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Age, Gender, And Physical Education Class On The Bmi Percentile Of School Aged Children

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AGE, GENDER, AND PHYSICAL EDUCATION CLASS

ON THE BMI PERCENTILE OF SCHOOL AGED CHILDREN
(TITLE)

BY

DIXIE MAYOL

THESIS

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ABSTRACT

Childhood obesity is a national epidemic. Physical activity during childhood and adolescence may influence the development of childhood obesity and even cardiovascular disease later in life. Information from previous studies has shown that adults who are more physically active have a lower occurrence of obesity, and recent studies show similar benefits in children. Unfortunately, there has not been a significant amount of research published to help us determine how childhood obesity is affected by public school physical education programs. The purpose of this study was to determine if there is a relationship between age, gender, or the number of days each week students participate in physical education class, and their Body Mass Index (BMI).

Data from a total of 1,230 students (395 kindergarten children, 416 fifth grade students, and 419 ninth grade students) in Coles County was used in this study. Height and weight measurements were collected from school physicals. Also obtained from each school was information pertaining to the number of days each week physical education class was offered. BMI was calculated for each subject using the standard equation: weight (kg)/ height (m^2). The BMI's were converted into a percentile ranking using the Center for Disease Control and Prevention's gender specific BMI-for-age charts. A Chi-Square test was run to determine if there were any significant differences in the proportions of overweight or obese students between age and gender, or in regards to the amount of physical activity children received in school. No significant difference in percentage of overweight or obese children was found between different age cohorts, ($X^2 = 2.65$, $p>.05$). There was also no significant difference between genders, ($X^2 =$

.020, p>.05), or between children who attended physical education two versus five times per week, ($X^2 = 2.772$, p>.05).

The expectation of the study was to find a significant difference in BMI percentiles between different age groups, genders, and students with different physical education options. Although, statistically, the data did not show differences between all of the cohorts, the data did show an alarmingly high percentage of subjects who are obese or overweight. To put the findings into perspective, it has been stated that the national average for obesity in children is approximately 15% (Hiller, 2002). The findings in this study show that approximately 35% of the children from these schools are either overweight or obese. These results show that there is a childhood obesity problem in Coles County.

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CHAPTER I

Introduction

About 15.5 percent of adolescents (12 to 19 year olds) and 15.3 percent of children (6 to 11 year olds) are obese, and these numbers have drastically increased over the past two decades. The prevalence of obesity for children ages 6 to 11 has more than doubled, and the prevalence of obesity for adolescents ages 12 to 19 has tripled over the past 20 years (www.obesity.gov).

A study, conducted in Hawaii in 1992, found that the obesity rate of Hawaii's school-aged children was 26 percent, which is almost two times the national average (Chai, Ho, Derenne, Kaluhiokalani, 2002). Researchers attribute such a high obesity rate to multiple factors. Dr. Chai cited low physical education requirements by the state, poor nutrition, and bad medical and lifestyle habits as the key factors. The Department of Education in Hawaii recommends between 18 and 22 minutes of daily physical education, depending on the grade level of the student. Sadly, many schools don't meet this recommendation because of the tremendous amount of pressure schools now have to improve academic performance. One official from Hawaii's Department of Education stated, "Seventy percent of public elementary schools in Hawaii do not have a teacher dedicated exclusively to teaching physical education," (Chai, et al., 2002). Changing one factor is not going to take care of obesity in its entirety, but attacking it from the physical activity perspective is a starting point where students, parents, teachers and doctors can all be involved.

Participation in physical activity declines as children get older, and this lack of physical activity during childhood and adolescence may influence the development of childhood obesity or even cardiovascular disease later in life. Information from previous studies has shown that individuals who are more physically active have a lower occurrence of obesity (Faith, et al., 2001). Armed with this piece of information makes one wonder why there hasn't been a significant amount of research completed to help us determine how childhood obesity is affected by age, gender, and even our school physical education programs.

The more physically active a child is, the lower his risk of becoming obese. Since physical education is the only exercise that we know for sure children are participating in, it is important to show that there is a relationship between increased physical activity and a decreased occurrence of obesity. This is important because of the impact childhood obesity has on this same child when he/she becomes an adult. Childhood obesity may be a precursor for a whole host of health problems such as diabetes, cardiovascular disease, and cancer (Steinbeck, 2001; www.obesity.gov: Moran, 1999).

Children have become less physically active in the past couple of decades. Today's children expend about 600 kcals less each day than children did 50 years ago (Boreham & Riddoch, 2001). Children in the past walked to school, rode their bikes through the neighborhood, or played baseball with a group of friends on a sunny afternoon. Today, children are more likely to be found on the computer, playing video games, or watching television. Technology has made these sedentary activities more appealing. It is no surprise, then, why our children are becoming obese. The health

problems associated with a reduction in energy expenditure is well documented in adults, however, there is very little direct evidence making the same link in children.

There have been studies finding three main benefits from having adequate childhood physical activity. First, evidence is mounting that more active children generally have healthier cardiovascular profiles and are leaner than their less active counterparts. Second, research shows that an improved adult health status is due in part to childhood physical activity. A longitudinal study conducted by Trudeau et al., (1999) found that daily primary school physical education programs have a long-term positive effect on exercise habits in women later in life. The last benefit mentioned is that active children are more likely to become active, healthier adults (Boreham & Riddoch, 2001; www.cdc.gov/nccdphp/dash/physicalactivity/promoting_healthy/background.htm, 11/21/03; Brett, 2002).

This evidence is compelling and it warrants further comparison between the different amounts of physical activity children receive in physical education class with other variables, such as gender and age, which could cause a change in Body Mass Index (BMI) percentiles.

Purpose of the Study

The purpose of this study is to determine if there is a relationship between the three variables of age, gender, and the number of days each week students participate in physical education class, and their BMI percentile.

Hypotheses

The hypotheses for this study are as follows:

1. With an increase in age, an increased percentage of children will be obese.
2. There will be a difference between males and females in regards to the percentage classified as obese.
3. The amount of physical activity children receive at school will have an effect on their BMI percentile.

Scope

Height (cm) and weight (kg) information were used from kindergarten, fifth grade, and ninth grade students from two different school districts. One school district had physical education classes two times a week, (District 1), and the other had physical education class five times a week (District 2). The height and weight information collected was used to calculate BMI for each student. Using this calculated BMI, their BMI percentile was determined using the Center for Disease Control and Prevention's Body Mass Index-for-Age percentile charts that are gender specific. The data was then analyzed to determine if certain variables do affect BMI percentile.

Limitations of the Study

The limitations of this study are:

1. The inability to account for what these children are eating;
2. The inability to monitor how much other physical activity the children get outside of school;

3. The inability of knowing how much time is spent "on-task" in each Physical Education class, as well as the focus of the curriculum, i.e. fitness, skills, etc.;
4. The sample was limited to children from Coles County.

Assumptions

1. The sample was representative of most American children.
2. Measurements from school physicals were accurate.
3. The Centers for Disease Control and Prevention gender specific BMI-for-age charts are a valid measure of obesity classifications in children.

Significance of the Study

Childhood obesity is a national epidemic affecting approximately 15% of children (www.surgeongeneral.gov, 10/14/02). To slow this epidemic, we must focus on the aspects of our environment that we can change, such as physical education. This study compared the effects of the amount of physical education children receive to their BMI percentile. Hopefully, the results will show that as the amount of physical activity children receive increases, BMI percentiles will decrease. Physical educators will be able to use these results to increase the amount of time they spend with students, or even to not lose any of the time they currently spend in physical education. Colleges and universities may use the findings as the basis for further study into the area to find other behaviors or aspects of the environment which can be manipulated to show a positive improvement in childhood obesity. Many studies have made the correlation between

physical activity and a lower occurrence of obesity in adults, however, this study looks at the possibility of physical activity decreasing childhood obesity.

Definition of Terms

Body Mass Index (BMI) – An anthropometric measure of weight and height that is defined as body weight in kilograms divided by height in meters squared (www.cdc.gov, 11/20/03).

Obese – an excessive accumulation of body fat; BMI measure greater than or equal to the 95th percentile.

CHAPTER II

Review of Literature

Information from previous studies has shown that adults who are more physically active have a lower occurrence of obesity. However, there has not been a significant amount of research completed regarding childhood obesity and physical activity. This chapter will provide a review of research that is pertinent to this study. This review of literature will include the following key topics:

- What is Childhood Obesity?
    1. Definition of obesity
    2. What is Body Mass Index, (BMI), and what values classify a child as overweight or obese?
    3. What are the CDC's gender specific BMI-for-age charts?
    4. Medical concerns
    5. Psychological problems
- What are Contributing Factors to Childhood Obesity?
    1. Excessive eating habits
    2. Familial influences – genetic and behavioral
    3. Bad exercise habits
    4. Lack of physical education in schools
- What Can be Done to Combat this Epidemic?

What is Childhood Obesity?

Obesity is defined as an excessive accumulation of body fat. Obesity is considered to be present when a boy's total body weight is more than 25% fat, or when a girl's total body weight is more than 32% fat (Lohman, 1987). In general, obesity occurs when there is an imbalance between energy intake and energy expenditure. This means we are eating too much and exercising too little. Energy output includes the basal metabolic rate, the thermal effect of food, and activity. Basal metabolic rate is the minimum amount of energy required to carry on normal biological functions, such as circulation and respiration. The thermal effect of food is the energy required to digest meals. Of these three variables, activity is the one most susceptible to change (Moran, 1999).

A measurement called percentile of Body Mass Index (BMI) is used to classify children and adolescents as overweight or obese. BMI is an anthropometric measure of weight and height that is defined as body weight in kilograms divided by height in meters squared, {Body Mass Index (BMI) = weight (kg)/height $(m)^2$}. The Center for Disease Control (CDC) has developed BMI-for-age charts that are gender specific. The advantage to using these charts is that it provides a measure that takes into account not only height and weight, but also age and gender. The factors of age and gender are important because they take into account the stage of sexual maturation the child may be in which is highly related to body fatness.

Once BMI has been calculated for a child, it is plotted on the CDC's BMI-for-age, gender specific chart (Appendix A, Appendix B). Once plotted, the percentile can be determined. These percentiles rank the BMI in a group of 100 children of the same gender and age. For example, out of 100 children, five will be at or above the 95^{th}

percentile, ten will be between the 85th and 95th percentiles, five will be less than the 5th percentile, and eighty children will be within the normal range, (www.cdc.gov, 10/24/03). The American Obesity Association (AOA) uses the 85th percentile as a reference point for overweight and the 95th percentile for obesity. The 95th percentile is used because it corresponds to a BMI of 30, which is the reference point for obesity in adults, and the 85th percentile corresponds to the overweight marker for adults, which is a BMI of 25. The validity of the cutoff points in regards to the percentiles has been investigated. Freedman (1999) found that cardiovascular risk factors are associated with the established BMI-for-age cutoffs. He found that about 60% of 5 to 10 year old children with BMI-for-age values $\geq$ 95th percentile had at least one risk factor for cardiovascular disease, and 20% had two or more risk factors. Using the 85th and 95th percentiles as cut off points, few children are incorrectly identified as overweight, but some overweight children may be missed.

Not only has there been a rise in the occurrence of childhood obesity, but also in the incidence of medical conditions in this same population that had been rare in the past. The Centers for Disease Control and Prevention has stated that hospital costs associated with childhood obesity have tripled in the last 20 years to $127 million per year (www.cdc.gov, 10/24/03). Mr. Kuntzleman stated during his testimony on Capitol Hill on April 30, 2002, that $1,390 is spent by the government per person to treat obesity, yet only $1.21 is spent per person to prevent it. More frequent cases of diseases once considered to be adult conditions, such as Type 2 diabetes, asthma, and hypertension, are being reported by pediatricians.

Osteoporosis could become a major medical concern as our sedentary population ages because we are not getting the type or amount of exercise needed for good bone health. Weight-bearing physical activity is an important contributor to bone health. It is important to get this physical activity starting in childhood and adolescence. The natural playtime activities of children such as jumping, climbing, and running, provide a significant amount of weight-bearing exercise and may actually be the most beneficial for bone health (Boreham & Riddoch, 2001).

Glucose intolerance and hyperinsulinemia are common in extremely obese children. They are more likely to have orthopedic problems and skin disorders, such as heat rash or acne, than non-obese children as well (Moran, 1999). Perhaps just as alarming is the statistic that overweight adolescents have a 70% chance of becoming overweight or obese adults. This percentage increases to 80% if one or more parent(s) are overweight or obese (www.surgeongeneral.gov, 10/14/02). Evidence from the Framingham Heart Study shows that obesity doubles the risk of heart failure in women. Also, a man with 22 extra pounds has a 75% greater chance of having a heart attack than one at a healthy weight (Spake & Marcus, 2002). This long-term outlook has prompted the medical field to classify childhood obesity as an epidemic.

Overweight children also have a higher risk of psychological problems. Society unfairly classifies obese people as lazy and stupid. Studies have shown that these negative attitudes are evident as early as kindergarten. The same studies also found that kindergarten children prefer a playmate who is bound to a wheelchair or disabled by a major physical handicap to one who is obese (Moran, 1999). In the physical education setting where performance is public, overweight children experience the teasing from

other children more often. Changing clothes is also a key reason for heavier girls disliking physical education. Events in schools comprise only one factor in the life of the overweight child, however, when a child spends approximately 45% of his waking hours in school, the school has the opportunity to make a positive contribution through its policies, curriculum, and teacher input (Fox & Edmunds, 2000).

What are Contributing Factors to Childhood Obesity?

There are many factors that may contribute to child or adolescent obesity. Some factors are modifiable such as lack of regular exercise, sedentary behavior, socioeconomic status, bad eating behaviors, and the environment. A cause that cannot be changed is genetics. Following is a discussion of the factors that are modifiable.

There is a basic driving force in human biology: Eat whenever food is available, and eat as much of it as possible. This is due to the fact that throughout history, food has been scarce, and it took a lot of physical energy to acquire it. Eating a lot of calories protected our ancestors against famine. Kelly Brownell, Director of the Yale Center for Eating and Weight Disorders, said that "humans are hard-wired to prefer rich diets, high in fat, sugar, and variety" (Spake & Marcus, 2002). The problem with this in today's society is that, as University of Colorado nutrition researcher James Hill said, "Our physiology tells us to eat whenever food is available, and now, food is always available" (Spake & Marcus, 2002). This excessive intake of food coupled with various other nutritional, psychological, familial, and physiological factors has led obesity to be classified as an epidemic.

A child's family could contribute to obesity through genetic factors, which cannot be changed, as well as bad eating and exercising behaviors, which are modifiable. The lack of adequate daily exercise is an important factor in obesity. Children may live in areas where they don't have the option to go outside and play after school because it isn't a safe environment, so they are trapped inside and resort to watching television or playing video games for several hours a day. Obesity is greater among children who spend their time in front of the television because little energy is being used and they are also usually eating high fat snack foods while watching the television (Phalen, 2000). Faith, et al. (2001) introduced a 'contingent TV' in their study that required pedaling on a stationary cycle at a specified rate in order to power the television. They found that the contingent TV not only increased physical activity, but also reduced television viewing among the participants (Faith, et al., 2001). Our society seems to be creating an environment that is making it more and more difficult to be active because technology has made sedentary activities like television, video games and the computer, very attractive. Therefore, this study is very important because the results show that interventions targeting sedentary behaviors do have potential benefits.

Go to any school playground during recess and you will see the area full of children throwing a ball, playing a game of tag, or a host of other types of physical activity. If children like exercise so much, then why are they now doing it so little? We now have a lifestyle full of 'sedentary alternatives' (Epstein, et al., 1995). Epstein found that if these sedentary alternatives are not available, most children will find a way of passing time that involves activity. During the mid-teens, activity amounts decline,

especially in girls. If this trend continues into early adulthood and eventually into adulthood, it is easy to see that one's future health is compromised (Epstein et al., 1995).

Americans are constantly on the run. This means more fast food meals which have higher fat and salt contents than we need. These foods may taste good, but unfortunately that does not mean that they are good for you. In 1977-1978, Americans ate approximately 19% of their total calories out. By 1995, this increased to 34% of their calories eaten away from home (Spake & Marcus, 2002). Throughout the literature there are two key points that are made: "Children adopt their parents' behaviors, and healthy children become healthy adults" (Brett, 2002). If parents consider themselves a role model in regards to their child's health and fitness, their children will adopt these positive behaviors and continue them into adulthood. However, when Americans are constantly on the run, the healthy lifestyles seem to get pushed to the side, so the opposite is being taught to children.

What Can be Done to Combat this Epidemic?

Both positive and negative behaviors are likely to persist throughout one's lifetime if they are established at a young age, therefore, teaching healthy behaviors to children when they are young is important because they may be more flexible in their ability to change their behaviors than adults. Families, schools, and healthcare professionals are the most important links in providing these behaviors. They must be sensitive to the child/adolescent and be careful to only focus on the positive. Physical education teaches healthy, active lifestyle behaviors to children so that they do not only improve cardiovascular endurance, body composition, strength, flexibility, and posture, but children will be introduced to these positive behaviors and continue them throughout

their lifetime. Physical education programs should teach students a variety of activities, and empower him/her to take ownership of his/her own health and fitness for a lifetime so they can live a longer, healthier, happier life.

A study on the effect of increasing the aerobic aspect of physical activity and improving what adolescents know about weight control and blood pressure had positive outcomes. McMurray, Harrell, Bangdiwala, Bradley, Deng, Levine, (2002), conducted this study with 1,140 youth aged 11 to 14 years old. These adolescents were randomly assigned into four treatment groups: exercise only, education only, exercise and education, or a control which received neither exercise or education. Height, weight and skinfold measurements were taken, and body mass index was calculated. Blood pressure was measured, and maximal oxygen uptake was predicted after a submaximal bike test. The researchers found that blood pressures increased more in the control group. There was no significant change in BMI, but the sum of skinfold measurements increased more in the education only and control groups than the exercise and the exercise and education groups. The increase in VO2max of the exercise and education group was significantly greater than the education only group. In summary, researchers found that an intervention of exercise and education had a positive effect on blood pressure, VO2max, and skinfold measurements (McMurray et al., 2002).

The face of physical education class is changing. Some people may have unpleasant memories of physical education class, such as being the last one picked or the first one out. Today, physical educators have a new approach, as well as a new outlook as to the best ways to get children back to the healthy lifestyle they should be living. Heart rate monitors are changing the thinking of many educators. The one-mile run that

was conducted each semester, where students had to complete the distance in a certain amount of time was dreaded. Some children could run the whole mile without stopping and earn an 'A'. Others could walk it swiftly, but their grade may have been a 'C' because it took them longer to complete the distance.

Now, teachers are strapping heart rate monitors onto their students and conducting a timed run. The students aren't keeping track of how far they run in the allotted time, and it doesn't matter if they are walking, jogging, or running. What does matter is that they are exercising vigorously enough to keep their heart rate in the target heart rate zone for a specified amount of time (Brink, 2002). The value to the heart rate monitor method is that teachers now realize that the slower, overweight student may not run as far as the faster, more athletic student, but he had his heart rate "in the zone" for a greater amount of time. What does this mean? This shows teachers those students really are working hard even if it may not look like it, while the athletic student was "in the zone" a lot less time and, therefore, was actually working at a lower level.

More than a third of students in grades 9-12 do not engage in regular, vigorous physical activity. Even more shocking is the statement made by Mr. Thomas Cove at a House Appropriations Committee Subcommittee on Labor, HHS, and Education, that 25% of children do not get any physical education instruction at all. So why is there less physical education instruction in schools today? Most people would respond to this by noting budget cuts from the government, or even time constraints because parents want elective classes and advanced placement classes for their children, which take up time and money that could be allotted for physical education classes. However, in a survey administered by the American Obesity Association, 78 percent of parents felt that

physical education or recess time should not be replaced with academic classes. It is up to parents, teachers, and communities to take a stand and let school board members and school principals know that physical education is too important for our children to cut it from the curriculum. Regular physical activity substantially reduces the risk of coronary heart disease, colon cancer, diabetes, and high blood pressure, to name a few. Physical activity also helps us tremendously as we get older by keeping our bones, muscles, and joints healthy, which leads to a reduction in the number of falls among the elderly, (www.ahrq.gov/ppip/activity.htm, 5/1/2002). These are just a few of the benefits of regular physical activity.

Changing behaviors is instrumental in preventing obesity in children and adolescents. Parents need to establish healthy behaviors aimed at obesity prevention. These behavioral changes need to be adopted by the family as a whole, and not just by one individual in the family. Parents should create an active environment for the whole family. Family activities will make it more fun and will show the child that exercise is important for everyone. To be physically active, children and their parents must choose to take part in either organized or leisure activities as a part of their daily schedule. Activity doesn't always have to be in the form of typical physical activity. It can also include chores such as washing the car, vacuuming, or raking leaves.

Healthy eating habits are a must for the entire family. Recording diet patterns to keep track of the types and amount of food eaten, as well as where it is eaten, may be useful in determining any problem areas in eating. Preparing foods together educates children about what is in the food they are eating. Eating together and eating slowly are very important. Eating at a slower pace allows food time to digest and gives a sense of

fullness. Don't force children to clean their plate if they are full or say they are not hungry and don't use food as a reward. Using food as a reward might make food items that much more desirable. Verbal praise should be used instead of food. The American Obesity Association listed the "Prescription for Change: Ten Keys to Promote Healthy Eating in Schools" that is to be used for guidance in school meal programs. The prescription, proposed by a coalition of five medical associations and the USDA, is as follows:

1. Students, parents, food service staff, educators and community leaders will be involved in assessing the school's eating environment, developing a shared vision and an action plan to achieve it.
2. Adequate funds will be provided by local, state and federal sources to ensure that the total school environment supports the development of healthy eating patterns.
3. Behavior-focused nutrition education will be integrated into the curriculum from pre-K through grade 12. Staff who provide nutrition education will have appropriate training.
4. School meals will meet the USDA nutrition standards as well as provide sufficient choices, including new foods and foods prepared in new ways, to meet the taste preferences of diverse student populations.
5. All students will have designated lunch periods of sufficient length to enjoy eating healthy foods with friends. These lunch periods will be scheduled as near the middle of the school day as possible.
6. Schools will provide enough serving areas to ensure student access to school meals with a minimum of wait time.

7. Space that is adequate to accommodate all students and pleasant surroundings that reflect the value of the social aspects of eating will be provided.
8. Students, teachers and community volunteers who practice healthy eating will be encouraged to serve as role models in the school dining areas.
9. If foods are sold in addition to National School Lunch Program meals, they will be from the five major food groups of the Food Guide Pyramid. This practice will foster healthy eating patterns.
10. Decisions regarding the sale of foods in addition to the National School Lunch Program meals will be based on nutrition goals, not on profit making.

Increased exercise and a common sense approach to moderation in what is eaten may prevent obesity, even among children who are genetically predisposed.

CHAPTER III

METHODS

Purpose

The purpose of this study was to determine if there is a relationship between the three variables of age, gender, and the number of days each week kindergarten, fifth grade, and ninth grade students participate in physical education class and their Body Mass Index (BMI) percentile.

Subjects

Kindergarten, fifth grade, and ninth grade students in Coles County were selected to participate in this study. Consent was received from each of the schools to use information from the student physicals without identifying the student. Parents were informed of the study via a letter and were to respond if they did NOT want the information for their child included (Appendix C).

Data Collection

Height and weight measurements, gender, blood pressure, whether the student was diabetic, and what grade the student was entering were collected from school physicals. Also obtained from each school was information pertaining to the number of days each week the subjects participated in physical education class.

Experimental Design

A descriptive design was used in this study so that any relationships between the variables could be determined.

Data Analysis

Body Mass Index (BMI) was calculated for each subject using the standard equation: weight (kg) / height (m^2). BMI was used because the height and weight data needed for its analysis was easily obtained. The individual BMI scores were then converted into a percentile of BMI using the Center for Disease Control's gender specific BMI-for-age charts. Next, subjects were grouped according to the number of days each week they attended physical education class (2 or 5 days). Chi-square tests were run to determine if there was a significant difference in the proportion of obese children in regards to age, gender, or the amount of physical education subjects received. Frequencies were also calculated to illustrate the distribution of children over the various BMI percentile ranges.

CHAPTER IV

RESULTS AND DISCUSSION

Results

There is an epidemic occurring among children in the United States. It currently affects approximately 15% of children and is associated with more health problems later in life. This epidemic is childhood obesity. Information from previous studies has shown that individuals who are more physically active have a lower occurrence of obesity. Since physical education class is the only exercise that we know for sure that children are participating in, it is important to determine if there is a relationship between increased physical activity and a decreased measure of obesity. The purpose of this study was to determine if there is a relationship between the three variables of age, gender, or the number of days each week students participate in physical education class, and their Body Mass Index (BMI) percentile.

It was hypothesized that BMI percentiles would change due to the amount of physical activity children received at school. It was thought that findings would also show that females have a higher BMI percentile than males, and that as children get older, there will be an increase in BMI percentiles. Height and weight information was gathered from students' school physicals. This information was then used to calculate BMI for each student. The BMI was then changed into a percentile using the Center for Disease Control and Prevention's gender specific BMI-for-age charts. Data was analyzed using Chi-Square to compare the schools with a two-day per week physical education

program, (District 1), to the schools with a five-day per week physical education program, (District 2).

Student Population Information

The student population information is provided in Table 1. The mean and standard deviation of the BMI for each age group and gender is shown as well as its corresponding BMI percentile.

Statistical Analysis

Chi-square tests were applied to see if there was a significant difference in the proportion of overweight or obese children in regards to age, gender, or the amount of physical education subjects received. Results shown in Table 2 indicate that there was no significant difference in the percent of children classified as overweight or obese in the schools with twice weekly physical education having a rate of 34.2%, compared to schools with daily physical education having a rate of 35.4% (x^2=.020; p>.05). Although there were not statistical significances between the two groups of schools, overall there were an alarmingly high percentage of subjects who were obese. To put these figures into perspective, it has been stated that the national average for obesity in children is approximately 15% (Hiller, 2002). The findings in this study show percentages in Coles County ranging from 19% to 20%. Further research as to the amount of time allowed for physical education class, the focus of the curriculum (i.e. fitness, skills, etc.) and the amount of time spent on task is needed in order to explain these findings.

Table 1. BMI Means and Standard Deviations with Corresponding BMI Percentiles

	Males			Females		
Age	N	BMI	%ile	N	BMI	%ile
5	42	16.9 (1.9)	86th	66	16.4 (2.5)	80th
6	151	16.8 (2.5)	84th	130	16.7 (2.1)	80th
7	6	17.7 (2.3)	87th	0		
10	66	18.9 (4.5)	82nd	37	18.0 (3.1)	70th
11	150	20.1 (5.1)	84th	151	20.6 (5.3)	82nd
12	7	21.7 (4.2)	88th	5	20.4 (5.1)	77th
14	42	23.6 (5.5)	88th	73	23.4 (6.6)	85th
15	149	23.2 (5.3)	83rd	141	23.3 (5.8)	80th
16	9	24.8 (4.1)	87th	5	21.8 (2.3)	62nd
Total	**622**	**20.0 (5.1)**		**608**	**20.1 (5.5)**	

Table 2. BMI Classification by District

District	>85%	<85%	Total # of Students	% of Students Overwt/Obese
1	192	369	561	34.2%
2	241	439	680	35.4%

There was no significant difference in the percent of overweight or obese children between the males and females (x^2=2.772; p>.05). Findings showed that 37.1% of males, and 32.6% of females in Coles County were overweight or obese (Table 3). Lastly, there was no difference between age groups in regards to the percent who were overweight or obese (x^2=1.423; p>.05). As shown in Table 4, the kindergarten population had 33.4% of children classified as overweight or obese, while the 5th and 9th grade percentages were 36.3% and 35.8%, respectively.

Table 3. BMI Classification by Gender

Gender	>85%	<85%	Total# of Students	% of Students Overwt/Obese
Male	231	391	622	37.1%
Female	202	417	619	32.6%

Table 4. BMI Classification by Grade

Grade	>85%	<85%	Total # of Students	% of Overwt/Obese
K	132	263	395	33.4%
5th	151	265	416	36.3%
9th	150	269	419	35.8%

Frequency Distributions

Frequency distributions were also calculated. Table 5 gives a frequency distribution of the BMI percentiles of all subjects. Groups 9 and 10 represent the subjects who were classified as obese. Groups 7 and 8 contain those who were considered to be overweight. Anything below group 7 was considered to be 'normal', with the exception of groups 0 and 1 who were classified as 'underweight' (www.cdc.gov, 10/25/02). Table 5 provides the number of males or females in each district who are obese, overweight, or considered to be in the normal range.

Table 5. Frequency Distribution of BMI percentiles of all Subjects

	Frequency
0 (↓ 3rd %ile)	23 (Underweight)
1 (3rd-5th %ile)	10 (Underweight)
2 (5th-10th %ile)	27 (Normal)
3 (10th-25th %ile)	102 (Normal)
4 (25th-50th %ile)	190 (Normal)
5 (50th-75th %ile)	281 (Normal)
6 (75th-85th %ile)	136 (Normal)
7 (85th-90th %ile)	104 (Overweight)
8 (90th-95th %ile)	112 (Overweight)
9 (95th-97th %ile)	70 (Obese)
10 (↑ 97th %ile)	175 (Obese)
Total	**1230**

Discussion

In summary, there were no significant differences in the proportion of overweight or obese children between males and females, different age cohorts, or between schools

with different amounts of time spent in physical education. The number of days children attended physical education class may not have been as important as knowing the actual amount of time the children spent in activity. The focus of the curriculum, whether it was fitness, skills, etc., is another aspect of physical education class that should be taken into consideration. If students are in a fitness oriented curriculum, and spend the first part of the class period jogging around the track, they are probably getting more benefit than the student who is strictly learning skills such as throwing, juggling, etc.

Other explanations in regards to the lack of differences in the proportion of overweight or obese children, whether we are discussing gender or different age cohorts, are differences in the nutritional value of foods eaten. The more fast food, or high fat, fried foods a child eats, the more likely he is to be overweight or obese. Socioeconomic status seems to have an effect on nutrition. Families with lower incomes tend to not be able to afford the healthy, but more costly, foods such as fruits and vegetables, as well as low fat meats.

Physiological factors such as puberty and maturation occur at different ages. The 11-year old pubescent girl will have a higher body fat percent than the post-pubescent 11-year old girl. Along with maturation also comes a change in adiposity. The two 13-year old boys who both weigh 100 pounds will have very different BMI percentiles if one of them is 60 inches tall while the other is 66 inches tall.

Another factor to take into consideration is whether the child's family lives on a farm or in the city. Children who live on a farm typically will have responsibilities that are physically demanding, such as cleaning out stalls. Although it may not be the most

fun type of physical activity, this type of work is demanding and could help a child to maintain a lower weight, and, therefore, have a lower BMI percentile.

CHAPTER V

CONCLUSIONS

Summary

As stated previously, there were no significant differences in the proportion of overweight or obese children between males and females, different age cohorts, or between schools with different amounts of time spent in physical education. There are various possible explanations for these results including varying amounts of physical education, socioeconomic status, varying dietary intake, and genetics to name a few. Even though significance was not found in regards to the variables being examined, there was one alarming statistic that came from this study and that was the overall percentage of obese children. The rate found in Coles County was 19.8%, which is much higher than the national average of 15%. Hopefully this finding will warrant further research into the reasons for varying levels of obesity across the nation.

Childhood obesity is now labeled an "epidemic". Studies have shown that obesity in adults can be combated with physical activity. There are studies listing numerous long term effects of childhood obesity such as cardiovascular disease, diabetes, and high blood pressure. Knowing that childhood obesity is a precursor to adult obesity and health disorders, it is important to find out what can be done to slow or prevent childhood obesity. The purpose of this study was to determine if there is a relationship between the three variables of age, gender, and the number of days each week kindergarten, fifth grade, and ninth grade students participate in physical education class and their Body Mass Index (BMI) percentile.

There were 1,230 subjects in this study. Of these, 395 were going into kindergarten, 416 were going into 5th grade, and 419 were going into 9th grade. The subjects ranged in age from 5 years old to 16 years old. Height and weight data were collected from school physical forms. This data was used to figure the body mass index for each subject. Once BMI was calculated, this number, along with the child's age and gender, was used to obtain a percentile from the CDC's gender specific BMI-for-age charts. Performing chi-square tests on these percentiles, there were no significant differences in proportion of overweight or obese children noted between males and females or different ages. All children mature at different points in their life, and with maturation comes changes in body fat percentages, height and weight; all of which have a great impact on BMI percentile.

The third expectation of this study was to find a significant difference in proportion of overweight or obese children between the district which conducted physical education class two times per week and the district that conducted physical education class five times per week. The results did not support this portion of the hypothesis. Future research on this topic should take into consideration more specific details such as minutes of physical education class each week the children are participating in, time spent in activity (as opposed to instruction, waiting in lines, etc.), the type of curriculum being used, other types of physical activity the children are participating in, a diet log, and other factors that affect energy expenditure.

Monitoring the physical activity more closely, whether in physical education class or other activity, could allow the children to be grouped according to activity level as

well as age and gender. This would alleviate the concern of how much other physical activity subjects were engaging in.

A diet log would also provide useful information. This could be used to help explain how two children who are alike in age, gender, and physical activity level can have such different BMI percentiles. The diet of one could be very healthy, while the diet of the other consists of fatty foods, and few fruits and vegetables.

Recommendations for Future Studies

Recommendations for further research are warranted. The inability to account for individual diets, not being able to monitor other physical activity outside of the classroom setting, not knowing how much time is spent "on-task" in physical education class, not knowing the focus of the curriculum, and the limited sample of students only from Coles County are all limitations that should be controlled as much as possible in future research.

Accounting for what children are eating could be useful if a study were to include energy intake as one of the variables being considered. Socio-economic status could be considered as well. Another aspect not to be overlooked is the amount of physical activity the subjects are getting outside of physical education class. This would have to be self-reported, and could easily be kept in a log book. Lastly, but very important, is recording the amount of physical education class time that is spent in "active time" versus how much time is used for instruction, waiting in line for a turn, sitting out while other teams play, etc.

Although the third hypothesis was not confirmed, there was some very alarming information obtained from this study. According to the BMI percentiles obtained in this study, 19.8% of the children were obese. This should be a cause for concern because this is much higher than the national average for childhood obesity which is 15%.

Although there is very little research showing a link between daily physical education class and a decrease in childhood obesity, there is research that states very clearly that an increase in physical activity decreases body fat without dietary intervention (Owens, Gutin and Allison, 1999). No one wants to have their child face a lifetime of illnesses and health problems due to something that could have been prevented. If children are not receiving daily, quality physical education classes, families must take on the responsibility of making sure their children are getting enough exercise by making exercise a family activity so everyone can benefit.

References

www.ahrq.gov/ppip/activity.htm, 5/1/2002

Bernhardt, Darren (2002). Schools Take New Approach to Fitness. The Star Phoenix; 9/4/02, C1.

Boreham, C., Riddoch, C., (2001). The Physical Activity, Fitness and Health of Children. Journal of Sports Sciences; 19 (12); Dec 2001, 915-929.

Brett, Kelly, (2002). Active Kids, Healthy Kids: Exercise & Healthy Eating: The Keys to our Children's Health. Edmonton Journal of Family Health, 18 (2), June 2002, 34-35.

Brink, Susan, (2002). Gym Class Isn't Just Dodge Ball Anymore. U.S. News & World Report, Vol. 132 (19), June, 2002, 50.

www.cdc.gov, 10/25/02, 10/30/03, 10/24/03, 11/20/03.

Epstein, L.H.; Valoski, A.M.; Vara, L.S.; McCurley, J.; Wisniewski, L.; Kalarchian, M.A.; Kelin, K.R.; and Shrager, L.R. (1995). Effects of Decreasing Sedentary Behaviour and Increasing Activity on Weight Change in Obese Children. Health Psychology, 14, 109-115.

Faith, M.; Berman, N.; Heo, M.; Pietrobelli, A.; Gallagher, D.; Epstein, L.; Eiden, M.; Allison, D. (2001). Effects of Contingent Television on Physical Activity and Television Viewing in Obese Children. Pediatrics; 107 (5); 1043-1048.

Fox, K.; Edmunds, L. (2000). Understanding the World of the 'Fat Kid': Can Schools Help Provide a Better Experience? Reclaiming Children and Youth; 9 (3); 177-184.

Hiller, Jennifer (2002). Fighting Obesity Starts With Getting Physical. www.the.honoluluadvertiser.com, 10/14/02.

www.kidsource.com/kidsource/content2/obesity.html, 10/14/02.

Lohman, T.G. (1987). The Use of Skinfolds to Estimate Body Fatness on Children and Youth. Journal of Physical Education, Recreation and Dance; 58 (9); 98-102.

McMurray, R.; Harrell, J.; Bangdiwala, S.; Bradley, C.; Deng, S.; Levine, A. (2002). A School Based Intervention can Reduce Body Fat and Blood Pressure in Young Adolescents. Journal of Adolescent Health; 31 (2); 125-132.

Moran, R. (1999). Evaluation and Treatment of Childhood Obesity. American Family Physician, Feb. 15, 1999, 860-870.

www.obesity.org, 10/30/03.

Owens, S.; Gutin, B.; Allison, J., (1999). Effect of Physical Training on Total and Visceral fat in Obese Children. Medicine and Science in Sports and Exercise; 31 (1); 143-148.

Phalen, K. (2000). "Cutting the Fat: CDC Report Targets Childhood Obesity: www.ama-assn.org, 12/25/00.

Roberts, S. (2000). "The Role of Physical Activity in the Prevention and Treatment of Childhood Obesity" Pediatric Nursing, 26 (1); 33-72.

Spake, A.; Marcus, M. (2002). "America's 'Supersize' diet is Fattier and Sweeter – and Deadlier" U.S. News & World Report, 133 (7); 8/19/02,40.

Steinbeck, K. (2001). "The Importance of Physical Activity in the Prevention of Overweight and Obesity in Childhood: A Review and Opinion" Obesity Reviews, 2 (2); 117.

www.surgeongeneral.gov, 10/14/02.

Trudeau, F.; Laurencelle, L.; Tremblay, J. (1999). "Daily Primary School Physical Education: Effects on Physical Activity During Adult Life" Medicine and Science in Sports and Exercise, 31 (1); 111-117.

APPENDECES

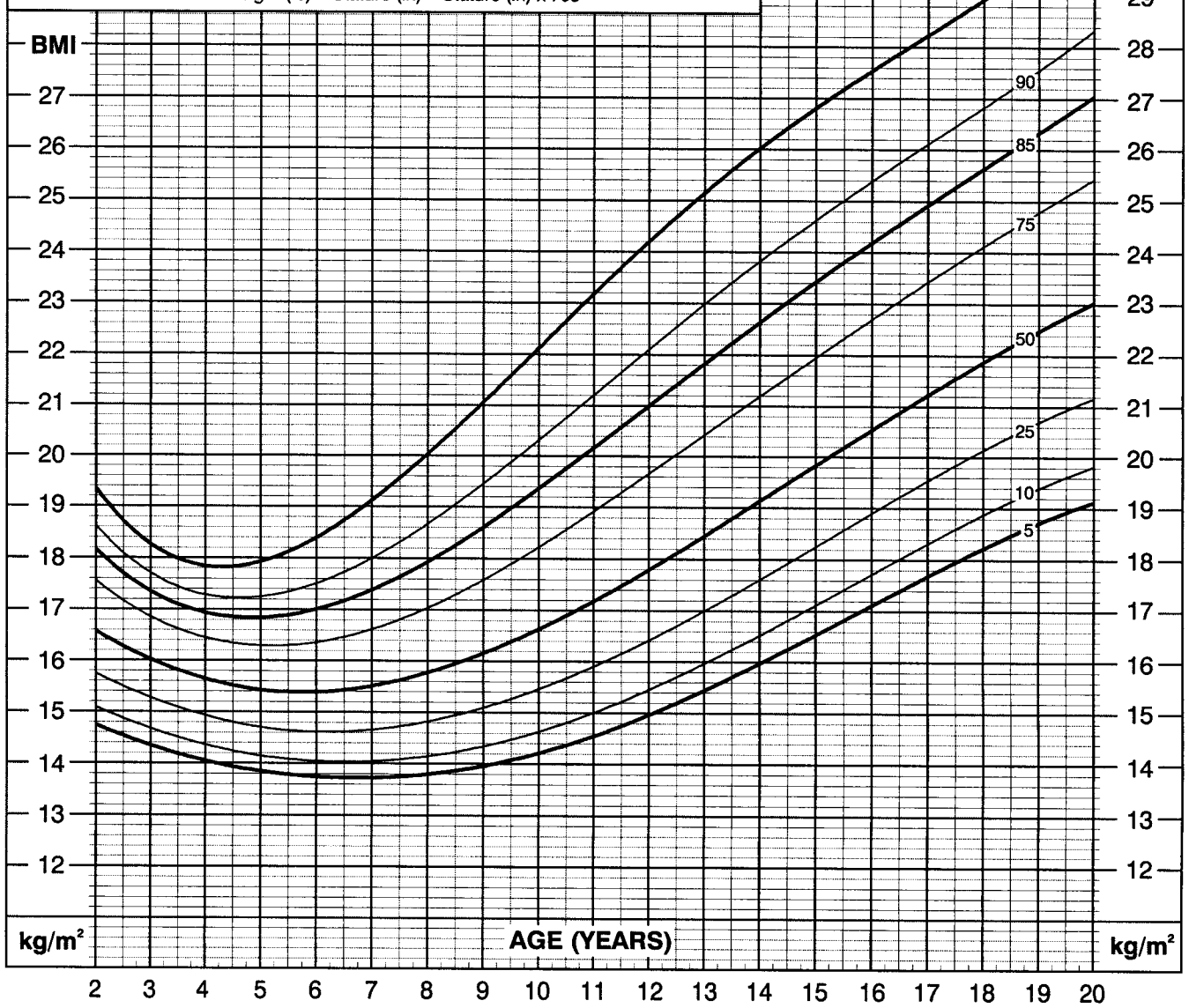
2 to 20 years: Boys
Body mass index-for-age percentiles

NAME _____

RECORD # _____

Date	Age	Weight	Stature	BMI*	Comments

***To Calculate BMI:** Weight (kg) ÷ Stature (cm) ÷ Stature (cm) x 10,000
or Weight (lb) ÷ Stature (in) ÷ Stature (in) x 703



Published May 30, 2000 (modified 10/16/00).
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

CDC
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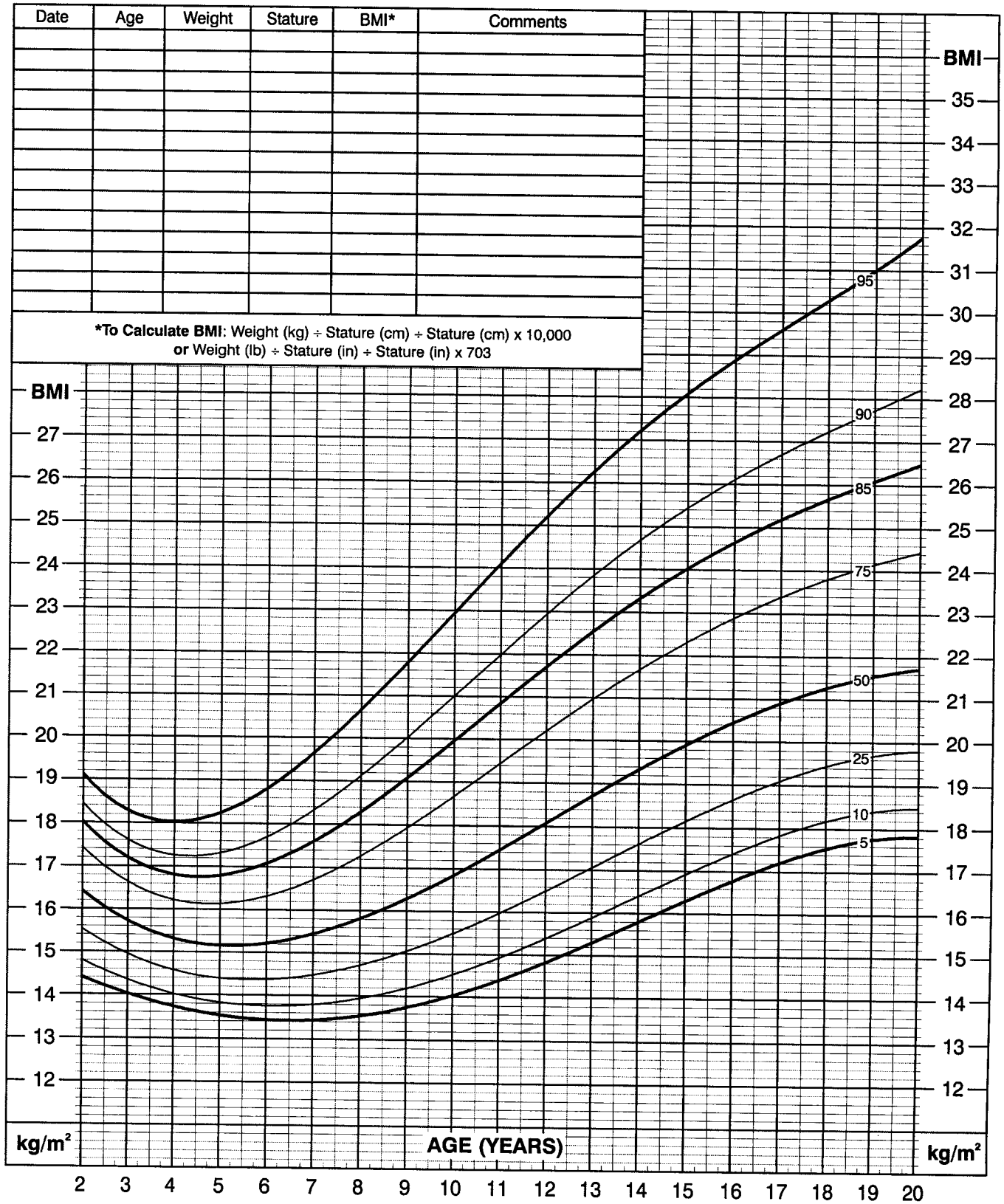
2 to 20 years: Girls
Body mass index-for-age percentiles

NAME _____

RECORD # _____

Date	Age	Weight	Stature	BMI*	Comments

***To Calculate BMI:** Weight (kg) ÷ Stature (cm) ÷ Stature (cm) x 10,000
or Weight (lb) ÷ Stature (in) ÷ Stature (in) x 703



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SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

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Coles County Health Department

P.O. BOX 1064 • CHARLESTON, ILLINOIS 61920

Dear Parent:

The mission of the Coles County Health Department is to assure quality health services through prevention, education, health promotion and protection efforts in a manner that ensures the dignity of each individual served. A Community Health Plan has been developed to maintain this standard. The Community Health Plan assists with the identification of health problems within the community.

One of the areas that have been identified as a health concern for Coles County is heart disease/stroke. Heart disease and coronary heart disease were the leading causes of death for 1990-1996. Coles County is significantly higher than the state crude rate per 100,000 people. Moreover, behavioral risk factors of obesity, sedentary lifestyle and smoking are all above the state rates.

In an attempt to improve the health status of the residents of Coles County, baseline data will be gathered from the school physicals of students in kindergarten, fifth grade, and ninth grade. This data will include the height to weight ratio, blood pressure, diabetic status and gender of the student. In order to ensure the privacy of each student, NO identifying information will be noted, such as the names and addresses of the students. The information gathered will be used to determine the need to change health behavior patterns of school-aged children in order to reduce the incidence of heart disease/stroke.

Great steps will be taken to maintain the confidentiality of each student. However, if you do not want your child's health record accessed, please return the bottom portion of this notice by April 17th to **Cindy Corrie, District Health Office, Charleston High School, 1603 Lincoln, Charleston, Illinois 61920.**

We greatly appreciate your cooperation in this worthwhile endeavor. Should you have any questions or need any additional information, do not hesitate to contact me at (217) 348-0530.

Sincerely,

Julie Dryden

Julie Dryden
Health Educator

_____ I **DO NOT** want data to be collected from my child's medical records.

Parent name: _____

Child's name: _____

School: _____

Grade: _____

825 EIGHTEENTH STREET
CHARLESTON, ILLINOIS

CHARLESTON 217/348-0530
MATTOON 217/258-0530