

## Introduction

### BACKGROUND

Childhood obesity has reached epidemic proportions both nationally and internationally for children of all ages and backgrounds [1-3]. Over the past decade, efforts have been made to assess the prevalence of childhood obesity over time.

The Coronary Artery Risk Detection in Appalachian Communities (CARDIAC) Project is a statewide screening program targeting children enrolled in select grades throughout West Virginia. As a noted cardiovascular risk factor, childhood obesity has been measured via children's body mass index (BMI) and percentiles over the past decade.

Recent reports from nationally-drawn samples [4] have noted that the percentage of obese children has been maintained. These findings have not been replicated elsewhere, particularly within areas where the childhood obesity rate appears to be doubled that reported nationally.

### RESEARCH OBJECTIVE

This is the first opportunity for comparing the CARDIAC cohorts based on the prevalence of overweight and obesity among rural, Appalachian children enrolled in the kindergarten, second, and fifth grades.

## Methods

### STUDY INFRASTRUCTURE

The CARDIAC Project collaborates with the West Virginia Rural Health Education Partnership (WVRHEP). WVRHEP provides comprehensive training for health science students in rural locations throughout the state. All study procedures were approved by the West Virginia University Institutional Review Board for the Protection of Human Subjects.

### STUDY PROCEDURES

Screenings are provided free of cost and are conducted during school hours. CARDIAC screenings take place in the larger gymnasiums or cafeteria during the early morning sessions of the school day, since most children are fasting for the lipids analyses.

The specific screening services provided through CARDIAC participation include assessments of: height (inches), weight (pounds), Body Mass Index (BMI; CDC-based gender and age comparisons), and Acanthosis Nigricans (AN; present marker on back of neck) for all grades. Fifth graders additional receive information about their blood pressure, and a fasting lipid profile (total cholesterol (TC), high density lipids (HDL), low density lipids (LDL), and triglycerides (TRI)).

BMI Percentile Category is categorized as underweight (BMI% <4.9), normal weight (5-84.9), overweight (85-94.9), obese (95-98.9), and morbidly obese ( $\geq 99$ ).



# Childhood Obesity Cohort Trends in an Appalachian Population



Lesley Cottrell<sup>1</sup>, Christa L. Ice<sup>1</sup>, Emily Murphy<sup>1</sup>, Valerie Minor<sup>2</sup>, Eloise Elliott<sup>3</sup>, William A. Neal<sup>1</sup>

<sup>1</sup>West Virginia University, <sup>2</sup>Alderson Broaddus College, and <sup>3</sup>Concord University

## Sample Studied

The study includes five years of Kindergarten (2003-2008), three years of 2nd grade screenings (2005-2008), and four complete years of 5<sup>th</sup> grade screenings (2003-2008). All children who received a BMI percentile were included. A total of 12,035 kindergarten, 10,097 second grade, and 38,486 fifth grade students were compared for this study.

## Principal Findings

### FIGURE SET 1: KINDERGARTEN COHORT TRENDS

No significant trends were noted overall ( $F(4,12,030) = 2.192, p = .07$ ) or within each BMI percentile category:

- ≥ BMI % 85<sup>th</sup> (Kruskal-Wallis,  $p = .16$ )
- ≥ BMI % 95<sup>th</sup> (Kruskal-Wallis,  $p = .13$ )
- ≥ BMI % 99<sup>th</sup> (Kruskal-Wallis,  $p = .11$ )

### FIGURE SET 2: SECOND GRADE COHORT TRENDS

Overall BMI % trends were significant [ $F(2, 10,094) = 5.712, p < .00$ ]. Pair wise comparison using Tukey HSD ( $p < .00$ ) found a significant increase between '06-'07 ( $M = 66.04$ ) and '07-'08 ( $M = 68.53$ ).

Significant trends were also noted within BMI % groups:

- ≥ BMI % 85<sup>th</sup> (Kruskal-Wallis,  $p = .00$ )
- ≥ BMI % 95<sup>th</sup> (Kruskal-Wallis,  $p = .00$ )
- ≥ BMI % 99<sup>th</sup> (Kruskal-Wallis,  $p = .00$ )

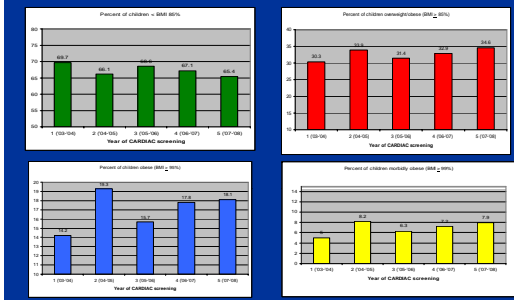
### FIGURE SET 3: FIFTH GRADE COHORT TRENDS

Overall BMI % trends were significant [ $F(4, 38,584) = 35.342, p < .00$ ].

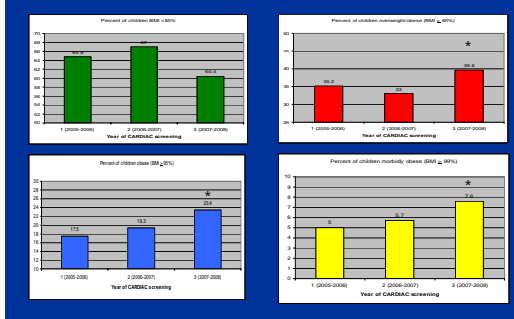
Significant trends were also noted within BMI % groups:

- ≥ BMI % 85<sup>th</sup> (Kruskal-Wallis,  $p = .00$ )
- ≥ BMI % 95<sup>th</sup> (Kruskal-Wallis,  $p = .00$ )
- ≥ BMI % 99<sup>th</sup> (Kruskal-Wallis,  $p = .00$ )

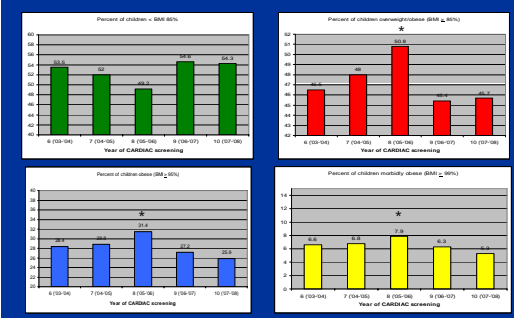
### FIGURE SET 1: KINDERGARTEN COHORT TRENDS



### FIGURE SET 2: SECOND GRADE COHORT TRENDS



### FIGURE SET 3: FIFTH GRADE COHORT TRENDS



For more information about this and related projects, please see our website: <http://www.cardiacwv.org>



## Principal Findings Cont.

## Discussion

National samples used to examine trends in childhood overweight and obesity have recently noted a leveling off of obesity nationwide. Representations of smaller samples potentially at more risk (e.g., rural, Appalachian) are fairly limited.

Trends in the proportion of overweight, obese, and morbidly obese children by grade differed in terms of significance.

Kindergarten trends were not significant based on the five-year sampling period. Second- and fifth-grade trends were significant, yet revealed different patterns.

Second grade rates of overweight, obese, and morbidly obese increased over the three year reporting period. Year 3 results demonstrated that 39.6% of students screened had BMI percentiles  $\geq 85^{\text{th}}$ , 23.4% had BMI percentiles  $\geq 95^{\text{th}}$ , and 7.6% of children screened were morbidly obese.

In contrast, fifth grade rates for each BMI category decreased. Year 8 rates for the  $\geq 85^{\text{th}}$  percentile,  $\geq 95^{\text{th}}$  percentile, and  $\geq 99^{\text{th}}$  percentile were 50.8%, 31.4%, and 7.9% respectively. These rates had decreased to 45.7% ( $\geq$  BMI 85<sup>th</sup>%), 25.9% ( $\geq$  BMI 95<sup>th</sup>%), and 5.3% ( $\geq$  BMI 99<sup>th</sup> %) by Year 10 of the 5<sup>th</sup> grade screening program.

## Implications

These cohort comparisons of the CARDIAC data by student grade indicate that BMI trends over time differ by grade and intensity (ie. significance).

All grades are not screened by the CARDIAC Project; however, those that are included reveal interesting areas for intervention and further study.

•Kindergarten cohorts should be studied further to better understand the lack of trends in this sample.

•Increases in the second grade cohorts should also be explored among future cohorts to identify potential factors associated with the increase; correlates associated with the decreases in the fifth grade cohorts also need to be identified.

• The historical presence of CARDIAC in the community over time may be one factor associated with the contrasting trends by grade. For instance, the 2<sup>nd</sup> grade screens are the newest in the CARDIAC series demonstrating increasing rates. The kindergarten program has existed for five years resulting in no trends in either direction. The 5<sup>th</sup> grade screens have been conducted for more than a decade and reveal decreases in children's BMI percentiles, particularly after the eighth year of existence.

## References

1. Rocchini A. Childhood obesity and a diabetes epidemic. *NEJM*. 2002;346(11): 854-855.
2. World Health Organization. Global surveillance, prevention, and control of chronic respiratory diseases: A comprehensive approach. *Chronic Respiratory Disease* 2007;15-21. Accessed on September 3, 2008 at <http://www.who.int/gard/publications/GARD%20Book%202007.pdf>
3. International Association for the Study of Obesity. Overweight and obesity in children have escalated dramatically in England over the past 20 years. Webpage content accessed on September 13, 2008 at: <http://www.iof.org/childhoodobesity.asp>.
4. Ogden CL, Carroll MD, Flegal KM. High body mass index for age among US children and adolescents, 2003-2006. *JAMA*. 2008; 299(20):2401-2405.

## Funding & Reporting

The CARDIAC Project is mutually funded by the WV Bureau of Public Health, the Benedum Foundation, and the Robert Wood Johnson Foundation. We have no conflicts of interest to report.

## Acknowledgements

We would like to thank our partners at the WV Rural Health Education Partnership (WVRHEP) for their tireless efforts coordinating the CARDIAC screenings throughout the academic year. We are grateful to the central CARDIAC team members who are pivotal to collecting quality screening information and providing comprehensive screening results to the children and families who participate in this project – Paula Nicholson, Violet Pastorial, Tammy Pyle, Carla Coleman, Kristin McCartney, Susan Ritchie, and Georgianna Tillis. Finally, we are grateful to the children and their families who participate in the project. Their involvement is immeasurable.