The Relationship between the Body Mass Index and the Daily Physical Activity of Children and their Parents

Jennifer Harmon

The College at Brockport

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The Relationship between the Body Mass Index and the Daily Physical Activity of Children and Their Parents

By

Jennifer Harmon

A thesis submitted to the Department of Kinesiology, Sport Studies, and Physical Education of the College at Brockport, State University of New York, in partial fulfillment of the requirements for the degree of Master of Science in Education

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By

Jennifer Harmon

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Author: Jennifer Harmon

Read and Approved by:
Dr. Timothy A. Brusseau, Co-Chairperson
Dr. Douglas Collier, Co-Chairperson
Dr. Elizabeth Lenz, Committee Member

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Date: 10/22/12

Dr. Susan Petersen, Chairperson, Department of Kinesiology, Sport Studies, and Physical Education
Dedication

This thesis is dedicated to my beautiful children, Crystal and Samuel.
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Table of Contents

Signatures................................................................................................................. iii
Dedication.................................................................................................................. iv
Acknowledgements................................................................................................. v
List of Tables........................................................................................................... x
List of Figures......................................................................................................... xi
Abstract................................................................................................................... xii
Chapter I – Introduction......................................................................................... 1
  Introduction........................................................................................................... 1
  Child Obesity Health Risks................................................................................ 3
  Physical Activity Recommendations............................................................... 5
  Physical Activity Benefits for Adults................................................................. 6
  Physical Activity Benefits for Children.............................................................. 7
  Measurement of Physical Activity..................................................................... 8
  Statement of Purpose......................................................................................... 9
  Research Question.............................................................................................. 9
  Hypotheses.......................................................................................................... 10
  Significance of Study......................................................................................... 10
Chapter II – Review of the Literature................................................................... 12
  Factors Influencing Physical Activity in Children......................................... 12
    Family.............................................................................................................. 12
    Parental Role and Influence on Physical Activity....................................... 14
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics</td>
<td>14</td>
</tr>
<tr>
<td>Encouragement</td>
<td>17</td>
</tr>
<tr>
<td>Interventions</td>
<td>19</td>
</tr>
<tr>
<td>Gender Differences</td>
<td>21</td>
</tr>
<tr>
<td>Physical Education</td>
<td>22</td>
</tr>
<tr>
<td>Resources</td>
<td>24</td>
</tr>
<tr>
<td>Standards</td>
<td>24</td>
</tr>
<tr>
<td>Parental Role and Factors Influencing the BMI of Children</td>
<td>25</td>
</tr>
<tr>
<td>Adult Obesity/Overweight Statistics for Monroe County</td>
<td>29</td>
</tr>
<tr>
<td>Child and Adolescent Obesity/Overweight Statistics for Monroe County</td>
<td>29</td>
</tr>
<tr>
<td>Parent's Physical Activity and Step Counts in Relation to BMI</td>
<td>30</td>
</tr>
<tr>
<td>Children’s Physical Activity and Step Counts in Relation to BMI</td>
<td>32</td>
</tr>
<tr>
<td>Children’s Step Counts</td>
<td>33</td>
</tr>
<tr>
<td>Chapter III – Methods</td>
<td>37</td>
</tr>
<tr>
<td>Participants</td>
<td>37</td>
</tr>
<tr>
<td>Instruments</td>
<td>39</td>
</tr>
<tr>
<td>Procedures</td>
<td>40</td>
</tr>
<tr>
<td>Data Collection</td>
<td>42</td>
</tr>
<tr>
<td>Data Treatment/Analysis</td>
<td>45</td>
</tr>
<tr>
<td>Chapter IV – Results</td>
<td>47</td>
</tr>
<tr>
<td>Parent-Child Physical Activity</td>
<td>47</td>
</tr>
<tr>
<td>Weekday and Weekend Step Counts in Children</td>
<td>50</td>
</tr>
</tbody>
</table>
List of Tables

Table 4.1 Parent-Child Physical Activity by Weekday, Weekend, and the Seven Day Week 48

Table 4.2 Children’s Step Counts based on Ethnicity 52

Table 4.3 Parent BMI and Step Counts 53

Table 4.4 Parent-Child BMI 56
List of Figures

Figure 4.1 Weekday, Weekend, and Seven Day Week Step Counts for Children  51

Figure 4.2 Children’s Step counts based on BMI  55
Abstract

Obesity is a problem that children locally and across the nation are facing. The objective of this study was to compare fifth grade children’s BMI and daily physical activity to their parents’ BMI and daily physical activity. The participants were 36 children from a Northeastern US urban elementary school in grade five and 18 of their parents. The parents and children wore the Yamax Digiwalker pedometer for 7 consecutive days in March 2012. Height/weight of the children was obtained and converted into BMI scores. For five consecutive school days (Tuesday – Monday) the children reported their previous day’s step counts in the presence of the researchers. The parents self-reported their daily step counts on a log sheet. Calculation of the means, standard deviations, paired and independent t tests, ANOVA’s, and Pearson correlations were utilized to analyze data. Results suggested that children took 9,535 (SD=2,594) steps/day, while female parents took 5,209 (SD=2,832) steps, and male parents took 10,161 (SD=7,010) steps per day. Children were significantly more active than their female parents and less active than their male parents. Boys took more steps than girls. Caucasian children took more steps than African American and Hispanic children. Healthy BMI children took more weekly steps than overweight and obese BMI children. Children took significantly more steps on physical education days than non-physical education days. Realistic programs in an urban area ought to be developed where children and their parents can be physically active together. When children and their parents participate in physical activity, and have a healthy lifestyle, they can be equipped to maintain a healthy body weight.
Chapter I
Introduction

Introduction

Obesity is a problem that many American adults and children are facing today as nearly 34% of U.S. adults and 17% of U.S. children aged 2-17 years are obese (Centers for Disease Control and Prevention [CDC], 2011d; CDC, 2011e). An association has been found between a parent’s weight and their child’s weight. If at least one parent is obese, their child is at an increased risk for becoming obese (Davison & Birch, 2002; Panagiotakos et al., 2008; Fogelholm, Nuutinen, Pasanen, Myohanen, & Saaletta, 1999). A lack of physical activity can be a major contributor in a person’s obesity (CDC, 2011f).

Obese adults and children have health risks. An obese adult has an increased health risk of type II diabetes, hypertension, cardiovascular disease, stroke, and certain types of cancers, while an obese child has many health risks, as compared to a normal weight child (CDC, 2011a). These include an early onset of type II diabetes, respiratory issues including asthma, liver disease, high blood pressure, female menstrual problems, the early onset of puberty, and depression (CDC, 2011a; National Institutes of Health [NIH], 2007).

Since obese people have health risks, it is important to know how to determine an adult or child’s weight category. The CDC has determined formulas for classifying people in categories of a healthy or normal weight, overweight, and obese weight. For adults, overweight is defined as having a body mass index (BMI) of 25-29.9, while
obesity is defined as having a BMI of 30 or greater (CDC, 2011c). BMI is calculated by taking the person’s weight in kilograms and dividing it by their height in meters squared. For children, overweight is defined as being in the 85th – 94th percentile. Obesity is defined as being in the 95th percentile or higher. Percentiles are determined based on the CDC growth charts for gender and age (CDC, 2010a). This research examines the relationship of parent and child physical activity levels and BMI, therefore, for the sake of comparison, a child’s weight status will be converted to normal/healthy, overweight, or obese, instead of referring to percentiles. When relating BMI to physical activity, Hands and Parker (2008) reported that if a child has a high BMI, there is a high likelihood the child is not very physically active.

When looking at the relationship of a parent’s BMI and physical activity level to that of their child’s BMI and physical activity level, a parent’s socio-economic level can have an impact on their child’s BMI. Lamerz et al. (2005) studied 1,979 parents and their children on parental social class, education, and obesity prevalence of their children. They reported that 5% of the children having a high socio-economic level had a BMI equal to or greater than the 90th percentile. For children having a low socio-economic level, 15% had a BMI equal to or greater than the 90th percentile (Lamerz et al., 2005). As can be seen, the lower socio-economic level children were three times more likely to have an unhealthy BMI than the high socio-economic children. Parents play a role in their child’s physical activity as socio-economic status impacts available resources (Johnson, Brusseau, Darst, Kulinna, & White-Taylor, 2010). It is possible that a family with low socio-economic status will not have the
disposable income available to spend on resources for their child’s physical activity as compared to a middle or high income family. Therefore, the child may not be exposed to a wide variety of physical activity choices outside of school.

**Child Obesity Health Risks**

Obese adults and children have a higher risk for many types of diseases than adults and children maintaining a healthy weight (CDC, 2011d). As noted, an obese adult has increased health risks. Children suffering from obesity are also at risk for many health problems (CDC, 2011f). Some of these risks are similar to adult obesity risks, while some are more age specific. Obese children and youth who regularly consume unhealthy amounts of foods high in sugar and saturated fat are at risk for developing insulin resistance and diabetes (U.S. Department of Health and Human Services [DHHS], 2007). While physical inactivity in children can contribute to obesity leading to type II diabetes, physical activity on a regular basis can contribute to a child’s healthy BMI, which helps to reduce the risk of getting type II diabetes (CDC, 2011d).

Besides type II diabetes, obese children have an increased risk of developing respiratory problems such as asthma. In a study by Gennuso, Epstein, Paluch, and Cerny (1998), the authors researched 85 children with asthma and 86 children without asthma aged 4-16 years. They noted that 30.6% of the children with asthma had BMI’s above the 95th percentile, classifying them as very obese, while only 12% of the non-obese children had asthma (Gennuso et al., 1998). By participating in regular physical activity at a moderate intensity, children can reduce their risk of developing
an obese BMI (CDC, 2010b).

In addition to type II diabetes and respiratory problems, children and youth that are obese have an increased risk for getting non-alcoholic fatty liver disease (NAFLD) (Dunn & Schwimmer, 2008). NAFLD affects the liver in that healthy cells break down and become diseased with the presence of fat inside the cell, which can gradually lead to cirrhosis. The current treatment is an increase in physical activity and a change in diet, so that the child is consuming healthy foods, in order to achieve the goal of weight loss (Dunn & Schwimmer, 2008).

Hypertension is yet another health condition that can affect obese children. Virdis et al. (2009) reported hypertension to be the main cardiovascular risk factor connecting obesity to cardiovascular disease. Unfortunately, obese children and youth can begin to develop atherosclerosis. When this condition is accompanied with hypertension, children are at an increased risk of cardiac mortality in adulthood if they remain obese (Virdis et al., 2009). The CDC (2011c) reported that maintaining a healthy BMI helps sustain a person’s blood pressure at a healthy level.

Diabetes, asthma, NAFLD, and hypertension are just a few of the health issues an obese child can face. These and other health issues, such as female menstrual problems, early onset of puberty, and depression can all contribute to a reduced quality of life for an obese child (CDC, 2011a; NIH, 2007). Physical inactivity can contribute to a child’s obesity, while an active child that participates in regular physical activity has an increased chance of achieving and maintaining a healthy BMI (CDC, 2011g).
Physical Activity Recommendations

Before describing the many benefits of physical activity for adults it is important to know what physical activity is and how much an adult needs. Physical activity is described by the DHHS (2008) as activity producing movement of the body. To have a health enhancing level of physical activity there are levels of intensity of physical activity that must be met referred to as low, moderate, and vigorous.

Agencies, including the DHHS, CDC, and The American Heart Association have created guidelines regarding how much physical activity a person needs to obtain the minimum health benefits from physical activity. These guidelines are for people in all BMI categories. If a person is to switch from an obese or overweight BMI to a healthy BMI, they will likely need to participate in physical activity in a manner to obtain more than just the minimum benefits. As noted, a major benefit of physical activity in adults and children is that it contributes to a healthy BMI (CDC, 2011f). To obtain the minimum health benefits, the DHHS recommends that adults participate in regular physical activity exercise for a minimum of two hours and 30 minutes a week at a moderate intensity, one hour and 15 minutes a week at a vigorous intensity, or a combination of the two. In addition to this aerobic activity, adults should engage in strength training for at least two days a week, using all the major muscle groups (DHHS, 2008). According to the State Indicator Report (CDC, 2010d) 64% of adults in New York State are physically active while 26% do not engage in leisure time physical activity (CDC, 2010c). According to this report residents of
New York State are in line with national averages.

While adults reap many benefits from physical activity, children do as well (CDC, 2011d). There are different guidelines for adults and children for the amount of physical activity they should participate in to get the minimum benefits. The U.S. Department of Health and Human Services recommends that children participate in physical activity a minimum of three days a week for at least one hour, at least at a moderate intensity level (DHHS, 2008). The weekly recommendations include aerobic activity and strength training. Local and national campaigns, (e.g. Be a Healthy Hero, NFL Play 60, and Michelle Obama’s initiatives) recommend children participate in physical activity every day for at least one hour to help end obesity in American children. These campaigns and initiatives often have tunes or songs that go with slogans to remind children to get active to improve their overall health and have a healthy body weight.

**Physical Activity Benefits for Adults**

In addition to the notion that physical activity contributes to a healthy BMI, there are also other advantages. Physically active adults have a reduced risk of contracting certain diseases (CDC, 2011d). The 1996 Surgeon General’s Report on Physical Activity and Health stated that if adults exercise regularly they significantly reduce their risk for heart diseases, diabetes, and colon cancer. Regular physical activity in adults also can reduce depression and anxiety, improve emotional health, increase an overall feeling of well-being, lower high blood pressure, increase or maintain bone density, maintain healthy joints, increase muscle mass, and is
instrumental in contributing to maintaining a healthy body weight (CDC, 2011f).

**Physical Activity Benefits for Children**

The CDC (2010b) reported that in 2007 in the United States, 38% of children aged 9-13 years, participated in organized physical activity during out of school hours, while 67% participated in unorganized physical activity. Only 17% of high school aged children participated in at least one hour of physical activity a day. These statistics suggest that children spend less time in physical activity as they mature (CDC, 2010b).

Some of the benefits of regular physical activity for children are improvement in bone mineral density, prevention of child onset type II diabetes, a reduction in the incidence of attention deficit hyperactivity disorder (ADHD), and prevention of obesity (CDC, 2011a). When girls are 11-14 years of age, and when boys are 14-16 years of age, there are quick increases in bone mass (Gracia-Marco et al., 2010). At these ages, participation in weight bearing activity can increase their bone density, which sets the stage for a healthy bone density level in adulthood (Gracia-Marco et al., 2010).

Research studies have been conducted that investigate physical activity in children in relation to their cognitive development, executive functioning, and academic performance. Tomporowski, Davis, Miller, and Naglieri (2008) reviewed studies of children’s cognitive functioning and exercise, and reported that physical activity may improve a child’s executive function with regard to cognitive development. For example, when a 5th or 6th grader plays a ‘five on five’ basketball
game, he or she is using the planning, working memory, and problem solving parts of executive functioning. The ability of the child to use strategy against an opponent and make quick decisions are components of cognitive functioning.

Gapin and Etnier (2010) reported that physical activity can improve the executive functioning of children diagnosed with ADHD. They studied the relationship between participating in physical activity and executive function performance in male students aged 8-12 years diagnosed with ADHD. They reported that a high physical activity level is associated with better executive functioning in boys diagnosed with ADHD.

Regular participation in vigorous physical activity may promote higher academic achievement in children (Coe, Pivarnik, Womak, Reeves, & Malina, 2006). Coe et al. (2006) studied the effect of physical education and activity levels on the academic achievement in 214, 6th grade children. They reported that students who met the vigorous physical activity guidelines in Healthy People 2010 had higher grades in math, science, English, and/or world studies, than children who did not participate in vigorous physical activity. When the 6th grade children took standardized tests, the students that were currently enrolled in a physical education class scored an average of 10% higher than the children who were not currently enrolled in weekly physical education (Coe et al., 2006).

**Measurement of Physical Activity**

While there are different ways to exercise or to be physically active, a person may wonder how to measure their own physical activity level. When a person wants
to know how much physical activity he or she is getting, it can be measured. Whether someone wants to determine their baseline amount of physical activity, reach a predetermined goal (such as walking at least 10,000 steps a day), or achieve a healthy BMI, accurately measuring physical activity eliminates guessing. Pedometers and accelerometers provide a direct form of measurement of the subjects’ physical activity. Pedometers provide an accurate way of measuring how physically active a person is and can be done by tracking how many steps are taken in a day. A pedometer is a non-complicated device a person can wear on their waist band in order to track the number of steps taken.

Previous research has shown that the use of pedometers and accelerometers is a practical, valid, reliable, and objective form of measurement (Tudor-Locke et al., 2008). They are especially useful when the data is being collected over a large number of hours such as from the time a subject wakes up in the morning, until the subject goes to bed at night.

**Statement of Purpose**

The purpose of this study is to compare fifth grade children’s BMI and daily physical activity level to their parents’ BMI and daily physical activity level.

**Research Question**

Are the body mass index and daily physical activity patterns of an elementary aged child correlated to the body mass index and daily physical activity patterns of his or her parents?
Hypotheses

1. The BMI of an elementary aged child is correlated to the BMI of his or her parents.
2. Parents that are physically active on a daily basis have elementary aged children that are physically active on a daily basis.
3. Children are more physically active on physical education days than on non-physical education days.

Significance of the Study

The Monroe County Department of Public Health (MCDPH) reported that as of February 2011, 36% of the children aged 2-10 years in the city of Rochester, and 25% of the children in the rest of Monroe County are obese or overweight. In the city of Rochester and in the rest of the county, 28% and 26% of adults, respectively, are obese. We know that if a parent is overweight, obese, or has a high BMI their child is at risk of having an unhealthy body weight or high BMI (Panagiotakos et al., 2008; Fogelholm et al., 1999; Davison & Birch, 2001). Adults and children that have a normal, healthy BMI take more steps per day (an indication that they are more physically active) than adults and children who are overweight or obese (Tudor-Locke et al., 2008; Hands & Parker, 2008). There has not been any research done examining the correlation between children and their parent’s physical activity level and BMI. Thus, the current study is important because the obesity statistics of adults and children in Monroe County, NY, (and indeed, across the United States) reveal that childhood obesity is a problem touching the lives of many youth in Rochester,
NY. As noted, an obese child is at risk for developing many serious diseases as he or she ages. Therefore this study will examine data on children and their parent’s physical activity level and BMI in order to initiate research that will ultimately result in the advancement of children achieving and maintaining a healthy lifestyle.

Parents play an important role in their child’s BMI and physical activity levels because they are an example to their children by their own BMI and physical activity habits. A parent’s values, socio-economic status, opinions, and encouragement influence their child’s attraction to physical activity and resources available to participate in physical activity (Olvera et al., 2010; Johnson, Brusseau, Darst, et al., 2010; Loprinzi & Trost, 2009; Ornelas, Perreira, & Ayala, 2007). If research is done on the physical activity levels and BMI of parents and their children, information may be found that would help these children achieve and maintain a healthy BMI. Research by Bauer et al. (2011) revealed that parents’ physical activity levels are associated with their daughter’s physical activity levels, especially if the daughter is of a minority ethnic background. Also, many parents of Hispanic children view an overweight child as healthy and a normal weight child as unhealthy (Elder et al., 2010). Therefore, an understanding of the relationship between physical activity levels and obesity between children and their parents can guide future research on ways to help children achieve and maintain a non-obese, healthy BMI. Research examining the physical activity of adults and their children can provide important information relating to the development of obesity. Studies like the one proposed can lead to future interventions to increase physical activity levels in school and at home.
Chapter II

Review of Literature

There has been much valid and reliable research done on the topics of overweight/obese children, overweight/obese adults, children’s physical activity, and adult physical activity. There is however, limited research on the relationship between a parent’s physical activity level and BMI, and their child’s physical activity level and BMI. This chapter will present information on the factors influencing physical activity and BMI in children, parental role and influence on children’s physical activity and BMI, obesity/overweight statistics for Monroe County, and physical activity and step counts in relation to BMI.

Factors Influencing Physical Activity in Children

There are different areas that influence the physical activity levels in children. Two such areas are the family and physical education. Within the family are the factors of the general sedentary lifestyle behavior of the child, encouragement from parents, and the physical activity behavior of parents (Bauer, Neumark-Sztainer, Fulkerson, Hannan, & Story, 2008; Alderman, Benham-Deal, & Jenkins, 2010). In the area of physical education there is a factor of school resources (Johnson, Brusseau, Darst, et al., 2010). These factors contribute individually or in combination to inspire children’s engagement in physical activity. Examining these factors can reveal information to help school aged children maintain a healthy body weight.

Family. The family and family environment can influence a child’s physical activity.
The lifestyle of a child is a factor influencing physical activity (Bauer, Neumark-Sztainer, Fulkerson, Hannan, & Story, 2008). If a child is sedentary for many hours of the day, by definition, they are not participating in physical activity. Sedentary activities (including computer use, video games, and television) are major obstacles (Bauer et al., 2008).

The family environment can play a role in a child’s BMI. Recent BMI research was completed by Bauer, Neumark-Sztainer, Fulkerson, Hannan, and Story (2011) on 253 girls aged 14-20 years of a minority ethnic background and their parents. The authors investigated the effect of the family environment on a teen girl’s physical activity, television viewing, BMI, and body composition. The BMI measurements of the girls were obtained, and the girls filled out a questionnaire and completed a three day physical activity recall survey. The parents of the girls completed a questionnaire. It was reported that the number of media resources (televisions, DVD players) in the home was positively associated with the BMI and percent body fat for the girls. In this study, a block was 15 – 30 minutes in length. The teen girls reported being active in moderate to vigorous physical activity for three blocks (45 – 90 minutes) per day, and being sedentary (watching television, using the telephone, listening to music, etc.) for eight blocks (two – four hours) per day. The authors did not state which girls (those with fewer televisions as compared to those with more) had the most moderate to vigorous physical activity time. Also, parents’ physical activity habits were associated with their daughters’ physical activity habits (Bauer et al., 2011).
Parental role and influence on physical activity.

A parent has many roles in influencing their child’s physical activity including their parenting style, values, opinions, gender role expectancy, support, and the parents’ participation in physical activity with their child (Olvera et al., 2010; Loprinzi & Trost, 2009; Ornelas, Perreira, & Ayala, 2007). Alderman, Benham-Deal, and Jenkins (2010) investigated the effect of parental influence on their child’s physical activity over time. There were 70 parents of children aged 3-5 years who participated in the study. The parents filled out a questionnaire where they answered specific questions regarding the number of minutes per day they engaged in different physical activities with their children. The researchers obtained a baseline reading, and the parents completed an additional survey, one to nine years later. From baseline to when the follow-up occurred, the parents averaged an increase of 29 minutes per week of physical activity while their children averaged an increase of 145 minutes per week of physical activity. The authors found that parents spend less time doing physical activities with their child as the child ages inferring that as the child aged, physical activity became more of their responsibility rather than the parents’ responsibility.

Characteristics.

There are many characteristics of parents such as their physical activity opinions, enjoyment of physical activity, and behaviors that can influence their children. The opinions parents hold can impact their child’s physical activity level when their child is as young as two years of age. Loprinzi and Trost (2009) studied
the effect of parental behaviors, opinions, and values of physical activity on their preschool children’s physical activity. The parents completed the International Physical Activity Questionnaire. The data revealed that parents do influence the amount of physical activity of their preschool aged children. If parents view their child as having physical competence, or skill, they are more likely to provide resources and support for physical activity (Loprinzi & Trost, 2009).

Brustad (1993) completed a study that investigated the effect of parental influence, psychological, and social factors on 4th grade children’s attraction to physical activity. There were 81 children in the study. The Harter’s Perceived Competence Scale for Children, the Children’s Attraction to Physical Activity scale questionnaire, and the parents’ answers to a Likert-type questionnaire were used to support the findings. It was reported that parents who enjoy physical activity encourage their children to be active more than parents who do not enjoy physical activity. Also, boys get more encouragement from parents to be active than girls, and boys have higher perceived physical activity competence than girls.

A child may be attracted to physical activity if they perceive their parent’s enjoyment of it. Brustad (1996) investigated the effect of parental physical activity socialization processes and influence on 107 underprivileged 4th-6th grade children’s attraction to physical activity, perceived competence, and gender differences. It was found that both boys and girls perceived their parents’ encouragement and enjoyment of physical activity, which encouraged their liking and attraction to physical activity, including games and sports. The boys and girls believed they had competence in
physical activities, with differences in that boys liked physical exertion and exercise, while girls favored good peer interactions (Brustad, 1996).

The general behaviors of parents influence their children’s behavior, even children’s physical activity habits (Alderman, Benham-Deal, & Jenkins, 2010). Davison and Birch (2002) studied the effect of parents’ physical activity level on predicting the obesity risk of their young daughters. They discovered that parents over-reported physical activity. Also, obese parents were prone to construct a family environment that encouraged habits and a life-style conducive to obesity. Davison and Birch (2002) noted that a child of an obese parent is at risk of becoming obese since the parent has behaviors such as an infrequency of physical activity and low activity intensity, which promotes, encourages, and maintains habits leading to an obese body weight. The data showed 14 girls out of 192 (7%) became overweight from age 5 to age 7. Of these girls, 11 were from families fitting into the study’s category of an obese family. If this weight increase were to continue, 28% of the girls would become overweight between ages 5 and 13 (Davison & Birch, 2002).

In addition to the encouragement a child receives from his or her parent, the physical activity behaviors of a parent impacts the physical activity of their children (Brustad, 1993). When a parent engages in regular physical activities and exercise, their child is likely to recognize their parent’s enjoyment of physical activity and thus desire to be physically active. Brustad (1993) investigated the effect of parental influence, psychological, and social factors on 4th grade children’s attraction to physical activity. Children completed the Harter’s Perceived Competence Scale for
Children and the Children’s Attraction to Physical Activity Scale while the parents completed a Likert-type questionnaire. It was reported that parents who enjoy physical activity encourage their children to be active more than parents who do not enjoy physical activity.

If a parent is not physically active, the inactive behavior, unfortunately, may also serve as an example to their children. Hamilton and White (2010) investigated parents’ physical activity behavior. It was reported that some female adults felt guilty or even selfish about rearranging the family’s schedule and about asking the husband to fill some traditional female roles in the home so that she could go to the gym twice a week. Hamilton and White (2010) noted that since the mother had guilt, she was highly unlikely to continue exercising. When a mother of a child is not engaged in physical activity, she is not setting an example of the importance of physical activity. As previously stated, inactivity can be a contributor to obesity (CDC, 2011f).

*Encouragement.*

When a parent encourages and supports their child to be physically active, the child has a better chance of being physically active as compared to the child of a parent who does not (Brustad, 1996). Parental encouragement and support also have an effect on the psychological health of their child, especially in relation to the self-esteem of a teenage child (Ornelas et al., 2007). These authors investigated the effect of parental influences and teenagers’ physical activity on their self-esteem and depression. The researchers used data from the National Longitudinal Study of Adolescent Health based on information from over 13,000 children in grades 7-12,
which was obtained through interviews and a physical activity recall report. During
the interviews, subjects also answered questions in a Likert-type format. Data
indicated that parents influence their teenage children’s physical activity through
family unity and good parent-child communication, which had a positive effect on
teenagers’ emotional health. The children with high levels of family cohesion,
communication, and parent involvement participated in at least five sessions of 30
minutes or more of moderate to vigorous physical activity per week.

The encouragement a child receives from his or her parents also has a role on
their physical activity (Loprinzi & Trost, 2009; Brustad, 1996). If the parent perceives
their child has physical ability, the parent is more likely to provide resources for their
child to participate in physical activities (Loprinzi & Trost, 2009). Brustad (1996)
investigated the effect of encouragement on 107, 4<sup>th</sup>-6<sup>th</sup> grade children’s attraction to
physical activity, and perceived competence. Children completed questionnaires such
as the CAPA scale, and a modified version of the Harter’s perceived Physical
Competence Scale for Children. It was found that most boys and girls perceived their
parents’ encouragement and enjoyment of physical activity, which encouraged their
liking and attraction to physical activity including games and sports. The boys and
girls believed they had competence in physical activities because their parents
couraged their participation and continuation of physical activity. The differences
were that boys liked physical exertion and exercise, while girls favored good peer
interactions (Brustad, 1996). Brustad (1993) reported boys get more encouragement
from parents to be active and have higher perceived physical activity competence.
Interventions.

Some parents of overweight or obese children have positive values about health in general and want their children to lose weight. Yet despite these values, some children remain obese for most of their childhood years (Olvera et al., 2010). Olvera et al. (2010) investigated the effect of a three week healthy lifestyle, fitness, and nutrition intervention on overweight and obese Latino and African American 10 year old girls. The overall intervention was successful in terms of weight loss as the girls averaged a weight loss of 1.4 pounds, which is more than published recommendations of .9 pounds per month for girls of this age. It was reported that at the beginning of the intervention, all 37 parents had feelings of guilt and hopelessness about their daughter’s weight according to the questionnaire they filled out. To alleviate their own guilt, they would give in to their daughter’s appeal for junk food, and would take them to fast food establishments. With this parenting style of allowing, and providing large amounts of unhealthy food, they were unintentionally giving their daughters the message that it is acceptable to eat that way and then not exercise. The authors noted the high attendance rate (at nearly 60%) for the training sessions where the parents were taught how to support their daughter in physical activities, encourage her self-esteem, and help her make better healthy choices. At the conclusion of the intervention, the researchers were hopeful that the girls were now on track to achieving a healthy BMI and that the parents had received some education on how to help their daughters in this process instead of giving in to their own guilty feelings thus allowing their daughters to make unhealthy decisions.
A type of physical activity intervention can be educational training for parents as in the study by Olvera et al. (2010) where the parents of the overweight and obese girls participated in educational training sessions while their daughters, simultaneously, participated in a separate intervention. The parent training sessions, led by a dietitian and fitness instructor, taught parents about healthy food choices and how to encourage their daughters in making healthy choices regarding eating and physical activity. The training also aimed at boosting the daughters’ self-esteem. At the end of the intervention, the parents were interviewed and they noted that their daughter’s self-esteem had increased as compared to what it was prior to the parent training sessions and intervention. Olvera et al. (2010) suggested that the parents learned how to facilitate their daughters decision making process on choosing what to eat and how to be active to achieve a healthy lifestyle.

Physical activity interventions for families can provide a positive impact on the type of influences parents have on their child. Ransdell, Dratt, Kennedy, O’Neill, and DeVoe (2001) did an intervention study on adolescent girls, investigating the effect of a 12-week physical activity intervention on mothers and adolescent daughters. The subjects completed the Physical Self-Perception Profile questionnaire, which revealed that several subjects had a positive change of their self-perception of physical activity, an increase in their self-esteem, and increased motivation for physical activity after the intervention was completed (Ransdell et al., 2001). For example, at post-intervention, a number of subjects had joined a school or recreational sports team for the first time, participated in a sport competition, or
joined a health club.

*Gender Differences.*

There can be gender differences with regard to the influence of parents. Fuemmeler, Anderson, and Masse (2011) found that parental encouragement, support, and influence on their child’s physical activity were gender specific. In a study that investigated the relationship of physical activity and inactivity of parents and their 4th and 5th grade children, it was reported that fathers’ sedentary activity was associated with children’s sedentary activity during the weekend. Parents and their children wore accelerometers for four days (Thursday – Sunday), including while they slept, but not bathing or swimming. Fathers averaged 744 minutes of sedentary time on Saturday and Sunday from 6 am to 12 am while children averaged 651 minutes of sedentary time. Mothers averaged 162 minutes of sedentary time during the weekdays from 3pm to 7 pm while children averaged 125 minutes of sedentary time during the weekdays. Mothers’ physical activity was correlated with their daughters’ physical activity, and fathers’ physical activity was correlated with their sons’ physical activity. There was a steady increase in the number of minutes per week of moderate to vigorous physical activity children participate in if their parents were physically active. When parents were rated as being very low in their weekly minutes of physical activity, their child averaged 107 minutes per week of moderate to vigorous physical activity. When one parent was rated as low in their weekly minutes of physical activity and the other parent was rated as high in their weekly minutes of physical activity, their child had 130 minutes of weekly moderate to
vigorous physical activity. When both parents were rated high in their weekly minutes of physical activity, their child had 195 minutes of weekly moderate to vigorous physical activity.

Gender differences can also be found in parental support. Edwardson and Gorely (2010) investigated the effect of parents' physical activity support on objectively measured physical activity via accelerometry, of 117 British children aged 7-10 years. Both the mother and the father completed a questionnaire to assess parental support. It was reported that mothers provide more support for limiting sedentary activities of their children than fathers (Edwardson & Gorely, 2010).

Regarding the role of parents as models, it is clear that many children tend to copy their parents' actions (Edwardson & Gorely, 2010). In a study that investigated the effect of parental support of physical activity of British children, the authors reported that fathers' modeling is associated with boys' moderate-vigorous and vigorous physical activity. In this study, mothers restricted sedentary activities for their sons and daughters more than fathers. The research findings of Edwardson and Gorely (2010) support the importance of fathers’ participation in physical activity in leading their sons to be physically active.

**Physical education.**

The quality of a physical education teacher and, additionally, the quality of the curriculum can have an impact on how physically active the children are during class. An effective physical education teacher has goals and plans lessons with objectives that lead to a high level of learning (Rink & Hall, 2008). A physical education
curriculum can be traditional or modern. A quality curriculum incorporates units and lessons that have progression of tasks from simple to complex, allowing the child plenty of practice time, leading to a top level of proficiency (Rink & Hall, 2008).

Also, some physical education curriculums can have a very high educational component, yet not require much physical activity from the children. For example, a cooperative games curriculum can educate children in a number of ways and teach many values needed to become an adult, yet it may not provide many activities where the children are achieving a moderate-vigorous heart rate. When there is a quality teacher and curriculum the result can be a balance of an educated, physically active student prepared to enter society with the knowledge to make healthy choices achieving and maintaining a healthy lifestyle.

Physical education class can be an excellent place for children to be physically active at moderate to vigorous intensity levels. Physical education class can also provide a safe environment where children are taught, guided, and encouraged to perform skills they can use to obtain a lifelong enjoyment of being physically active. Datar and Strum (2004) investigated the effect of physical education time on the change of BMI in children from kindergarten through first grade. It was reported that increasing physical education time from 1 - 1.5 hours per week to five hours per week reduces BMI in girls that are overweight or are at risk of becoming overweight. There could be a 43% reduction in the prevalence of overweight in girls by increasing physical education time to five hours per week. There was not a significant change in the BMI of overweight or at risk boys and children that were at a normal healthy BMI
in kindergarten (Datar & Sturm, 2004).

**Resources.**

The resources of the school play a part in the physical activity level of its students (Johnson, Brusseau, Darst, et al., 2010). If a school has a generous budget with lots of pre-existing equipment, it is likely there are more opportunities for the students to participate in different types of activities with more of a variety of equipment. If a school has a very limited budget with outdated equipment, it is possible there are fewer opportunities for its students. An urban school with a small budget, very few resources, and restricted outside space may limit the physical education teacher to creating lessons using inside space, or lessons using outside space, which have limited activity time (Johnson, Brusseau, Darst, et al., 2010).

**Standards.**

Currently, there is not a national, enforceable, standard regarding how much physical education a child should have (National Association of Sport and Physical Education, 2012). Even with New York State learning standards for physical education, school districts have great latitude in how physical education is executed. In Monroe County, elementary physical education classes average 30-45 minutes (Rochester Central School District [RCSD], 2012; Webster Central School District [WCSD], 2012). The frequency of how many days per week physical education is offered also varies among districts because the duration of the physical education classes is different. Most local schools have physical education for students in grades K-2 for 1 ½ hours per week, which equates to 30 minutes a class every other day.
The intensity level of physical activity in physical education varies with each activity and task, which also impacts the physical activity level of a student. For example, students will be active at a higher intensity level during units such as chasing, fleeing and dodging, or soccer, compared to units such as cup stacking or bowling. Depending on the type of activity, students may or may not meet the weekly physical activity recommendations set by the CDC (2010b).

**Parental Role and Factors Influencing the BMI of Children**

A parent has many roles in influencing their child’s BMI such as their own physical activity, characteristics, and BMI. The physical activity of parents, can impact a child’s weight. Timperio, Davis, Miller, and Naglieri (2008) investigated the influence of family physical activity and a sedentary environment on the weight change over a three year time period of 344 children aged 10-12 years. It was reported that there were significant increases in BMI for girls as compared to boys, and 34 children (10%) increased their weight category of non-overweight, overweight, or obese. Normal weight girls received more praise for physical activity than overweight or obese girls. Also, sibling physical activity is associated with weight change (Timperio et al., 2008). There are very few studies examining the role of sibling physical activity having an effect on the overweight or obese child.

Besides a parent’s own physical activity, another way a parent influences their child’s BMI is with regards to their general characteristics. Elder et al. (2010) investigated the effect of the parents’ characteristics, parenting, school, and the community on children’s BMI. In the study, over 70% of the subjects were Hispanic.
It was reported that many Hispanic parents of normal weight children view these children as underweight (Elder et al., 2010). Hispanic parents that follow many of their native customs and culture as opposed to modern American customs and philosophy (less acculturated) have more overweight children (Elder et al., 2010). A difference in the Hispanic culture compared to many other cultures in America is that overweight children are viewed as healthy children (Elder et al., 2010)

A parent’s BMI can influence their child’s BMI. Davison and Birch (2002) suggest that parental overweightness, obesity, and high BMI scores are an indication that their child is at an increased risk for developing obesity as he or she matures. The authors investigated the effect of parents’ physical activity on predicting obesity risk of their young daughters aged five and seven years. The parents of the 192 girls completed the Food Frequency Questionnaire, and BMI measurements were taken. It was reported that the girls were at an increased risk for obesity if both parents were obese due to genetics and the family environment. Weight and height measurements revealed that 19% of the girls were overweight or obese when they were five years old, and 54% of the mothers, and 76% of the fathers were overweight. When the girls were seven years old 23% of the girls were overweight or obese, and 57% of the mothers and 79% of the fathers were overweight (Davison & Birch, 2002). The authors noted that as the girls aged from five to seven years, (only a two year period) their weight status increased by 4% while the mothers and fathers increased by 3%.

Elder et al. (2010) studied parents’ BMI and the BMI of their children in kindergarten through second grade. Overweight and obesity were calculated
according to the CDC 2000 growth charts. In this study, 17% of the boys and 17% of the girls were overweight, and 29% of the girls and 30% of the boys were obese. For the parents, 33% were overweight, and 41% were obese (Elder et al., 2010). This study revealed that parents’ BMI is strongly correlated with their child’s BMI. Therefore, the authors noted that parents are a model to their children by their BMI, thus suggesting a strong relationship of parent and child BMI.

The overweight and obesity level of parents can be a predictor for their child’s BMI. Fogelhom et al., (1999) researched obese children, studying the effect of physical activity and parent-child physical activity patterns on normal-weight and overweight/obese children aged 7-12 years. It was reported that if at least one parent is obese it is a strong predictor that the child will develop obesity and if both parents are obese it is a very strong predictor that the child will be obese. When the average BMI of the parents was taken, the data showed that the average BMI for mothers of obese girls was 25.9 and of obese boys it was 26.5. The average BMI for fathers of obese girls was 27.1 and for obese boys it was 27.7 (Fogelholm et al., 1999).

Parental weight and its connection to child obesity were studied by Panagiotakos et al. (2008) by obtaining parents’ and children’s BMI, and through questionnaires. The parents and children completed questionnaires and BMI data was taken. The authors studied 626 parents and their children aged 10-12 years in Athens, Greece. This study investigated the effect of parental weight and infant breast feeding on the prevalence of childhood obesity. International cut-off scores for the child’s BMI were used to classify the child as either overweight or obese. It was reported that
8.6% of the boys and 9% of the girls were overweight, while 33.9% of the boys and 22.1% of the girls were obese. Having obese parents resulted in a greater chance the child would be obese, and breast-feeding for more than 3 months resulted in a 72% lower chance of obesity likelihood for boys and an 81% lower chance for girls (Panagiotakos et al., 2008).

Research was conducted on parental characteristics and the BMI changes of young girls over a two year period. Davison and Birch (2001) investigated BMI changes in five year old girls and their parents residing in Pennsylvania, and then followed up two years later when the girls were seven years old. In their study they investigated the effect of parent and child characteristics on the prediction of a change in girls’ BMI from 5 to 7 years old. It was reported that 80% of girls who were overweight when they were 5 years old were still overweight when they were 7 years old, and 9% of girls became overweight from 5-7 years of age. In families where the parent has a high BMI there is a risk of raising a child with a high BMI due to genetics, and the family environment regarding food intake and physical activity habits (Davison & Birch, 2001).

A parent’s general health behaviors can influence their child’s BMI. Burke, Beilin, and Dunbar (2001) studied the effect of parents’ health behaviors. It was reported that parents’ BMI can be a predictor of children’s BMI with contributing factors such as fitness and alcohol consumption. The overweight/obesity rate for fathers’ at middle age was 70%, and for mothers’ at middle age it was 50%. When parents are overweight or obese in middle age their children will be at risk for
becoming overweight or obese, and low fitness of children remains a strong predictor of an unhealthy BMI (Burke et al., 2001).

The studies presented offer similar results. Children aged 5-12 are at an increased risk and high likelihood for developing obesity during childhood if at least one parent is obese.

**Adult Obesity/Overweight Statistics for Monroe County**

This information on the risks of obesity brings to light the question of what are the obesity rates for adults and children in the northeast where the current study takes place. In 2006, the Monroe County Health Department published statistics on the obesity and overweight rates for adults based on self-reports of their height and weight. There were slight gender differences in the percentage of obese adults of all ages living in Monroe County with men having higher percentages (28%) than females (26%) (MCDPH, 2008). Similar results were noted for the obesity rate for adults living in the city of Rochester at 28%, as compared to the county wide statistics. The overweight rate (not obesity) for males is 41% and for females it is 28%. The rate of a male being obese or overweight is 69% and for a female it is 54% (MCDPH, 2008).

**Child and Adolescent Obesity/Overweight Statistics for Monroe County**

As there are children with a BMI above the normal or healthy category living throughout the U.S., there are overweight and obese children living in Monroe County. In February, 2011 the obesity rate for children aged 2-10 years living in Monroe County was 14%, with an overweight rate of 14% (MCDPH, 2011). When
looking at the city of Rochester 36% of the children fall into the category of obese or overweight, while in the suburbs 25% of the children fall into this category. The likelihood of a Hispanic child being obese or overweight is 42%, while the African American child it is 34% and for the White child there is a 23% likelihood of being obese or overweight (MCDPH, 2011).

In 2006, the MCDPH published the Adolescent Health Report Card. It reported that 16% of children aged 11-14 years were obese, and 17% were overweight, equaling 33% of Monroe County adolescents as overweight or obese. When looking at this age group based on race, 23% of African American adolescents were obese, 17% of Hispanic adolescents were obese, and 15% of White adolescents were obese. In the city of Rochester, 24% of the adolescents were obese compared to 14% in the suburbs (MCDPH, 2006).

**Parent’s Physical Activity and Step Counts in Relation to BMI**

The CDC has not published guidelines for the recommended number of steps per day an adult should take. Tudor-Locke et al. (2008) reported that while 10,000 steps a day is a popular recommendation for maintaining health the actual number of steps depends on the age of the adult and this figure may not be appropriate for adults over the age of 60. They also reported that adults with a healthy BMI are taking more steps per day than adults that have an overweight or obese BMI (Tudor-Locke et al., 2008).

As there is a popular belief that adults should take 10,000 steps per day for health reasons, this number may vary with the age of the adult. Tudor-Locke, Hart,
and Washington (2009) studied the current pedometer expected values literature concentrating on adults aged 50 years and older. All studies but one reported that males took more steps per day than females with an average of 497-1,450 more steps. Adults classified as having a normal weight took 1,659-4,060 more steps per day than adults classified as overweight or obese. Caucasians took more steps per day than other ethnic groups. Healthy adults aged 50 years and older on average took 2,000-9,000 steps per day. This study did not give a steps-per-day recommendation because the authors believe more research is needed examining the difference in the ages of adults. It is likely that the stamina of an adult aged 50 years is very different than the stamina of an adult aged 90 years. Tudor-Locke et al. (2008) did give recommendations for minimum steps per day for BMI cut points for older adults, which are described in detail in the following paragraph.

It is not known how many steps per day an adult should take if he or she wants to reduce their BMI. Tudor-Locke et al. (2008) collected international adult pedometer physical activity data and described the process in establishing pedometer physical activity cut-points for adults based on BMI. It was reported that normal weight males aged 18-50 years, averaged 10,084 steps per day, while overweight/obese males of the same age averaged 8,802 steps per day. Normal weight females, aged 18-39 years averaged 9,399 steps per day, and overweight/obese females of the same age averaged 7,562 steps per day. For both genders and all age groups, overweight/obese adults took fewer steps per day than normal weight adults. The cut-point for males aged 18-50 years, and females aged 18-39 years for a normal
BMI (below 25 kg/m²) was 12,000 steps per day. The cut-point for males aged 51-88 years, and females aged 40-49 years for a normal BMI was 11,000 steps day. The cut-point for females aged 50-59 years for a normal BMI is 10,000 steps per day. The cut-point for females aged 60-94 years for a normal BMI is 8,000 steps per day (Tudor-Locke et al., 2008).

Children’s Physical Activity and Step Counts in Relation to BMI

There are factors that influence the physical activity and BMI of children such as family composites, the communities in which the children live, and school, which all contribute to the lifestyle of a child. Research studies have been done exploring factors such as ethnicity, gender, age, the size of the community, the amount of sedentary time and activities of children, the daily number of hours children spend outside, and the amount of time spent in physical education class.

When children are outside, they have opportunities to play without the distractions of sedentary activities like the T.V. and computer. Cleland et al. (2008) investigated the effect of time spent outside on the physical activity and BMI scores of children aged 5-6 years, and 10-12 years. It was reported that older boys had more outdoor physical activity than older girls in warm and cool weather months. Older boys had more minutes per week of cool weather weekday moderate to vigorous physical activity (514 minutes) than older girls (382 minutes). Older boys had more minutes per weekend of warm weather moderate to vigorous physical activity (257 minutes) than older girls (216 minutes). Older girls had higher BMI scores than younger girls. It is interesting to note that there was a very small association of time
spent outside and BMI scores in younger children, while older children who spent more time outside had more physical activity and less obesity than children spending less time outside (Cleland et al., 2008).

Children in the different BMI categories appear to have differences in their daily step count averages. Hands and Parker (2008) investigated the relationship between pedometer measured steps per day on BMI and waist circumference in children aged 7-16 years. It was reported that according to BMI measurements, 22.5% of the boys and 27.5% of the girls were classified as overweight/obese, while according to waist circumference, 18.4% of the boys and 17.8% of the girls were classified as having high trunk fat. When looking at children aged 9-10 years classified as having a healthy BMI, boys took 12,899 steps per day and girls took 11,245 steps per day. For children classified as overweight or obese, boys took 11,383 steps per day and girls took 10,218 steps per day. When looking at children of the same age classified as having a healthy waist circumference, boys took 12,707 steps per day and girls took 11,210 steps per day. For children classified as having high trunk fat, boys took 11,775 steps per day and girls took 9,823 steps per day (Hands & Parker, 2008).

**Children’s Step Counts**

Research studies have been done exploring factors such as the ethnicity, gender, age, and size of the community, in relation to a child’s daily step counts. Johnson, Brusseau, Graser, Darst, and Kulinna (2010) studied the physical activity of 10 year-old children based on their ethnicity, community size, and gender, and used
pedometers to measure their step counts per day over a three day period. It was reported that African American girls accumulated 9,600 steps per day. Caucasian girls accumulated 10,800 steps per day and Hispanic girls accumulated 10,400 steps per day. Hispanic boys accumulated 13,300 steps per day, which is 500 more steps than Caucasian boys who accumulated 12,800 steps per day. African American boys accumulated 12,000 steps per day. Boys living in an urban location accumulated 12,400 steps per day, which are 1,100 less steps per day than boys living in a suburban area who accumulated 13,500 steps per day. Boys living in a rural area accumulated 12,900 steps per day (Johnson, Brusseau, Graser, et al., 2010).

The factors of gender and ethnicity have been specifically looked at in regards to the number of steps a child takes in a day. Johnson, Brusseau, Darst, et al. (2010) investigated the effect of gender, ethnicity, and type of transport to and from school on step counts of minority children. It was reported that minority boys accumulated 12,620 steps per day, which is about 3,000 more steps per day than minority girls who accumulated 9,650 steps per day. Minority boys equaled about the same steps per day as Caucasian boys. Minority girls accumulated fewer steps per day than Caucasian girls. Minority children participated in more active transport to or from school such as riding a bike or walking, than Caucasian children. Minority girls walking to or from school averaged 11,320 steps per day and minority boys walking to or from school averaged 14,230 steps per day. Urban children participated in more active transport to or from school than suburban or rural children. Children who participated in active transport to or from school averaged 2,700 – 2,200 more steps per day than children
who did not (Johnson, Brusseau, Darst, et al., 2010).

There are differences in step counts of children based on gender and ethnicity. Brusseau et al. (2011) investigated fourth and fifth grade children’s step counts during a 24 hour period by gender, ethnicity, and body mass differences. It was reported that boys took more steps (13,082) per day than girls (11,065). Hispanic children averaged 12,639 steps per day while African American children averaged 12,130 steps per day, and Caucasian children averaged 11,687 steps per day.

Boys are taking more steps per day than girls through age 18. Tudor-Locke, McClain, Hart, Sisson, and Washington (2009a) studied the current pedometer literature concentrated on children, and it was reported that boys took more steps per day than girls. After the age of 9 years, boys generally gradually decline in steps per day so that by age 18 they are taking similar steps per day as girls. Girls have less of a decline because their average steps per day are not as high as boys. On the weekdays, boys are averaging 12,000-16,000 steps per day and girls are averaging 10,000-14,000 steps per day. On the weekend, boys are averaging 12,000-13,000 steps per day and girls are averaging 10,000-12,000 steps per day (Tudor-Locke et al., 2009a).

A daily step count of American children has been compared to children living in other parts of the world. Beets, Bornstein, Beighle, Cardinal, and Morgan (2010) investigated the global patterns of physical activity measured by a pedometer in children aged 5-18 years. It was reported that children in the U.S. have the lowest or second lowest steps per day across all age groups as compared to 12 other industrialized countries. In this study, the findings showed U. S. children aged 7-10
years averaged 10,500 – 13,000 steps per day. Children from six European countries are taking over 2,300 more steps per day than U.S. children. Boys and girls aged 14 years in China are taking more weekday steps per day (11,300 - 13,300) than U.S. boys and girls (10,800 - 11,000) aged 14 years (Beets et al., 2010).

From the literature, it is known that parents have an influential role on their child’s physical activity and BMI in terms of normal weight, overweight, or obesity. Also, parents influence their child’s physical activity through their opinions, values, modeling, parenting style, enjoyment of, and support of physical activity (Olvera et al., 2010; Edwardson & Gorely, 2010; Hennessey, et al., 2010). Boys are taking more steps per day than girls, and overweight and obese children take fewer steps per day than their normal weight peers. Adult males are taking on average more steps per day than adult females and normal weight adults are taking more steps per day than overweight and obese adults. The correlation of parents’ physical activity and BMI to their children’s physical activity and BMI is not known. While Tudor-Locke et al. (2008) reported average daily step counts for adult normal weight, overweight, and obese males aged 18-50 years, and normal weight, overweight, and obese females aged 18-39 years, the activity level of parents of elementary aged children is not known.
Chapter III

Methods

In this section, participants, instruments, and procedures will be described. The data collection and data treatment/analysis will also be explained.

Participants

For this study, 36 children (14 males and 18 females) and 23 of their parent(s) or guardian(s) (5 males and 18 females) agreed to participate by wearing a pedometer throughout the day for seven consecutive days. All of the children attended one of two fifth grade classes in an urban elementary school, located in the northeastern United States. The school used in this investigation was chosen based on its location along with the excellent rapport that had been developed with the administrators and educators. When looking at the elementary school as a whole, 85% of the children were eligible for the free or reduced breakfast/lunch program at school for the 2009/2010 school year. The ethnic/racial background for the children in the study was 78% African American, 14% Hispanic, and 8% Caucasian.

Letters were sent to the parents/guardians of 39 children explaining the study. By the first day of the study, 36 children and 23 parents had agreed to participate. By the last day of the study there were 36 children (16 males and 20 females) and 18 parents (3 males and 15 females) who had provided usable BMI data. Also, on the last day of the study there were 32 children (14 males and 18 females) and 11 parents (4 males and 7 females) who had provided usable step count data. Four children (2 males and 2 females), and 12 parents (1 male and 11 females) were given a
pedometer yet never reported any step counts. The mean age of the children was 10.5 years with a standard deviation of .607. For the parents, the mean age of the females was 35.5 years with a standard deviation of 8.297, and the mean age of the males was 34 years with a standard deviation of 8.124. Of the 17 adult females reporting their ethnicity, 70% were African American, 18% Hispanic, and 12% Caucasian. For the five adult males reporting their ethnicity, 60% were African American, 20% Hispanic, and 20% Caucasian. For the 12 adult females listing their occupation, eight were employed, two were homemakers, and two were either retired or disabled. For adult males, three listed themselves as employed. For the 17 adult females reporting their marital status, 59% were single, 35% married, and 6% divorced. For the five adult males reporting their marital status, 60% were single and 40% married.

The data obtained from this study were for research purposes only, and kept in a locked filing cabinet for three years. At the end of three years, the data will be shredded with the exception of a spreadsheet and coding list, which could be used in future research if needed. A subject’s data was not shared with any other person, with the exception of the primary researcher. Informed consent was obtained from the parent or guardian of each child. Each child filled out a child assent form. Each parent or guardian also filled out an informed consent for their own participation in the study. The school principal, physical education teacher, and additional homeroom teachers also gave their approval and permission to come into their school and classrooms between January and May, 2012. The informed consent for child participation, child assent form, adult informed consent form, adult daily step count
log sheet (parent data collection form), and the adult and child demographics forms are contained in appendixes A, B, C, D, E, and F. Institutional Review Board approval was obtained from the State University of New York College at Brockport, in February of 2012.

**Instruments**

In this study, one goal was to capture a direct measurement of how active the subjects were on a daily basis. This was done by having the subjects wear a pedometer that recorded daily step counts. The Yamax Digiwalker SW-200 pedometer was used for all adults while the Yamax Digiwalker CW-600 was used for all children. The CW-600 is exactly like the SW-200 except that it is a newer version with added features that include a clock and seven day recall function. Both the SW-200 and the CW-600 models of the Yamax pedometer are research grade pedometers. The SW-200 has been used in other pedometer based physical activity studies (Brusseau, et al., 2011; Tudor-Locke et al., 2009). Both Yamax pedometers are small, discrete monitors worn on the waist band of clothing. The SW-200 is 5 cm in width x 4 cm in height (without the clip) and the CW-600 is 6 cm in width x 4.5 cm in height. These pedometers are very lightweight and count each step that is taken through a lever arm action. The SW-200 was found to be valid and reliable in the adult population (Tudor-Locke et al., 2009), and in the pediatric population (Tudor-Locke, McClain, Hart, Sisson, and Washington, 2009b).

Tudor-Locke et al. (2009b) examined the current pedometer literature regarding brand, validity, reliability, how many days pedometers should be worn,
reactivity, and data treatment for pedometer studies of children. It was reported that the Yamax pedometers were used in 30 of 34 studies. Research grade pedometers, like the Yamax, have a sensitivity threshold of 0.35 Gs, and are within one step of the 20 step test. A step test is used to determine pedometer accuracy. The Yamax had nearly an exact reading as compared to hand written steps while walking on a track (Tudor-Locke et al., 2009b). With regard to validity, the Yamax Digiwalker SW-200 showed high agreement with an intraclass correlation of ≥.931 with treadmill steps at ≥ 80m·min⁻¹ for children aged 5-11 years. This model was within 5% of actual steps taken on a treadmill at a speed of ≥67m·min⁻¹ (Tudor-Locke et al., 2009b). With regard to reliability, the Yamax has been shown to have internal consistency reliability. Wearing a pedometer for four days had an intraclass correlation of .69-.91 with .70 being a criterion value for reliability, and .80 being the standard (Tudor-Locke et al., 2009b). For children, it is imperative to expose them to pedometer use before actually collecting data to avoid reactivity. Reactivity refers to a subject altering his or her normal behavior based on being observed (wearing the pedometer). For example, a child may be curious and enjoy seeing the step counts on the pedometer accumulate quickly so he or she deliberately runs up and down the stairs 18 times. This activity would increase the daily number of steps abnormally. Adults may also experience reactivity, which is why they received the pedometer the day before data collection started.

**Procedures**

A shake test was done on all pedometers used in this study in order to check
for its accuracy. The pedometer was closed and gently shaken 4-20 times to hear a click noise. The pedometer was then opened and the number read. The pedometer was reset to zero and the shake test was performed again if the number was off by more than one (of the actual number of shakes). If, the second time, the pedometer was again inaccurate, it was set aside and later checked for operator level maintenance. Only pedometers that had an accurate reading on the shake test were used.

New batteries were placed in the pedometers prior to data collection. Ten days before data collection began, the children were given pedometers to wear during a segment of classroom time, and the pedometers were collected at the end of the class. Adults were given the pedometers on a Monday with data collection beginning on Tuesday. This allowed the subjects to become familiar with, and practice wearing the pedometers thus reducing a reactivity effect, as the data collection was aimed at recording typical activity behavior during a normal week. The children were given the pedometers that they would wear during the week of data collection on Monday morning at the start of the school day. Immediately following the Pledge of Allegiance, a brief, five-minute review of how and when to wear the pedometer was given to the children. The children (and adults) were instructed not to wear the pedometers when sleeping nor during any water activities such as full body bathing or swimming. During the review, the children were able to ask any questions they had about the pedometers.

Of the 23 Digiwalker SW-200 pedometers (for adults) that were handed out
during the study, only one was exchanged for a new one, because it stopped working for an unknown reason. Of the 36 Digiwalker CW-600 pedometers (handed out to the children) three were exchanged for new ones. It is suspected that one was dropped into water, and two were damaged from improper use.

The attachment site for all subjects was on the waist band on the right side, centered above the knee. A step test was taken by the children in order to ensure proper placement and an accurate pedometer. This was an additional check for accuracy as the shake test was previously administered. The students performed the step test on a level surface before data collection started. For the step test, the pedometers were set to zero, closed, and the students took 20 steps. They then opened their pedometers and read them. If any pedometers did not read 20, they performed the step test again. If a pedometer still did not read 20, the student was assessed with regard to the proper attachment site for the pedometer. If, after three step tests, a student did not get a reading of 20, they were given a different pedometer. A numerical sticker was placed on all pedometers for coding purposes. Data was collected for seven consecutive days of pedometer use by the children and the adults.

Data Collection

The parent or guardian was given a demographics questionnaire to fill out. Questions regarding a subject’s age, race, ethnic background, profession, and marital status were asked on this form. A sample questionnaire can be found in appendix D. The adults recorded their daily step counts on a log sheet. A sample log sheet can found in appendix C. The demographics form and log sheet for adults, and the
demographics form for children was included in the informational materials sent home with each child. The children recorded their daily step counts (for the previous day) at the start of each school day, in the presence of the researchers. On the last day of data collection for the children (Monday morning), they recorded their Friday, Saturday, and Sunday step counts.

A child’s BMI was obtained by weighing each child on a digital scale and recording their weight in kilograms, to the hundredth of a kilogram. A child’s height was measured using a SECA 360° Wireless stadiometer, model 703 and their height was recorded to the nearest half centimeter. It was then converted into meters for the purpose of computing their BMI. These measurements were taken at the school individually, respecting the privacy of all subjects. Children’s weight was measured wearing light clothing and without shoes. Adults self-reported their height and weight in feet/inches and pounds. Their height and weight was then converted to the metric system. BMI was determined for all subjects by using the formula kg/m².

The protocol for collecting the data was as follows. Each subject was given a pedometer number and identified by that number, not their name. A subject’s BMI measurements were collected and recorded using a pencil and paper, six days before pedometer data was collected. A subject’s BMI was then entered onto a computer spreadsheet. The following week, on Monday morning, the students were told to set their pedometers to zero. On Tuesday morning, at the start of the school day, the students opened their pedometers and recorded the number of steps taken on a data collection sheet. The researchers walked around the room observing the students,
answering any questions, and looking for any unusual number of steps (such as below 1,000, or above 30,000). As participation in all aspects of this study was voluntary, the children were asked to answer eight simple questions on the pedometer data collection sheets. An example of these questions were “Did you go to physical education yesterday?” and “Did your class have recess yesterday?” The data collection sheets were placed in a folder and stored in the child’s desk, or collected and given to the homeroom teacher, depending on the preference of the teacher. At this point, the children closed their pedometers.

Daily, a small prize consisting of a pencil or colorful eraser top was given to each student who brought back their pedometer. This process was done during the weekdays on Tuesday through the following Monday morning. The step counts from the data collection sheets were entered into the computer spreadsheet on Friday and Monday. The students recorded their Friday, Saturday, and Sunday steps counts on Monday morning on the data collection sheet by using the one day, two day, and three day recall button on the pedometer. The pedometers were then collected and the students received a certificate for their participation in the study.

The parents or guardians were given the pedometers on Monday afternoon and data collection started on Tuesday. The adults started wearing the pedometers on Tuesday morning, while the children started on Monday morning. Starting on Tuesday night at bedtime, the adults wrote down their number of steps, each day and then reset their pedometer back to zero. On the following Tuesday, the adult subjects had their children return the pedometers and adult log sheets to the school. This
methodology captured seven days of recorded steps by the adults.

**Data Treatment/Analysis**

Determination of means, standard deviations, frequencies, paired $t$ tests scores, independent samples $t$ tests scores, analysis of variance scores, and Pearson correlations, were done using the computer software program, SPSS Statistics 17.0. These tests were run to assess the relationship between the physical activity levels and BMI of children and their parents. Microsoft Windows Excel spreadsheets were used to organize and list the data from the demographics forms, BMI calculations, and step count log sheets.

An outlier is a piece of data that is extremely below or above normal reported data. Outliers were identified as children with less than 1,000 steps, or more than 30,000 steps in one day. Outliers were identified as adults with less than 950 steps, or more than 30,000 steps in one day (Tudor-Locke et al., 2009b). If a pedometer had an unusually high reading, the subject was asked what physical activities they did the previous day. If the subject’s answers made sense (e.g. “I ran five miles with my brother” or “I played basketball for three hours”) the data was included. Abnormally low step counts were not included in the data analysis.

Missing data was defined as any data that was not reported for a day. However, if a child forgot to bring in their pedometer on one of the days, their data for the other days was still included in the study. If a child forgot their pedometer for six or more days, all of their data was discarded. If an adult forgot to wear and/or record their pedometer steps on a given day, their data for the other days was still
included in the study. If an adult forgot to wear and/or record their step counts for three days or more, all of their data was discarded from the study. This is standard procedure in pedometer research as it has been shown that two days of observation is a valid and reliable amount of time to capture typical activity habits (Tudor-Locke et al., 2009; Brusseau et al., 2011; Johnson, Brusseau, Darst, et al., 2010; Johnson, Brusseau, Graser, et al., 2010). Data was collected for seven days in a row because it was not realistic to expect that every subject would be compliant for the entire length (seven days in a row) of data collection. A subject could choose not to participate at any time. Therefore, if a child only turned in two days of pedometer step counts, the data could still be used. For the adults that turned in usable step count data, no adult had less than five days of data.

Missing data was not included. For example, if only 26 children reported step count data for Wednesday, and 28 children reported step count data for Thursday, the analysis was done on the data that was reported. Data that was identified as an outlier was not included in any analysis. With regard to the children, there was subject mortality of four students as they did not report any step count data. With regard to the parents, there was subject mortality of 12 parents. Their data were not included in any step count analysis.
Chapter IV

Results

The purpose of this study was to investigate and compare fifth grade children’s BMI and daily physical activity levels to their parents’ BMI and daily physical activity levels. It was important to investigate this relationship because parents influence their child’s physical activity levels and because of the prevalence of obesity among elementary aged children and adults, particularly those of a low socio-economic status, minority ethnic background, and living in an urban area (Bauer et al., 2008; Timperio et al., 2008; MCDPH, 2008; MCDPH, 2011). This chapter will describe the relationship between parent and child physical activity, parent and child BMI, and BMI differences in children by gender and ethnicity. Differences in step counts were examined with regard to a five day week, the weekend, and the seven day week. Differences with regard to gender, ethnicity, and BMI differences in children, and between physical education and non-physical education days were, as well, examined. A power analysis was not used to determine the sample size. Determination of the means, standard deviations, paired t tests scores, independent samples t tests scores, analysis of variance scores, and Pearson correlations was calculated. These tests were calculated because their results gave insight into the fifth grade children’s BMI and daily physical activity level as they related to their parent’s BMI and daily physical activity level.

Parent-Child Physical Activity

The means and standard deviations depicting the physical activity of the
parents and children are shown in Table 4.1. The mean steps per day in the seven day week for children = 9,535 (SD=2,594), female parents = 5,209 (SD=2,832), and male parents = 10,161 (SD=7,010). The increment of change in scores from children to female parents was Δ = 4,326, children to male parents was Δ = -626, and from female parents to male parents was Δ = -4,952. A Pearson correlation examining the relationship between children and female parents across the seven day week step count was not significant (r = .19, p = .65), but indicated a weak relationship. The relationship between children and their male parents was not significant (r = -.47, p = .53). This score indicated a moderate inverse relationship (Holcomb, 2006).

Table 4.1

<table>
<thead>
<tr>
<th></th>
<th>Weekday Mean</th>
<th>Weekday SD</th>
<th>Weekend Mean</th>
<th>Weekend SD</th>
<th>Seven Day Week Mean</th>
<th>Seven Day Week SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children^a</td>
<td>9,951</td>
<td>2,747</td>
<td>7,557</td>
<td>4,337</td>
<td>9,535</td>
<td>2,594</td>
</tr>
<tr>
<td>Female Parents^b</td>
<td>4,333</td>
<td>2,781</td>
<td>7,252</td>
<td>3,594</td>
<td>5,209</td>
<td>2,832</td>
</tr>
<tr>
<td>Male Parents^c</td>
<td>11,026</td>
<td>7,348</td>
<td>8,358</td>
<td>6,349</td>
<td>10,161</td>
<td>7,010</td>
</tr>
</tbody>
</table>

Note. For children and female parents, the Pearson correlation was p = .8 for weekday, p = .97 for weekend, and p = .65 for the seven day week. For children and male parents, the Pearson correlation was p = .83 for weekday, p = .9 for weekend, and p = .53 for the seven day week.

^a n = 32. ^b n = 7. ^c n = 4.

Paired samples t-tests were conducted on these data to determine if there were significant differences. When analyzing children and female parent seven day week
step counts the results \( t(7) = 2.8, p = .03 \) demonstrated a significant difference. For children and their male parent seven day week step counts the results \( t(3) = -.44, p = .69 \) indicated that there was not a significant difference.

The mean weekday steps for children was 9,951 (SD=2,747), female parents 4,333 (SD=2,781), and male parents 11,026 (SD=7,348). When analyzing the data for weekday step counts, the correlation between children and female parents was not significant \( (r = .1, p = .8) \), which indicated a weak relationship. The correlation between children and their male parents was not significant \( (r = -.17, p = .83) \) and indicated a weak inverse relationship (Holcomb, 2006). Paired samples t-tests were performed to determine if there were significant differences. When analyzing children and female parent weekday step counts the results \( t(7) = 3.98, p = .00 \) indicated that there was a significant difference. For children and their male parent weekday step counts the results \( t(3) = -.56, p = .62 \) indicated that there was not a significant difference.

The mean weekend steps per day for children was 7,557 (SD=4,337), female parents, 7,252 (SD=3,594), and male parents, 8,358 (SD=6,349). The weekend step count correlation for children and female parents was not significant as the results \( (r = -.02, p = .97) \) indicated a weak inverse relationship. The correlation between children and their male parents was, as well, not significant as the results \( (r = .16, p = .9) \) indicated a weak relationship (Holcomb, 2006). Paired samples t-tests were conducted to determine if there were significant differences. When analyzing children and female parent weekend step counts the results \( t(6) = -.69, p = .52 \) indicated that
there was not a significant difference. For children and their male parent weekend step counts the results \([t(2) = -.98, p = .43]\) indicated that there was not a significant difference.

**Weekday and Weekend Step Counts in Children**

Statistical analyses were performed for weekday and weekend step counts of the children. Step count means on the weekday was 10,090 (SD=2,939), and on the weekend 7,557 (SD=4,337), with an increment of change of \(\Delta = 2,533\). A paired samples \(t\)-test was performed to determine if there were differences. The \(t\)-test revealed \(t(16)=2.38, p =.03\), which indicated there was a significant difference.

**Gender Differences in Step Counts of Children**

The means and standard deviations for the weekday, weekend, and seven day week step counts for the children examined by gender are illustrated in figure 4.1. The differences in step counts between boys and girls for weekdays was 1,756, weekends 681, and seven day week 1,409 with boys having more steps in each case.

An independent samples \(t\)-test was conducted for children’s weekday, weekend, and seven day week step counts based on gender. For the weekday steps \([t(30)= 1.86, p =.07]\), and for the weekend steps \([t(15)=.31, p =.76]\), and for the seven day week steps \([t(30)= 1.56, p =.13]\) the results revealed that there was not a significant difference in the step counts between boys and girls.
Step Counts for Children by Gender

Figure 4.1. Weekday, weekend, and seven day week step counts for children. There was not a significant difference in the step counts based on gender as $p = .07$ for weekday, $p = .76$ for weekend, and $p = .13$ for the seven day week.

Ethnic Differences in Step Counts of Children

The means and standard deviations for the step counts of the children based on ethnicity are shown in table 4.2. A one-way ANOVA was conducted on children’s weekday, weekend, and seven day step counts based on their ethnicity (African American, Caucasian, or Hispanic). For the weekday $[F(2,29)= .77, p = .47]$, the weekend $[F(2,14)= 1, p = .39]$ and the seven day week $[F(2,29)= .98, p = .39]$ the differences were not statistically significant at the .05 level.
Table 4.2

Children’s Step Counts based on Ethnicity

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Weekday Mean</th>
<th>Weekday SD</th>
<th>Weekend Mean</th>
<th>Weekend SD</th>
<th>Seven Day Mean</th>
<th>Seven Day SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>African American</td>
<td>9,637</td>
<td>2,986</td>
<td>7,672</td>
<td>3,559</td>
<td>9,188</td>
<td>2,638</td>
</tr>
<tr>
<td>Caucasian</td>
<td>11,599</td>
<td>1,148</td>
<td>8,937</td>
<td>7,460</td>
<td>11,166</td>
<td>2,911</td>
</tr>
<tr>
<td>Hispanic</td>
<td>10,469</td>
<td>1,891</td>
<td>1,918d</td>
<td>0d</td>
<td>10,220</td>
<td>2,141</td>
</tr>
</tbody>
</table>

Note. A one-way ANOVA showed the differences in step counts based on ethnicity were not statistically significant at the .05 level.

*b^n = 24. *n = 3. *n = 5. dReflects results of only one child who turned in weekend data.

Physical Education and Non-Physical Education Days

Statistical analysis was performed for step counts of children on physical education and non-physical education days. For physical education days, the mean number of steps was 10,610 (SD=2,842) and on non-physical education days, the mean number of steps was 8,338 (SD=2,802), with an increment of change of $\Delta = 2,272$. A paired samples $t$-test was performed to determine if there were differences. The $t$-test [$t(30)=4.7, p=.00$] indicated that there was a significant difference for children on physical education and non-physical education days. Regarding gender, the mean for boys on physical education days was 11,633 (SD=2,405), and for girls, 10,176 (SD=3,356), with an increment of change of $\Delta = 1,457$. The mean for boys on non-physical education days was 8,982 (SD=2,990), and for girls, 7,873 (SD=2,645) with an increment of change of $\Delta = 1,109$. The change in the step count for boys, from physical education days to non-physical education days, was $\Delta = 2,651$. The
change in the step count for girls, from physical education to non-physical education days, was $\Delta = 2,303$. An independent samples $t$-test was done to determine differences between physical education and non-physical education day step counts by gender. For physical education days [$t(30) = 1.37, p = .18$], and for non-physical education days [$t(29) = 1.09, p = .29$] the results indicated that there was not a significant difference in step counts based on gender for physical education and non-physical education days.

**Parent BMI and Physical Activity**

Parent BMI, the percentages for each BMI category, and step counts are summarized in table 4.3.

Table 4.3

*Parent BMI and Step Counts*

<table>
<thead>
<tr>
<th></th>
<th>BMI (M)</th>
<th>Normal Weight (%)</th>
<th>Overweight (%)</th>
<th>Obese (%)</th>
<th>Step Count (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female Parents$^a$</td>
<td>29.1</td>
<td>27</td>
<td>33</td>
<td>40</td>
<td>5,209</td>
</tr>
<tr>
<td>Male Parents$^b$</td>
<td>26.8</td>
<td>33</td>
<td>67</td>
<td>0</td>
<td>10,161</td>
</tr>
<tr>
<td>All Parents$^c$</td>
<td>27.2</td>
<td>26</td>
<td>42</td>
<td>32</td>
<td>7,010</td>
</tr>
</tbody>
</table>

*Note. M = mean; % = percentage of parents.*

$^a n = 15. ^b n = 3. ^c n = 18.$

**Children’s Step Counts based on BMI**

The means for children’s step counts, based on BMI category, is shown in Figure 4.2. A one-way ANOVA was performed on children’s weekday, weekend, and seven day week step counts based on BMI weight categories of healthy, overweight,
or obese. The weekday step count means were: healthy = 10,484 (SD=2,577), overweight = 9,540 (SD=3,059), and obese = 9,057 (SD=2,884) \( [F(2,29)=.73, \ p = .49] \). The weekend step count means were: healthy = 5,488 (SD=2,362), overweight = 8,711 (SD=4,427), and obese = 10,764 (SD=6,741) \( [F(2,14)=2.24, \ p = .14] \). The seven day week means were: healthy = 9,707 (SD=2,308), overweight = 9,382 (SD=3,053), and obese = 9,275 (SD=3,089) \( [F(2,29)=.08, \ p = .93] \). The differences in weekday, weekend, and the seven day week step counts for children based on BMI category were not statistically significant at the .05 level.

**BMI Differences by Gender in Children**

An independent samples \( t \)-test was performed to analyze children’s BMI based on their gender. The mean BMI for girls was 21.4 (SD=4.8), and for boys 18.98 (SD=3.4), with an increment of change of \( \Delta = 2.4 \). The \( t \)-test \( [t(34)=-1.7, \ p = .10] \) indicated that there was not a significant difference in the BMI of the girls and boys.

**BMI Differences by Ethnicity in Children**

Children’s BMI and their ethnicity were analyzed by a one-way ANOVA. The mean BMI for African American children was 20.2 (SD=3.4), for Caucasian children 19.5 (SD=3.7), and for Hispanic children 21.5 (SD=3.8) \( [F(2,33)=.25] \). Differences in BMI, based on ethnicity, were not statistically significant.
Figure 4.2. Children’s step counts based on BMI. A one-way ANOVA indicated the differences were not statistically significant at the .05 level in weekday \( F(2,29) = .73 \), weekend \( F(2,29) = .73 \), and the seven day week \( F(2,29) = .08 \) step counts for children based on their BMI category.

**Parent-Child BMI**

The means and standard deviations of the BMI’s for the parents and for the children are shown in table 4.4. The mean BMI for the participants were: children = 20.3 (SD=4.3), female parents = 29.1 (SD=5.7), and male parents = 26.8 (SD=3). This resulted in an increment of change from children to female parents of \( \Delta = -8.8 \), from children to male parents \( \Delta = -6.5 \), and from female parents to male parents \( \Delta = 2.3 \).

The correlation between children and female parents’ BMI was significant \( (r = .52, p = .04) \), which indicated a moderately strong relationship. Between children and their male parents, the correlation was not significant but showed potential for a
strong relationship \( r = .99, p = .08 \).

For BMI values, there was a significant difference between children and their female parents \[ t(15) = -6.5, p = .04 \]. For children and their male parents, there was not a significant difference in BMI \[ t(2) = -2.23, p = .08 \].

Table 4.4

<table>
<thead>
<tr>
<th>Parent-Child BMI</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Children(^a)</td>
<td>20.3</td>
<td>4.3</td>
</tr>
<tr>
<td>Female Parents(^b)</td>
<td>29.1</td>
<td>5.7</td>
</tr>
<tr>
<td>Male Parents(^c)</td>
<td>26.8</td>
<td>3</td>
</tr>
</tbody>
</table>

Note. For adult BMI standards normal/healthy = 18.5 - 24.9, overweight = 25 - 29.9, and obese = 30 and above. For the BMI standards for children, they are often given in percentiles based on gender/height/weight. For the percentiles normal/healthy weight = 5 - 84.9, overweight = 85 - 94.9, and obese = 95 and above. For the sake of comparison, the actual BMI average, not the percentile is listed in table 4.4. \( M \) = mean; SD = standard deviation.

\(^a\)\(n=36\). \(^b\)\(n=14\). \(^c\)\(n=3\).

Conclusions

In conclusion, data was obtained on children and their parents’ physical activity and BMI in February and March, 2012. A \( t \)-test showed that children were significantly more active than their female parents. The correlation between children and their female parents’ BMI revealed a moderately strong relationship. Boys took more steps than girls during the seven day week, weekdays, and on the weekends. Caucasian children took more steps during the seven day week, weekdays, and on the weekends than African American and Hispanic children. Children in the healthy BMI category took more steps in the seven day week than children in the overweight or
obese BMI categories. Children took significantly more steps on physical education
days than on non-physical education days indicating that children are more active on
physical education days than non-physical education days.
Chapter V

Discussion

This chapter will discuss the importance of the findings from the examination of children and their parents' physical activity level and BMI, and directions for further research.

Parent-Child Physical Activity

Children averaged significantly more steps (4,326) per day than their female parent over the seven day week. There was not a correlation between the weekly number of steps for children and their female parent. Children averaged 626 less steps per day than their male parent in the seven day week, which indicated an inverse relationship. Children averaged 5,618 more steps per day than their female parent during the weekdays indicating that children in the current investigation are considerably more physically active than their female parent during this time frame. This equates to 56 minutes more moderate activity for the child than the female parent during the weekdays. Children averaged 1,075 less steps per day than their male parent during the weekdays. Had the subject population been larger, especially including more male parents, the statistical results could have been different.

A reason for the differences in step counts of female parents, male parents, and children could be that some of the male parents in this study had occupations that required them to be physically active. For example, one male parent was a roofer and two were restaurant managers. Possibly, the female parents in this study have taken a passive role in their child’s physical activity, implying physical activity is the child’s
responsibility in that the female parent is not playing with the child while he or she is active. Additionally, some of the female parents had occupations that were very sedentary. Two of the female parents worked in an office, while one female parent listed her occupation as disabled. Some female and male parents did not list their occupation, nor stated whether they were employed or not employed. It is not known why some parents only partially filled out the demographics form. Possibly they did not feel comfortable revealing the answers to some of the questions on the form, or they may have thought it was private information and did not want to share it.

Also, the children may have engaged in physical activity after school that the female parents were not interested in participating in such as basketball, jumping rope, cheerleading/tumbling, or bike riding. It could be beneficial for female parents if after school programs included activities where the female parents could participate in physical activities with their child. As it is, many after school programs are designed so that when the parent comes to pick up their child, they can leave the facility together in a very timely manner. For example, at a local after school program located inside a family health club facility, there is a sign indicating which parking spaces are for only five minutes. While this may be convenient for a parent in a hurry, it is not encouraging the parent to stay and get physically active with their child.

An additional thought is that since many of the female parents in this study were single mothers, (65% of the female parents completing the demographics form were single/divorced) and all lived in an urban area, they could have other priorities and/or opportunities when their child gets home from school other than their own
physical activity. Besides after school programs designed to encourage physical activity of female parents with their child, non-school programs should be developed, which are aimed at making it feasible for the single mother and her child to engage in physical activity together. The Greater Rochester YMCA has a program in place where free onsite child care is given to children for two hours a day while the parent exercises. It is possible that many single mothers do not know about this and do not know that financial aid (reduced membership cost) is given to families that qualify. Since in this study, the children had much higher average step counts than their female parents during the week, it leads us to believe that for this sample, female parents do not positively influence their child’s physical activity level. This is contrary to the current literature on this topic as exemplified by the Ransdell et al. (2001) study. The authors reported that after mothers were given educational training on how to be more encouraging and supportive of their daughter’s health needs, the daughters made much better healthy choices regarding nutrition and physical activity. The mothers’ encouragement of their daughters to make healthy choices and stay physically active resulted in a number of subjects choosing to be on school sport teams and participate in public athletic events.

In American society women have an assumed gender role where they are the ones who will take care of the home and children by being responsible for completing the laundry, house cleaning, grocery shopping, cooking, running errands, and nurturing of their children. This sense of duty mothers have of fulfilling gender expected and assumed roles have influences on children’s physical activity (Hamilton
& White, 2010). Hamilton and White (2010) did a qualitative study interviewing 40 parents of preschoolers. The study investigated the effect of parental social role influence, and patterns of physical activity on the physical activity behavior of 21 mothers and 19 fathers. It was reported that many mothers felt guilty about asking for help with traditionally female roles around the home and with their children in order to make time to exercise. If a woman feels guilty, or even selfish, about rearranging her family's schedule or about asking her husband to fill some traditional female roles in the home, she is highly unlikely to continue exercising. This could be another reason why the female parents in this study had lower step counts than the male parents and children.

When looking at the weekend step counts, the children took an average of only 305 more steps than their female parent and 801 less steps than their male parent. These were non-significant differences in step counts. This indicated that the physical activity of children and their female and male parents was similar over the weekend. Since the children, female parents, and male parents all had similar average step counts over the weekend, it could be inferred that when there is more time (such as when children are not in school and parents are not at work) families participate in physical activity together. Also, during Saturday and Sunday, there are more hours of daylight available for outdoor physical activity compared to the work week when there are only a few hours, at most. However, children’s average step counts were less on the weekend as compared to the weekday, which suggests children are not getting as much physical activity on the weekend compared to weekdays.
Weekday and Weekend Step Counts in Children

In this study, children were more active during the week than on the weekends by an average of 2,533 steps. In a study by Tudor-Locke et al. (2009a), which concentrated on literature for children’s pedometer step counts, the authors reviewed 31 articles. Fifteen articles studied step counts of American children and 16 articles studied step counts of children from Europe and other industrialized countries throughout the world. The authors noted that boys are taking an average of 12,000-16,000 steps per day during the week while girls are taking an average of 10,000-14,000 steps per day during the week. During the weekend, boys are averaging 12,000-13,000 steps per day while girls are averaging 10,000-12,000 steps per day. The boys in the present study took an average of 3,061 less steps per day during the week and 4,543 less steps per day during the weekend, while the girls in the present study took on average 2,817 less steps per day during the week and 3,724 less steps per day during the weekend than in the Tudor-Locke et al. (2009a) meta-analysis. This indicates the children in the present study are taking fewer steps per day than their peers on the weekdays, and especially on the weekends.

A feasible reason the children in the current study had such a wide difference (at the low end) in step counts compared to other children in the U.S. and across other industrialized countries could be the living environment of the children. At least 13 of the 36 children lived with a single-parent and this number is likely much higher as 17 of the children returned a demographics form where the parent did not fill out their marital status. Only six children returned a demographics form where the parents
listed their marital status as married. It is probable that children in urban single-parent homes usually have more home responsibilities, and less disposable income to engage in and participate in physical activities compared to children from suburban and dual/married-parent homes. Another reason for the low step counts could have been safety concerns in an urban area and limited modeling from the parents.

There are some things that can be done to try and increase the amount of physical activity for the children who participated in the current study. Giving a child a pedometer to discover their own step counts whenever they want may serve as a motivator to get physically active. In this study pedometers were given to the children to keep. Most of the children enjoyed finding out what their daily step counts were. They were additionally interested to know how many steps they took when they performed certain activities.

Further education of parents is a necessary step in promoting physical activity of children. When a parent learns and fully understands the importance of physical activity for their child, they start to value physical activity because they want their child to be healthy. Educating parents on the benefits of physical activity and the many different ways to get active can teach children to make healthy lifestyle choices even when they are living in a low socio-economic urban area with limited family income.

Beets, Bornstein, Beighle, Cardinal, and Morgan (2010) did a study that revealed United States children average 11,750 steps per day. The children in the present study averaged 9,535 steps per day (seven day week), which is 2,215 steps
per day less than other children across the United States. This means the children in the current study average 15,505 less steps per week. Over a period of time such as 40 weeks this equals 620,200 steps, which is over 310 miles. In terms of time, this suggests the children are getting 2 ½ hours less of moderate physical activity per week than their peers across the United States. Over the course of the school year this equals 100 hours. This is alarming to point out. If the children in this study continue to be considerably less active than other children their age across the United States it is highly likely that they will exhibit decreased levels of physical activity as they age, leading to sedentary lifestyles, which greatly increases the chance of becoming obese.

One possible reason the children in the current study are taking less steps per day could be that the importance of daily regular physical activity is not stressed enough outside of school. The parents could become more informed (educated) through literature sent home with the students, and even by e-mails or Facebook messages. The notes should not be wordy or lengthy, but short and visually appealing. One page tri-fold pamphlets, or one page brochures could be given to the parents once every two weeks for the entire school year. These information sheets could highlight facts, and give suggestions, and encouragement to help the parents in getting their child more physically active. Some of the information sheets could contain general ‘healthy lifestyle’ tips such as choosing fruit for a snack instead of potato chips, and the benefits of drinking six to eight glasses of water per day.

Realistic programs need to be developed and implemented so children and parents can participate in physical activity together in the area where they live. One
example that has been used at a local urban elementary school is a ‘shoot-out’ at the culmination of a basketball unit. At that school, the children invited a parent to come to school with them at 6:00 P.M. to count how many free throws each parent/child pair could make out of 10 (the parents were given 10 attempts and the child got 10 attempts). The parents and children were given a warm-up period prior to the actual contest. The top three children of the parent/child pairs received a small prize, a certificate, and had their name announced over the loud speaker the following morning at school.

**Gender Differences in Step Counts of Children**

In this study boys took more steps per day than girls during the weekdays, weekend, and in the seven day week, which is consistent with the literature for children of this age. A study by Brusseau et al. (2011) also reported that boys take more daily steps than girls during the week. In the current study, the difference was greatest between boys and girls in the steps per day during the week (1,756). An example may illustrate how great this difference is. Taking 1,756 more steps per day multiplied by seven days equals 12,292 more steps per week. Over the course of a 40 week school year this would equate to over 491,680 steps, or approximately 245 miles. This finding indicates that in this age group boys are much more active than girls, accumulating hundreds more miles of physical activity per school year. In terms of time, boys are getting 17 minutes more of moderate physical activity a day as compared to girls, and almost two hours per week. During a 40 week school year that would equal 80 hours more physical activity for boys than girls. When comparing the
children in the present study to children the same age living in the Southwest United States (Brusseau et al., 2011), the boys in this present study averaged 2,755 less steps per day and the girls averaged 2,147 less steps per day, amounting to 27 minutes and 21 minutes less of moderate physical activity, respectively. Also, as reported in a study by Beets et al. (2010), United States children when compared to children in other parts of the world, such as Europe and China, are taking, on average, fewer steps per day. The children in the current study took, on average, less steps per day than other United States, European, and Chinese children. The reason as to why the children in the current study were less active than other United States children is a combination of variables. Many of these children were of a minority ethnic background (African American and/or Hispanic), lived in a single-parent home, lived in an urban area, and were from families of a low socio-economic status.

Cleland et al. (2008) had similar findings in a study investigating the amount of time 10-12 year old children engaged in physical activity outside. Boys spent more time than girls outside participating in physical activity in both warm and cool weather. When looking at weekday totals of moderate to vigorous physical activity in cool weather, the boys had over 2 hours more physical activity time per week than girls. From November through April (winter and spring) the normal weather climate where the current study was conducted has cold and cool weather. The two previous studies along with this current study clearly show that boys are engaged in more physical activity than girls.

The question of why the girls in this present study were generally less active
than the boys needs to be addressed. Perhaps the girls are indirectly learning from their female parent that physical activity does not need to be a priority during the week while the boys are modeling their male parent’s behavior of high physical activity during the week. Or, there could be stricter safety rules for girls than for boys living in an urban area, which limits their physical activity. For example, maybe a 10 year old boy is allowed to ride his bike by himself 15 houses down the street from his home but the girl is not allowed to go farther than 4 houses down the street past her home by herself. In the current study only one boy and no girls reported walking to or from school on a regular basis.

The mean number of steps per day for the seven day week for boys was 10,327 and for girls was 8,918, which shows that girls are taking an average of 1,409 less steps per day than boys. When looking at these findings as a whole, the children in this study, regardless of gender, took fewer steps per day than children their same age in other parts of the United States. Special programs designed to encourage, motivate, and give children the opportunity to increase their physical activity in a safe environment, especially for the girls, could help the children get more physical activity. A ‘before school’ or ‘after school’ intramurals program is an option. There is a local elementary school in a low income district that had a ‘before school’ physical activity program. As well, most of the children qualified for a free/reduced breakfast and lunch. The children played physical education games in the gymnasium for about 20-30 minutes. Near the entrance to the gymnasium two cafeteria tables were set up where the child could pick up and eat their breakfast. This required minimal extra
work on the part of the physical education, janitorial, and cafeteria staff, and the staff did not have to come into work early as they were already in the building for their scheduled duties. It gave approximately 30 students the opportunity to get extra physical activity before school every morning.

**Ethnic Differences in Step Counts of Children**

In this study, where 32 children actively participated, three were Caucasian, five were Hispanic, and 24 were African American. Caucasian children averaged the most steps per day during the week, weekend, and seven day week, followed by Hispanic children, and then African American children. These results, however, are based on an extremely small sample size of three Caucasian children. In this study African American children averaged 2,493 less steps per day than African American children of the same age in a previous study by Brusseau et al. (2011). The sample size of five Hispanic children is also small. However, the Hispanic children in this study also averaged 2,170 less steps per day than Hispanic children of the same age in the Brusseau et al. (2011) study. The Caucasian children in this study averaged 88 less steps per day than the Caucasian children of the same age in the Brusseau et al. (2011) study, which is nearly identical. The socio-economic status of the children in the Brusseau et al. (2011) study was similar to the current study. In the Brusseau et al. (2011) study 53% of the children qualified for the free or reduced breakfast/lunch program. Also, in the Brusseau et al. (2011) study, which had 829 students, 12% of the students walked or rode a bike to school whereas in the current study only 3% of the students walked or rode a bike to school.
There are possible reasons for why the children in the present study accumulated fewer steps per day than the Brusseau et al. (2011) investigation of children the same age and of the same ethnic background. Brustad (1996) suggested that socio-economic status can play a huge role in the amount of physical activity children get. Previously, the example of bike riding was used, yet it is quite possible that some of the children in the current study did not even own a bicycle. Children from families with a low economic status (such as living with only one parent in an urban area) may not have resources available to them for certain types of physical activity like bikes or roller blades.

It is unlikely that the weather conditions were much of a factor for why the children in this present study accumulated fewer steps per day than the previous study by Brusseau et al. (2011). For this study the average daily high temperatures were between 63 and 78 degrees, which were above normal for that time of year in this area of the northeast. However, if children are in the habit of playing video games, watching television, and doing indoor activities after school because of a cold climate, this could be a hard habit to break even in unseasonably warm weather.

Johnson, Brusseau, Graser, et al. (2010) suggested that urban children were less active than suburban and rural children. Living in an urban area usually limits the space available for certain neighborhood physical activities such as volleyball, soccer, and tennis. Safety in an urban area is also a concern for parents. They might make their child come inside the home for the night, even before it is dark. Fourteen of the parents completing a demographics questionnaire for this study listed their marital
status as single/divorced. The children in these families could have additional responsibilities at home limiting the time available for physical activity.

**Physical Education and Non-Physical Education Days**

There was a statistical difference in children’s step counts on physical education and non-physical education days. Children took an average of 2,272 more steps per day on physical education days than on non-physical education days. The children in the present study had physical education three days per week, for 30 minutes. It is thought-provoking to notice that in a study by Datar and Strum (2004), increasing physical education time from 1 - 1.5 hours per week to five hours per week reduces BMI in girls that are overweight or are at risk of becoming overweight. There could be a 43% reduction in the prevalence of overweight in girls by increasing physical education time to five hours per week (Datar and Strum, 2004). In the present study children were in physical education for 1.5 hours per week. If physical education increased to 4.5 hours per week, the children in the present study would be taking an average of 5,544 more steps during the school week, which over a 40 week school year would equate to 221,760 steps, which is over 110 miles. This gives support to the concept that daily physical education is essential, and vital in helping children reduce their risk of becoming obese. If a child takes just 1,000 more steps per day, every day, that would equal over 182 miles per year. Traversing an additional 182 miles a year is bound to have a positive effect on a child’s BMI.

**Parent BMI and Physical Activity**

The average BMI of female and male parents was 27.2. For the parents that
reported their height and weight, 28% were of a normal weight, 39% were overweight, and 33% were obese. The rate of being overweight or obese for the adults in the current study was 72% (females 73%, males 66%). In Monroe County the rate of a male being obese or overweight is 69% and for a female it is 54% (Monroe County Department of Public Health, 2008). This indicates that compared to current statistics for the City of Rochester, a higher percentage of female adults in this current study were overweight or obese. For male adults in the current study they were slightly below the Monroe county averages (69%) at 66% being overweight or obese.

Tudor-Locke et al. (2009) presented data describing the process in establishing pedometer physical activity cut-points for adults based on BMI. Normal weight males, aged 18-50 years averaged 10,084 steps per day while normal weight females aged 18-50 years averaged 9,399 steps per day. The female parents in this present study averaged 5,209 steps during the seven day week, which is 4,190 less steps per day than other females in their age bracket from the Tudor-Locke, et al. (2009) study. The male parents in this current study averaged 10,161 steps per day in the seven day week, which are 4,952 more steps per day than the female parents. In this current study the female parents had a higher average BMI of 29.1 than the male parents of 26.8. The findings in this current study had similar results as in the published article by Tudor-Locke et al. (2009) where adults with a healthy BMI were more physically active than adults with an overweight/obese BMI.

**Children's Step Counts based on BMI**

The step counts for children based on BMI differences of healthy, overweight,
and obese had interesting results. For weekday and the seven day week step counts, healthy children took the most steps, followed by overweight children, and obese children took the least amount of steps, which is consistent with a study by Hands and Parker (2008). However, over the weekend, obese children took the most steps, followed by overweight children, and healthy weight children took the least amount of steps. That result was not consistent with the literature as exemplified in studies by Burke et al. (2001) and Brusseau et al. (2011). A possible reason for this finding is the small sample size of 32 children as compared to larger sample sizes used in the other studies. The differences in step counts between the healthy, overweight, and obese children were not statistically significant during the weekdays, weekend, and seven day week with healthy weight children taking an average of 1,427 more steps than obese children during the weekdays, and 432 more steps during the seven day week. This trend is alarming when extrapolated to a full school year. When examining a small difference of steps such as healthy weight children took 432 more steps during the week as a whole than obese children, over 52 weeks this can equal 22,464 steps, which is over 11 miles. If an overweight or obese child adds just five more minutes a day of at least moderate physical activity, they can add 30 hours a year to their physical activity time.

One suggestion that may possibly help the overweight and obese children achieve more daily step counts is to have a walking club at school where the children can chart their steps and receive a non-monetary reward when certain milestones are achieved. The rewards could include such things as being the teacher’s helper for
three days in a row, being the line leader for the entire week, choosing where his/her desk will be in the classroom for one week, or being the one to choose the first game on ‘free Friday’ for physical education class. It would be similar to a reading club where children get points for the number of books they read in a three month period. A program like this would have a zero expense to a school district or an elementary school.

**BMI Differences by Gender and Step Counts in Children**

In the current study, the BMI differences between boys and girls were not statistically significant, yet girls averaged a higher BMI than boys by 2.4. In a study conducted by Hands and Parker (2008), according to BMI measurements, 22.5% of the boys and 27.5% of the girls were classified as overweight/obese, while in the present study 44% of the children (31% boys and 55% girls) were classified as either overweight or obese according to BMI measurements. A reason why the children in the current study had a higher percentage of overweight/obesity could be that they were less physically active than other children. In the Hands and Parker (2008) study overweight/obese boys took 11,383 steps per day and overweight/obese girls took 10,218 steps per day. When averaged together, it totaled 10,800 steps per day. In the current study, overweight and obese boys and girls together averaged 9,328 steps per day (seven day week), which is 1,472 less steps per day than in the Hands and Parker (2008) study.

More girls in the present study (55%) were overweight or obese than the national averages. This needs immediate attention. Unfortunately, it appears the girls

73
in this investigation are on track to develop a sedentary lifestyle leading directly to a lifetime of obesity. Programs, information, education, and encouragement need to be directed toward girls in this 10-12 year old age group. Elementary schools, day care centers, after school care centers, social groups at churches, organizations such as the Girl Scouts, and recreation centers need to stress the importance of daily physical activity, and equally important, provide increased opportunities for the girls to participate in these activities. Secondarily, the girls need increased opportunities to be active at the moderate to vigorous levels, not just the low to moderate levels.

An example of a program to encourage girls to get physically active is a ‘stepping club’. Stepping is a modern dance form popular with youth and young adults in many urban communities. A stepping club could be formed at school. Basically no equipment is needed so expense is not a factor. Double-Dutch jump roping has also been popular with girls in the past. School wide assemblies could be held where the dance stepping club and Double-Dutch club would perform. A ‘girls only’ basketball club is also an idea to get the girls more physically active. The girls may be less intimidated and play at a higher intensity level if they are competing/playing with only their own gender. The basketball club does not have to be only before or after school. It could be set up so the girls can participate during recess or during lunch, as some girls do not need the entire lunch time to consume their meal.

**BMI Differences by Ethnicity**

Hispanic children had the highest averaged BMI, followed by African
American children, and then Caucasian children, which is consistent with the findings of Sorof et al. (2004). This is also consistent with the current statistics for Monroe County children aged 2 – 10 years, which listed the likelihood of a Hispanic child being overweight or obese at 42%, followed by an African American child at 34%, and a Caucasian child at 23% (MCDPH, 2011). When computing the means for the BMI of the children based on their ethnic background, the range was 19.5 – 21.5.

Statistical analysis revealed that there was not a significant difference in children’s BMI based on their ethnicity. This infers that there was no ethnic group that stood out as having more obese, overweight, or healthy weight children.

**Parent-Child BMI**

The children in the present study had an average BMI, which was less than that of their female parent. The results showed that there was a positive relationship between a child’s BMI and their female parent’s BMI. This suggests that as the female parent’s BMI increases, their child’s BMI increases. This finding is consistent with the literature on BMI in children and their parents (Elder et al., 2010; Davison & Birch 2001; Fogelhom, Nuutinen, Pasanen, Myohanen, & Saaleta 1999). The children also had an average BMI, which was less than their male parent, although there was not a statistical significant difference. The results suggested potential for a strong relationship between the BMI of children and their male parent. With a larger sample size of male parents, it is quite likely that the results would show that as a male parent’s BMI increases, their child’s BMI increases, which is consistent with the literature on parent and child BMI.
Since this study and previous literature shows that a child’s BMI can be representative of at least one parent’s BMI, this topic needs to be addressed. Parents should be educated on this topic, and helpful solutions should be suggested. Simple encouragement and the presentation of options regarding healthy choices can bring about positive dramatic changes (Ransdell et al., 2001). For example, we know physical activity helps achieve and maintain a healthy body composition. Similar to the idea of a walking club at school, there could be a parent-child walking club conducted outside of school. The parents and children would be encouraged to walk and thus engage in physical activity together. They could chart their daily or weekly step count progress and non-monetary rewards could be presented to the children at school for meeting monthly step count goals.

**Future Research**

Additional research should be done regarding the relationship between children and parents’ physical activity and BMI. A future study expanding upon this work but with a larger sample size could show results that are more reflective of the general population. Additionally, had the data been collected for a shorter duration, such as for only three or four consecutive days, it is possible there would have been fewer subjects who dropped out. Also, if a similar study were to be conducted while the children were out of school/on vacation it would represent 12 weeks of the year not previously researched. It is very important that further research be conducted specifically on 10-12 year old girls living in an urban area to help identify specific reasons for their low step count as compared to their peers across the country. With
research, helpful, practical solutions for this population to increase their physical activity and maintain a healthy BMI could be established. Further research should also be done specifically on minority children living in a depressed socio-economic urban area to determine what can be done to increase their physical activity level. Specifically researching the physical activities that male parents participate in with their children after school and the length of time they spend together at those activities would be of interest.

A longitudinal study with these subjects is also an idea for future research. As the children from this current study were in 5th grade, conducting research on the children and parent’s BMI and physical activity level again when the children are in 8th grade and 11th grade could provide additional insight into important developmental issues regarding childhood obesity and physical activity levels, along with providing potential solutions. This study could be replicated for the same subjects, when they are in any grade in middle or high school, with slight modifications to the incentives so that the prizes are age appropriate.

Interviews with the parents could, additionally, provide valuable information. Focused interviews with open ended questions leading to a discussion about topics such as reasons for not participating in physical activity, ways to encourage participation in physical activity with their children, safety concerns, opportunities, and resources, could provide specific answers to some of these questions.

The diet and nutritional status of the subjects were not examined. Research involving the relationship between food intake and children and their parents’
physical activity and BMI could shed even more light on possible solutions to combatting the obesity problem in low socio-economic urban areas. It is suggested that research be conducted on the nutritional choices offered in school cafeterias and the correlation between the choices and children’s BMI. It would be very interesting to see the results on children’s BMI if a school stopped offering all items for purchase containing more than four grams of added sugar, as one teaspoon of granulated sugar equals 4.2 grams.

During the week data for the present study was collected, the high daily temperature ranged from 63-78 degrees, which was 13-28 degrees above the normal high temperatures (of around 50 degrees) for this time of year. Replication this study could be conducted in the winter months when the temperatures are averaging a normal range. It would be interesting to note if there are changes in step counts for children and adults. Future research should also be done regarding the influence of siblings, whether older or younger, on the physical activity and BMI of children. Also, researching attitudes, values, opinions, and habits of physical activity of the urban dwelling female parent of 10-12 year old children would be helpful to know in order to design an appealing physical activity program for female parents to participate in with their child.

Limitations

There were some limitations to this present study. A sample size of four male parents and seven female parents is small. One potential reason the children had an inverse relationship with regard to the physical activity of their male parents could be
because of the small sample of male parents. A larger sample size of male parents could yield different results. A larger sample size of female parents could demonstrate results showing a positive relationship between children and their female parents with regard to physical activity. For the children, a sample size of three Caucasian children and five Hispanic children is also small. Additionally, the parents used an older model pedometer that did not have the seven day recall feature. This meant that all their step count data was based on self-reporting. Giving parents a pedometer with the seven day recall feature would result in greater accuracy.

Conclusions

The children involved in this study averaged considerably less steps per weekday and on the weekend than other children their age across the United States. Boys accumulated hundreds of thousands of more steps per school year than girls equating to hundreds of miles. As well, girls averaged a higher obesity level than boys, while female parents were much less physically active than male parents during the weekdays. Since female parents are role models to their daughters, and as the female parent’s BMI increases, their child’s BMI is likely to increase, immediate attention must be given to the overweight and obese girls and their mothers. Excellent programs need to be developed and implemented where children and parents can be physically active together in an urban environment. Parents of elementary aged children should receive more information on the importance of regular, daily physical activity for their child. The parents should be encouraged to participate in the physical activities with their child whereby both parent and child together would be reaping
the benefits of an active lifestyle. Increasing physical education duration and
can have a substantial positive impact on helping overweight and obese
children become more physically active, which will help alleviate the obesity problem
faced by so many children today.
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to improve physical self-perception and increase recreational physical activity.


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Appendix A

Informed Consent for Adult Participation

STATEMENT OF INFORMED CONSENT
The purpose of this research project is investigating the physical activity patterns of children and their parents/guardians. This research project is being conducted by Dr. Timothy Brusseau and Jennifer Harmon for a Master’s Thesis in the Department of Kinesiology, Sport Studies, and Physical Education at the College at Brockport, SUNY. This project will involve wearing a pedometer on the outside of your clothes, completing a daily activity log, and measuring your height and weight confidentially (or self-reporting your height and weight). We would also ask that the attached demographic information sheet be completed. The project will take place during the spring of the 2011-2012 school year.

In order to participate in this study, your informed consent is required. You are being asked to make a decision whether or not to participate in the project. If you want to participate in the project, and agree with the statements below, please sign your name in the space provided at the end. You may change your mind at any time and leave the study without penalty, even after the study has begun.

I understand that:

1. My participation is voluntary and I have the right to refuse to answer any questions.
2. My confidentiality is protected. My name will not be written on the forms. There will be no way to connect me to my written survey. If any publication results from this research, I would not be identified by name.
3. There will be no anticipated personal risks or benefits because of my participation in this project.
4. My participation involves wearing a pedometer on the outside of my clothes, completing a daily activity log, and measuring my height and weight confidentially (or self-reporting your height and weight). We would also ask that the attached demographic information sheet be completed.
5. Approximately 60 children and up to 120 parents/guardians will take part in this study. The results will be used for the completion of a master’s thesis by the primary researcher.
6. Data will be kept in a locked filing cabinet by the investigator. Data and consent forms will be destroyed by shredding when the research has been accepted and approved.
I am 18 years of age or older. I have read and understand the above statements. All my questions about my participation in this study have been answered to my satisfaction. I agree to participate in the study realizing I may withdraw without penalty at any time during the survey process. Returning this form indicates my consent to participate. If you have any questions you may contact:

Dr. Tim Brusseau  
Department of  
Kinesiology, Sport Studies and Physical Education

[signature]

[Date]

Participant Signature Date
Appendix B

Informed Consent for Child Participation

STATEMENT OF INFORMED CONSENT FOR PARENTS OF MINORS
This form describes a research study being conducted with young people and their families. The purpose of the research is to learn about the physical activity patterns of children and their parents/guardians. The person conducting the research is a faculty member at The College at Brockport, SUNY in the Department of Kinesiology, Sport Studies and Physical Education. You are being asked to give permission your son or daughter to participate in this research. If you agree that your child may participate in this study, your child will be asked to wear a pedometer on the outside of their clothes, complete a daily activity log, and measure their height and weight with confidentiality. We would also ask that the attached demographic information sheet be completed. This study will take about 8 days.

There are no anticipated risks. My child does not have to answer any question they do not want to. My child will have a chance to discuss any questions you have about the study with the researcher.

The possible benefit from being in this study could be that information will be learned that would allow professionals to better help parents/guardians and their children become more physically active. Information from this study might also help young people and their families better understand their daily physical activity patterns.

Confidentiality will be protected as any information that my child gives in this study will be known only to the researchers. Except for this consent form, all questionnaires/forms will be given a code number and my child’s names will not be on them. If publications in scientific journals arise from this research, results will be given anonymously and in group form only, so that my child cannot be identified.

If you have any questions during this research you may call Dr. Tim Brusseau at 585-395-5979. My child’s participation in this study is completely voluntary. Being in it or refusing to be in it, will not affect the services or benefits that my child is entitled to through her/his school. My child is free to change his/her mind or stop being in the study at any time during it.

You are being asked whether or not you want to have your child participate in this study. If you wish for your child to participate, and you agree with the statement below, please sign in the space provided. Remember, your child may change their mind at any point and withdraw from the study. Your child can refuse to participate even if you as parent/guardian give permission for your child to participate.
I understand the information provided in this form, I agree to have my child participate.

If you have any questions you may contact:

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<tr>
<th>Dr. Tim Brusseau</th>
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<tr>
<td>Department of</td>
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<td>Kinesiology, Sport</td>
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<td>Studies, and Physical Education</td>
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I am over 18 years old.

[Signature of parent/guardian] [Date]
Appendix C

Adult Daily Step Count Log Sheet (Parent Data Collection Form)

Dear Parents:

This week we are beginning the study measuring the activity level of you and your son or daughter by counting the number of steps they take each day using a pedometer. A pedometer is a simple device that is secured at the waist and measures vertical movements as counts or steps. Please remind your child to wear the pedometer on the right side of the waistband of their pants or shorts until bedtime and to put it on again when he/she gets dressed the next morning. Please also remember to wear your pedometer all day and to record your step values each night on the provided sheet. Pedometers are not waterproof so they will need to be taken off to shower or swim. Encourage your child to keep the pedometer sealed and to just go about their normal activities. The results of the study will be kept confidential. If you have any questions please call me at _____________.

Thank you for your help,

Tim Brusseau

The College at Brockport

Parent Data Collection Form

Please record the number of step you had at the end of each night......

<table>
<thead>
<tr>
<th>Steps</th>
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<tbody>
<tr>
<td>Tuesday Night</td>
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<tr>
<td>Wednesday Night</td>
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<td>Thursday Night</td>
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<td>Friday Night</td>
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<td>Saturday Night</td>
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<td>Sunday Night</td>
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<td>Monday Night</td>
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</tbody>
</table>
Appendix D

Adult Demographics Form

Parent/Guardian Information Sheet

Physical Activity Project  ID________________
Age __________________

Gender  Male or Female  (Please Circle)

Profession _______________________

Ethnicity:

_____ African American (black)

_____ Asian – American

_____ Arab – American

_____ Caucasian (white)

_____ Hispanic

_____ Native American

_____ Other (please specify) _______________________

Marital Status:

_____ Married

_____ Single

_____ Divorced

Education:

_____ Some High School

_____ High School Degree

_____ Some College

_____ Bachelor’s Degree

_____ Advanced Degree (Masters or Doctorate)

Estimated Height ______________  Estimated Weight ______________
Appendix E
Child Demographics Form

Student Information Sheet (Completed by parent/guardian)

Physical Activity Project ID_______________

Date _________________

Age _________________

Grade _________________

Gender  Boy or Girl (Please Circle)

Teacher's Name _____________________________

Ethnicity:
   _____African American (black)
   _____Asian – American
   _____Arab – American
   _____Caucasian (white)
   _____Hispanic
   _____Native American
   _____Other (please specify) ____________________________
Appendix F

Child Assent Form

Statement of Children's Assent

I am a teacher at the College at Brockport, SUNY in the Department of Kinesiology, Sport Studies, and Physical Education. I want to learn more about your physical activity. Specifically, I want to see how many steps you take each day. Each day you will be asked to wear a pedometer and go about your normal day. Each morning you will be asked to write down your steps from the previous day and answer a couple of questions about your physical activity. You will also be asked to have your height and weight measured during physical education class maintaining confidentiality.

If you decide to participate, I won’t write down your name or let anyone else know who you are.

Your parent or guardian has given permission for you to take part in the study, but it is up to you to decide if you would like to. If you would like to take part in my study, but change your mind later on, you can tell me that you have changed your mind. It is okay to change your mind at any time. You can refuse to participate even if your parent/guardian gives permission for you to participate.

If it is okay with you for me to learn more about your physical activity, you can write your name and date on the first line below.

__________________________________________________________

Thanks you very much,

Dr. Tim Brusseau
Appendix G

Child Data Collection Form

Student Data Collection Form

<table>
<thead>
<tr>
<th></th>
<th>Steps</th>
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<tbody>
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<td>Saturday</td>
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<td>Sunday</td>
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</tbody>
</table>

How many steps did you take...