

# Body Mass Index Screening Report for Pre-kindergarteners, Third Graders and Sixth Graders in Ottawa County Schools

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## Introduction

### Background

The percentage of young people who are overweight has more than tripled nationally since 1980. Among children and teens aged 6 to 19 years, 16 percent (over nine million young people) are considered overweight.<sup>6</sup> Since the 1960's, several large, nationally representative surveys have assessed the prevalence of obesity in children. These include the National Health Examination Survey Cycles I to III and the National Health and Nutrition Examination Surveys I to III.<sup>6</sup> From these surveys, the prevalence of childhood obesity is estimated to be 25 to 30 percent.<sup>2</sup> This increase is seen in both children and adolescents, and in all age, race and gender groups.

Childhood overweight is often under diagnosed and under treated. As a result, children may suffer life-long physical and emotional consequences. Some of the implications of being overweight or obese include increases in the risk of many health conditions, including the following: hypertension, dyslipidemia, type II diabetes, coronary heart disease, stroke, gall-bladder disease, respiratory problems, some cancers (endometrial, breast, and colon) and liver disease.

There are many causes of obesity. While there's no doubt genetics play a role, genes alone cannot account for the huge increase in obesity rates over the past few decades. The main culprits are the same as those for adult obesity: poor diet and physical inactivity. For example, almost half of children ages 8-16 years watch three to five hours of television a day.<sup>8</sup> The best way to significantly affect the prevalence of obesity is to prevent it.

## Epidemiology

The most recent survey data collected nationally indicates that the incidence of obesity for ages 2-5 years is 20.6%, 30.03% for ages 6-11 and 30.4% for ages 12-19.<sup>6</sup> Hispanic, Native American and African American races tend to be more affected than other populations.<sup>3</sup>

The persistence of obesity into adulthood depends on several factors, including the age at which the child becomes overweight, the severity of the disease and the presence of obesity in at least one parent. Obesity in a child under three years of age does not predict future obesity, unless at least one parent is also obese.<sup>1</sup> After age three, however, the likelihood that obesity will persist into adulthood increases with the advancing age of the child and is higher in children with severe obesity in all age groups.<sup>1</sup> After an obese child reaches six years of age, the probability that obesity will persist exceeds 50 percent, and 70 to 80 percent of obese adolescents will remain so as adults.<sup>1,4,5</sup> The presence of obesity in at least one parent increases the risk of persistence in children at every age.<sup>1</sup>

## **Methods**

### Data Collection

Data was collected at different school and community sites within the county during hearing and vision testing for pre-kindergarten and third grade children and during scoliosis screening for sixth graders. Height and weight were collected using standardized scales. The date of birth was reported by parents for pre-k children and by the school for third and sixth grade children. Gender was coded based on screener's observation.

The collected data was entered into an Excel spread sheet and the data was analyzed using the SAS statistical software package. The demographic variables collected included date of birth, height, weight, gender and screening date. Other variables such as age in years, body mass index (BMI), BMI percentile and weight classification were calculated from the variables listed above.

The BMI was calculated using a child's height and weight and was based on Centers for Disease Control and Prevention (CDC) guidelines. This number is then compared to a growth chart for children of the same age and gender to determine a healthy weight range for a child. The CDC BMI percentiles listed below are guidelines for weight classification by age;

|                        |  |
|------------------------|--|
| Underweight            | < 5 <sup>th</sup> percentile                                   |
| Normal                 | ≥ 5 <sup>th</sup> percentile to < 85 <sup>th</sup> percentile  |
| At risk for overweight | ≥ 85 <sup>th</sup> percentile to < 95 <sup>th</sup> percentile |
| Overweight             | ≥ 95 <sup>th</sup> percentile                                  |

### Variable Modeling

The outcome variable, weight classification, as mentioned above, was determined using the BMI. Weight classification was measured as 'overweight', 'at-risk for overweight', 'normal weight' and 'underweight'. The ages of children who participated in the screening ranged from 2 to 14 years old. For this analysis, age was used to categorize kids into different grades. Ages 2 to 5 years were categorized as 'pre-k', ages 6 to 9 years were categorized as third grade and ages 10 to 14 years were categorized as sixth grade.

## Statistical Methods

Frequencies, percents and bivariate analysis were calculated to determine distribution of the population. A chi square test was used to determine association between the outcome variables and the explanatory variables. Association was determined at p-value less than 0.05. The strength of association for odds ratio is as follows: weak odds ratio = 1 - 2, moderate odds ratio = 2 - 4 and strong odds ratio = 4 times and above.

## Results

### Descriptive Analysis

The tables below represent the distribution of kids who participated in the BMI screening from September 2004 to June 2005 by collected demographic characteristics. Among the 2678 participants screened, 51.27% were females and 58.72% were 6<sup>th</sup> graders. Approximately 38% of kids sampled were 11 years old. According to the CDC weight classification of children, approximately 15% of children screened were classified as overweight and approximately 17% were classified as at-risk for being overweight.

Table 1: Gender representation of kids involved in BMI Screening

| Gender | Frequency | Percent |
|--------|-----------|---------|
| Female | 1373      | 51.27   |
| Male   | 1305      | 48.73   |

Table 2: Grade Level Representation of kids involved in the BMI Screening

| Grade Level           | Frequency | Percent |
|-----------------------|-----------|---------|
| 3 <sup>rd</sup> Grade | 826       | 30.86   |
| 6 <sup>th</sup> Grade | 1572      | 58.72   |
| Pre-K                 | 279       | 10.42   |

Table 3: Age representation of kids involved in BMI Screening

| Age in Years | Frequency | Percent |
|--------------|-----------|---------|
| 2            | 1         | 0.04    |
| 3            | 13        | 0.49    |
| 4            | 141       | 5.27    |
| 5            | 124       | 4.63    |
| 6            | 4         | 0.15    |
| 7            | 9         | 0.34    |
| 8            | 584       | 21.82   |
| 9            | 229       | 8.55    |
| 10           | 25        | 0.93    |
| 11           | 1007      | 37.62   |
| 12           | 521       | 19.46   |
| 13           | 19        | 0.71    |

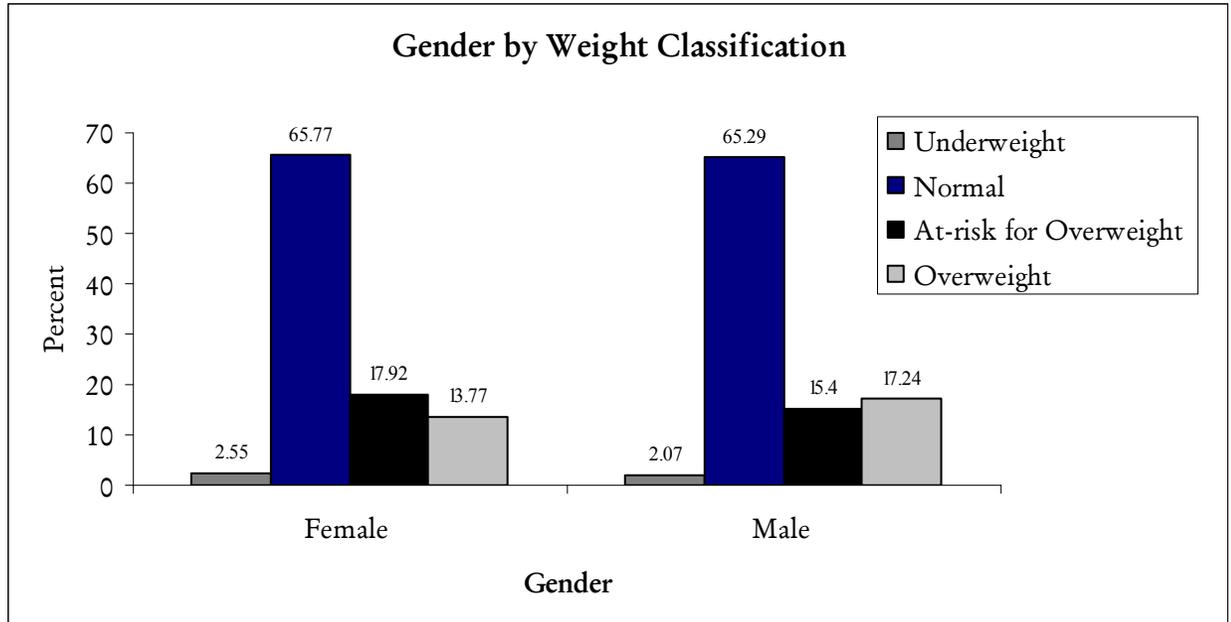
Table 4: Weight categorical representation of kids involved in BMI Screening

| Weight Classification  | Frequency | Percent |
|------------------------|-----------|---------|
| Normal Weight          | 1755      | 65.53   |
| Overweight             | 414       | 15.46   |
| At-risk for Overweight | 447       | 16.69   |
| Underweight            | 62        | 2.32    |

#### Bivariate analysis

Overall, 65.53% of the sample screened was classified as normal; 33.72% female and 31.81% male. The following graphs represent bivariate analysis of age, grade and gender by weight classification of participants. The data indicated that among the 1373 females, 189 (13.77%) were overweight, 246 (17.92%) were at-risk of overweight while 35 (2.55%) were underweight (graph 1). Of the 1305 males, 225 (17.24%) were overweight, 201 (15.40%) were at-risk for overweight and 27 (2.07%) were classified as underweight (graph 1). The bivariate analysis of weight classification by grade indicates a trend (graph 3). As the kids move from a lower to a higher grade the weight classification tends towards overweight. Among third graders, 27.48% of screened children were classified as at-risk for overweight or overweight (graph 5). For sixth graders, 35.62% and for pre-kindergarten, 26.52% were classified as at-risk for overweight or overweight (graph 5). The bivariate analysis of weight classification by age also indicates a similar trend (graph 6). As the kids progress from younger (four years) to older ages (12 years) the classification tends towards overweight.

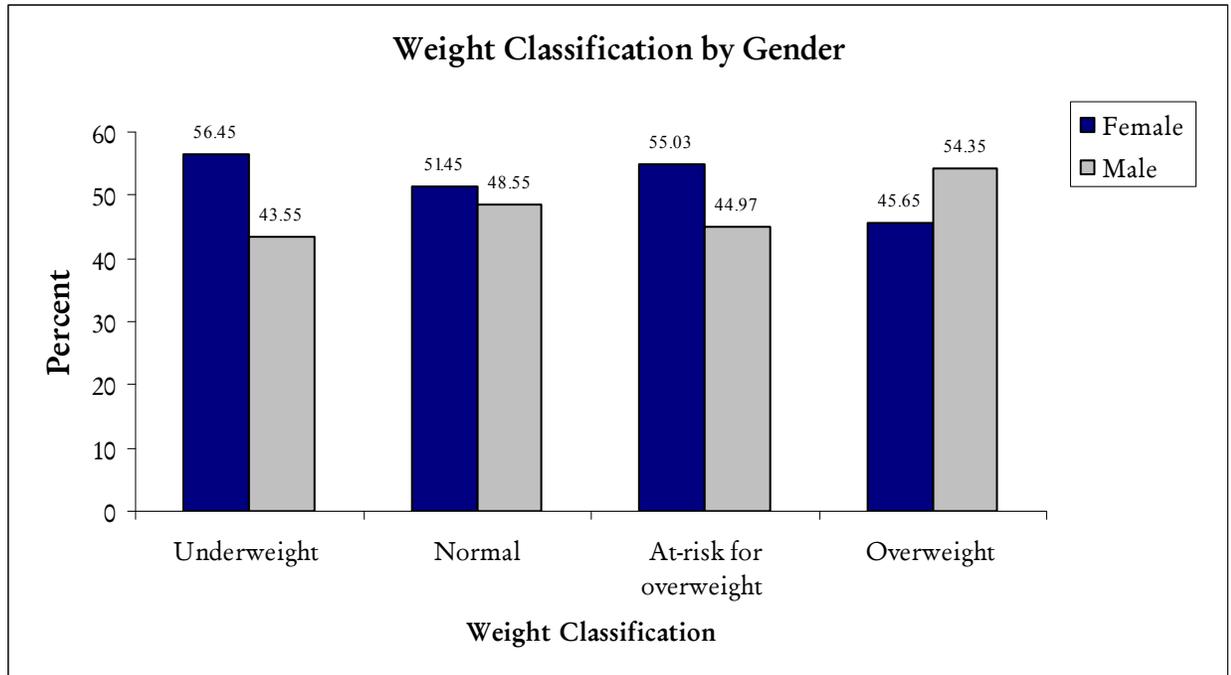
Graph 1: Bar graph of gender by weight classification



Females n = 1373

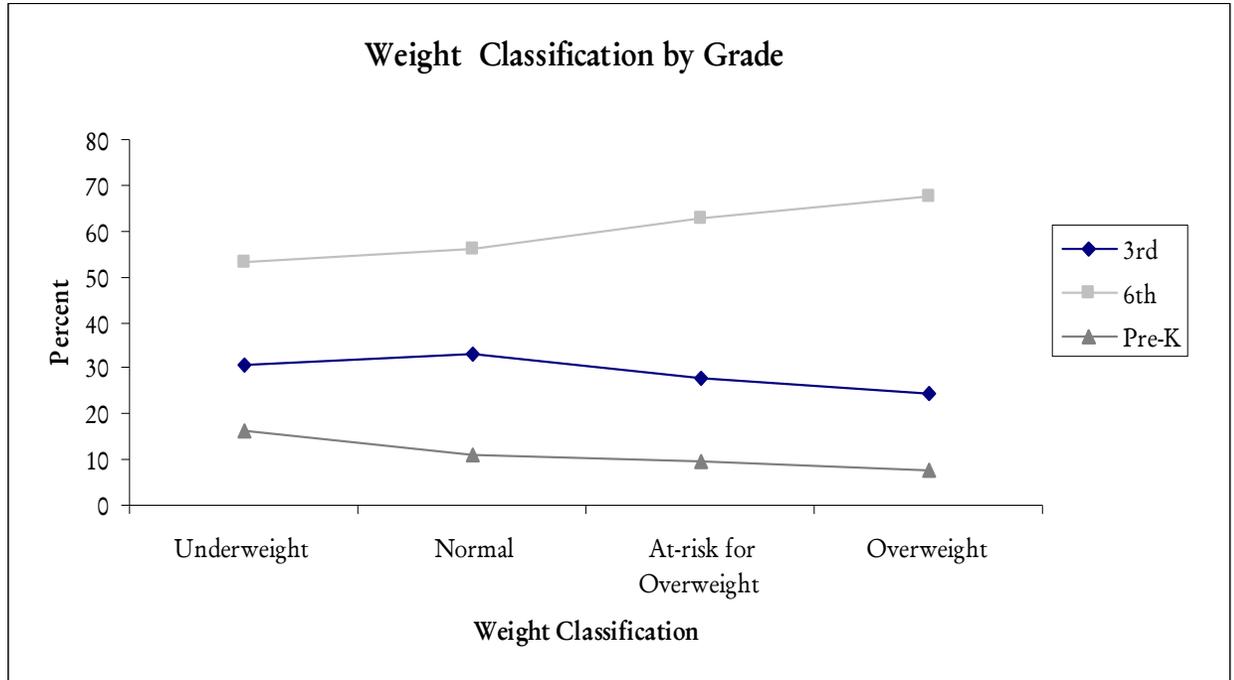
Males n = 1305

Graph 2: Bar graph of weight classification by gender

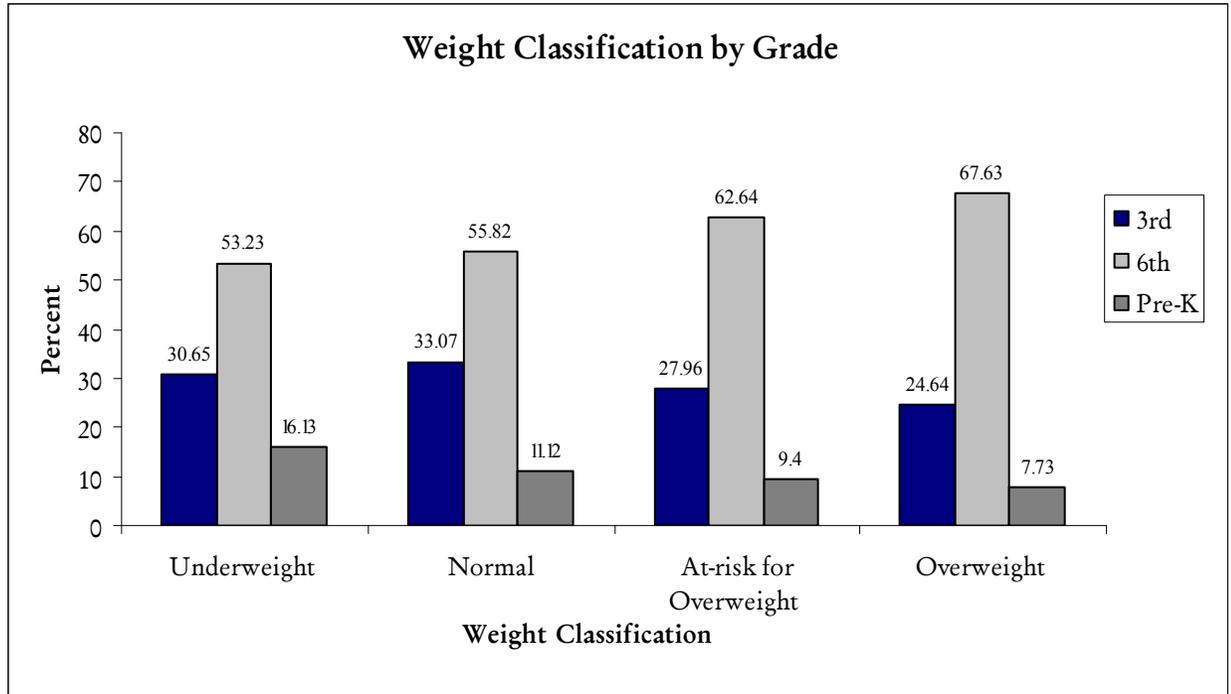


Underweight n = 62  
Normal n = 1755  
At-risk n = 447  
Overweight n = 414

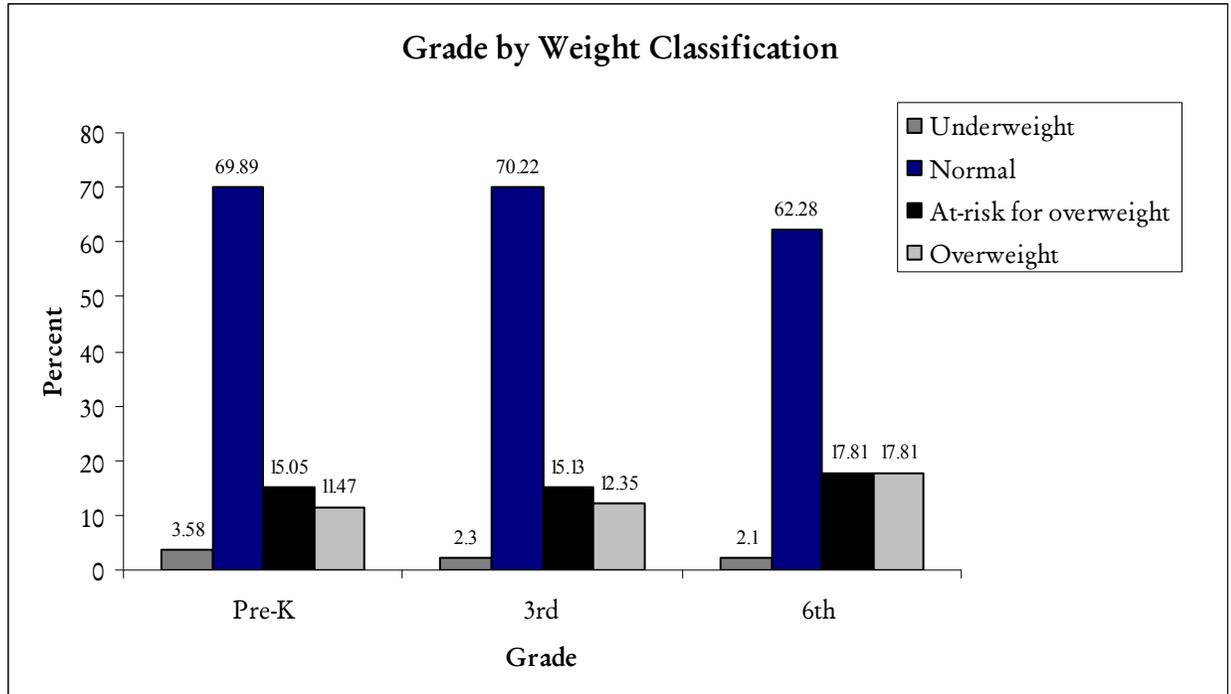
Graph 3: Line graph of weight classification by grade



Graph 4: Bar graph of weight classification by grade



Graph 5: Bar graph of grade by weight classification

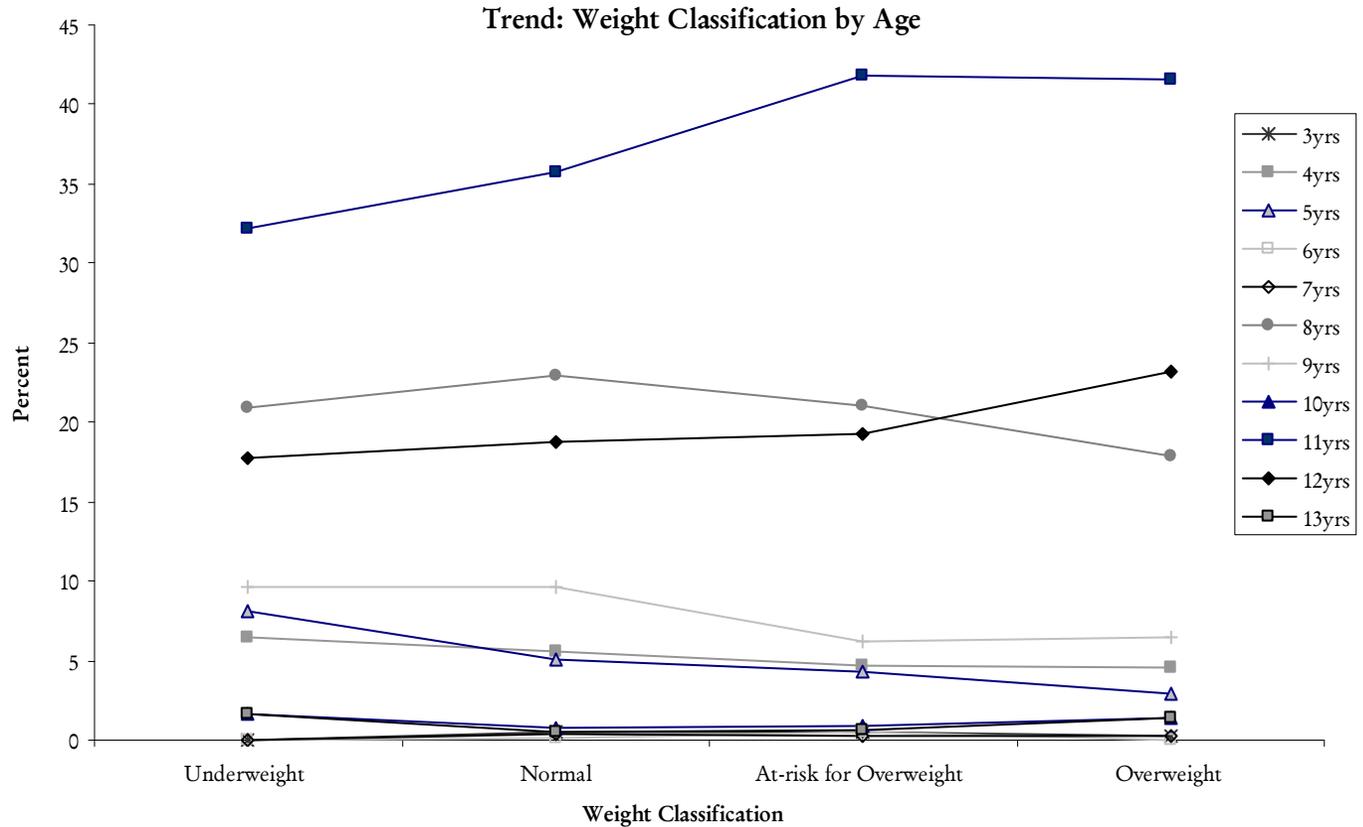


Pre-K n=279

Third n=826

Sixth n=1572

Graph 6: Line graph of weight classification by age in years



### Statistical Analysis:

The table below summarizes the crude effect measures for associations found between the outcome variables and the explanatory variables. For the outcome variable weight classification (overweight versus normal weight), the results indicated that females were 1.26 times less likely to be overweight compared to males. Sixth graders were 1.74 times more likely to be overweight compared to pre-kindergarten children. Also, third graders were 1.63 times less likely to be overweight compared to sixth graders. See table 5.

Table 5: Association for weight classification (Overweight versus Normal Weight)

| Variables | Comparison group                         | Crude Odds Ratio | 95% confidence interval | P value |
|-----------|--|------------------|-------------------------|---------|
| Gender    | Female vs Male                           | 0.79(1.26)       | 0.63 – 0.98             | 0.0338  |
| Grade     | 6 <sup>th</sup> vs Pre-K                 | 1.74             | 1.17 – 2.59             | 0.0056  |
| Grade     | 3 <sup>rd</sup> vs 6 <sup>th</sup> grade | 0.61 (1.63)      | 0.47 – 0.78             | 0.0001  |

Analysis with weight classification (at-risk for overweight versus normal weight) as outcome indicated that third graders are 1.33 times less likely to be at-risk for overweight compared to sixth graders. See table 6.

Table 6: Association for weight classification (At-risk for Overweight versus Normal Weight)

| Variables | Comparison group                         | Crude Odds Ratio | 95% confidence interval | P value |
|-----------|--|------------------|-------------------------|---------|
| Grade     | 3 <sup>rd</sup> vs 6 <sup>th</sup> grade | 0.75 (1.33)      | 0.59 – 0.95             | 0.0178  |

Analysis with weight classification (overweight versus underweight) as outcome indicated that sixth graders are 2.65 times more likely to be overweight compared to pre-kindergarten kids. See table 7.

Table 7: Association for weight classification (Overweight versus Underweight)

| Variables | Comparison group         | Crude Odds Ratio | 95% confidence interval | P value |
|-----------|--------------------------|------------------|-------------------------|---------|
| Grade     | 6 <sup>th</sup> vs Pre-k | 2.65             | 1. 19 – 5.88            | 0.0133  |

Analysis with weight classification (overweight versus underweight) as outcome indicated that females are more 1.47 times less likely to be overweight compared to males. See table 8.

Table 8: Association for weight classification (Overweight versus At-risk for Overweight)

| Variables | Comparison group | Crude Odds Ratio | 95% confidence interval | P value |
|-----------|------------------|------------------|-------------------------|---------|
| Gender    | Female vs Male   | 0.68(1.47)       | 0.52 – 0.89             | 0.0060  |

Statistical analysis of the data indicated that there was no association found between the outcome and the explanatory variables listed below;

- Gender (male/female) versus weight classification (underweight/normal weight)
- Grade (3rd/pre-k) versus weight classification (underweight/normal weight)
- Grade (6th/pre-k) versus weight classification (underweight/normal weight)
- Grade (6th/3rd) versus weight classification (underweight/normal weight)
- Gender (male/female) versus weight classification (at-risk of overweight/underweight)
- Grade (3rd/pre-k) versus weight classification (at-risk of overweight/underweight)
- Grade (6th/pre-k) versus weight classification (at-risk of overweight/underweight)
- Grade (6th/3rd) versus weight classification (at-risk of overweight/underweight)
- Grade (3rd/pre-k) versus weight classification (overweight/normal weight)
- Gender (male/female) versus weight classification (at-risk of overweight/normal weight)
- Grade (3rd/pre-k) versus weight classification (at-risk of overweight/normal weight)
- Grade (6th/pre-k) versus weight classification (at-risk of overweight/normal weight)
- Gender (male/female) versus weight classification (overweight/underweight)
- Grade (3rd/pre-k) versus weight classification (overweight/underweight)
- Grade (6th/3rd) versus weight classification (overweight/underweight)
- Grade (3rd/pre-k) versus weight classification (overweight/at-risk of overweight)
- Grade (6th/pre-k) versus weight classification (overweight/at-risk of overweight)
- Grade (6th/3rd) versus weight classification (overweight/at-risk of overweight)

## Discussion

The data collected from the screening assessment is vital in providing insight into the issue of childhood obesity. Due to difficulties and obstacles posed by confidentiality and parental consent, some vital information (such as demographics, history of physical activities at school or home and eating habits at school or home) that could have provided further understanding of childhood overweight was not available. Nevertheless, the data available provides the ground work for further investigation and data collection activities that could assist in answering the hypothetical question on why childhood overweight is on the rise in our communities. Information gleaned from this report can be utilized for planning prevention interventions around the issue of obesity.

The bivariate analysis of weight classification by grade provides a glimpse of a potential trend that could be further investigated. The trend observed indicates that as children move from pre-k to sixth grade, there is a shift in weight classification from underweight to overweight by sixth grade (graph 3). The analysis of weight classification by age indicates a similar trend. For example, progression from 4 years to 12 years old indicates weight classification shifting from underweight to overweight (graph 6). Graph six also indicates that four and five year olds peak at underweight, and then level out in at-risk and overweight classifications. In the case of eight and nine year olds, their peak is observed at a normal weight classification followed by a slight decline in at-risk and overweight classifications. The reverse is seen for 11 and 12 year olds, however. A gradual increase is observed from underweight, peaking between at-risk for overweight and overweight classifications. The line graph shows the data points for ages 3, 6, 7, 10 and 13 between 0 and 5 percent. This is due to insufficient data col-

lected on these age groups. The sample size for these age groups needs to be increased in order to explore the weight classification trends of between 3 to 4 years, 6 to 8 years, 10 to 11 years and after 12 years. Additionally, further investigation of potential correlations between change in eating habits, physical activity or physiological body changes and the trend in weight gain at the different ages should be explored. Such data could be very helpful for designing interventions for specific populations. The overall analysis indicates that sixth graders were more likely to be classified as overweight compared to third and pre-kindergarten children. Furthermore, males were more likely to be classified as overweight compared to females.

## Conclusion

In conclusion, if overweight and obesity are not addressed during childhood, the disease lingers into adulthood resulting in many health implications. The best strategy for addressing childhood obesity is prevention from the onset. Moreover, childhood obesity is an issue that requires comprehensive prevention efforts. The community has a responsibility to provide an environment conducive to physical activity; the schools have a responsibility to promote healthy habits; and finally, parents have a responsibility to model behavior. As such, the recommendation is that a multifaceted collaboration is needed between the communities, schools and parents to address and prevent obesity. (Approximately 32% of children screened in Ottawa County are classified as at-risk for becoming overweight or overweight)

An increasing number of schools are promoting healthy lifestyle behaviors. More nutritious choices in cafeterias and vending machines, such as salad bars and baked food rather than fried, encourage kids to try items other than sodas, candy bars and fries. Some schools offer opportunities for increased physical activity through intramural sports programs, physical education

(PE) and recess. Parents can get involved by ensuring their schools have healthy food options and offer PE. While children can play ball at the local park and choose healthier foods in school, at the end of the day family support counts. Children form habits from parents, and usually maintain them into adulthood. People are influenced and make decisions based on their environment or community. For example, a person may choose not to walk to the store because of a lack of sidewalks. Because of this influence, it is important to create environments that make it easier to engage in physical activity and to eat a healthy diet.

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