BMI-for-age Categorization & Demographic Analysis of K-4th Graders in a Western Wisconsin Elementary School

by

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ABSTRACT

Baseline data collection on K-4th grade elementary students (n=232), ages 6-11, attending a Midwest elementary school in Wisconsin included measuring heights and weights to calculate the BMI-for-age-by-gender percentile. Students were then classified as underweight if they were in the lowest 5th percentile, healthy weight (HW) if between the 5th and 85th, at risk of overweight between the 85th to 95th percentile, and overweight if equal to or greater than the 95th percentile. Only 7% of the students were overweight as compared to the national average of 18.8% (NHANES 2003-2004 study). As the grade level increased, the number of HW female students increased, plateauing out in 3rd and 4th grades (93% and 92% respectively), with corresponding decreases in the frequency of girls at risk for overweight or overweight. Percent frequencies of HW males ranged from 73-80% with the exception of 1st grade for which the frequency of HW males dropped to 64%. Interestingly, for males the highest percentage for HW (80%) occurred in kindergarten, while only 63% of the girls at this age were classified as HW. Future research will determine if these weight trends will continue. Analysis of healthy practices utilized to achieve these positive health outcomes is justified.

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Chapter I: Introduction

The prevalence of childhood obesity in North America, as well as internationally, has progressively escalated to levels that are three folds greater than they were two decades ago (DHHS-CDC, 2009; Ogden et al., 2006; Hedley et al., 2004; Schwarcz & Berkoff, 2004). These researchers contend that between 1980 and 2004, the percentages for overweight categorization in our youth (denoted as 6-11 years old) rose from 7% to 19%, while adolescent overweight categorization (denoted as 12-19 years old) increased from 5% to 17%.

This obesity epidemic is affecting every age group, independent of ethnicity. The Centers for Disease Control and Prevention recommends that the BMI-for-age percentile for boys and girls be used for all racial/ethnic backgrounds of children 2-19 years of age (Krebs et al., 2007; DHHS-CDC, 2009). These are based on the BMI-for-age percentiles that take into account the variables of height, weight, age in days (from date-of-birth to date-of-screening), and gender. Using this criterion, a comparison of adiposity of African American children tended to be leaner, while Hispanics/Latinos had higher body fat percentages when in comparison with Caucasian children with similar BMI-for-age percentiles.

As reported by the CDC (2009), this BMI-for-age percentile is divided into four categories, which include underweight (less than the 5^{th} percentile), healthy weight (5^{th} percentile to less than the 85^{th} percentile), at risk of overweight (85^{th} to less than the 95^{th} percentile), and overweight (equal to or greater than the 95^{th} percentile). The two categories that indicate the most risk for a child's health status include: underweight and overweight. The Institute of Medicine (IOM, 2005) stated that the federal government formulated recommended guidelines for schools to effectively screen for BMI-for-age percentiles to accurately classify children's weight status and acquire accurate information for dissemination.

Terminology of weight status categories is not consistent across the literature. One scheme uses the terms: underweight, healthy weight, at risk of overweight, and overweight, while the other uses: underweight, normal weight, overweight, and obese. The DHHS-CDC website (2009) has conflicting messages that denote the classification of equal to or greater than the 95th percentile as both "obese" and "overweight," depending on what section or article is accessed. The latter scheme is more psychologically hindering for parents and children when receiving results, because being categorized as obese has a greater negative stigmatism connected to it. In a society that stigmatizes those who are not the ideal body weight, many serious psychological, socially-contrived circumstances may cause a negative impact on the eating habits of children and adolescents, which ultimately continues into adulthood. These eating habits can range from the most severe weight-related disorder, anorexia nervosa, to the opposite end of the spectrum of excessive energy intake leading to overweight status (Worthington-Roberts & Williams, 2000). Thus, with justification, this thesis will adopt the former scheme: underweight, healthy weight, at risk of overweight, and overweight.

This rise in weight is not without direct or indirect economic burdens to our society. The 2004 national health care expenditures relating to both adult obesity and overweight categorization lead to approximately $98 billion to $129 billion in billing costs, even after adjusting for inflation (IOM, 2005). These statistics were taken at the beginning of the adult obesity upsurge, but didn't factor in the child, adolescent, and teen overweight percentages that just started to incline. Thus, the predicted medical costs for prevention, diagnosis, and treatment in the future will be even more extensive when the additional child health expenditures for weight gain are factored in (DHHS-CDC, 2009).

Moreover, there are barriers such as environmental, behavioral, and genetic risk factors interfering with effective treatment in the reduction and prevention of unhealthy weight gain of

our youth (DHHS-CDC, 2009; Barlow & the Expert Committee, 2007). The environmental influences include parental role models, the school systems, high accessibility to fast food restaurants, as well as affordable technological devices, while some behavioral examples include media and bad eating habits. The genetic risk factor is less controllable, and thus, not as effective in treatment and prevention on our child and adolescent national overweight crisis.

Those students identified as "at risk of overweight" and "overweight" are at an increased risk for earlier on-set of disease. These weight-induced disease diagnoses include hypertension, hyperlipidemia, type II diabetes mellitus, cardiovascular disease, stroke, sleep apnea, and asthma (DHHS-CDC, 2009; Department of Health and Family Services (DHFS), Division of Public Health (DPH), Wisconsin Nutrition and Physical Activity Program, 2008; Office of Disease Prevention & Health Promotion, 2008; Institute of Medicine, 2005). The leading cause of death in Wisconsin from 1995-2001 was heart disease, stroke, and cancer (DHHS-CDC, 2009). Each of these leading mortality causes has a direct correlation to weight-induced diseases.

Statement of the Problem

The need for accurate and reliable collection of height and weight to calculate BMI-for-age percentiles is necessary to acquire valid information for dissemination. The Center for Disease Control and Prevention (DHHS-CDC, 2009), indicated that the gold standard for calculating these statistics accurately for children ages 2-19 is the BMI-for-age percentile, which is plotted on gender specific growth charts to determine weight status categorization.

This investigation will focus on conducting a cross sectional study on the K-4th graders attending the St. Croix Central Elementary School from the St. Croix Central School District in Wisconsin to obtain informational and baseline data. If the parents' requested their child's information, this research also served as a tool to inform parents or guardians about their own child's weight status.

Purpose of the Study

The purpose of this investigation initiated a longitudinal study on K-4th grade students from the St. Croix Central Elementary School in Wisconsin. This baseline data includes heights and weights to calculate BMI-for-age percentiles by gender, which subsequently was used to categorize students into four different weight classifications. Data collection was conducted in January 2009.

Research Questions

This study allows the comparison of St. Croix Central elementary students to both state and national data. In addition, comparisons of gender and grade at this school will be conducted. The following are questions that apply to this specific study.

1) Will there be a significant difference in the BMI-for-age percentile categorization across grade levels?

2) Will there be a significant difference between genders for BMI-for-age percentile and categorization between and within the K-4th graders?

Definition of Terms

The following terms have been provided to further clarify the content covered in this study.

At Risk of Overweight. It is the percentile range that correlates to those children or adolescents that fall between the 85th to less than the 95th percentile (DHHS-CDC, 2009).

Body Mass Index. The DHHS-CDC (2009) defines body mass index (BMI) as a number calculated from a child's or adult's weight and height. Using the metric system, BMI can be calculated as follows:

BMI = weight in kilograms / (height in meters)^2

Body Mass Index-for-age percentage. As stated by the DHHS-CDC (2009), this percentage is determined after the BMI is calculated. Based on sex-specific growth charts, height and weight are used to obtain a percentile ranking. In the United States, percentiles are the most commonly used indicator in children for assessing size and growth patterns. The percentile indicates the relative position of the child's BMI variables (height and weight) among children of the same sex and age. In this study four variables are defined: underweight as less than the 5th percentile, healthy weight as 5th percentile to less than the 85th percentile, at risk of overweight as 85th to less than the 95th percentile, and overweight as equal to or greater than the 95th percentile.

Healthy weight. Is the percentile range that correlates to those children or adolescents that fall between the 5th percentile to less than the 85th percentile (DHHS-CDC, 2009).

Overweight. It is the percentile range that correlates to those children or adolescents that lie equal to or greater than the 95th percentile (DHHS-CDC, 2009).

Stadiometer. Instrumentation known as a height board (i.e. it measures a subject's standing height) that comes in either portable or wall mounted forms (Department of Health and Family Services, 2008).

Underweight. It is the percentile range that correlates to those children or adolescents that are less than the 5th percentile (DHHS-CDC, 2009).

Assumptions of the Study

Assumptions that were formulated before conducting this research project include the following: that the instrumentation utilized in the study (standard scale and stadiometer) were calibrated to acquire accurate and reliable data, that all participants who had parental consent will take part in the complete screening process, and that all screening staff were trained correctly and subsequently measured and recorded heights and weights accurately.

Limitations to the Study

The limitations of this study are apparent in both the defined target population, as well as the most accurate and reliable measuring methods for children or adolescents based on their physical status or body composition. If a child has any body disfigurement that inhibit the student from standing erect, then other methods not provided at this study's screening would be necessary. Students, for instance, who have scoliosis, may have more accurate height measurements by using the knee-height method. Another limitation is that if a student was above 250 lbs. a special scale would be required to collect weight data accurately. Students with special needs may also have different growth patterns, and this may skew the database if the BMI-for-age percentiles are calculated using CDC growth charts for boys and girls without special needs.

When investigating local limitations on this study, the small sample size in one elementary school in the Midwest could be a limiting factor. The St. Croix Central Elementary School may not be representative of the general population, because it is predominately Caucasian students (~99%). Another limitation that could affect the sample pertains to the study relying on parental consent of their children to participate in the study. Also, the accuracy of the anthropometric measures was based on the children's willingness to participate and their compliance in cooperating with the screening staff in wearing light clothing and removing shoes when required. A final limitation involves the chance of human error in recording measurements, which could be overcome by using a computer system that directly imports the results into a spreadsheet. All of these limitations need to be made aware of, and the researcher must utilize the best methods of control to make this project both reliable and accurate.

Chapter II: Literature Review

The information presented in the following chapter covers an in-depth discussion of the negative impacts of the overweight crisis in our society for our general population, and then focuses on child and adolescent circumstances. Subsequent topics will include demographic trends, environmental risk factors associated with schools and parents, behavioral risk factors of media's influence, and putative genetic predisposed risk factors. Next, the consequences of disease risk related to being overweight will be covered. Closing topics will discuss current school screening procedures recommended for BMI-for-age percentile collection, as well as the discussion of misclassification and its negative outcomes on our children's psychological development.

Obesity Epidemic

The United States and Wisconsin are currently dealing with a progressive health crisis with escalating numbers appearing on our scales measuring body weight, as well as correlating with increasing BMI statistics and categorization. It was stated by chief consultants Schwarcz and Berkoff (2004) that North American adults epitomize these trends as evidenced by the increasing percentages of overweight individuals at 60% and 20% being categorized as obese. The 1999-2002 National Health and Nutrition Examination Survey (NHANES) revealed that the percentage of obese adults over the age of 20 amounts to approximately 60 million individuals (National Center for Health Status, 2004). Being overweight or obese is denoted as the primary nutrition health concern of our time. Commercial weight loss programs and diets take $33 billion dollars a year from Americans, but are short-term fixes that lack sustainable results. Thus, medical and nutrition professionals have been increasing their efforts to assist their patients and clients with more effective weight control methods.

There is a great deal of focus on prevention, especially for school-aged populations, in an effort to reverse these current trends (Barlow & the Expert Committee, 2007). Evidence found by Whitaker, Wright, Pepe, Seidel, and Dietz (1997) indicated a strong correlation of parental obesity linked to obesity in our youth and young adults. These predisposing circumstances indicate that prevention efforts must begin early on. In addition, these researchers stated children of normal body weight who have either one or more parent who is obese, have a higher risk of becoming obese as young adults themselves. It is, thus, evident that intervention is needed at all age groups and weight classifications to prevent further statistical peaks on BMI scores for adults and BMI-for-age percentiles in children and adolescents.

Childhood & Adolescent Overweight & Obesity Trends.

Childhood obesity has escalated by three-fold over the past 20 years as indicated in NHANES (DHHS-CDC, 2009; Ogden et al., 2006; Hedley et al., 2004; Schwarcz & Berkoff, 2004). The U.S. Department of Health and Human Services (2008) stated that their goal was to have classification of overweight children under 5%. The reality was that the actual figures were more than twice the target percentage at 11%, observed in the 1988-1994 NHANES III study. When looking at national measures of height and weight done every 5 years by Ogden et al. (2006), as part of the NHANES data of 1999-2004, it indicated that the prevalence of overweight percentiles in children increased from approximately 5% in 1963-1970 to 17% in 2003-2004. Additional confirming 2003-2004 survey results found in Wisconsin's youth aged 10-17 that 13.5% are overweight (National Survey of Children's Health (NSCH), 2008). These statistics have alarmed many health professionals from public health agencies, health researchers, clinicians, dietitians, and the general public. The NCHS, a division of the U.S. Department of Health and Human Service (2006), found that over 9 million children and teens between the ages of 6-19 are defined as overweight, which equates to 16% of this age grouping. The weight gain is

evident at all age levels. The prevalence of overweight children ages 2-5 increased from 5.0% to 13.9%, for adolescents aged 6-11 prevalence increased from 6.5% to 18.8%, and for older youth aged 12-19 it increased from 5% to 17.4% (Ogden et al, 2006). These statistics are generalized for the entire United States children, adolescent, and teen population, but many variables differentiate the prevalence of overweight status within specific groups.

Demographic trends. A differential between socioeconomic status of household providers, race/ethnicity, and gender differences have been shown as predictors of varying degrees of overweight status in children and adolescents. According to the Department of Health and Family Services (2008), and Ogden et al. (2006), low-income families tend to have less access to intervention programs, and thus have an increased risk of becoming overweight. It is also frequently evident that those youth who are categorized as being overweight will not receive treatment. This is due to a lack of medical insurance or their insurance plans do not cover this type of service.

Researchers Gordon-Larsen, Adair, and Popkin found that those female subjects of similar socioeconomic statuses who were non-Hispanic whites had lower predicted overweight probabilities (BMI of $\geq$ 95th percentile Centers for Disease Control and Prevention/National Center for Health Statistics 2000), while this was not evident among non-Hispanic black girls. Another resource that documents ethnic weight segregation was conducted by Ogden et al. (2006), which stated that in 2003-2004 the two particularly high overweight groups were black girls at 24% and Mexican boys at 22%. As reported by the 1999-2002 NHANES survey reviewed by Ogden et al. (2002), it is stated that non-Hispanic white children ages 12-19 had lower obesity rates at 14%, while non-Hispanic blacks and Mexican Americans were higher with 21% and 23%, respectively. It was also stated by DHHS-CDC (2009), Ogden et al. (2006), and Hedley et al. (2004) that boys age 12-19 varied in overweight percentages from 1988-1994 data

to 2003-2004 data as follows: non-Hispanic white boys went from 11.6 to 19.1%, non-Hispanic black boys from 10.7 to 18.5%, and Mexican-American boys from 14.1 to 18.3%. These statistics were also calculated for girls, and the results were non-Hispanic whites increasing from 7.4% to15.4%, non-Hispanic blacks from 13.2% to 25.4%, and Mexican-American from 9.2% to 14.1%. All of these percentages indicate a distinct differentiation from one ethnic group to the next. In particular, non-Hispanic blacks and Mexican-Americans were indicated as being at greater risk. However, the latter comparison data of boys indicated a trend showing greater obesity in all categories, as evidenced by the plateauing off around 18-19% for all groups. For the girls, the greatest weight gain above all gender and race groups ended up being non-Hispanic black at a peak of 25.4%. The objective would then be to create intervention programs that would be developed specifically for these ethnic and gender distinctions. However, it is evident that regardless of the child's make-up or background, there is a definite elevation in all children across our nation.

Environmental risk factor: Schools. The primary role of the school is to support and promote healthy nutrition and physical activity by offering recess, athletic events, providing nutritious meals, and developing polices to ensure students are eating healthy foods and beverages, while minimizing competitive foods and low nutrient-packed vending machines (Koplan, Liverman, & Kraak, 2005). The current trend in schools is transitioning to provide more healthy options to their students such as salads and wraps, but cafeterias across our nation still offer saturated and trans fat foods such as French fries and other processed convenience foods simultaneously (Schwarcz & Berkoff, 2004). These circumstances set up a dilemma for the students to select which items to consume and most adolescents are gravitating to foods that are unhealthy for them, leading to our students' poor nutritional status.

A healthy lifestyle should be the primary focus when trying to maintain a healthy body weight. It was stated by the Department of Health and Family Services (2008) and Barlow and the Expert Committee (2007) that the essential steps to maintain a balanced lifestyle consist of regular exercise, healthy eating habits, and a supportive environment to nurture positive growth. The full circuit of families, schools, and communities provide a part of the solution to overcoming this current epidemic. Both families and the societies they reside in play an integral part in influencing a student's lifestyle habits more powerfully than the school environment alone. This is not an indication that the school is not an influential tool, but it states that no one part carries the full burden of our youth's current weight status.

The Department of Health and Family Services (2008) has coordinated a school health program that advocates for health education, physical education, health services, nutrition services, healthy school environment, etc., but the school cannot address this multifaceted problem on their own. They have the assets to provide and promote, but require support from the larger community. Even community members can make an impact at this level by bringing forward topics of concern around their children's access to resources to positively impact the wellness of their community's children.

Environmental risk factor: Parents. The parental influences, or more specifically the gatekeepers of the household, serve as a role model to provide and prepare healthy foods for their child (Barlow & the Expert Committee, 2007; Schwarcz & Berkoff, 2004). This is done by interacting with them at regular meal times, as well as allowing their child to indicate their satiety level. Family meals have been associated with higher quality diets that benefits weight and psychological status. Oftentimes, when the growing period begins around the age of ten, eating habits change and consumption increases. It is up to the parents to set a strong foundation such as the Schwarcz and Berkoff's (2004) recommendations: snack on healthy foods, prepare

meals as a family, and follow a child's natural appetite; also avoid unnecessary sugary beverages, excess sodium consumption, forcing the "clean your plate" method, or using food as a bribe. If the parent provides food items that meet the child's basic daily requirements for macronutrient sources such as protein, fat, and carbohydrates, as well as a variety of vitamins and minerals from a variety of food sources, then children will be more apt to selecting these foods when they are confronted with peer pressure or media sources (Schwarcz & Berkoff, 2004). Parents are the tool to making healthy foods accessible to their child. This is done through emphasizing foods that are lean such as chicken instead of processed meats; another example is choosing yogurt over high sugar foods, such as pudding. These food habit modifications will help children avoid intake of unnecessary fats, sugars, and artificial flavorings or colors in the foods they choose. As stated by the DHFS-DPH-Wisconsin Nutrition and Physical Activity Program (2008) and DHHS-CDC (2009), they advise some additional suggestions for parents including the following: consume 9 servings of fruits and vegetables as recommended by the U.S. Department of Agriculture (USDA), consume a diet rich in calcium and high in fiber, limit energy dense foods, control portion sizes, provide balanced portions of macronutrients based on the daily recommended intake (DRI) for age, and also minimize television viewing to less than 2 hours a day.

Behavioral risk factor: Media. In accordance with the Institute of Medicine (2005), the advertising world is maximizing its profits through media sources such as: television, the internet, radio, movies, etc. that are negatively impacting children by promoting unhealthy food options and sending biased messages when skinny actresses consume fatty foods with no effect (Koplan, Liverman, & Kraak, 2005). The Kaiser Family Foundation 2005 Survey reported that the typical U.S. adolescent of ages 8-18 on average views 44.5 hours per week of some source of media device such as televisions and computers outside of the school (Department of Health &

Family Services, 2008). Television commercials on Saturday morning cartoons are directed to foods such as candy, processed items, and high fat fast foods providing minimal nutritional value. One of advertising's main focuses is sugary beverages such as soda. This product's advertising increases consumption of the item, and the Lancet Medical Journal revealed that a regular soft drink a day increased the risk of a child becoming overweight by 60% (Schwarcz & Berkoff, 2004). Consumption of fatty fries and hamburgers when consumed with soda negatively impacts body metabolism by causing the pancreas to excrete excessive insulin resulting in the body storing the fat instead of burning it. Thus, these two key advertising focuses of fast food and soda consumption are having irreversible effects on these children's fat stores earlier on in life.

In addition, the combination of excessive intake and increased sedentary activities in front of media devices is proposed to decrease basal metabolic rates (Department of Health and Family Service, 2008; Coon & Tucker, 2002). These factors result in fewer calories being burned, which would be less than if the child was sleeping. The prevalence of overweight has a positive correlation with the number of hours children watch television in the national cross-sectional surveys. As reported by the Department of Health and Family Services (2008), the 2007 Youth Risk Behavior Survey (YRBS) stated that television watching in 49% of students was at least two or more hours per day, leaving little time for exercise. The young minds of children are fascinated by new technologies and media devices, which provoke excessive sedentary activities. As reported by the NHHS-CDC (2009), media displaces physical activity, as evidenced by the average of 3 hours per day spent viewing and utilizing media devices.

Yet, some media is transitioning to incorporating more positive messages to the child population. The United States Department of Agriculture (USDA, 2008) has a commercial using Disney animation to provide nutrition education to children about the bare necessities of healthy

living habits such as eating from all the areas on the food pyramid and being active while still having fun. The U.S. Department of Health and Human Services, Division of United States Department of Agriculture (2008) produced the 2005 Dietary Guidelines for America, and utilized these standards to produce the positive messages in this commercial. The key recommendations this commercial advocates are as follows: to get at least 60 minutes of physical activity on most days of the week, consume half of their grains whole, consume, depending on age, two to three 8 oz. glasses of low-fat or skim milk, etc. The USDA is trying to reach children through media sources, and in turn try to help the general population, especially children, meet their intake and physical activity needs.

Genetic risk factors. The human genome has not significantly changed in the last three decades. The three-fold increase in overweight children is only partly due to genetics. The general trend observed is that those families with obese parents tend to have obese children. Whitaker, Wright, Pepe, Seidel, and Dietz (1997) found that children younger than 10 years of age regardless of their weight status and who have obese parents are more likely to have altered body weight in their adulthood. The child's predicted weight status is based on two primary influences including exposure to similar environmental factors and/or shared genes. Genes affect the body through various mechanisms such as signaling appetite, satiety, fat distribution, and metabolism, which are controlled by hormone levels that are produced by different biochemical pathways. Oftentimes, external factors such as food choices, supplement use or medications can alter gene activity. As such, some individuals may be genetically more prone to obesity than others. Although genetics do play a role in susceptibility to obesity, the environmental and behavioral factors have a greater determining factor on the child's risk of being obese as an adult (Barlow & the Expert Committee, 2007).

Disease consequences & risks. Disease risk is greatest to those individuals defined as equal to or greater than the 95th percentile (DHHS-CDC, 2009). According to the NHHS-CDC (2009), the DHFS-DPH-Wisconsin Nutrition and Physical Activity Program (2008), the U.S. Department of Health and Human Services (2008), and Barlow and the Expert Committee (2007) health risks for overweight individuals include hypertension, hyperlipidemia, gallbladder disease, osteoarthristis, respiratory problems, sleep apnea, asthma, and some cancers. Also, being an overweight child was the primary influence on increases of pediatric hypertension, type II diabetes mellitus, both risk factors for coronary heart disease, and joint stress. Another health concern is that once a child becomes overweight, the production of fat cells will never be reversed. Schwarcz and Berkoff (2004) reported that fat cells in the body will remain at the highest level their body produces for the rest of their lives. These cells will never decrease in number, but are able to increase in size to accommodate for more fat storage or replicate into more storage cells. Obese adults tend to store fat more readily versus those who were thinner during their younger years due to their pre-existing large adiposities. There is also a risk of low self-esteem development due to discrimination from peers and adults in their lives (Department of Health & Family Services, 2008; U.S. Department of Health & Human Services, 2008). It is important that professionals disseminate weight categorization in a sensitive manner to avoid triggering eating disorders or other compulsive eating habits (Schwarcz & Berkoff, 2004). This source also documented that poor diets can lead to high cholesterol that could cause fatty deposits building up in arteries leading to angina, heart attack, stroke, and/or cardiovascular disease. A cardiovascular disease (CVD) study conducted on a population of 5-17 year olds that was researched by Krebs, Himes, Jacobson, Nicklas, Guilday, and Styne found, "60% of overweight children had at least one CVD risk factor, while 25% of overweight children had 2 or more CVD risk factors" (NHHS-CDC, 2009, n.p.). The NHHS-CDC (2009) approved Must's

and Anderson's research that stated overweight children and adolescents will often develop type II diabetes mellitus, leading to cardiovascular and kidney health problems.

The diagnosis of these various diseases are strong indicators that monetary support early on in areas of prevention will defer more extreme medical bills that will accumulate if this epidemic continues. Screening for height and weight, as well as calculating BMI-for-age percentiles to categorize risk of children being overweight is worth our medical professionals' and school districts' time. Preventing weight-induced diseases will have a positive effect on society in many ways.

BMI-for-age Screening

According to researchers Nihiser, Lee, Wechsler, McKenna, Odom, Reinold, et al. (2007), they found that the implementation of school screenings for BMI measurements is both widely accepted, yet still controversial in identifying the percentage of students who are at risk of having weight-related problems. This study indicated that BMI screening meets most of the standards established by the American Academy of Pediatrics for screening to identify specific health conditions. It is important for schools to evaluate screenings to verify their overall effectiveness. Key focus areas include the following: the parents' and children's weight-related knowledge levels, their attitudes, and their behaviors; schools should also have established safeguards to decrease the risk of harming students, provide a safe and supportive environment for students that require assistance, and initiate science-based interventions to positively increase awareness on healthy eating to physical activity. It is also important to provide the parents with a clear and specific explanation of what their children's BMI-for-age percentile results mean and what is the appropriate action that should be taken after providing that information. The families need to have a safe environment to obtain resources to make a positive impact in the children's lives. However, Crawford et. al. (2006) indicates that this process takes a lot of time and

resources, which school districts are currently struggling with because of restricted budgets. Further nutrition economic analysis is necessary in order to determine if BMI screening in schools is really the best alternative for allocation of school resources to improve overall health status of our children.

Another area of concern is ensuring that this information does not negatively impact the growing children and adolescents. It is known that children and adolescents can grow at different rates, even within their defined sex and age specific trends (Crawford, et. al., 2006). And it is normal to have varying heights and weights, but this could contribute to miss categorizing a child's weight status. To reduce the risks of harming the students in both the BMI measurement and disseminations process, some safeguards need to be put in place such as follows: introduce the screening to the school staff, acquire parental consent before beginning research, train staff members, guarantee privacy for the students, use calibrated equipment, and evaluate program outcomes to make overall improvements (Nihiser et al., 2007). These critical aspects were built into the methods of this study.

Chapter III: Methodology

This section on methodologies covers topic areas such as selection and description of subjects, as well as the instrumentation and screening procedures used for anthropometric data collection. Then, specific details on procedures for data analysis are discussed. The conclusion of this chapter focuses on the limitations pertaining to the methodologies used in this study.

Subject Selection and Description

Approval from the Institutional Review Board (IRB) at the University of Wisconsin-Stout was obtained (Appendix A). The public elementary school of the Robert-Hammond school district was defined as the target population of interest for this study. The target population of interest was further defined for the cross-sectional study by focusing on the kindergarteners to fourth graders attending school during the 2008-2009 school year. Permission from the superintendent of the school district and the elementary school principal was verbally granted.

In order to obtain participants from this population, an initial letter to the parents, information sheet, and consent form were distributed to parents or guardians of children in the K-4th grades during the month of December 2008 (Parental Consent Letter, Informational Sheet, and Consent Form placed in Appendix B, C, and D, respectively). The parents were asked for permission of their child's participation in this study by returning the signed consent form to the elementary school.

The primary data collection tools utilized for this research included the standard scale and stadiometer (Detecto Physician's Balance Beam Scale and Portable Stadiometer; Model #338). These pieces of equipment, owned by the university, were calibrated by the researcher. Each measurement was taken 2 to 3 times to avoid errors. The next tool utilized was the CDC BMI-for-age calculator (DHHS-CDC, 2009) that plotted the child's percentile on age and sex-specific

growth charts. This percentile was used to define the child's weight status (Table 1) into one of four groups: underweight, healthy weight, at risk of overweight, and overweight.

Table 1

BMI-for-age by Gender Categorization

Weight Status Category	**Percentile Range**
Underweight	Less than the 5th percentile
Healthy weight	5th percentile to less than the 85th percentile
At Risk of Overweight	85th to less than the 95th percentile
Overweight	Equal to or greater than the 95th percentile

Data Collection Procedures

Data was collected on January 8th & 9th, 2009 according to a schedule that was arranged with the teachers of the K-4th grades with assistance from the principal. The following procedures were conducted based on the guidelines from the Public Health Nutrition and Physical Activity Program (2008) with modifications.

Step 1: Selection of Assistants & Training

A team of four research assistants, who were all graduate students in the Human Nutritional Sciences concentration (Food & Nutritional Sciences Masters Program), were recruited and trained by the researcher on how to accurately conduct the measurements and abide by the confidentiality rules (Training Manual in Appendix E). Research assistants were required to provide a copy of their Human Subjects Training certificate to the researcher prior to the screening.

Step 2: Preparatory Screening Procedures

The researcher obtained the student's name and date-of-birth from parents on the returned consent form. Then assignment of randomized identification numbers for each participating child was conducted. Prior to the day of screening, a form created in Microsoft Excel® was developed (Appendix F) containing the following variables:

student's name (last, first), student ID, student birth date, gender, date of measurement, height measurements within 1 cm, and weight measurements within 0.1 kg. This form was utilized for check-in purposes and logging measurements on the day of the screening.

Step 3: Height and weight measurements

Next, on the day of the screening two stations were blocked off to establish privacy for the children. Each child had a sticker placed on their shirt containing their unique ID number, and this sticker was disposed of before the child left the screening area. Then the research assistant began measuring the height of the child with the calibrated stadiometer at station one. The stadiometer was calibrated at two points during the day: eight a.m. and noon. First, the child was requested to remove their shoes or hair accessories that may skew the measurement. Then the child was told to stand against the stadiometer with legs straight, heels together, arms to the sides, while looking straight forward. The research assistant then placed the stadiometer headpiece so it touched the crown of the child's head. It was important that the assistant read the measurement straight on in order to avoid parallax. The measurement was read to the nearest 0.1 cm for this study and was repeated at least twice with values being within 1 cm of agreement. Each height measurement was recorded immediately on the form discussed in Step 2. Later, the researcher averaged the obtained measurements.

Then, the child moved to the second station where another research assistant collected the weight on a standard scale that was calibrated before the screening, as well as at noon. The research assistant asked the child to remove any heavy items such as sweaters, as well as keep their shoes off. The child then stood erect in the center of the scale platform. The weight was recorded to the nearest 0.01 kg in this study, and it was conducted twice or a third time with weights agreeing within 0.1 kg. This data was then

entered on the form in Step 2, and the child was allowed to go back to their classroom with the escort after discarding their sticker in the garbage. Later, the average of the measured weights was calculated.

Step 4: Data Calculations

The child's height, weight, and date-of-birth, as well as the day of the screening were used in calculations. BMI was determined in two primary ways to verify accuracy: 1) CDC calculator tool and 2) manual calculation using equation kg/m^2. Then, the BMI-for-age percentiles were also calculated using the same CDC calculator stated above and plotted on the age and sex specific growth charts. Parents who requested to be informed about the results received a letter in February reporting the child's height, weight, BMI, BMI-for-age percentile, and categorization (Appendix G). A general statement was made that if the parents had any concerns they could contact the researcher directly or acquire further assessment from a physician.

Data Analysis Procedures

Statistical analysis was conducted using the Statistical Program for Social Sciences (SPSS, version 16.0) licensed by the University of Wisconsin-Stout. The variables of interest were entered into the SPSS program to analyze the descriptive measures such as averages, maximum, minimum and frequency for BMI-for-age percentiles, categorization, grade, and gender (descriptive variables). ANOVA, chi-squared, and t-test analysis (as indicated in results) were used to determine if correlational relationships exist between and within variables.

Limitations of Methods, Sample, and Procedures

The predominant limitation pertaining to this research involved the sample size being localized in one elementary school in rural Wisconsin. This study also did not provide any special equipment for those individuals who may have been disabled or excessively overweight.

Other limitations of this study were that we had a child with disabilities and measured the weight and height of the child with the same standard scale and stadiometer. The weight was probably skewed, due to the fact that the student was supported by his/her teaching assistant. This was done on both pieces of equipment. The data collected from this student was not used in the statistical analysis, because the results were not considered accurate and reliable. The better option would have been to use the knee height tool for the child, because the child's body disfigurement inhibited his/her ability to stand erect. Children with disabilities or diseases have different growth patterns that require special growth charts based on their specific age and gender trends as well. Also, excessively overweight children above 250 lbs would require a special scale of which was not provided at this screening. Other limitations of the study were related to students who did not participate through the complete screening process due to absentees or inability to participate, even though parental consent was obtained. Another issue to mention is child compliance with the procedure requirements to obtain accurate measures. For instance, some of the children did not wear light clothing under their sweatshirts. Procedures suggest removal of heavy items, so this could impact the results as well. These limiting factors affected the researcher's ability to make generalizations about this sample to all elementary school districts in the state of Wisconsin and nationwide. This research was best suited for extrapolation to similar schools in the mid-west area. Another limitation is that manual scales were utilized without digital instrumentation that could automatically transfer the measurements to a data base in a computer system. This additional piece of equipment would eliminate possible human errors that can occur. One error was verified, but the data was corrected before analysis was conducted on the sample.

Chapter IV: Results

This chapter will cover an in-depth overview of the study's results, obtained by conducting item analyses, on both descriptive and correlational relationships. The initial research questions will also be summarized based on the results found.

Item Analysis

Although 237 consent forms were returned, a total of five students were absent or unable to participate during the screening period, which yielded a sample size of 232 students in grades K-4th. The participation rate was 42% with a total student elementary population for K-4th grades of 556 students. The students ranged in age from 6-11 years of age. The participation rate in each grade was relatively equivalent with grade (Table 2) and gender (Table 3).

Table 2

Participating Students by Grade

Grade	*Frequency*	*Percent*
Kindergarten	40	17.2%
First	53	22.8%
Second	47	20.3%
Third	51	22.0%
Fourth	41	17.7%

Table 3

Participating Students by Gender

Gender	*Frequency*	*Percent*
Female	114	49.1%
Males	118	50.9%

The distribution of participating students in regards to weight classification, as well as further sub-classification by gender is summarized in Table 4. Cross tabulation analysis found that there were no significant differences between number of males and females when looking at all three categorizations as follows: healthy weight, at risk of overweight, and overweight. The Pearson's coefficient was $p = 0.315$, indicating no significance based on the alpha <0.05 or a 95% confidence interval. The majority of students were healthy weight, but 24.2% of participants were either categorized as at risk of overweight or overweight. The percentage of healthy weight students was 75.2%.

Table 4

Frequency of Students by CDC Categorization: Total & Separated by Gender

Categorization	***Total Frequency*** *Boys / Girls Freq.*	***Total Percent*** *Boys / Girls Percent*
Underweight*	**2** x/x	**xx** xx/xx
Healthy weight	**173** 85 / 88	**75.2%** 73.3% / 77.2%
At risk of Overweight	**41** 20 / 21	**17.8%** 17.2% / 18.4%
Overweight	**16** 11 / 5	**7.0%** 9.5 % / 4.4%

* Due to a risk of disclosing the identity of participants, students in the underweight category are excluded from gender calculations. Underweight status is an additional health concern, but not the main focus in this thesis.

Another consideration is to separate the data by grade levels (Table 5). A cross tabulation of CDC categorization by grade found no significant relationship based on a Pearson's coefficient of $p = 0.255$. For all grade levels, two-thirds to three-fourths of the children fell into the healthy weight group, with the first grade being the lower limit. The third grade had the upper limit for the most students with optimal weight. It is also evident that there are less

overweight students in each grade versus at risk of overweight students. A One-way ANOVA with Tukey post hoc test indicated that there was no significant difference between any of the grades with respect to percentile calculations. This is a positive aspect, because it indicates consistency from one grade to the next.

Table 5

Frequency of Students by CDC Categorization & Grade

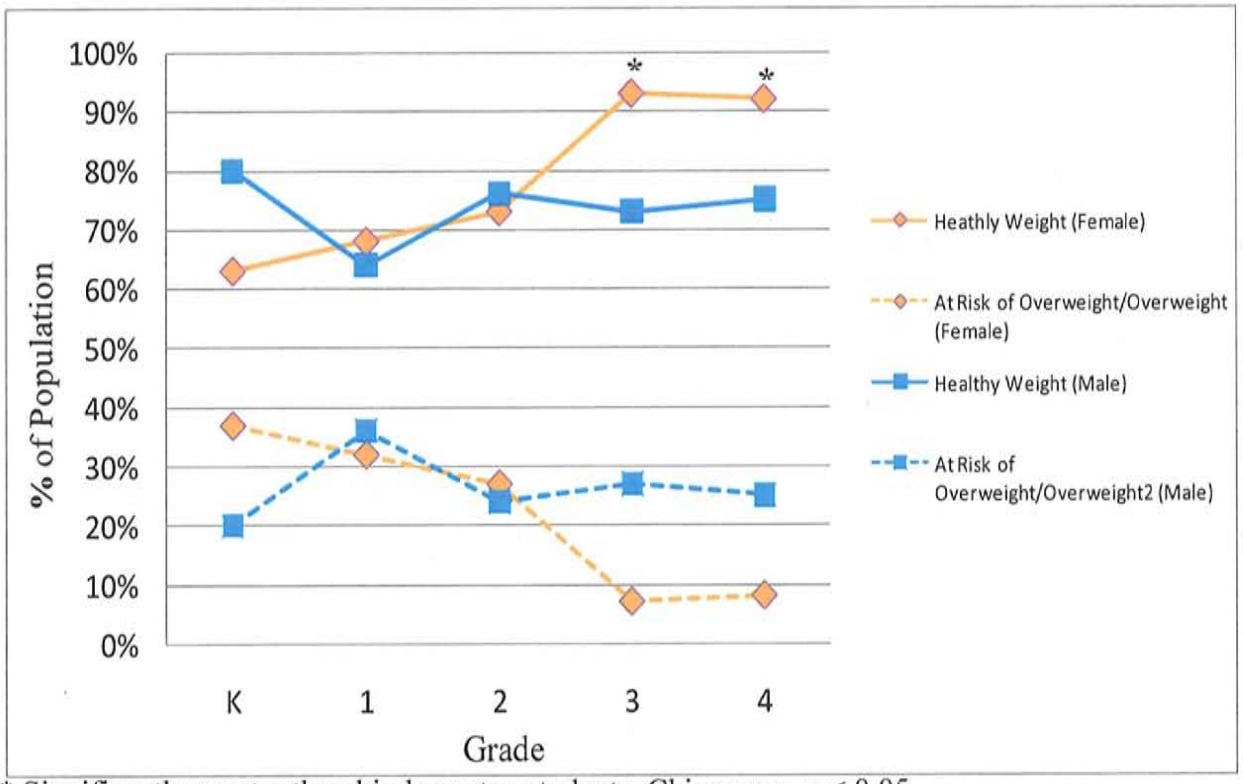
CDC Categorization	*Grade*				
	K	*1*	*2*	*3*	4
Underweight*	x (x)	x (x)	x (x)	x (x)	x (x)
Healthy Weight	28 (72%)	35 (66%)	35 (75%)	42 (84%)	33 (81%)
At Risk of Overweight	7 (18%)	14 (26%)	8 (17%)	6 (12%)	6 (15%)
Overweight	4 (10%)	4 (8%)	4 (9%)	2 (4%)	2 (5%)
Total	39	53	47	50	41

* Due to a risk of disclosing the identity of participants, students in the underweight category are excluded from these calculations. Underweight status is an additional health concern, but not the main focus in this thesis.

Further analysis from an additional cross tabulation between gender, CDC categorization, and grade level is indicated in (Figure #1). From this analysis, data from at risk for overweight and overweight were combined. For females a significant improvement in weight status was observed as the grade level increased (Pearson Chi-Square of 9.352^{a} and a Pearson's coefficient of $p = 0.053$). The likelihood ratio was at 10.498 with a significance of 0.033. For males, no significant relationship was found between grade level and CDC categorization (Pearson coefficient of $p = 0.791$ and likelihood ratio of $p = 0.798$).

Figure 1

Frequency of Students by Gender, Categorization, and Grade



* Significantly greater than kindergarten students, Chi-square, $p < 0.05$

It was interesting that the males had the highest percentage of healthy weight children in kindergarten at 80%, while the females in kindergarten had 63%, the lowest for all grade levels. The range for healthy weight frequency percentages in girls from K-4th was from 63-93%. Males had a smaller range of 64-80%.

Chapter V: Discussion

This chapter provides the conclusions from the data and discussion regarding their meaning in relationship to existing state, national, and international trends. The remaining section will provide recommendations to the school district and those schools that this information can be generalized to, about maintaining and reducing the prevalence of overweight children, as well as the importance of using BMI screening to track weight status trends.

Limitations

The limitations of this study are predominantly based on the sample being from one rural elementary school. This factor makes it difficult for these statistical findings to be generalized to schools that are not similar at the state and national levels, as well as internationally. One of the key reasons this data cannot be applied to the greater population is due to the lack of diversity in this rural community. This elementary school's demographics are 99% Caucasian whereas the statistics for Wisconsin are 89.9% Caucasian, while at the national level, Caucasians make-up only 80% (U.S. Census Bureau, 2009). Another limitation concerns not having available equipment to accurately measure disabled or excessively overweight children. This was an issue with one student who had a disability, but that information was not included in the analysis of this research. Also, the compliance of the participants, as well as completion of the entire screening was a concern. Lastly, the fact that the data was recorded by a research assistant versus directly importing the measurements into a computer system was another limitation.

Conclusions

At the state level, The DHFS-DPH-Wisconsin Nutrition and Physical Activity Program (2008) reported that data on overweight children ages 5-13 years is limited. That is why this research in a Wisconsin rural elementary school can add to the current body of knowledge on the child overweight crisis. Other Wisconsin state schools and communities have conducted

research, but data hasn't been released at this time. However, one study conducted in Wausau, Wisconsin by Hughes, Murdock, Olson, Juza, Jenkins, Wegner, et al. (2006) found overweight percentages of 14.8% in second graders and 16.5% in fifth graders, which is much higher than the 7% overweight students in this study. In addition, there were two other recent thesis projects that focused on BMI screening in the Menomonie, WI elementary schools. The most recent study conducted by Kelly Samz, R.D., C.D., (n = 66) found that 66% were healthy weight, 19% were at risk of overweight, and 14.5% were overweight (Samz, K., Personal Communications). The other research was conducted by Diane Rasmussen (2007), who reported on 42 subjects as follows: 2.4% underweight, 54.7% healthy weight, 26.2% at risk of overweight, and 16.7% overweight. Both of these studies of Menomonie elementary children were higher in comparison to the St. Croix Central Elementary School data for at risk of overweight and overweight categories. Another important point at the state level is that the St. Croix Central Elementary School sample population is very comparable to the male and female percentile distribution for the state of Wisconsin for children ages 1-24 (Health of Wisconsin Report Card, 2007). This was indicated as approximately 50% boys and girls. Thus, when additional state information is released, further comparative analysis can be made in the future. Yet, even though there is minimal data on state trends, more available research has been produced at the national and international levels.

The national data for overweight status in our youth, ages 6-11, has increased from 11% to 19% from the 1988-94 to the 2003-2004 NHANES Studies (2006). This report used the estimation for overweight categorization at or above the 95th percentile for the sex-specific BMI growth charts, which was parallel to the methods in this study. The 2010 national health objective formulated a goal to reduce the overweight status of our nation's children to less than

11%. It is not clear if this Wisconsin elementary school achieved this goal or has never exceeded more than 11% of its student population to be overweight.

Some additional regional urban studies in the United States have been reported. The first study was on forty-one elementary schools in New York City's Westchester County, with a primary focus on BMI-for-age percentile categorization (Table 6) of children in grades kindergarten, second, and fourth (Spano, 2007). This study found that 34% of the student population were overweight or at risk of overweight. The second study focused on a larger population New York City public elementary school children (Table 6, Thorpe, List, Marx, May, Heigerson, & Frieden, 2004). A third study, also shown in Table 6, in northern Florida reported 36% of its students in grades K-8th carried excess weight (Johnson, Pilkington, Deeb, Jeffers, He, & Lamp, 2007). In contrast, the St. Croix Central Elementary School had 75% of its student body classified as healthy weight and only 25% at risk for overweight or overweight.

Table 6

Weight Status Profiles Reported from Multiple Studies

Weight Status Category	**NY counties**	**New York City**	**FL**	**National***	**St. Croix Central**
Underweight	3%	4%	2%	4%	--%
Healthy Weight	63%	29%	62%	64%	75.2%
At risk of Overweight	17%	43%	17%	15%	17.8%
Overweight	17%	24%	19%	17%	7.0%

* Calculated from NHANES data for 4-10 year old children (cited in Spano, 2007)

BMI-for-age research has also been conducted internationally. However, the vast majority of that research has found variations in weight status trends by gender in comparison to

this study. A study conducted on adolescents and teens of both genders found that the prevalence of the BMI-for-age percentiles for the categorizations of at risk of overweight (85^{th} to 95^{th} percentile) and overweight ($\geq 95^{th}$ percentile) were significantly higher in girls versus boys in the age range of 11-18 (Kelishadi, 2003). These findings were for an Iranian population, but there was also supported British research as well. These researchers found that girls in both developed and developing countries were more overweight versus boys in these stages of development (Kelishadi et al., 2003; McCarthy, Ellis & Cole, 2003). These international findings may be a predictor of what the girls' weight status will be in the future.

Thus, the St. Croix Central Elementary School has shown to have overall higher percentages of healthy children than the state, national, and international trends. Future studies are necessary to look closer at the trend of rural elementary schools, such as the longitudinal studies being conducted on the Menomonie School District. The focus of long-term and broader research would produce a better representation of the children's weight status trends over time. These curves can then be utilized to focus on each child's growth patterns. For instance, if a child is consistently above the curve and grows in a linear fashion, then this is an indication that the child is growing in a healthy manner based on their genetic make-up. The key focus is looking for spikes in weight gain. This would be an indication for intervention and weight management. Overall, it is warranted that further long-term longitudinal BMI-for-age percentile studies are necessary to pin-point the most critical point of intervention in both boys and girls.

Recommendations

The positive outcomes that are evident in this research are strong indicators that this school district, specifically its elementary school, currently could be providing some form of effective interventions or treatments to its students. These findings indicate that St. Croix Central Elementary School has an overall healthier weight profile as compared to the state, nation, and

world population. Thus, the question for future research is what variables are positively influencing this school.

In order to identify these key variables, some primary areas of interest for analysis include the professionals within the institution, as well as the external community. It is evident that the school principal is very active in the well-being of his students, especially their health and wellness. Conducting a survey on how parents feel the school provides nutrition education and wellness support to their children, could reveal some key areas of impact. Also, it would be interesting to interview the principal and see what current programs or policies are currently in place for wellness initiatives. Another key professional is the physical education teacher. She, like the principal, is very passionate about the health of the students. A similar study could be conducted for her as well. Also, the teachers could be questioned with short open-ended survey questions to determine how nutrition education and ideas, if any, are incorporated into classroom curriculum. Overall, the professional staff, especially the principal and physical education teacher, values the health status of their students. Both professionals have also been involved in athletics from elementary to high school sports. Their personal passions for health may be a key factor positively influencing the weight status of the children at St. Croix Central.

Another level of research could be conducted at the community level. This research could be a community assessment of how the local programs such as the Lions Club, Girl Scouts, Boy Scouts, the School Board, etc. advocate for health and wellness. Finding out how they educate or provide monetary support to provide a safe environment or physical activity resources within the community would also be an interesting study.

In a broader sense, this study could be investigated at an even larger scale by conducting BMI-for-age screening in multiple rural school districts, as well as assessing the resources and support systems in each community. Ultimately, the researcher would be looking for the best

solution to help make a positive impact in our local mid-west schools. The recommendations of the CDC are a comprehensive approach that will facilitate schools to more effectively handle the overweight crisis (2009). This program would utilize the BMI-for-age screening procedures, as well as incorporating physical activity and proper nutritional intake controls. The primary focus would be producing an environment conducive for behavioral change, and identifying the obesogenic environments/influences, in order to minimize these factors within schools. It is easier to implement healthy eating and activity patterns in childhood, thus identifying the risk areas through BMI-for-age screening is beneficial based on these research findings.

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Appendix A: IRB Approval Forms

STOUT
UNIVERSITY OF WISCONSIN

Research Services
152 Voc Rehab Building

University of Wisconsin-Stout
P.O. Box 790
Menomonie, WI 54751-0790

715/232-1126
715/232-1749 (fax)
http://www.uwstout.edu/rs/

Date: November 10, 2008

To: Stephanie Kaltenberg

CC: Dr. Ann Parsons

From: Sue Foxwell, Research Administrator and Human Protections Administrator, UW-Stout Institutional Review Board for the Protection of Human Subjects in Research (IRB)

Susan Foxwell

Subject: **Protection of Human Subjects**

Your project, "*BMI-for-age Categorization & Demographic Analysis of K - 4th Graders in a Western Wisconsin Elementary School,*" has been approved by the IRB through the expedited review process. The measures you have taken to protect human subjects are adequate to protect everyone involved, including subjects and researchers.

Please copy and paste the following message to the top of your survey/interview form before dissemination:

This research has been approved by the UW-Stout IRB as required by the Code of Federal Regulations Title 45 Part 46.

This project is approved through **November 8, 2009**. Modifications to this approved protocol need to be approved by the IRB. Research not completed by this date must be submitted again outlining changes, expansions, etc. Federal guidelines require annual review and approval by the IRB.

Thank you for your cooperation with the IRB and best wishes with your project.

***NOTE: This is the only notice you will receive – no paper copy will be sent.**

Appendix B: Parental Consent Letter

STOUT
UNIVERSITY OF WISCONSIN
WISCONSIN'S POLYTECHNIC UNIVERSITY

University of Wisconsin-Stout
P.O. Box 790
Menomonie, WI 54751-0790

December 11th, 2008

Dear Parent or Guardian,

My name is Stephanie Kaltenberg, and I am a graduate student in the Food & Nutritional Sciences Master's program at the University of Wisconsin-Stout. I grew up in the St. Croix Central School District, graduating in 2003. I have stayed connected to the community by volunteering as a co-leader for one of its Girl Scout troops.

The reason for this letter is regarding my master's thesis project. For my project, I will be measuring heights and weights to investigate the Body Mass Index (BMI) of the elementary students at St. Croix Central. As you are probably aware, the prevalence of overweight children is growing in this country. The data gathered will be used to assess the situation here at SCC, and will be valuable information for the school district with regards to this issue. I hope that you will allow your child to participate.

My study has been reviewed and approved by UW-Stout's Institution Review Board, which protects the rights of participants. It is important that you read and understand the study before allowing your child to participate. The study is entirely voluntary, and you have the right to withdraw your child from the study at any time.

If you choose for your child to participate, please sign the *Consent Sheet* and return it to your child's teacher. Only one form per family is needed. Please place the *Consent Sheet* in the provided envelope, and return it in your child's Thursday folder by **Friday, December 19th.**

If you have questions regarding the study or your child's rights, please contact myself or others listed on the attached information sheet.

Thank you for your time and consideration.

Sincerely,

Stephanie Kaltenberg

Appendix C: Informational Sheet

INFORMATION SHEET

Project: BMI-for-age Categorization & Demographic Analysis of K-4th Graders in a Western Wisconsin Elementary School

Purpose: The purpose of this study is to identify the percentage of childhood overweight students in the St. Croix Central Elementary School. Collecting data on your child(ren)'s health status allows us to assess and report findings that may positively promote healthier children.

What will your child(ren) do for this study: If you agree to have your child(ren) participate in this study, your child(ren) will have their height and weight measured. Students will be excused from their class by the teacher, and will walk down to the principal's office for check-in. This will minimize any chance of teasing for participating. Data will be collected by trained research assistants with one student at a time in a separate room in the principal's office. Children will be asked to remove their shoes and any heavy outer layers of clothing.

Risks and Benefits: There are no known risks associated with this study. Height and weight will be measured in private. No comments will be made during the assessment process, and the research assistants doing the assessment will be trained in proper data collection methods. Individual information will not be shared with others, and only the researcher and advisor will have access to this data. The scale will be disinfected between children.

The findings of your child(ren)'s assessment will be provided to you only if you provide your address on the consent form. A summary report will be available at the end of the study and presented to the St. Croix Central Elementary School.

Location: Privacy for your child(ren) is important; the forms on which data is collected will not reveal names, only an identification number. My faculty advisor and I are the only individuals who will know what number refers to your child(ren). All measurements will be taken in a room in the principal's office during the normal school day. This will help ensure privacy and avoid embarrassment for your child.

Confidentiality: All information regarding this study will be kept in Dr. Ann Parsons' office with only the researcher and research advisor allowed to access the data. Your child(ren) will be given a number identifier so we can track data over time. This also allows us to send your child(ren)'s individual results to you. These matched names and numbers will be kept in a locked area in Dr. Parsons' office. Informed consent forms will be kept in a separate locked area away from other data. All other data will have an ID number assigned to it.

Right to Withdraw: Participation in this study is completely voluntary. You may choose not to participate or withdraw at any time by contacting us. If you agree to participate in this study, please sign the following form and return it in the Thursday folder to be given to the teacher.

Investigator: Stephanie Kaltenberg
kaltenbergs@uwstout.edu or 715-222-9459

Advisor: Dr. Ann Parsons
parsonsa@uwstout.edu or 715-232-2563

IRB Administrator
Sue Foxwell, Director, Research Services
152 Vocational Rehabilitation Bldg.
UW-Stout
Menomonie, WI 54751
foxwells@uwstout.edu
715-232-2477

This research has been approved by the UW-Stout IRB as required by the Code of Federal Regulations Title 45 Part 46.

Appendix D: Consent Form

Appendix D: Consent Form

CONSENT FORM

Project: BMI-for-age Categorization & Demographic Analysis of K-4th Graders in a Western Wisconsin Elementary School

Please fill in your child(ren)'s name(s), grade(s), teacher(s), birthdate(s), and check the box(es) for gender

Child's or Children's Name	Grade	Teacher's Name	Birthdate	Gender
				□ Male □ Female
				□ Male □ Female
				□ Male □ Female
				□ Male □ Female

Statement of Content:
I understand and have read the information presented in the information and consent sheets. I understand my child(ren)'s participation is entirely voluntary and he/she can be withdrawn at any time during the study. By signing this consent form I agree to allow my child(ren) to participate in this project.

_____

Signature of parent or guardian Date

If you would like you child(ren)'s results sent to you, please provide your address in the space provided below.

_____

_____

_____

Appendix E: Training Manual

Health Assessment Staff Training

Human Performance Lab – December 16, 2008

Data Collection Dates: January 7 at River Heights Elementary School in Menomonie, WI and January 8 and 9 at St. Croix Central Elementary School in Roberts, WI

Times: Data collection on January 7 will run from 8:00 am until 12:00 pm or later as needed to measure all children's height and weight and have children complete the Hearts n' Parks survey. **Please arrive promptly by 7:15** in the Parking Lot off of 24th Avenue of River Heights Elementary School.

Data collection on January 8 and 9 will run from 8:30 am until 2:30 pm both days based on the turnout of consent forms. Two entire school days will be used to measure children's height and weight. **Please arrive promptly at 6:30** in the Home Economics Parking Lot to depart to St. Croix Central Elementary School.

Meals: Please bring snacks or a sack lunch as needed. A break or lunch will occur sometime during the day.

Human Subjects Training: Prior to the dates of data collection, you must complete the *Human Subjects Training*. This training module is available at http://www.uwstout.edu/rs/humansubjects.shtml.

> When at the website, click on Human Subjects Training and complete the module. This tutorial provides information on the rules and regulations of research involving human subjects. You will need your UW-Stout ID number to complete this training. The module will take approximately 30 minutes to complete.

If you believe you have completed the Human Subjects Training before, click the link below the training module to check for certification of completion. Enter your UW-Stout ID number to check for completion.

Upon completion of this module, please print two copies of the completed Certificate to give to Kelly and Stephanie and print an additional copy for yourself for future reference.

Research Assistant Information/Guidelines

This training session will cover how to properly measure children's height and weight and verify research assistants' ability to perform these measurements correctly. In addition, other guidelines throughout the administration of the survey and data collection process will be reviewed.

To ensure confidentiality of the child and ensure others do not hear specific measurement results, a few precautions are placed on this study. Children will not be identified by name. The following exceptions apply:

1. The individual who escorts the participants from the classroom to the designated data collection area will be allowed to call the participant by name only when getting them from the classroom.
2. The research assistants performing measurements and administering surveys can talk to the participants but they cannot ask the child what their name is. Furthermore, these research assistants cannot give children the results of their measurements or surveys. You may talk to relieve anxiety by letting the participant know what you are doing for each measurement and clarifying questions on the survey as needed.

***If a child asks what was my height or weight, the suggested response is:** "For our research study, we are not sharing this information at this time. However, your parents can request this information, if they have not already."

Height and Weight Measurement:

*Prior to use of the Detecto physician scale, calibrate and verify with the Investigator that the scale is calibrated according to manufacturer's instructions.

1. Greet the participant by saying, "Hi, how are you today?"
2. Explain the measurement by stating, "First you will have to take off your shoes and remove extra layers of clothing (jackets, sweaters, sweatshirts, etc.) and hair pieces. Then you will step on the platform to record some measurements."
3. Start by measuring weight with children facing forward, arms at their side (with nothing in their hands), and feet slightly apart near the middle of the scale to evenly distribute weight. Record the measurement legibly on the data collection sheet to the nearest ½ ounce (0.01 kilogram (kg)).

    - Measure children's weight by moving the *lower weight poise* away from zero until the marker drops below the center point, then slide the *lower weight poise* back one notch so it is above the center point. Move the *upper weight poise* away from zero until the marker is centered. This may take a few times adjusting the *upper weight poise* back and forth until the scale balances. Read and record the measurement to the nearest ½ ounce (0.01 kilogram (kg)) and return the *lower and upper weight poises* to zero.

    - If children are not able to stand on the scale alone, another research assistant will hold the child and they will be weighed together, if possible. The research assistant will then be weighed separately to subtract his or her weight from the combined weight.

4. Repeat this measurement until two weights agree within ¼ pound (0.1 kilogram (kg)) (the tolerance limit). Record measurements legibly on data collection sheet. Once again, return weight poises to zero.

    - If two measurements do not agree within ¼ pound, complete an additional measurement and record this result on the data collection sheet. All three measurements will be averaged in this scenario.

- If unable to obtain an accurate measurement or to obtain measurements within the tolerance limit, document this on the data collection form including reason.

5. Let the child know there will be another measurement performed with the portable stadiometer attached to the scale.
6. Have the child stand looking straight ahead with heels together, legs straight, shoulders relaxed, arms to the side, and have their head in the Frankfort horizontal plane *(the top of the external auditory meatus (ear canal) should be level with the inferior margin of the bony orbit (cheek bone))* to ensure an accurate measurement. The heels, buttocks, shoulder blades, and back of the head will be checked to be against the vertical surface of the stadiometer ***(with a minimum of two out of three touching)***.
   Bring the measuring rod down so it touches the crown of the child's head, have child inhale deeply and hold their breath and then bring the measuring rod down just to compress their head. Read the measurement with eye parallel with the headpiece. Stand on platform to read measurement at eye level if child is taller than you.
7. Record the measurement to the nearest 1/8 inch (0.1 centimeter (cm)) on the data collection sheet.
8. Repeat this measurement until two measurements agree within 1 cm (the tolerance limit). Record measurements legibly so that the averages can be calculated.

   - If two measurements do not agree within ¼ inch (0.1 cm), complete an additional measurement and record this result on the data collection sheet. All three measurements will be averaged in this scenario.
   - If unable to obtain an accurate measurement or to obtain measurements within the tolerance limit, document this on the data collection form including reason.

9. Raise the measuring rod to avoid injury.
10. Thank the participant, have children put their shoes and other accessories back on. *In addition, the River Heights children will also have their Heart n' Parks survey returned to him or her.*
11. Direct children to the next data collection station at River Heights. At St. Croix Central, direct the child to the research assistant responsible for escorting children back to their classroom.
12. Use sanitizing spray to clean the platform and wipe the measuring rod.

*If standing height cannot be obtained, measure *knee height*.

1. Have children remove their shoes and expose their leg if possible.
2. Place the knee and ankle at a 90-degree angle.
3. Use a square to ensure these angles are correct.
4. Place the blade of the large sliding caliper under the heel, running parallel to the tibia.
5. Place the other blade of the caliper behind the shaft of the fibula or right above the kneecap.
6. Tighten the caliper with just enough pressure to compress the tissue.
7. Record this value will to the nearest 0.1 centimeter (cm). This measurement will be entered into a formula to estimate the child's height.
8. Wipe the calipers down with sanitizing solution between each use.

Survey Administration *(River Heights Elementary School only)*:

The Hearts n' Parks survey will be completed in a quiet section of the room in which heights and weights are measured. This process requires one research assistant to:

1. Seat participants at desks and hand participants a pencil.
2. Let participants know you are available for questions.
   *Some questions may need to be read to participants.
3. Upon completion of the Hearts n' Parks survey, collect coded survey and place survey in the correct folder according to grade and classroom.
4. Give the child a thank you certificate.
5. Verbally thank the child for participating in the study.
6. Direct the child to the research assistant responsible for escorting children back to their classroom.

River Heights Elementary School Research Assistant Positions

Escort: This research assistant will assist the teacher in each grade and classroom in determining the children that will participate in the study with a list of eligible participants created by the Investigator. The information on the eligible participant list must be kept confidential and in possession of the research assistant at all times. No identifiers other than the child's name, grade, and teacher will be present on this particular list. Children who will not participate in the study will remain in their designated classroom. At this same time, this research assistant will give the classroom teacher envelopes with the coded Child Feeding Questionnaires and a thank you letter. The child's name on will be on the envelope. These envelopes are to be sent home to the child's parents or guardians. Participating children will then be escorted by this research assistant to the data collection site where the Investigator will check in children. Escorts will stop at restrooms to encourage children to go to the bathroom before being weighed or measured.

Participant Check-In: At the check-in site, children will be matched to their assigned identification number with the identification form by the Investigator. Only the Investigator will be able to see the identification form and it will be kept in possession of the Investigator. Once verification is complete, a Hearts n' Parks survey with the child's identification number will be given to the child by the Investigator. The child will be asked to not put their name on the Hearts n' Parks survey. Children will then be directed to the first data collection station where a research assistant will be present to record the child's height and weight.

Height Measurer/Weight Measurer: This research assistant will greet and inform children of the measurements that are going to be taken according to the script above. Following this, the children's height and weight will be measured. Once this is complete, the research assistant will then send the child to the final station.

Survey Administrator: Children will be directed to a quiet place with desks where another research assistant will be present. The research assistant will hand out pencils and be available to help children fill out the Hearts n' Parks survey.

Runner: This research assistant will be available to help the Investigator and research assistants as needed. All tasks will be assigned by the Investigator.

St. Croix Elementary School Research Assistant Positions

Escort: This research assistant will assist the teacher in each grade and classroom in determining the children that will participate in the study with a list of eligible participants created by the Investigator. The information on the eligible participant list must be kept confidential and in possession of the research assistant at all times. No identifiers other than the child's name, grade, and teacher will be present on this particular list. Children who will not participate in the study will remain in their designated classroom. Escorts will stop at restrooms to encourage children to go to the bathroom before being weighed or measured. Participating children will then be escorted to the data collection site where the Investigator will check in children.

Participant Check-In: At the check-in site, children will be matched to their assigned identification number with the identification form by the Investigator. Only the Investigator will be able to see the identification form and it will be kept in possession of the Investigator. Children will be provided with a sheet with an identification number. Children will then carry this sheet to the data collection station where a research assistant will be present to record the child's height and weight.

Height Measurer/Weight Measurer: This research assistant will greet and inform children of the measurements that are going to be taken according to the script above. Following this, the children's height and weight will be measured. Once this is complete, the research assistant will direct the child to return to their classroom. An escort can direct if the child needs assistance.

Runner: This research assistant will be available to help the Investigator and research assistants as needed. All tasks will be assigned by the Investigator.

Detecto Physician's Balance Beam Scale

Additional equipment: Calibrated weights, sanitizing solution, rags, and calibration log
Model Number: 338
Tech Support: (866) 254-8261or www.detectoscale.com (tech@cardet.com)

Set up Procedures:

- Place scale with attached stadiometer on a hard, flat surface. If a hard surface is not available, use a hard wooden platform.
- Check if the scale is at a horizontal plain using the carpenter's level.
- Calibrate the scale for 0, 50, and 100 lbs prior to taking any measurements. Use certified calibrated weights. This is to be done prior to the start of each measurement session.

To calibrate:

- Check that the upper and lower beams are pointing to zero. If the beams are not pointing to zero, move the weight poises so that they are pointing to zero.
- Place the 100-pound weight on the scale platform and move the weight poises on the sliding scale starting with the largest poise. Use the smallest poise to balance the beams down to the nearest pound.
- Determine the weight by adding up the numbers corresponding to the large and small weight poises.

- Record this weight on the calibration log and verify it is reading the same weight as the amount of weight you placed on the scale.
- Take an additional measurement to ensure accuracy.
- If weights are not accurate, refer to the instruction manual on how to properly calibrate the scale.
- Remove the weight and move the poises back to zero.

Errors to Eliminate:

- Scale not calibrated to zero
- Scale placed on carpeting or pad
- Participant not centered on scale
- Participant not undressed accordingly (shoes, coats, etc.)
- Measurement taken when participant was moving
- Measurement taken before balance beam indicator stopped moving
- Measurement not recorded immediately
- Measurement not repeated
- Participant had not voided recently

Adapted from Rasmussen (2007).

Portable Stadiometer attached to Detecto Physician's Scale

Additional Equipment: Sanitizing solution and rags
Model Number: 338
Tech Support: (866) 254-8261or www.detectoscale.com (tech@cardet.com)

Set-up Procedure:

- See set-up procedures for Detecto Physician's Scale, in which stadiometer will be attached.
- Check height rule with standardized rods and correct if greater than 2 mm. Refer to scale's instruction manual for calibration procedure.

Errors to Eliminate:

- Stadiometer not calibrated correctly with standardized rods
- Participant did not remove shoes or hair (or hair accessory) was interfering with the measurement
- Head is not in proper position (Frankfort plane)
- Knees were bent
- Feet were not flat on the floor
- Measurer was at an angle when recording the height measurement
- Knee height caliper was not used for individuals whose height could not be measured using the stadiometer
- Appropriate unit were not read (English and metric units both present on the scale).

Special Procedures/Precautions:

If the subject is taller or shorter than the research assistant, the measurer should stand on a platform to look straight on to the measuring device for taller students and lower one's body to

the height of the child with a shorter stature. Some instruments read both English and metric units. Be sure to read appropriate units and record on the data collection sheet accordingly.

Be sure to read to the nearest 0.1 cm using the vertical lines provided. When a measurement falls between two readings, record the nearest 0.1 cm and if it is exactly between, always round down. Adapted from Rasmussen (2007).

List of Supplies:

- Escort List
- Check-in Form
- Screening Form
- Kelly's Surveys
- Calculators (at least 2)
- Pens (at least 10)
- Stool to use w/ Stadiometer
- Measuring Rod
- Calibrating Weights
- Stadiometer/Scale (1)
- Maps of the School
- Ruler for Frankfort plane
- Carpenter's level
- Knee calipers
- Sanitizing solution
- Rags
- Large Envelopes for data collection sheets

References:

Rasmussen, D. (2007). *Nutrition, physical activity, and health assessment of school age children.* Unpublished master's thesis, University of Wisconsin-Stout, Menomonie.

Department of Health and Family Services & Wisconsin Nutrition and Physical Activity Program. (2008). *To weigh and measure height, weight, and body mass index.* Retrieved December 8, 2008, from http://dhs.wisconsin.gov/health/physicalactivity/index.htm

Appendix F: Anthropometric Recording From

Child Data Collection Form

Date: ______________________________ Grade: ____________________________ Class: ____________________________

ID #	Gender	DOB	Age	Weight (pounds)				Height (inches) *Indicate if Knee Height				Calculated BMI	BMI-for-Age/ Gender %	Weight Status
				1st measurement	*2nd measurement*	*3rd measurement*	Avg	*1st measurement*	*2nd measurement*	*3rd measurement*	Avg			
C###	M/F	#-##-##	##	Kilograms	Kilograms	Kilograms	Kg	Centimeters	Centimeters	Centimeters	Cm	Weight (lbs)/(height (in))^2 x 703	##%	List Category
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Please return forms immediately to Investigator following the completion of data collection. Thank you!

Research Assistant Initials: _____

For Office Use Only: ❑ Data Entered into Data Analysis Document Date Data Entered: ________________ _____, _______

STOUT
UNIVERSITY OF WISCONSIN

February 9th, 2008

Dear Parent/Guardian,

Thank you for allowing your child to participate recently in my research project, which measured heights and weights at St. Croix Central Elementary School. Enclosed you will find the results of your child's measurements that were collected on January 8th & 9th, 2009. This includes height and weight, as well as the calculated Body Mass Index (BMI), BMI-for-age percentage, and categorization.

Your child's or children's results are as follows:

Child 1: _____ **Weight:** _____ *pounds* **Height:** _____ *feet* _____ *inches*

BMI: _____ **BMI-for-Age Percentile:** _____ **Weight Status Category:** _____

Child 2: _____ **Weight:** _____ *pounds* **Height:** _____ *feet* _____ *inches*

BMI: _____ **BMI-for-Age Percentile:** _____ **Weight Status Category:** _____

---

*__Please note__: The results from this study are not diagnostic.

BMI is a reliable indicator which estimates the level of body fat composition. Many factors, including sports participation or family history, can influence height and weight in children. Some athletes and serious dancers may have a higher than expected BMI due to their increased muscle mass, which weighs more than fat mass.

Your child's results were plotted on the CDC BMI-for-age Growth Chart. The chart below indicates the percentile categories which show the relative position of a child's BMI number among children of the same sex and age. Being either overweight or underweight can put a child at risk for certain health problems. (Resource: CDC website).

Weight Status Category	Percentile Range
Underweight	Less than the 5th percentile
Healthy weight	5th percentile to less than the 85th percentile
At Risk for Overweight	85th to less than the 95th percentile
Overweight	Equal to or greater than the 95th percentile

Please realize that a single measurement does not provide a complete assessment of your child's health. Your primary health care provider is the best person to evaluate whether or not your child's measurements are within a healthy range. Please share the results with your family physician to receive further information and/or recommendations. If you have any questions, please feel free to contact me.

Sincerely,

Stephanie Kaltenberg
kaltenbergs@uwstout.edu
UW-Stout Graduate Student

Appendix H: Principals Approval Letter

March 26, 2009

Stephanie,

I am writing this letter to give you permission to use our school name, *St. Croix Central Elementary School*, in your BMI Test that was conducted on January 8 and 9, 2009.

I have heard many positive comments from the parents about the results. Thank you for asking St. Croix Central Elementary to be part of this screening.

Sincerely,

Steve Sanders
Elementary Principal
St. Croix Central Schools