caregivers and children how to play with the equipment and to give them ideas of different activities that they could do.

Dance area. An area where age-appropriate music was played and different movements were lead by student activity leaders. Skipping, side-stepping, hopping, twirling, and twisting are all examples of movements that were done during this activity. Special guests also came to Open Gym to lead dance workshops for both children and caregivers (e.g., Zumba! and Salsa dancing).

Younger child area. This area was dedicated to provide activities for smaller children (i.e., three to five years old). Activities in this area focused more on the acquisition and practice of skills (e.g., catching, throwing, hopping on one foot). Activities in this area progressed in a lesson format, allowing the children time to familiarize themselves with an activity and practice it before progressing.

Older child area. This area was dedicated to providing activities for older children (i.e., six to eight years old). Activities in this are focused more on gross motor development (e.g., running, throwing small and large balls, kicking balls, playing tag). Oftentimes, older children had been introduced to most locomotor skills and the activities provided at this station allowed them the chance to practice those skills. Older children have a higher endurance capacity than younger children and activities at this station allowed for MVPA for longer periods of time.

Challenge area. An area dedicated to gymnastics, obstacle courses, and relay races. This area focused on teaching tumbling, jumping, balancing, and crawling. This area put these skills together and challenged children and caregivers to different tasks as they moved through the space. Activities offered at this station were adaptable for children of all ages and student activity leaders made adjustments to an activity based upon an individual's physical capabilities.

Group game. During the final 15 minutes of Open Gym all caregivers and children attending Open Gym were brought together and student activity leaders ran a game. The game(s) offered during this time were for all caregivers and children to participate in together (i.e., Simon Says, Tag). This allowed caregivers and children the chance to interact and socialize while participating in a structured activity.

Methods

Direct Observation to Assess Behavior. Direct observation was used to assess physical activity participation. During direct observation an observer recorded information about a child's activity types and patterns. Direct observation can be used in place of measurement tools such as an accelerometer which quantifies movement but does not show in what context the child was moving to obtain those steps (i.e., walking versus running) and their inability to detect and account for upper body movement (Oliver et al., 2007). Momentary time sampling and partial-interval recording are both techniques used to assess physical activity and behavior during direct observation. During momentary time sampling a behavior is scored as either present or absent only during the exact moment the observations is made during each observation interval, regardless of any other behavior present during the observation interval. Momentary time sampling is based on the smallest sample of observed behavior but allows for the least biased estimate of behavior (Hintze, Volpe, & Shapiro, 2008). During partial-interval recording a behavior is recorded as being observed if at any point during the observation interval the behavior is exhibited. Partial-interval recording is used for behaviors that occur at low-rates or behaviors that occur for inconsistent durations. Partial-intervals tend to overestimate the actual occurrence of a behavior (Hintze et al., 2008).

System for Observing Fitness Instruction Time (SOFIT). SOFIT is a tool used for direct observation. It was specially designed for use in physical education classes (McKenzie, 2009; McKenzie et al., 1991). Its validity for accurately estimating engagement in physical activity has been documented using real-time measurements

(Heath, Coleman, Lensegrav, & Fallon, 2006) and accelerometers (Pope, Coleman, Gonzalez, Barron, & Heath, 2002).

Pope et al. (2002) compared the validity of the original SOFIT tool (SOFIT5; McKenzie, 2009; McKenzie et al., 1991) using TriTrac Accelerometers. TriTrac Accelerometers collected minute-by-minute data on the child's movement patterns. Direct observations were conducted based upon the predetermined SOFIT protocol (McKenzie, 2009; McKenzie et al., 1991). Children from third, fourth, and fifth grade physical education classes were randomly selected prior to the beginning of physical education classes and were fitted with a TriTrac Accelerometer. At the end of data collection, data from the TriTrac Accelerometers were downloaded to a computer and SOFIT5 observations were entered into a spreadsheet and matched to the TriTrac data by time interval. The correlation between the TriTrac Accelerometer and SOFIT5 was $r = .60$ (CI = .43-.73), supporting the use of SOFIT for assessing physical activity of children during physical education classes (Pope et al., 2002).

Researchers compared estimates of time spent in various physical activity intensities using the SOFIT6 paper and pencil tool (Pope et al., 2002) to actual time spent in various physical activity intensities using the Behavioral Evaluation Strategies and Taxonomies (BEST) software tool. The BEST software was designed to observe and record behaviors in real time. The BEST software was programmed specifically for the SOFIT6 activity and lesson context used. Researchers observed 148 third, fourth, and fifth grade girls and boys during physical education classes at seven elementary schools. Five students were randomly selected from each class and observed for four-minute intervals. Observations were conducted on a rotational basis until the end of the physical education class. BEST

was used during the same time period and used the same randomly selected students. Researchers reported no significant difference seen between the time spent in various physical activity intensities in the SOFIT6 paper and pencil version and BEST. The results of this research strongly support the use of the SOFIT tool to estimate physical activity intensity and total time spent in various physical activity intensities (Heath et al., 2006).

Training of Student Observers. Two trained graduate students served as student observers. Graduate student observers were trained by the Open Gym coordinators on how to implement the modified System for Observing Fitness Instruction Time (SOFIT; McKenzie, 2009; McKenzie et al., 1991) tool using a SOFIT training DVD. Training included familiarizing the students with the SOFIT protocol and modified data collection sheets. Students practiced their observations using a video provided with the SOFIT training DVD. The training video and intervals provided in the SOFIT training DVD were not the same as the intervals being observed during Open Gym so a modified interval answer key from the training DVD was made by the Open Gym coordinator and used to train the student observers. The two trained observers were trained to an 80% criterion on all observation categories using a training videotape of physical activity with practice observational intervals prior to commencing data collection.

Inter-observer agreement. Once trained, one graduate student served as the primary data collector and the second student was used for inter-observer agreement reliability check for one of the seven (14%) observation sessions. Reliability checks using inter-observer agreement for the SOFIT tool is

recommended for 10-15% of coded sessions (McKenzie, 1998). Point-by-point agreement was used to assess agreement. Percentage of point-by-point agreement was determined by the number of agreements (where primary and inter-observer observations were in agreement) divided by the total number of observations made, multiplied by 100. The percentage of point-by-point agreements between student observers across 17 behaviors of children, caregivers, and student activity leaders was 93%.

Procedures

Institutional Review Board Approval. All study documents/procedures were approved by the Institutional Review Board (IRB) at Northeastern University prior to commencement of this study.

Enrollment of Children and Caregivers. Enrollment of families for this study was conducted at each Open Gym. As families arrived at Open Gym, they were first directed to the sign-in table in the lobby area outside of the Open Gym space. All new families registered for Open Gym by completing registration forms (i.e., listing all names and ages of family members attending Open Gym and family contact information). Families were also required to read and sign a liability waiver (Appendix A) in order to participate in Open Gym. During registration, families eligible for this study were identified. Families who had not previously attended Open Gym prior to September 2009 and had at least one child three to eight years old were given the opportunity to participate in this study. Once identified, Open Gym coordinators and/or a student research assistant discussed the study details with the caregiver and families were given the opportunity to participate. Caregivers who agreed to participate in the study were

given a consent form to sign (Appendix B). Consent forms permitted trained student observers to observe caregivers and children. Caregivers who agreed to participate in the study were also administered a questionnaire regarding background information on themselves as well as two questions regarding their weekly physical activity participation (Appendix C). Consent forms and liability waivers were provided in both English and Spanish. Consent forms and liability waivers were discussed in detail with the caregiver(s) and Open Gym coordinators, project manager, and/or student research assistant. E-mails were provided in both English and Spanish. Telephone calls were made in English only. Child assent was also administered to all children of eligible enrolled caregivers (Appendix D). During child assent, Open Gym coordinators, project manager, and/or student research assistant explained to the child(ren) that their caregiver had decided to participate in the study and asked if the child(ren) would also like to participate. Caregiver name, child name, date of birth and/or age, and consent were recorded by the staff member who administered the assent. Ten caregivers and 15 children were enrolled into the study. One caregiver declined participation and 18 were ineligible.

Selection of Observed Children and Caregivers. For this study, an observed family consisted of a dyad of one caregiver and one child. Random selection for observation was based upon the order and number of children arriving at Open Gym. A registration list of all families participating in Open Gym was compiled and updated each week by Open Gym coordinators. Families enrolled in this study were indicated on the registration list. During registration at each Open Gym, registration staff were asked to list names of all eligible children who were attending the Open Gym that day along with

the age(s) of the child(ren) on a separate list. Caregiver names for each child were also recorded. Only children present at the Open Gym were recorded and were eligible for randomization for that day. Selection for the randomization list occurred during the first 15-20 minutes of Open Gym.

Enrollment of Student Activity Leaders. Students who agreed to participate in the study were given consent forms (Appendix E) during the student activity leader training. Seventeen trained student activity leaders were enrolled into the study.

Training of Student Activity Leaders. Northeastern University students recruited to be Open Gym student activity leaders were required to attend one, four-hour training session. Training was held on September 16th from 4-8pm at Madison Park Community Center in Roxbury, MA, where Open Gym sessions were held on Saturday mornings. A detailed outline of the student activity leader training is described below.

Healthy Kids, Healthy Futures. A brief overview of Healthy Kids, Healthy Futures (HKHF) was delivered to the student activity leaders to familiarize students with the entire program and the program goals. Background information about the program as well as the different organizations that were involved was included.

Introduction to Madison Park Community Center. A brief overview of BCYF, the organization that runs the community center where Open Gym sessions took place. A short introduction by a staff member from the Madison Park Community Center was also included.

Overview of Open Gym. Student activity leaders were familiarized with Open Gym and the role that it plays within the HKHF program and the importance of teaching physical activity at such a young age. The aspects of the program that make Open Gym unique and how limited programming for children this age was discussed. A brief description of the activity stations, the registration table, and overall set-up of the Open Gym space was included.

Expectations of students. Expectations of student activity leaders were discussed. Dress code, arrival time, and attendance was included as well as an overview of the Open Gym Blackboard site. Students had access to the Blackboard website where Open Gym coordinators and project manager contact information, Open Gym activity schedules, and any other information regarding Open Gym was posted.

Stages of locomotor development. A presentation provided by a faculty member in the Physical Therapy Department provided a brief overview of the stages of locomotor development of children. Student activity leaders were provided with examples of different stages and tips on how to best work with children to continue their motor skill development.

How to engage children and caregivers. Included in this section were strategies and tips for student activity leaders to engage both the child and caregiver in an

activity. Handling behavioral issues was also addressed. Open Gym rules, and how to explain the activities and rules was also discussed.

Caregiver panel. Caregivers who had previously participated in the Open Gym pilot were at the training session to provide student activity leaders insight into Open Gym from their perspective and experience in the summer Open Gym pilot program.

Student roles during Open Gym. Student activity leader roles and responsibilities while at the activity stations and registration table were presented. Student activity leaders had an opportunity to practice activities, explore available equipment, and familiarize themselves with the registration table materials.

Activities. Student activity leaders were divided into groups of four and five students and each group was assigned an activity that would be used during Open Gym. Students were given time to discuss the activity, set up any equipment that was needed, and role-play leading the activity. Each group rotated implementing their activity. A debriefing meeting with all student activity leaders was held at the end of the mock Open Gym to give student activity leaders feedback with regard to Open Gym activities.

Selection of Observed Student Activity Leaders. Student activity leaders were assigned to one of six groups (three people per group) at the beginning of their

participation in Open Gym. At the beginning of each Open Gym four groups were assigned to an activity station, one group was assigned to lead the group game, and one group was assigned to the registration table. Assignments were made by the Open Gym coordinators before each Open Gym. One student activity leader from each activity station and one student activity leader from the group assigned to run the group game were randomly chosen to be the observed student activity leader for that station prior to the beginning of each Open Gym for a total of five student activity leaders selected at each Open Gym for observation. All eligible and enrolled student activity leaders were listed in alphabetical order by last name by group. Prior to the beginning of the first observed Open Gym, the first student activity leader listed in each group was chosen for observation. For each subsequent Open Gym the next student listed for each group was chosen. If that student was not there that day, the next student on the list was chosen. A student activity leader was chosen from each group each observed Open Gym session except for the group that was assigned to the registration. The student activity leader group at registration was not included in the observations for that session because that group was not within the observation space. The student activity leader group assigned to the registration table rotated each week. Student activity leaders were blind to random selection and were not aware that they had been chosen for observation.

During Open Gym, selected student activity leaders were observed when the observed dyad was in their designated activity station. If the observed dyad moved to another activity station during the observation interval, observations of the student activity leader at the activity station the dyad was in at the beginning of the observation interval continued.

Assessment

Assessment of Physical Activity During Open Gym. The goal of this study was to examine the extent to which children and their caregivers were engaged in MVPA during Open Gym. The modified SOFIT tool (McKenzie, 2009,1991) was used to ascertain this information. By using a modified SOFIT tool we were able to quantify the level of physical activity that both children and caregivers were engaged in during Open Gym. The modified SOFIT tool was also used to observe the behaviors of the student activity leaders during Open Gym.

Using direct observation to determine physical activity levels during Open Gym did not allow researchers to determine the exact heart rate and energy expenditure of the caregivers and children during participation in Open Gym activities. The observations were used to determine participation in activities that require low energy expenditure (i.e., sitting, standing) and participation in vigorous activities that require more energy than sitting or standing (i.e., running, jumping).

Student observers arrived 30 minutes prior to the start of Open Gym. Observers wore an audiotape and earphones with audio instructions pacing the observations. Observers were given data collection forms to use for their coding during observations (Appendix F).

Student observers began their observations within the first 30 minutes of the start of Open Gym. Momentary time sampling was conducted at the end of 10-second intervals followed by a 10-second recording interval for both child and caregiver activity level. Partial-interval observations were made of the student activity leader behavior using the same observation and recording intervals. Student observers coded each dyad

for four minutes (240 seconds) for a total of 12 observations for each interval. Student observers alternated among the chosen observed families for approximately 64 minutes of Open Gym.

All data were recorded using data collection forms that had been modified from McKenzie (2009, McKenzie et al., 1991; Appendix F). The SOFIT tool (McKenzie, 2009; McKenzie et al., 1991) was originally developed for assessing physical education classes and observing student activity levels, the lesson context, and teacher behavior. For the present study, the behaviors of children, their caregivers, and the student activity leaders was assessed. For this reason, the SOFIT tool was modified as follows. Child and caregiver behavior codes remained the same as the original SOFIT tool with the exception of one additional code for caregivers (code 6: not engaged). Codes used for student activity leader behavior were the same as the original codes for teacher behavior. Student observers were responsible for observing two different phases (as described below) during the Open Gym.

Phase 1: Student observers observed randomly selected children and their caregiver to determine their level of physical activity using the Phase 1 coding system below. Observers recorded activity behavior at the end of each 10-second interval. Behaviors in Phase 1 are mutually exclusive.

Phase 1 Coding System:

1. Lying down
2. Sitting
3. Standing

4. Walking
5. Vigorous
6. Not engaged (caregivers only)

Definition of Phase 1 Coding System:

Code levels 1-4 (lying down, sitting, standing, walking) unless the caregiver or child is engaged in an activity that expends more energy than required for normal walking.

Code level 5 (vigorous) if the caregiver or child is engaged in an activity that requires more energy than required for normal walking (i.e., running, jogging, hopping, wrestling, riding a bike). When a caregiver or child is in transition from one level to another, the code for the higher level was recorded.

Code level 6 (not engaged) for caregivers only. Coded this level if the caregiver was within the Open Gym space but was not participating in any form of physical activity or play (i.e., sitting on the bleachers, standing to the side talking with another caregiver). This was also coded if the caregiver left the Open Gym space but the child remained within the space.

Phase 2: Student observers coded the student activity leaders' involvement during the Open Gym using the Phase 2 coding system below. Coding categories are listed in hierarchical order. Only one code was selected for each 10-second

interval. The highest level was coded if at any time during the 10-second interval it occurred.

Phase 2 Coding System:

P. Promotes Fitness

D. Demonstrates Fitness

I. Instructs Generally

M. Manages

O. Observes

T. Other Tasks

P. Promotes fitness: When the student activity leader promoted fitness by prompting or encouraging fitness related activity or caregiver or child (i.e., initiated or increased engagement in a fitness activity, praises fitness activity).

D. Demonstrates fitness: When the student activity leader modeled how to do a fitness task or activity, or participated with caregivers and/or child in a fitness activity.

I. Instructs generally: When the student activity leader described, lectured or provided feedback to children or caregivers related to all fitness activity content (i.e., technique, strategy, skill development, rules). Did not include fitness activity engagement.

M. Manages: When the student activity leader engaged in non-fitness activity tasks and managed the overall Open Gym space (i.e., equipment set-up, equipment clean-up, addressed behavioral issues, directed caregivers and/or children to do management).

O. Observers: When the student activity leader monitored the entire group of caregivers and children or an individual. For this to be coded, activity leader could not have been engaged in any other coding category for the entire 10-second interval.

T. Other task: When the student activity leader was engaged in an activity not related to the Open Gym (i.e., make phone calls, reading the newspaper, left instructional area to meet with someone not involved with Open Gym). For this to be coded, activity leader had to have been engaged in the other task for the entire 10-second interval.

If during the observations a dyad left the Open Gym space, the next dyad listed was observed for that rotation. If the original dyad returned to the space during the observation of the alternate dyad, observations of the alternate dyad continued. The observer moved to the next dyad listed after the alternate dyad for the next rotation.

Assessment of Behavior Intervals at Open Gym. At the end of each Open Gym session, modified SOFIT data collection sheets were turned in by the student observer to

the Open Gym coordinators. An Open Gym coordinator then counted the number of intervals that each behavior was observed for the child, caregiver, and student activity leader. The total number of each behavior for all intervals for all families and student activity leaders observed for each session was recorded and divided by the total number of intervals to yield the percentage that each target behavior was engaged in during the session.

Assessment of Baseline Measurements at Open Gym. At registration, once families agreed to participate in the study, caregivers were given a brief questionnaire (Appendix C). The questionnaire included two questions regarding weekly physical activity levels. Questions regarding weekly physical activity levels were adapted from the Patient-Centered Assessment and Counseling for Exercise Plus Nutrition (PACE+) Adolescent Physical Activity Measure (Prochaska et al., 2001). PACE+ Adolescent Physical Activity Measure questions were originally administered to adolescents who self-reported physical activity levels and were found to be reliable with an intraclass correlation of 0.77. Validity correlated significantly ($r=0.40$) with the use of accelerometers (Prochaska et al., 2001). The questionnaire served as a baseline measurement of caregivers' weekly physical activity levels.

Assessment of Post Measurements at Open Gym. During the last Open Gym session, enrolled caregivers who attended were asked to complete the same questionnaire used to collect baseline measurements during enrollment. For enrolled caregivers who did not attend the last Open Gym session, phone calls were made and/or emails were sent by the student research assistant to complete the questionnaires. Attempts to complete the

post measurement questionnaire were made during the two weeks following the last Open Gym session.

Implementation of Activities

Open Gym coordinators were responsible for determining which activities were offered at each Open Gym. Activities were selected during a weekly planning meeting that took place prior to each Open Gym. Open Gym coordinators assigned student activity leaders to activity stations and assigned pre-selected activities. A 15-minute debriefing meeting was conducted after each Open Gym. Debriefing meetings were lead by the Open Gym coordinators and/or the project manager. A list of all intended activities was compiled prior to each Open Gym during the weekly training meeting (Appendix G). During the debriefing meeting, student activity leaders were asked to report which activities were implemented, the duration that the activities were conducted, rate the activity (1-5 scale), and any comments the student activity leaders had regarding the activities that were implemented. The scale used to rate activities was based on the following: 1. very unsuccessful; 2. somewhat unsuccessful; 3. moderately successful; 4. successful; 5. very successful. The successfulness of an activity was determined by how well received the activity was by participants and how easy it was to implement by student activity leaders.

Statistical Analysis Plan

The analytical plan described below is based on the research questions and hypotheses:

To test hypothesis one, child physical activity levels were determined by calculating the percentage of intervals for each behavior using the modified SOFIT tool.

To test hypothesis two, caregiver physical activity levels were determined by calculating the percentage of intervals for each behavior using the modified SOFIT tool.

To test hypothesis three, student activity leader behavior was determined by calculating the percentage of intervals for each behavior using the modified SOFIT tool.

To test hypothesis four, caregiver physical activity participation outside of Open Gym were determined using the PACE+ Adolescent Physical Activity Measure (Prochaska et al., 2001). Independent chi-square tests were performed to assess the differences in the level of participation in physical activity outside of Open Gym using pre- and post-Open Gym measurements. Attendance rates and changes in caregiver physical activity participation were dichotomized. Attendance to four or more Open Gym sessions was considered high attendance, while attendance to less than four Open Gym sessions was considered low. A change in physical activity participation was defined as “YES” if participation increased their activity levels from pre-Open Gym measurements. In contrast, no change or a decrease in physical activity participation from pre-Open Gym measurements compared to post-Open Gym measurements was defined as “NO”.

Process evaluation was used to assess if at least 80% of the activities that were intended to be offered during Open Gym were actually implemented. A checklist of intended activities was kept for each Open Gym session and activities that were implemented were recorded.

Chapter IV Results and Discussion

This chapter presents the statistical analysis and interpretation of the results.

Results

Ten caregivers were enrolled and nine completed the study (eight female and one male). The average age of enrolled caregivers was 38 years old. Five caregivers were black (56%) and four were Hispanic (44%). Eighteen caregivers were ineligible for enrollment due to the following reasons: enrolled in Open Gym prior to September 2009 ($n=14$), children not within target age group ($n=3$), and language barrier ($n=1$). An average of three child and caregiver dyads and five student activity leaders at each Open Gym session were observed. Observations of child and caregiver physical activity levels and student activity leader behavior during seven Open Gym sessions were conducted. An average of 159 intervals (64 minutes) and an average of 477 observations were recorded. Pre- and post-Open Gym questionnaires were obtained from enrolled caregivers to determine their weekly physical activity participation (days during which they engaged in physical activity for at least 60 minutes). Weekly caregiver physical activity participation was measured using the PACE+ Adolescent Physical Activity Measure (Prochaska et al., 2001).

Child Behavior. Children were observed engaging in vigorous activity for 409 (37%) of 1097 total observed intervals. Children were observed walking or engaging in vigorous activity for 606 (55%) of 1097 total observed intervals (Figure 1).

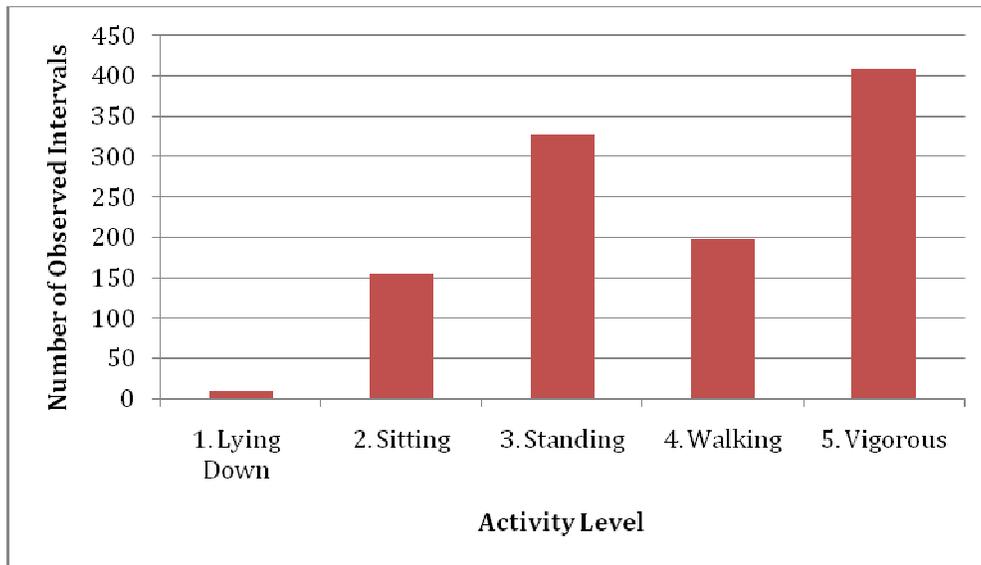


Figure 1. Number of intervals children engaged in activity levels (1-5) for all Open Gym sessions.

Caregiver Behavior. Caregivers were observed engaging in vigorous activity for 168 (16%) of 1069 total observed intervals. Caregivers were observed walking and engaging in vigorous activity for 168 (24%) of 1069 total observed intervals. Caregivers were observed as not engaged for 522 (49%) of 1069 total observed intervals (Figure 2).

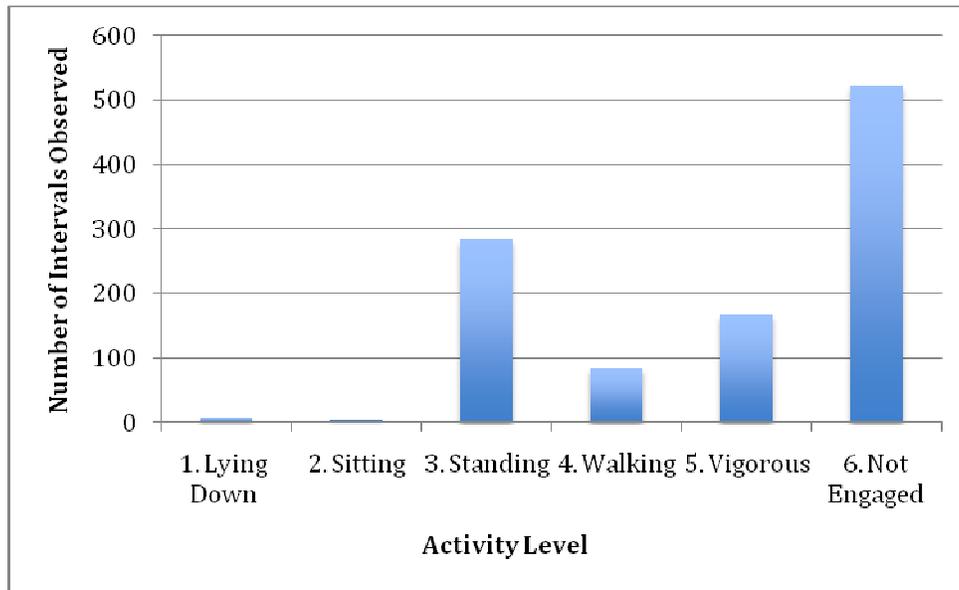


Figure 2. Number of intervals caregivers engaged in activity levels (1-6) for all Open Gym sessions.

Student Activity Leader Behavior. Student activity leaders were observed at codes promotes fitness, demonstrates fitness, or instructs children and caregivers for 702 (64%) of 1099 total observed intervals (Figure 3).

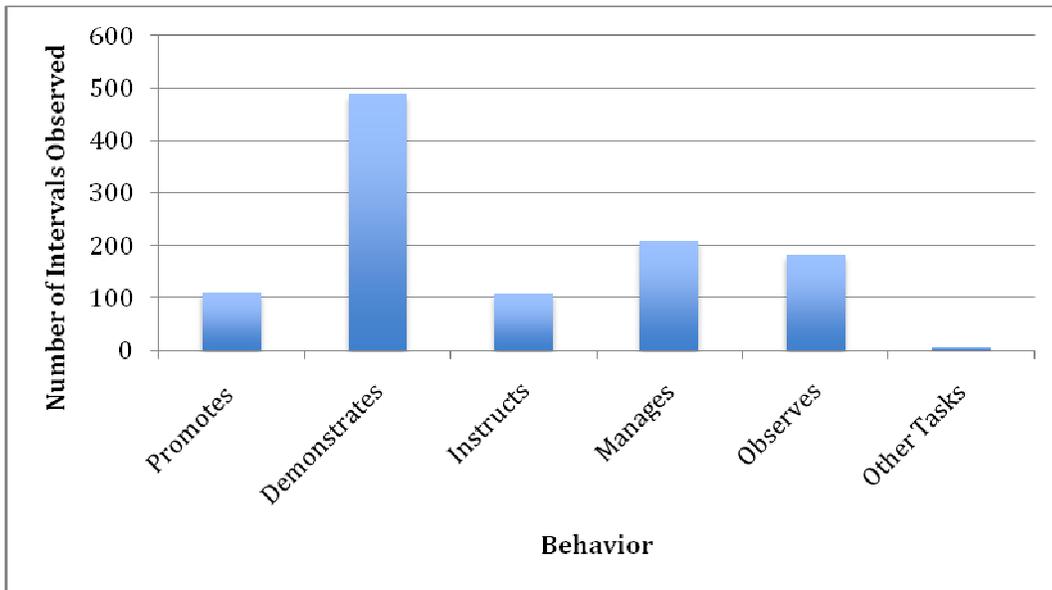


Figure 3. Number of intervals student activity leaders engaged in each behavior for all Open Gym sessions.

Inter-observer Agreement. Point-by-point agreement was used to assess agreement. Percentage of point-by-point agreement was determined by the number of agreements (where primary and inter-observer observations were in agreement) divided by the total number of observations made, multiplied by 100. Inter-observer agreement across the 17 behaviors was 93% (Tables 1-3).

Table 1. Inter-observer reliability for child behaviors

	Child SOFIT codes				
	1 ¹	2 ²	3 ³	4 ⁴	5 ⁵
Disagreements	0	6	41	19	31
Agreements	183	177	142	164	152
% Agreement	100	97	78	90	83

Table 2. Inter-observer reliability for caregiver behaviors

	Caregiver modified SOFIT codes					
	1 ¹	2 ²	3 ³	4 ⁴	5 ⁵	6 ⁶
Disagreements	1	3	32	19	15	0
Agreements	182	180	151	164	168	183
% Agreement	99	98	83	90	92	100

Table 3. Inter-observer reliability for student activity leader behaviors

	Student activity leader SOFIT codes					
	P ⁷	D ⁸	I ⁹	M ¹⁰	O ¹¹	T ¹²
Disagreements	5	6	2	9	10	0
Agreements	178	177	181	174	173	183
% Agreement	97	97	99	95	95	100

¹ Lying Down

² Sitting

³ Standing

⁴ Walking

⁵ Vigorous

⁶ Not Engaged

⁷ Promotes Fitness

⁸ Demonstrates Fitness

⁹ Instructs Generally

¹⁰ Manages

¹¹ Observes

¹² Other Tasks

Correlation of Observed Behaviors. A statistically significant correlation was observed between children observed at code level 5 (vigorous) and student activity leaders observed at code M (manages; $r=0.81$; $p=0.03$; Figure 4). Moderate correlations were seen for children observed at code level 5 when student activity leaders were observed at code D (demonstrates; $r=0.65$; $p=0.11$; Figure 5) and code I (instructs; $r=0.57$; $p=0.18$; Figure 6). A statistically significant correlation was also seen when caregivers were observed at code level 5 (vigorous) and student activity leaders were observed at code O (observes; $r=0.9$; $p=0.01$; Figure 7). No association was found between children observed in code level 5 (vigorous) when student activity leaders were observed at code P (promotes fitness; $r=0.26$; $p=0.56$) or code T (other tasks, $r=0.20$; $p=0.66$). Similarly, no associations were observed between caregivers observed in code level 5 (vigorous) when student activity leaders were observed at code P (promotes fitness; $r=-0.26$; $p=0.56$) or code T (other tasks, $r=-0.11$; $p=0.82$). Notwithstanding, there were important statistically significant associations observed despite the small study sample size ($n=10$).

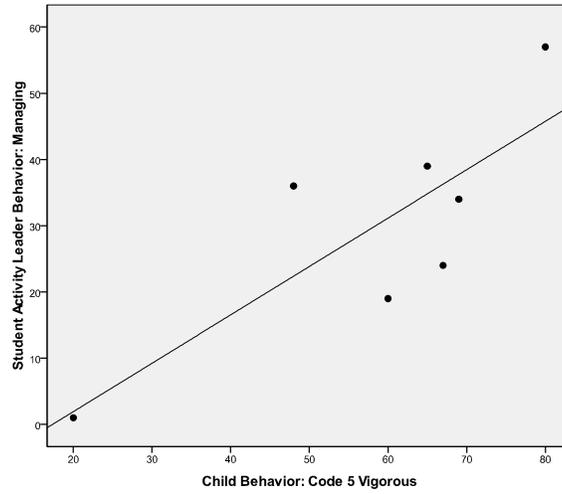


Figure 4. Relationship between children engaged in VPA while student activity leaders managed the Open Gym space, $r=0.81$, $p=0.03$.

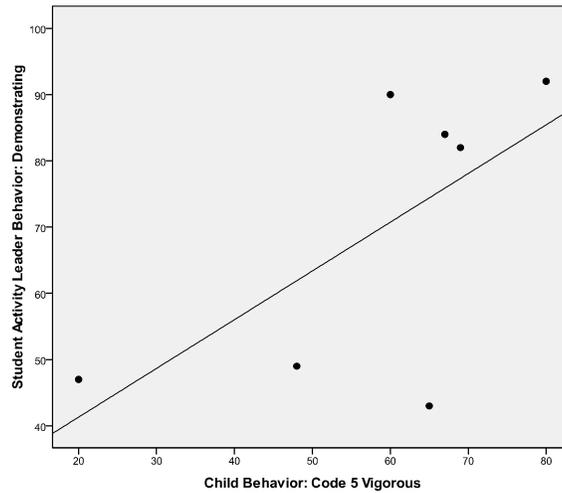


Figure 5. Relationship between children engaged in VPA while student activity leaders demonstrated activities at Open Gym, $r=0.65$, $p=0.11$.

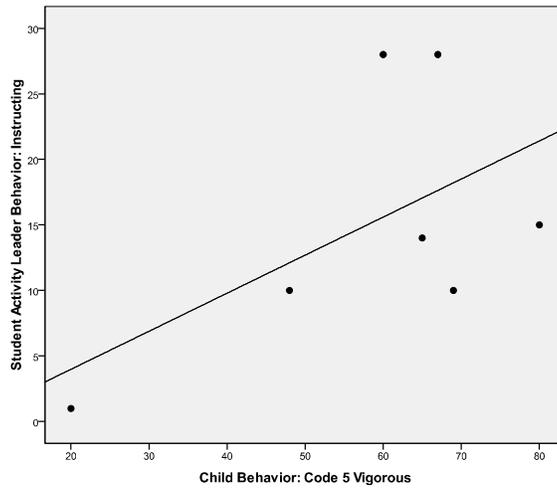


Figure 6. Relationship between children engaged in VPA while student activity leaders instructed during activities at Open Gym, $r=0.57$, $p=0.18$.

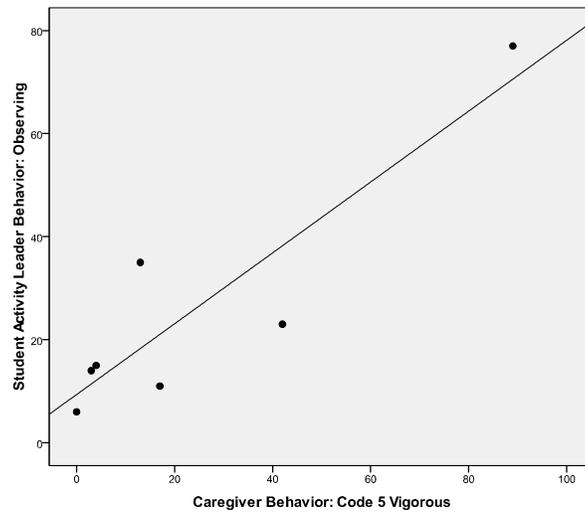


Figure 7. Relationship between caregivers engaged in VPA while student activity leaders engaged in observing the Open Gym space, $r=0.9$, $p=0.01$.

Caregiver Physical Activity Outside of Open Gym. Caregiver self-reported participation in at least 60 minutes of physical activity during a normal or typical week increased in four out of six caregivers from pre-Open Gym as assessed by the pre- and post-Open Gym questionnaires. Physical activity participation decreased in one caregiver and remained the same in one caregiver (Figure 8). The mean number of days caregivers self-reported participation in physical activity pre-Open Gym during a normal or typical week was 2.3. The mean number of days post-Open Gym was 4.2. Caregiver self-reported participation in at least 60 minutes of physical activity during the previous seven days increased in four out of seven caregivers from pre-Open Gym. Two caregivers reported a decrease and one caregiver reported no change (Figure 9). The mean number of days caregivers self-reported participation in at least 60 minutes of physical activity during the previous seven days pre-Open Gym was 2.9. The mean number of days post-Open Gym was 3.7.

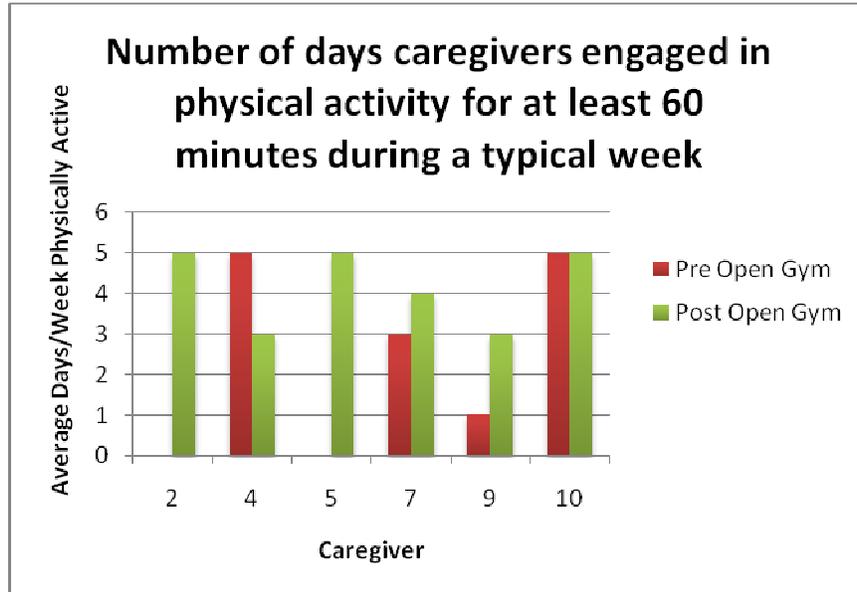


Figure 8. Number of days caregivers self-reported engaging in at least 60 minutes of physical activity during a typical week pre- and post-Open Gym.

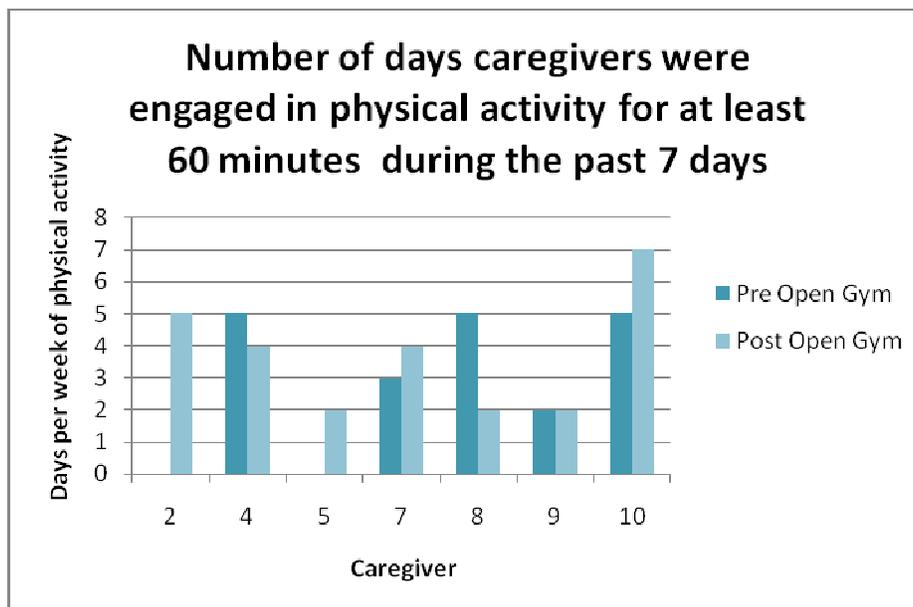


Figure 9. Number of days caregivers self-reported engaging in at least 60 minutes of physical activity during the previous seven days pre- and post-Open Gym.

Association between Attendance and Pre/Post Open Gym Measurements.

Open Gym attendance rates of enrolled caregivers were compared to pre- and post-Open Gym self-reported physical activity participation using chi-square tests. Attendance was separated into two categories; attended four or more Open Gyms and attended less than four Open Gyms. Changes in physical activity participation were categorized as either increasing physical activity at post-Open Gym compared to pre-Open Gym or physical activity participation remaining the same and/or decreasing from pre-Open Gym measurements. A chi-square test was run to compare physical activity changes pre- and post-Open Gym during a typical week and attendance rates (Table 4). A chi-square test was also run to compare physical activity changes during the previous seven days pre- and post-Open Gym and attendance (Table 5). Changes in physical activity participation from pre- and post-Open Gym were not statistically significant.

Table 4. Association between attendance rates at Open Gym and physical activity participation during a typical week.

		Change in physical activity levels pre/post Open Gym ($p=0.80$)		Total
		No change/decrease	Increase	
Attendance	Low	1	2	3
	High	1	2	3
Total		2	4	6

Table 5. Association between attendance rates at Open Gym and physical activity participation during the previous seven days.

		Change in physical activity levels pre/post Open Gym ($p=0.63$)		Total
		No change/decrease	Increase	
Attendance	Low	1	2	3
	High	2	2	4
Total		3	4	7

Activity Implementation. On average, 7.8 activities were intended to be offered during the eight Open Gym sessions. On average, 6.4 activities were implemented. 81% (51 out of 63) of the proposed activities in the Open Gym curriculum were implemented over the eight Open Gym sessions that were examined.

Discussion

We found that children engaged in VPA 37% of Open Gym intervals. It was also shown that caregivers engaged in VPA for only 16% of Open Gym intervals. Caregivers were observed as not engaged for 49% of intervals. We believe that the reason for these findings can be contributed to several factors. Children, even those of the same age, have varying levels of physical ability and skills. This variability can make it difficult to provide programming in an open setting. The difference in physical ability and skill level is even greater between children and caregivers. Because of decreased ability, a child will have to work harder at tasks that a caregiver could easily accomplish (i.e., maneuvering around an object, throwing a ball).

Physical activity patterns of preschool aged children tend to be very sporadic, with quick bursts of vigorous activity (Oliver et al., 2007). Young children do not possess the endurance needed to sustain long bouts of VPA and are frequently observed in sedentary behavior. This can make it challenging to capture the true amount of VPA without continuously monitoring a child. The use of momentary time sampling through direct observation to capture physical activity levels tends to underestimate levels because of the natural variability of child physical activity behavior and the lack of continuous recording (Oliver et al., 2007). Previous studies have been published on programming

aimed at increasing physical activity in school aged children. A majority of the programming developed is for a school setting. Open Gym was modeled after the SPARK Early Childhood (Kimbrell et al., 2003) and SPARK Physical Education Grades K-12 curriculum (Rosengard et al., 2008) as well as the I am Moving, I am Learning (IMIL) curriculum used at Head Start programs. These curricula were designed to be implemented by teachers within the classrooms and/or physical education classes. The curricula, activities, and equipment offered at Open Gym support MVPA in preschool aged children. It is currently recommended that preschool aged children engage in at least 60 minutes of physical activity each day (CDC, 2009b) and Open Gym can help children meet these recommendations. What makes Open Gym unique but also creates a challenge is that the curricula and activities are provided by the student activity leaders to both the children and their caregiver in a community setting. To date, there are a limited number of interventions aimed at preschool aged children. This may be due to the fact that finding large groups of young children to implement such interventions may be difficult and why a majority of interventions aiming at increasing physical activity levels in children are designed to be implemented in school settings. In our own experience with Open Gym, we found that careful attention was needed when selecting the type of activities to offer as well as the developmental stages of preschool aged children at Open Gym. A benefit of an intervention in a community setting, as in the case of Open Gym, as opposed to an intervention in a school setting is that with the former it is possible to focus more on the family and not just individuals. School interventions are limited to the children in attendance because that is who is present for the intervention. The Open Gym physical activity promotion that we implemented is unique because the programming is

not just provided to the preschool aged children but also to their caregivers. The presence of caregivers provides a positive role model for young children, helping to maximize the positive effects of the intervention. Role modeling has been shown to be important for healthy behavior promotion for children (Golan & Crow, 2004). Student activity leaders were encouraged to participate in activities and to provide support to families during Open Gym. While student activity leaders were found to be engaged in instructing, demonstrating, and promoting fitness during 64% of Open Gym intervals, caregivers were shown to actually participate in more VPA when student activity leaders were engaged in other tasks. We believe that the reason for this is that when student activity leaders were not participating in the activities, caregivers were more responsible to engage their child(ren) in the activities. Currently there is no published data on programming to increase physical activity levels in preschool aged children that also involves caregiver participation. The high number of student activity leaders present at Open Gym compared to the number of families in attendance may have contributed to the low level of VPA engagement by caregivers. We believe that caregivers were less likely to participate in an activity if their child(ren) was participating with a student activity leader. Caregiver participation in physical activity outside of Open Gym did not significantly increase from pre-Open Gym. Several factors are believed to have contributed to this finding. The sample size of this study was small ($n=10$). The method of data collection for physical activity participation was based on self-report using a questionnaire. Attendance to Open Gym was not required and the maximum attendance rate of any enrolled family was four Open Gym sessions. It is also possible that low attendance may have contributed to the lack of increase in physical activity from

baseline, but sample size was not large enough to show a statistically significant correlation. The primary researcher of this study also served as a coordinator during Open Gym. She identified eligible families and student activity leaders that were going to be observed at each of the seven Open Gym sessions. Study participants (family dyads and student activity leaders) were identified prior to the commencement of observations at each session. During the Open Gym, while observations were conducted by the trained student observer, the primary researcher performed regular coordination type activities (i.e., monitoring of space, supporting student activity leaders, and interacting with children and caregivers). As a result no additional encouragement beyond the regular interaction was given to any of the study participants (caregivers, children, or student activity leaders) selected for observation. This is important because study participants may have altered their behavior if more attention had been given to them by the primary researcher, or if they felt in any way that they had been “selected” from others participating in Open Gym. The use of direct observation to assess behaviors is a way to minimize attention given to selected participants because it is relatively discreet (Oliver et al., 2007). Open Gym is a community-based, family oriented approach to increasing physical activity. Open Gym is a unique program that provides preschool aged children and their caregivers the opportunity to participate in MVPA. The use of a community setting increases accessibility of the program and maximizes the number of families that can be reached and have access to physical activity promotion interventions (Guide to Community Preventative Services, 2009). The open format of the curriculum developed for Open Gym includes activities and equipment that allow children of varying ages and skill levels the opportunity to acquire and practice new skills. The acquisition of new

skills is important to support proper growth and development (Gallahue & Ozmun, 2002). Open Gym delivery depends upon student activity leader participation and attendance. It provides Northeastern University students the opportunity to work with families of young children within the community that they live. Some limitations of this study include the following. A small sample size ($n=10$) due to the limited number of families eligible for observation who were also asked to self-report their physical activity participation. Recall bias by the caregiver when self-reporting engagement in physical activity could have also been an issue in addition to the small number of self-report questionnaires collected; however, we were unable to document it. Participation in Open Gym was voluntary, regardless of enrollment in this study. Because of this, the number of eligible enrolled families was unknown each week until each session. Student activity leaders were provided with SPARK and IMIL curricula, though the amount of training on curricula implementation was limited due to the large number of student activity leaders and the short amount of time between student training and the start of the program. Similar challenges were seen with the student observers. Observation protocols were modeled using a modified SOFIT tool, and the training tools for the student observers were modified to better fit their use within the Open Gym. Some strengths of this study include the following. Open Gym is a community-based program that supports physical activity behavior changes. Open Gym provides an opportunity for preschool aged children and their caregivers to engage in MVPA. A physical activity program designed for both children and caregivers provides the opportunity for caregivers to role model physical activity for their children. This gives children the opportunity to learn healthy behaviors

at a young age, which is important for supporting a healthy lifestyle throughout their lifetime.

Chapter V Summary, Conclusions, and Recommendations for Future Research

Summary

The purpose of this study was to determine if preschool aged children and their caregivers were engaged in moderate-to-vigorous physical activity (MVPA) during Open Gym. Caregiver physical activity behavior changes outside of Open Gym were also monitored. Ten families were enrolled in this study and nine completed it. Enrolled families were randomly selected at the beginning of each Open Gym for observation. Randomly selected families were observed by trained student observers for the duration of the Open Gym session using a modified SOFIT (McKenzie, 2009; McKenzie et al., 1991) tool. Changes in caregiver physical activity from baseline to the end of the 8th Open Gym session were ascertained by self-report using a questionnaire adapted from the PACE+ Adolescent Physical Activity Measure (Prochaska et al., 2001). Children engaged in VPA when student activity leaders were managing the activity space. Caregivers were engaged in VPA when student activity leaders were engaged in tasks other than demonstrating, engaging, or promoting physical activity, or managing the activity space. Healthy Kids, Healthy Futures Open Gym offers preschool aged children and their caregivers the opportunity to engage in moderate-to-vigorous physical activity. Additional research is needed to determine factors that may increase caregiver participation in MVPA at Open Gym and increase participation in physical activity outside of Open Gym.

Conclusions

Based on the hypotheses set forth in the present study the following conclusions are warranted:

1. Children were observed for a combined code level 4 (walking) and code level 5 (vigorous) for 606 (55%) of 1097 total observed intervals. Therefore, the first hypothesis is accepted.
2. Caregivers were observed at a combined code level 4 (walking) and code level 5 (vigorous) for 168 (24%) of 1097 total observed intervals. Therefore, the second hypothesis is rejected.
3. Student activity leaders were observed at codes promotes fitness, demonstrates fitness, or instructs children and caregivers for 702 (64%) of 1099 total observed intervals. Therefore, the third hypothesis is accepted.
4. No statistically significant difference was seen from pre- and post-Open Gym measurements in the number of days caregivers engaged in at least 60 minutes of physical activity during a normal or typical week or the number of days caregivers engaged in at least 60 minutes of physical activity during the week the questionnaire was administered. Therefore, the fourth hypothesis is rejected.

Findings from this study suggest that a community-based program aimed at increasing physical activity in families with preschool aged children may be successful in providing the engagement in moderate-to-vigorous physical activity. Limited data has

been published looking at community-based, family centered approaches to increase physical activity levels in families with preschool aged children. Therefore, the Healthy Kids, Healthy Futures Open Gym may be a promising program model that provides an opportunity for families to engage in moderate-to-vigorous physical activity and helps support an active lifestyle for families of young children.

Recommendations for Future Research

Recommendations of the present study include the following:

A larger sample size should be a goal of any future research conducted on the Open Gym program to better capture changes of physical activity participation and to help determine any factors that may influence child and/or caregiver participation in MVPA. An increase in the number of activities and equipment supporting participation in MVPA by preschool aged children is also recommended. Modification of current curricula and activities offered at Open Gym to increase caregiver participation in MVPA is also recommended. Decreasing the number of student activity leaders may also increase caregiver engagement and participation in MVPA. Emphasis should also be placed on student activity leaders roles while at Open Gym. Decreasing student activity leader participation in activities intended for the families as well as increasing the amount of time that student activity leaders spend facilitating activities for the families and monitoring the Open Gym space should be emphasized. The continuation of Open Gym in a community setting is highly recommended. Additional research aimed at families of preschool aged children to increase physical activity is also needed and should be a priority going forward.

APPENDIX A. Healthy Kids, Healthy Futures Open Gym Waiver

I, _____, declare for myself and for my child/children:

(Names of all children attending/participating)

that we intend to use some or all of the activities, facilities, and services offered by Northeastern University, the Boston Red Sox and Children’s Hospital Boston during Open Gym sessions. This is a partnership among Northeastern University, Children’s Hospital Boston, and the Boston Red Sox.

I understand that the Open Gym session includes the following activities:
Warm up and cool down stretching, hopping, skipping, jumping, dancing, running and other aerobic activities that may raise my heart rate

I understand that there is a risk in participating in the Open Gym sessions which includes accident, injury and or in rare cases even death.

I understand that activities offered during Open Gym sessions may be conducted by personnel who may not be licensed, certified, or registered instructors.

I acknowledge that it is my decision for my child/children and me to participate in any activity during the Open Gym sessions. I also declare that I will participate voluntarily and that Northeastern University, the Boston Red Sox and Children’s Hospital Boston are not requiring me to participate and has not influenced my decision to participate in any way. I understand that I could suffer injury or illness as a result of my participation. In exchange for allowing me to participate in the Open Gym, I accept all risks of participating including injury and illness. I will use my health insurance to cover the potential medical bills that may need to be paid as a result of an injury or illness I may suffer as a result of participating in the Open Gym. I also promise that I will pay any costs that are not covered by my insurance and that I will pay all bills that may be sent to Northeastern University, its officers, employees, staff, volunteers, agents or Trustees as a result of injuries or illnesses I may suffer while participating in the Open Gym.

Also in exchange for participating in the Open Gym, I agree, to the fullest extent the law allows, to release my rights to sue Northeastern University, the Boston Red Sox and Children’s Hospital Boston their officers, employees, staff, volunteers, agents or Trustees for whatever claims I may have related to all my injuries, illness or other damages I suffer. I intend this agreement not to sue to be made both for me and for anyone who may have a legal right to make a claim on my behalf, now or in the future. If anyone does make a claim as a result of injuries I receive, I will defend Northeastern University,

the Boston Red Sox and Children's Hospital Boston and pay any amounts that Northeastern University, the Boston Red Sox and Children's Hospital Boston would otherwise have to pay as a result of such a claim made on my behalf.

I understand that I may ask staff questions at any time.

I declare that I have read, understood, and agree to the contents of this consent form and that I am the parent or legal guardian of the children listed above.

Signature _____ Date _____

Name _____

APPENDIX B. Family Informed Consent Form

Why am I being asked to take part in this research study?

We are asking you to be in this study because you and your child/children are participating in the Saturday Open Gym. The purpose of this research is to observe how the children, parents, and Northeastern University student leaders play at the different Open Gym activity stations and the amount of physical activity that children and caregivers participate in during the week. Participation in this study is completely voluntary.

What will I be asked to do?

If you decide to take part in this study, we will ask you to participate in the Open Gym activities as you normally would.

Benefits

The data that is collected as part of this study may be of no direct benefit to you. Researchers will use the data collected for future Open Gyms.

Risks

There are no known risks associated with the observations that will be done during this study.

Cost

There will be no cost to you or your family to participate in this study.

Who will see the information about my child and I?

Your part in this study will be confidential. Only the researchers in this study will see the information about you. No reports or publications that come from this study will use information that can identify you in any way. All paper data collected will be kept locked in secure file cabinets and access to computer data will be controlled by passwords.

Can I stop my participation in the study?

Your participation in this research is completely voluntary. You do not have to participate if you do not want to. Even if you begin the study, you may stop at any time. If you do not participate or if you decide to stop, you will not lose any rights, benefits, or services that you would otherwise have.

Who to Contact

In the event you have any questions about the study or experience any problems during the study, please contact:

Dr. Carmen Castaneda Sceppa	(617) 373-5543 office
Ms. Jordan Thomas	(617) 373-8009 office

If you have any questions about your rights as a participant, you may contact the Human Subject Research Protection Department

Northeastern University
413 Lake Hall, Boston, MA 02115
Telephone: 617-373-7570.
You may call anonymously if you wish.

I agree that my child/children and I will take part in this research.

Signature of person [parent] agreeing to take part

Date

Printed name of person above

Signature of person who explained the study to the participant above and obtained consent

Date

Printed name of person above

APPENDIX C. Caregiver Questionnaire

Name _____

Home Phone _____

Cell Phone _____

Mailing Address _____

E-mail _____

1. Would you prefer weekly contact from Open Gym staff to be made by telephone or e-mail?

- Telephone
- E-mail

2. What is your gender?

- Female
- Male

3. What is your age? _____

4. How would you describe your race?

- American Indian or Alaska Native
- Asian or Pacific Islander
- Black or African American
- Hispanic/Latino
- White
- Other (please list)

5. What is the highest level of education you have reached? (Check one response)

- Some High School
- High School Diploma/GED

- Some College
- College Degree
- Some Graduate School
- Graduate Degree
- Other (please list)

6. Over the last 7 days, on how many days were you physically active for a total of at least 60 minutes? Please circle.

0 1 2 3 4 5 6 7

7. Over a typical or usual week, on how many days are you physically active for a total of at least 60 minutes per day? Please circle.

0 1 2 3 4 5 6 7

APPENDIX D. Script for Obtaining Child Assent

Hi, how are you? (Listen to responses, honestly, respond appropriately). Well, my name is _____, and today I'm asking you to help me with a research study. We're doing this study to learn more about the activities and games that we play here at Open Gym. Here are some things you should know about the study:

- We are going to have someone come and watch the games that you play here at Open Gym.
- Sometimes we may have someone come in and take pictures or videotape you playing games.
- If you have any questions for me, or you don't know what I mean by something, please ask me.
- You might have fun doing the study, but we won't give you anything for doing it.
- Your parent(s) have already said it's OK for you to do the study, but you can still decide yes or no for yourself.

OK. Do you have any questions? Do you want to do this research study with me?

	CONSENT
Child Name (1)_____ DOB_____	Y/N
Child Name (2)_____ DOB_____	Y/N
Child Name (3)_____ DOB_____	Y/N
Child Name (4)_____ DOB_____	Y/N
Child Name (5)_____ DOB_____	Y/N

Caregiver Name_____

I certify that I provided the above information to this/these child(ren), and that the child(ren) assented to participation in the project *Healthy Kids, Healthy Futures Open Gym Observations*.

Name of researcher who explained consent

Date

Signature of researcher who explained consent

APPENDIX E. Student Informed Consent Form

Why am I being asked to take part in this research study?

We are asking you to be in this study because you are participating in the Saturday Open Gym as an activity station leader. The purpose of this research is to observe Northeastern University student leaders at the different activity stations and how student leaders, caregivers and children interact throughout the Open Gym.

What will I be asked to do?

If you decide to take part in this study, we will ask you to lead the activities during the Open Gym as you normally would and to interact with caregivers and children as you have been trained to do.

Benefits

The data that is collected as part of this study may be of no direct benefit to you. Researchers will use the data collected for future Open Gyms.

Risks

There are no known risks associated with the observations that will be done during this study.

Cost

There will be no cost to you to participate in this study.

Who will see the information about me?

Your part in this study will be confidential. Only the researchers in this study will see the information about you. No reports or publications will use information that can identify you in any way. All paper data collected will be kept locked in secure file cabinets and access to computer data will be controlled by passwords.

Can I stop my participation in the study?

Your participation in this research is completely voluntary. You do not have to participate if you do not want to. Even if you begin the study, you may stop at any time. If you do not participate or if you decide to stop, you will not lose any rights, benefits, or services that you would otherwise have.

Who to Contact

In the event you have any questions about the study or experience any problems during the study, please contact:

Dr. Carmen Castaneda Sceppa

Ms. Jordan Thomas

(617) 373-5543 office

(617) 373-8009 office

If you have any questions about your rights as a participant, you may contact the Human Subject Research Protection Department

Northeastern University
413 Lake Hall, Boston, MA 02115
Telephone: 617-373-7570.
You may call anonymously if you wish.

I agree that I will take part in this research.

Signature of person [parent] agreeing to take part

Date

Printed name of person above

Signature of person who explained the study to the participant above and obtained consent

Date

Printed name of person above

APPENDIX F. Modified SOFIT Data Collection Form

Date _____ Observer _____ Observer Gender M/F
 No. of Observations _____ Reliability Observation Y/N Total No. Eligible Children _____
 Time Start _____ Time End _____ Session Length _____

Interval	Child Activity	Caregiver Activity	Activity Leader Behavior	Notes	
FAMILY ONE	1	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	Child: m/f Caregiver: m/f Name of Student:
	2	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	3	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	4	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	5	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	6	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	7	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	8	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	9	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	10	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	11	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	12	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
FAMILY TWO	13	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	Child: m/f Caregiver: m/f Name of Student:
	14	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	15	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	16	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	17	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	18	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	19	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	20	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	21	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	22	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	23	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	24	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
FAMILY THREE	25	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	Child: m/f Caregiver: m/f Name of Student:
	26	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	27	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	28	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	29	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	30	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	31	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	32	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	33	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	34	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	35	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	36	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
FAMILY FOUR	37	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	Child: m/f Caregiver: m/f Name of Student:
	38	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	39	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	40	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	41	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	42	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	43	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	44	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	45	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	46	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	47	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
	48	1 2 3 4 5	1 2 3 4 5 6	P D I M O T	
Total					

- 1. Lying Down**
- 2. Sitting**
- 3. Standing**
- 4. Walking**
- 5. Vigorous**
- 6. Not Engaged (Caregivers Only)**

- P. Promotes Fitness**
- D. Demonstrates Fitness**
- I. Instructs Generally**
- M. Manages**
- O. Observes**
- T. Other Tasks**

APPENDIX G. Activity Debriefing List

Date of List Completion _____ Date of Open Gym _____

Number of Student Activity Leaders _____

Activity Name	Implemented Y/N	Duration (min)	Rate Activity (1-5)	Comments
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Total Number of **Intended** Activities _____

Total Number **Implemented** Activities _____

Percentage of Implemented Activities _____

References

- American Academy of Pediatrics. About childhood obesity. Retrieve from <http://www.aap.org/obesity/about.html>
- American Academy of Pediatrics. (2006). Policy Statement Active Healthy Living: Prevention of Childhood Obesity Through Increased Physical Activity. Council on Sports Medicine and Fitness and Council on School Health, American Academy of Pediatrics. *Pediatrics*, 118(3), 1834-1842.
- American Heart Association. (2009). Exercise (physical activity) and children. American Heart Association. Retrieved from <http://www.americanheart.org/presenter.jhtml?identifier=4596>
- Anderson, S.E., & Whitaker, R.C. (2009). Prevalence of Obesity Among US Preschool Children in Different Racial and Ethnic Groups. *Archives of Pediatric & Adolescent Medicine*, 163(4), 344-348.
- Brown, W.H., Pfeiffer, K.A., McIver, K.L., Dowda, M., Addy C.L, & Pate, R.R. (2009). Social and Environmental Factors Associated with Preschoolers' Non-sedentary Physical Activity. *Child Development*, 80(1).
- Bower, J.K., Hales, D.P., Tate, D.F., Rubin, D.A., Benjamin, S.E., & Ward, D.S. (2008). The Childcare Environment and Children's Physical Activity. *American Journal of Preventive Medicine*, 34(1), 23-29.
- Centers for Disease Control and Prevention. (2006). Prevalence of overweight and obesity among adults: United States, 2003-2004. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. Retrieved from http://www.cdc.gov/nchs/products/pubs/pubd/hestats/overweight/overwght_adult_03.htm
- Centers for Disease Control and Prevention. (2008). Prevalence of overweight among children and adolescents: United States, 2003-2004. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. Retrieved from http://www.cdc.gov/nchs/products/pubs/pubd/hestats/overweight/overwght_child_03.htm
- Centers for Disease Control and Prevention. (2009a). Balancing calories. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Division of Nutrition, Physical Activity and Obesity, National Center for Chronic Disease Prevention and Health Promotion. Retrieved from <http://www.cdc.gov/healthyweight/calories/index.html>

- Centers for Disease Control and Prevention. (2009b). Overweight and obesity health consequences. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Division of Nutrition, Physical Activity and Obesity, National Center for Chronic Disease Prevention and Health Promotion. Retrieved from <http://www.cdc.gov/obesity/causes/health.html>
- Centers for Disease Control and Prevention. (2009c). Defining childhood overweight and obesity. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Division of Nutrition, Physical Activity and Obesity, National Center for Chronic Disease Prevention and Health Promotion. Retrieved from <http://www.cdc.gov/obesity/childhood/defining.html>
- Centers for Disease Control and Prevention. (2010). Obesity Prevalence among low-income, preschool-aged children 1998-2008. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Division of Nutrition, Physical Activity and Obesity, National Center for Chronic Disease Prevention and Health Promotion. Retrieved from <http://www.cdc.gov/obesity/childhood/lowincome.html>
- Child Trends. (2007). Child and adolescent trial for cardiovascular health (CATCH). Child Trends. Retrieved from <http://www.childtrends.org/Lifecourse/programs/ChildandAdolesentTrialforCardiovascularHealth.htm>
- Cools, W., De Martelaer, K., Samaey, C., & Andries, C. (2009). Movement Skill Assessment of Typically Developing Preschool Children: a Review of Seven Movement Skill Assessment Tools; Report. *Journal of Sports Science and Medicine*, 8(2), 154-69.
- Dietz, W.H. (1998). Health consequences of obesity in youth: Childhood Predictors of Adult Disease. *Pediatrics*, 101(3), 518-525.
- Dowda, M., Brown, W.H., McIver, K.L., Pfeiffer, K.A., O'Neill, J.R., Addy, C.L., et al. (2009). Policies and Characteristics of the Preschool Environment and Physical Activity of Young Children. *Pediatrics*, 123(2), 261-266.
- Dowda, M., Sallis, J.F., McKenzie, T.L., Rosengard, P., & Kohl, H.W. (2005). Evaluating the Sustainability of SPARK Physical Education: A Case Study of Translating Research Into Practice. *Research Quarterly for Exercise and Sport*, 76(1), 11-19.
- Falkner, B., Gidding, S.S., Ramirez-Garnica, G., Wiltrout, S.A., West, D., & Rappaport, E.B. (2006). The Relationship of Body Mass Index and Blood Pressure in Primary Care Pediatric Patients. *Journal of Pediatrics*, 148, 195-200.

- Golan, M., & Crow, S. (2004). Targeting Parents Exclusively in the Treatment of Childhood Obesity: Long-term Results. *Obesity Research*, 12, 357-361.
- Gallahue & Ozmun, D.L., & Ozmun, J.C. (2002). *Understanding motor development infants, children, adolescents, adults*. Fifth Edition. New York: McGraw-Hill.
- Guide to Community Preventive Services. (2009). Promoting physical activity: behavioral and social approaches. Retrieved from www.thecommunityguide.org/pa/behavioral.html.
- Hannon, J.C., & Brown, B.B. (2008). Increasing Preschoolers' physical activity intensities: an activity-friendly preschool playground intervention. *Preventive Medicine*, 46, 532-536.
- Haywood, K.M. (1993). *Life span motor development*. Second Edition. Champaign, IL: Human Kinetics Publishers.
- Heath, E.M., Coleman, K.J., Lensegrav, T.L., & Fallon, J.A. (2006). Using Momentary Time Sampling to Estimate Minutes of Physical Activity in Physical Education: Validation of Scores for the System for Observing Fitness Instruction Time; Research Note--Pedagogy. *Research Quarterly for Exercise and Sport*, 77(1), 142-145.
- Hintze, J.M., Volpe, R.J., & Shapiro, E.S. Best practices in the systemic direct observation of student behavior. *In Best Practices in School Psychology V* (pp. 319-330). National Association of School Psychologists.
- [Http://www.letsmove.gov](http://www.letsmove.gov). America's move to raise a healthier generation of kids. Retrieved from <http://www.letsmove.gov/>
- Irwin, J.D., He, M., Bouck, L.M., Tucker, P., & Pollett, G.L. (2005). Preschoolers' Physical Activity Behaviours: Parents' Perspectives. *Canadian Journal of Public Health*, 96(4), 299-303.
- Kimbrell, P.A., Rosengard, P.F., Richey, P.A., & McKenzie, T.L. (2003). SPARK Sports, Play & Active Recreation for Kids! Early Childhood Program Preschool. The SPARK Programs. San Diego, CA.
- Krassas, G.E. (2004). Do Obese Children Become Obese Adults: Childhood Predictors of Adult Disease. *Pediatric Endocrinology Reviews*, 1, 445-459.
- Luepker, R.V., Perry, C.L., McKinlay, S.M., Nader, P.R., Parcel G.S., Stone E.J., et al. (1996). Outcomes of a Field Trial to Improve Children's Dietary Patterns and

- Physical Activity: The Child and Adolescent Trial for Cardiovascular Health (CATCH). *Journal of the American Medical Association*, 275(10), 768-776.
- Marcoux, M., Sallis, J.F., McKenzie, T.L., Marshall, S., Armstrong, C.A., & Goggin, K.J. (1998). Process Evaluation of a Physical Activity Self-management Program for Children: SPARK. *Psychology and Health*, 14, 659-677.
- McKenzie, T.L. (1998). CATCH institutionalization SOFIT protocol. San Diego State University. Retrieved from http://www.sph.uth.tmc.edu/catch/KidsClub/SOFIT_protocol.pdf
- McKenzie, T.L. (2009). System for Observing Fitness Instruction Time (SOFIT) Generic Description and Procedures Manual. San Diego State University.
- 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.
- McKenzie, T.L., Sallis, J.F., & Rosengard, P. (2009). Beyond the Stucco Tower: Design, Development, and Dissemination of the SPARK Physical Education Programs. *American Academy of Kinesiology and Physical Education*, 61, 114-127.
- Miller, J., Rosenbloom, A., & Silverstein, J. (2004). Childhood Obesity. *Journal of Clinical Endocrinology & Metabolism*, 89(9), 4211-4218.
- Morbidity and Mortality Weekly Report. (2009). Differences in Prevalence of Obesity Among Black, White, and Hispanic Adults --- United States, 2006-2008. Centers for Disease Control and Prevention, Department of Health and Human Service, *Morbidity and Mortality Weekly Report*, 58(27), 740-744.
- Office of Planning Research and Evaluation. Research Brief I am Moving, I am Learning: Early Findings from the Implementation of an Obesity Prevention Enhancement in Head Start Region III. Administration for Children and Families, Office of Planning Research and Evaluation.
- Oliver, M., Schofield, G.M., & Kolt, G.S. (2007). Physical Activity in Preschoolers Understanding Prevalence and Measurement Issues. *Sports Medicine*, 37(12), 1045-1070.
- Pate, R., McIver, K., Dowda, M., Brown, W.H., & Addy, C. (2008). Directly Observed Physical Activity Levels in Preschool Children; Research Article; Report. *Journal of School Health*, 78(8), 438-445.
- Pope, R.P., Coleman, K.J., Gonzalez, E.C., Barron, F., & Heath, E.M. (2002). Validity of a Revised System for Observing Fitness Instruction Time (SOFIT). *Pediatric Exercise Science*, 14, 135-146.

- Prochaska, J.J., Sallis, J.F., & Long, B. (2001). A Physical Activity Screening Measure for use with Adolescents in Primary Care. *Archives of Pediatric & Adolescent Medicine*, 155(5), 554–559.
- Proctor, M.H., Moore, L.L., Gao, D., Cupples, L.A., Bradlee, M.L., Hood, M.Y., et al. (2003). Television Viewing and Change in Body Fat From Preschool to Early Adolescence: The Framingham Children's Study. *International Journal of Obesity*, 27, 827–833.
- Region III Administration for Children and Families. (2006). I am Moving, I am Learning: A Proactive Approach for Addressing Childhood Obesity in Head Start Children. Summary Report: The First Two Years. Region III Administration for Children and Families. Retrieved from http://eclkc.ohs.acf.hhs.gov/hslc/ecdh/Health/Nutrition/Nutrition%20Program%20Staff/IMIL/imil_report.pdf
- Rosengard, P., Baranowski, M., Williston, B.J., McKenzie, T., & Short, K. (2008). SPARK Sports, Play & Active Recreation for Kids! Physical Education Program Grades K-2. The SPARK Programs. San Diego, CA.
- Sallis, J.F., McKenzie, T.L., Alcaraz, J.E., Kolody, B., Faucette, N., & Hovell, M.F. (1997). The Effects of a 2-year Physical Education Program (SPARK) on Physical Activity and Fitness in Elementary School Students. *American Journal of Public Health*, 87(8), 1328-1334.
- Sallis, J.F., McKenzie, T.L., Elder, J.P., Broyles, S.L., & Nader, P.R. (1997). Factors Parents Use in Selecting Play Spaces for Young Children. *Archives of Pediatric & Adolescent Medicine*, 151,414-417.
- Sallis, J.F., Prochaska, J.J., & Taylor, W.C. (2000). A Review of Correlates of Physical Activity of Children and Adolescents. *Medicine & Science in Sports & Exercise*, 32(5), 963-975.
- Seal, N., & Yurkovich, E. (2009). Physical Activity Within Rural Families of Overweight Preschool Children: A Pilot. (Report). *Online Journal of Rural Nursing & Health Care*, 9(1), 56-69.
- Serdula, M.K., Ivery, D., Coates, R.J., Freedman, D.S., Williamson D.F., & Byers, T. (1993). Do Obese Children Become Obese Adults? A Review of the Literature. *Preventive Medicine*, 22, 167-177.
- Task Force on Community Preventive Services. (2002). Recommendations to Increase Physical Activity in Communities. *American Journal of Preventive Medicine*, 22(4s), 67-72.

- U.S. Surgeon General. (2007). The Surgeon General's Call To Action To Prevent and Decrease Overweight and Obesity. Office of the Surgeon General, U.S. Department of Health & Human Services.
- Van Sluijs, E.M.F., McMinn, A.M., & Griffin, S.J. (2007). Effectiveness of Interventions to Promote Physical Activity in Children and Adolescents: Systemic Review of Controlled Trials. *British Medical Journal*. DOI:10.1136/bmj.39320.843947.BE
- Weiss, R., Dziura, J., Burgert, T.S., Tamborlane, W.V., Taksali, S.E., Yeckel, C.W., et al. (2004). Obesity and the Metabolic Syndrome in Children and Adolescents. *New England Journal of Medicine*, 350(23), 2362-2374.
- World Health Organization. (2010). Obesity and overweight. World Health Organization, Global Strategy on Diet, Physical Activity and Health. Retrieved from <http://www.who.int/dietphysicalactivity/publications/facts/obesity/en/>
- Zhang, Q., & Wang, Y.F. (2004). Trends in the Association Between Obesity and Socioeconomic Status in US Adults: 1971 to 2000. *Obesity Research*, 12(10), 1622-1632.