The Influence of Elementary School Programs on Childhood Obesity

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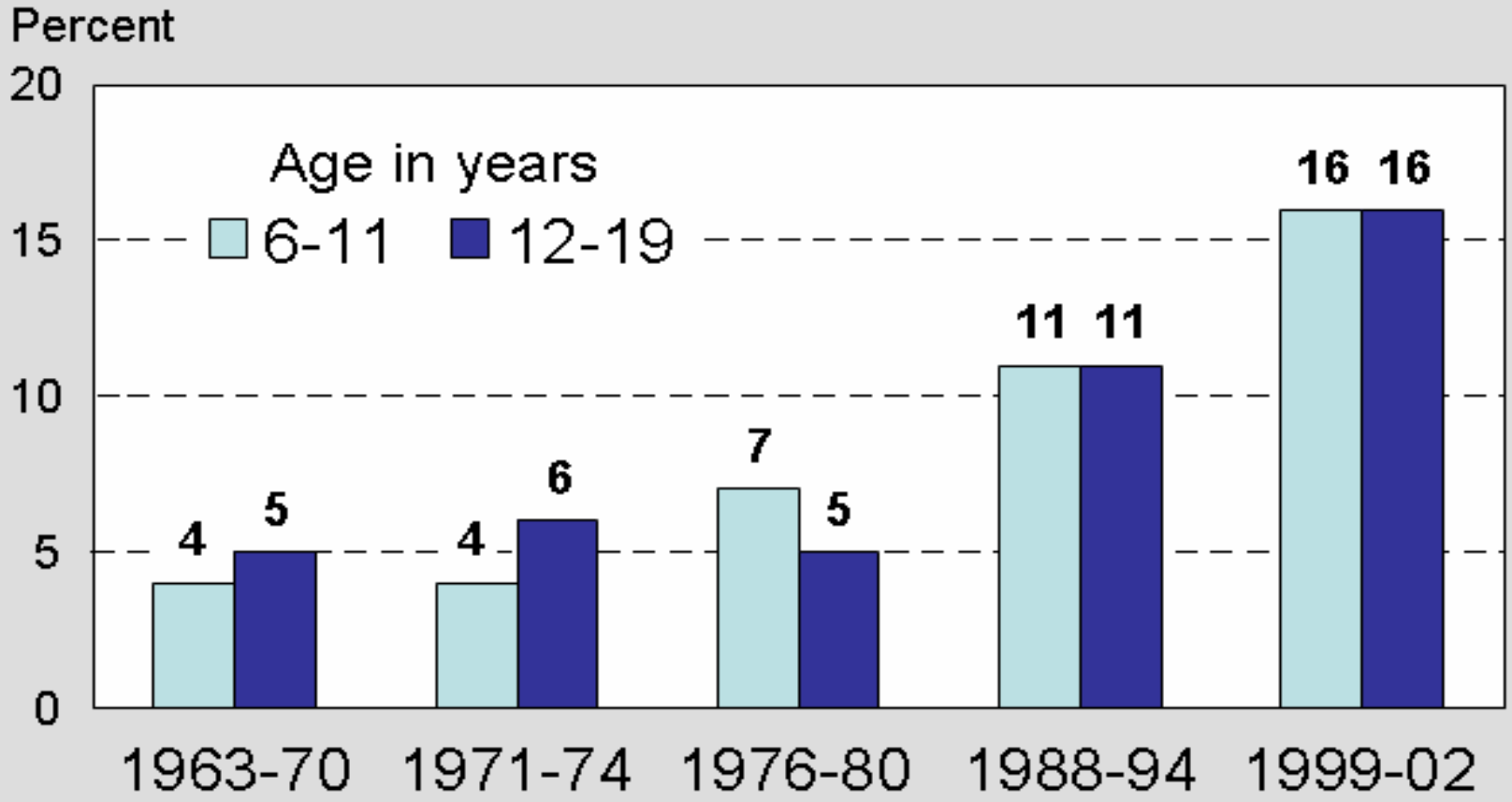
Prevalence of overweight among children and adolescents ages 6-19



NOTE: Excludes pregnant women starting with 1971-74. Pregnancy status not available for 1963-65 and 1966-70. Data for 1963-65 are for children 6-11 years of age; data for 1966-70 are for adolescents 12-17 years of age, not 12-19 years.
SOURCE: CDC/NCHS, NHES and NHANES

Source: CDC, NCHS, 2005

Definition

- The Centers for Disease Control and Prevention's (CDC) definition for childhood obesity/overweight) is based on age and gender. Using growth curves for ages two to twenty, children are classified as bring overweight when their BMI >/= 95%. An at risk child is one whose BMI is between the 85th and 95th percentile on the growth curves% (CDC, 2004).

Lay Person's Graph to Determine Overweight Status of a Child

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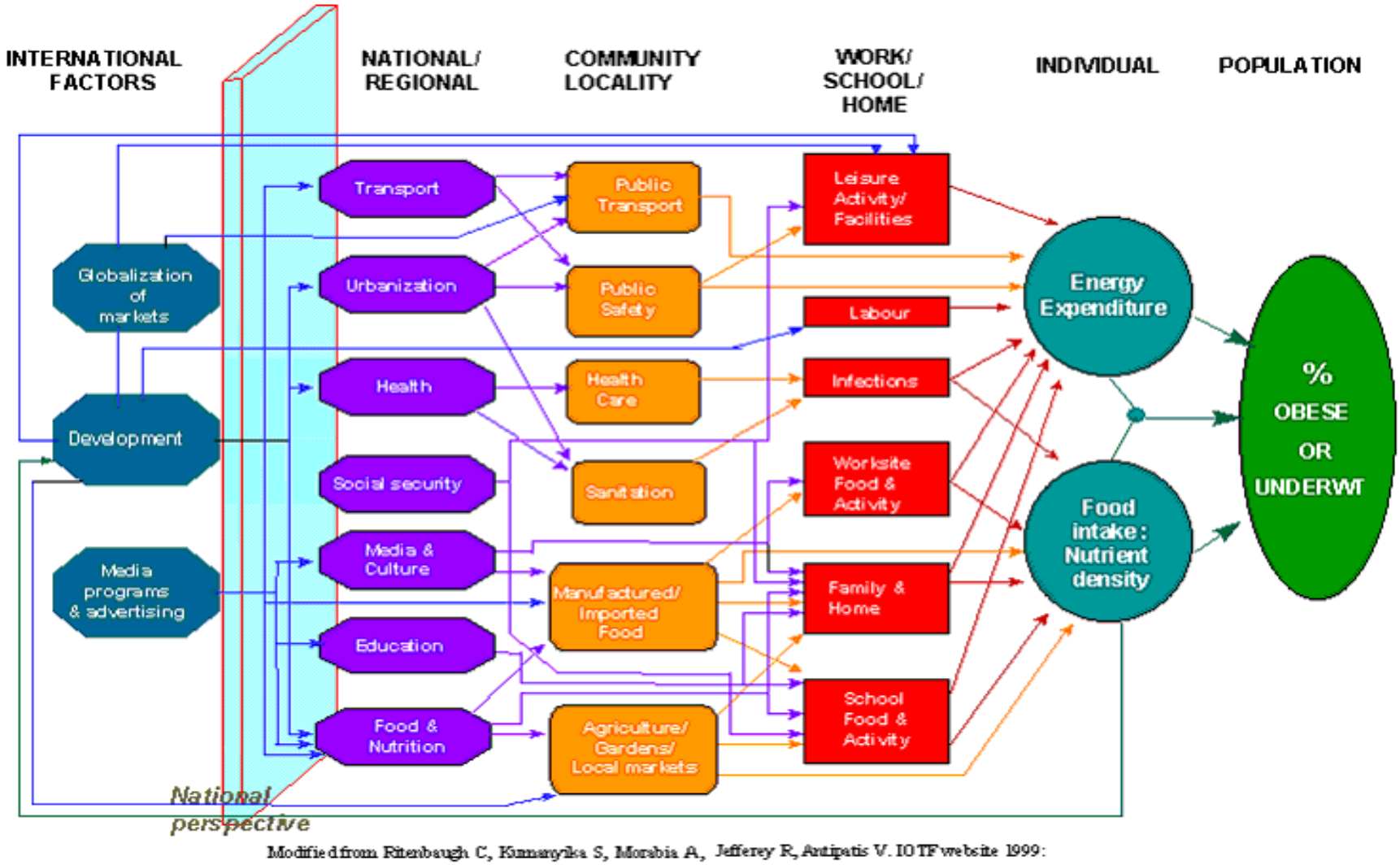
Long Term Consequences

- Obesity is linked to not only social discrimination, depression and low self esteem but to increased rates of high blood pressure, high cholesterol and Type 2 diabetes- all precursors to other chronic health states such as premature death, heart disease, asthma and orthopedic problems (The Surgeon General, 2001).

Cost of Obesity

- Annual hospital costs for children and adolescents related to overweight was $127 million dollars during 1997-1999 up from $35 million during 1979-1981 (Finkelstein, Fiebelkorn & Wang, 2003).
- Moderately obese people spend at least $10,000 more on the lifetime medical costs of five disease and conditions (hypertension, diabetes, heart disease stroke and high cholesterol) than healthy weight people (CDC, 2004).The CDC has found that a 10% weight loss could reduce an overweight person's lifetime medical costs by $2200 to $5300 (CDC, 2004 & APHA, 2004).
- Schools lose between $9 to $20 a day per student who are absent (Thorpe et al., 2004).
- Students that are severely overweight miss approximately 9 school days per year (median value).
- An extrapolation of these values can mean that an average school district can lose $95,000 a year and very large districts can lose as much as $28 million a year (Thorpe et al., 2004).
- Schools also have higher administrative costs associated with overweight students due to more resources needed to help with remediation as well as staff for administration of medication to treat students with mental and emotional problems cause by their condition (Thorpe et al., 2004)

Etiology



Modified from Ritenbaugh C, Kumanyika S, Morabia A, Jefferey R, Antipatis V. IOTF website 1999:

Role of Schools

- Schools have access to over 95% of the youth in the United States.
- Children spend nearly 2000 hours and consume between 35-40% of their total calories at school (Satcher, 2004).

IOM Interventions for Recommendation #9.

- Nutritional standards for all competitive foods sold in schools
- Ensure all meals meet the Dietary Guidelines for Americans
- Initiate pilot programs for school meal funding for high risk children
- Ensure all children have at least 30 minutes of vigorous physical activity per day during the school day
- Expand opportunities for physical activity though PE classes, physical activity clubs, programs and lessons; after school programs at the school, programs to get more children to walk or ride their bikes to school
- Initiate health curricula which spends time on instruction for healthy eating, physical activity, and reducing sedentary behaviors
- Have school policies to make schools advertisement free to the greatest possible extent
- Use school health services in obesity prevention efforts
- Conduct annual assessments of each student's eight, height, and gender and age specific BMI percentile and make this information available to parents.
- Perform periodic assessments of each school's policies and practices related to nutrition, physical activity and obesity prevention.

Statement of the Problem

- Childhood obesity lays the foundation for long term health problems such as type 2 diabetes, hypertension, sleep apnea, orthopedic problems which can lead to an early death as well as increasing the financial burden to society through increased medical spending and lost productivity (APHA, 2004).
- Schools, because they reach 95% of the school aged children, are in unique positions to help combat the prevalence and incidence of childhood obesity.
- IOM's recommendations call for schools to provide a consistent environment that is conducive to healthful eating behaviors and regular physical activity (IOM, 2004, pg 15).
- Before incorporating recommendations need an understanding of the current environment.

Purpose of Study

- Explore the relationship between the time children spend in vigorous physical activity and the school lunch program on the prevalence of overweight children and academic achievement.
- To examine the relationship between the prevalence of overweight children and the socio-demographic makeup of the elementary schools.
- To determine the amount of educational instruction children receive in healthy food choices and physical activities throughout their elementary school years.
- To determine the impact the prevalence of being overweight has on the academic achievement of the children in the elementary schools.

Significance of Study

- Seeks to establish the important role elementary schools have in offering vigorous physical activity during physical education classes and recess as well as nutritious meals on a daily bases to not only assist in combating the rising prevalence of children being overweight but also to increase the academic achievement performance children.
- The study will also try to establish the important role elementary schools have in educating children to make healthy nutrition and physical activity choices.

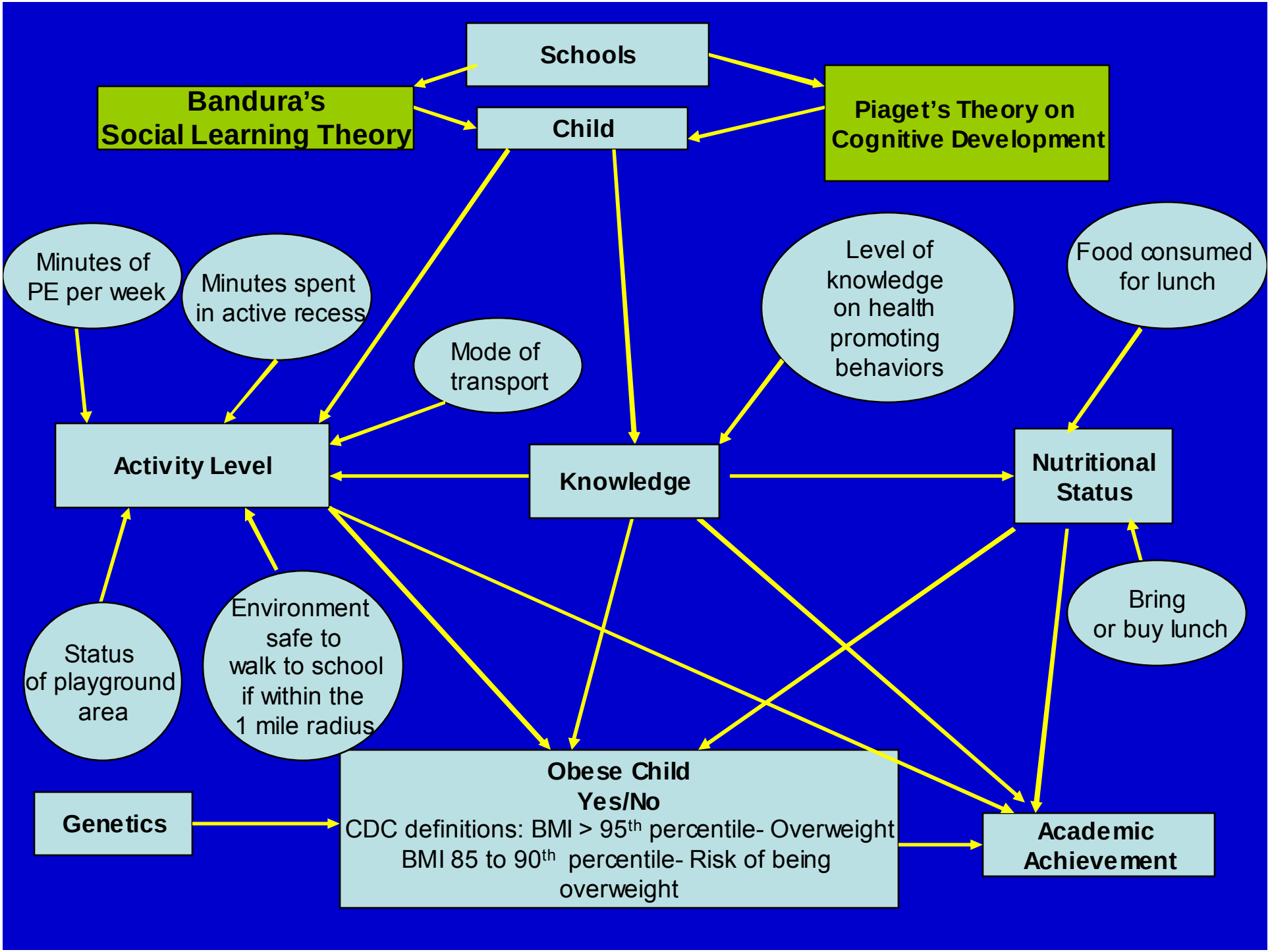
Conceptual Framework

- ***Bandura's Social Learning Theory/ Cognitive Theory (1977)***
- ***Piaget's Cognitive Development Theory (1969)***

- Both recognized that children acquire new behaviors based on their respective level of cognitive development.

- Both theorists acknowledged the impact of the environment in how and what children learn noting that learning occurs through imitation and then action.

- Schools provide a major environment for a child's learning. They provide a consistent social environment for role modeling, peer interaction, physical experiences and behavior reinforcement.



Design

The design of the study used secondary data to quantify, describe, and explore at the elementary school level:

- The amount of activity or inactivity during a typical day spent at school
- The effect the activity level had on a child's BMI
- The relationship between children's academic performance and their BMI
- The effect of school lunches on a child's BMI.
- The physical environment of the school playgrounds
- The amount of instruction time spent on the health promoting behaviors of nutrition and physical activity
- The role of ethnicity in the percent of children classified as overweight

Research Questions

- For the selected elementary schools in this study, the research questions are:
- 1. Does regularly eating a school purchased lunch affect a child's BMI?
- 2. Among elementary schools, are there ethnic differences in the number of children who are overweight?
- 3. Does the playground physical environment affect the child's ability to be physically active?
- 4. How many hours of nutrition education does a child receive during his/her elementary school years?

Hypotheses

- For the selected elementary schools of this study, the hypotheses are:
- 1. A child's propensity for being overweight or at risk for being overweight is influenced by the school lunch program.
- 2. Among these specific elementary schools, there are ethnic differences in the number of children who are overweight or at risk for being overweight.
- 3. The playground physical environment influences a child's ability to be physically active at recess.
- 4. The number of instructional hours in nutrition that a child receives during his/her elementary school years influences his/her propensity to being overweight or being at risk for being overweight.

Sample

- The sample population was the 36 elementary schools in one school district located in Central Virginia. Clustered within each school were cohorts of students in kindergarten and third grade.

School Variables

- Number of free lunch participants at the school
- Number of children enrolled in ESL classes
- Number of students who ride the bus
- Number of students who walk to school
- Number of students who are driven to school
- Number of minutes spent per week in PE by grade level for kindergarten and third grade
- Number of minutes spent per week in active recess for kindergarten and third grade
- Number of minutes students receive on instruction of on nutrition and exercise
- Academic performance measures as measured by the scores achieved on the standardized objectives of learning (SOL's) tests that are administered in the third grade to every school in the state of Virginia. Readiness for kindergarten will be the measure for the academic performance for kindergarteners (PALS-K).
- The playground physical activity environment will be assessed by the information obtained through the county (number of slides, number of swings, other playground equipment such as monkey bars, climbing pole, running track availability, number of basketball goals and availability of basketballs)

Student Variables (cont)

- BMI
- Number of school lunches sold per day
- The number of calories contained in a daily school lunch (one week of meals)
- Ethnic breakout for each elementary school
- Number of students per school
- School boundaries

Measures

•Secondary data.

-Sources of data: BMI, obtained from the county's department of health epidemiological report on prevalence of overweight for the school age child 2003-2004. BMI reported for each elementary school and for the kindergartner and third grade classes within each elementary school. The data is reported by categories: underweight, normal, at risk of overweight and overweight.

-The socio-demographic variables were collected from US Census Report and the National Center for Education Statistics (NCES) as reported on the world wide web site: www. Greatschools.net.

-Third grade academic achievement data was obtained from the world wide web site: www. greatschools.net, a website that is developed from the National Department of Education and the National Center for Education Statistics.

- Readiness for kindergarten information was obtained from county's education office.

Measures (cont)

- The nutritional value of lunch was obtained from published school lunch menus. The calories and nutritional content will be calculated using the United States Department of Agriculture nutritional tool found at www.barc.usda.gov/bhnrc/foodsurvey/summary.html.

-Bus route information was not ptovided from the Central Virginia's county's department of transportation mapping division.

-Playground environment information was obtained from the school districts maintenance and recreation departments which will note the play equipment available, size of playground area and maintenance of the equipment.

-A data collection tool was used only as a repository for the information collected from the schools which include school and student variables as noted above.

Data Analysis Tools

- **SPSS® Version 13** was used to perform statistical analysis.
- **GIS Arc View 3.0** was used to analyze and spatially display the data.

Data Analysis

- Descriptive analysis of each school population.
- Scatter plots and Correlationals for:

  -Ethnicity and prevalence of overweight for third graders and kindergartners;

  -Percent of overweight and academic achievement for kindergartners and third graders

  - Percent of school lunches sold and prevalence for overweight for third graders
- Multiple regression to determine which if any variables explain the variance for the prevalence of overweight children in the third grade.

Data Analysis (cont)

- **GIS maps were generated for:**

  - The ethnic break down of each elementary school

  - The prevalence of overweight for kindergartners and third graders by elementary school

  - The percent of school lunches sold by elementary school

  - The percent of children on free lunch by elementary school

- **Nutrition**

  -An analysis of the school lunch program to determine the nutritional content of the meals which included the amount of fats, carbohydrates, protein as well as selected micronutrients and calories.

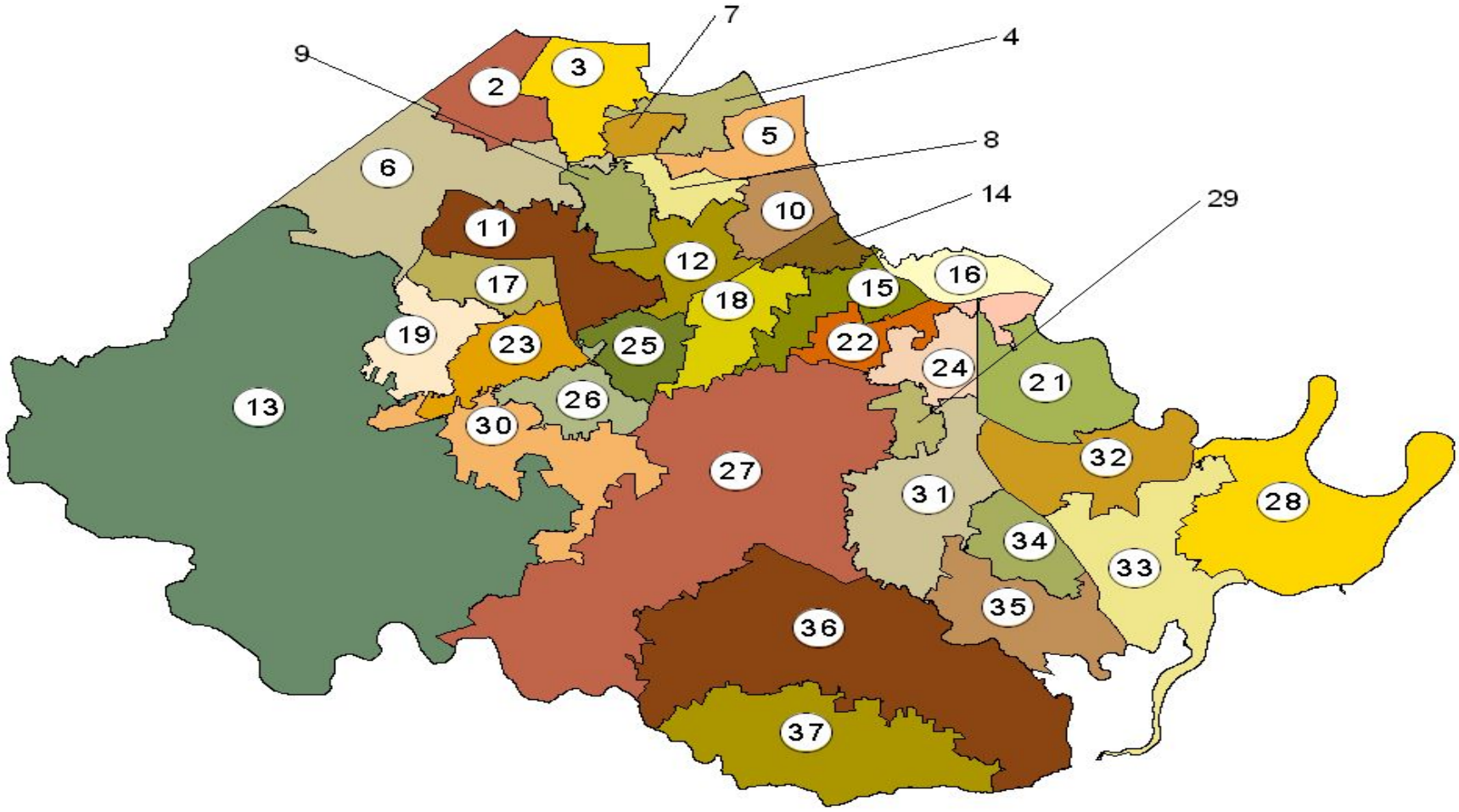
Comparison of Selected Demographic Characteristics for the County and the United States

- **Median Household Income**: $44,684 (US), $61,543 (County)
- **Median Age**: 36.2 years (US), 36.3 years (County)

  Families Below Federal Poverty Level: 10.1% (US), 6.1% (County)
- **Individuals Below Federal Poverty Level**: 13.1% (US), 5.9% (County)
- **Ethnicity**: White, 75.6% (US), 75.5% (County)
  Black/African-American: 12.2% (US), 19.3% (County)
  Hispanic: 14.2% (US), <3% (County)
  Asian: 4.2% (US), <1% (County)
  American Indian: <1% (US), <1% (County)
- **Educational Attainment**: High School Graduate or Higher: 83.9% (US), 88.6% (County)
- Bachelor's Degree or Higher: 27.0% (US), 33.3% (County)

*Source: US Census Bureau American Community Survey 2003-2004

Schools



Description of Schools

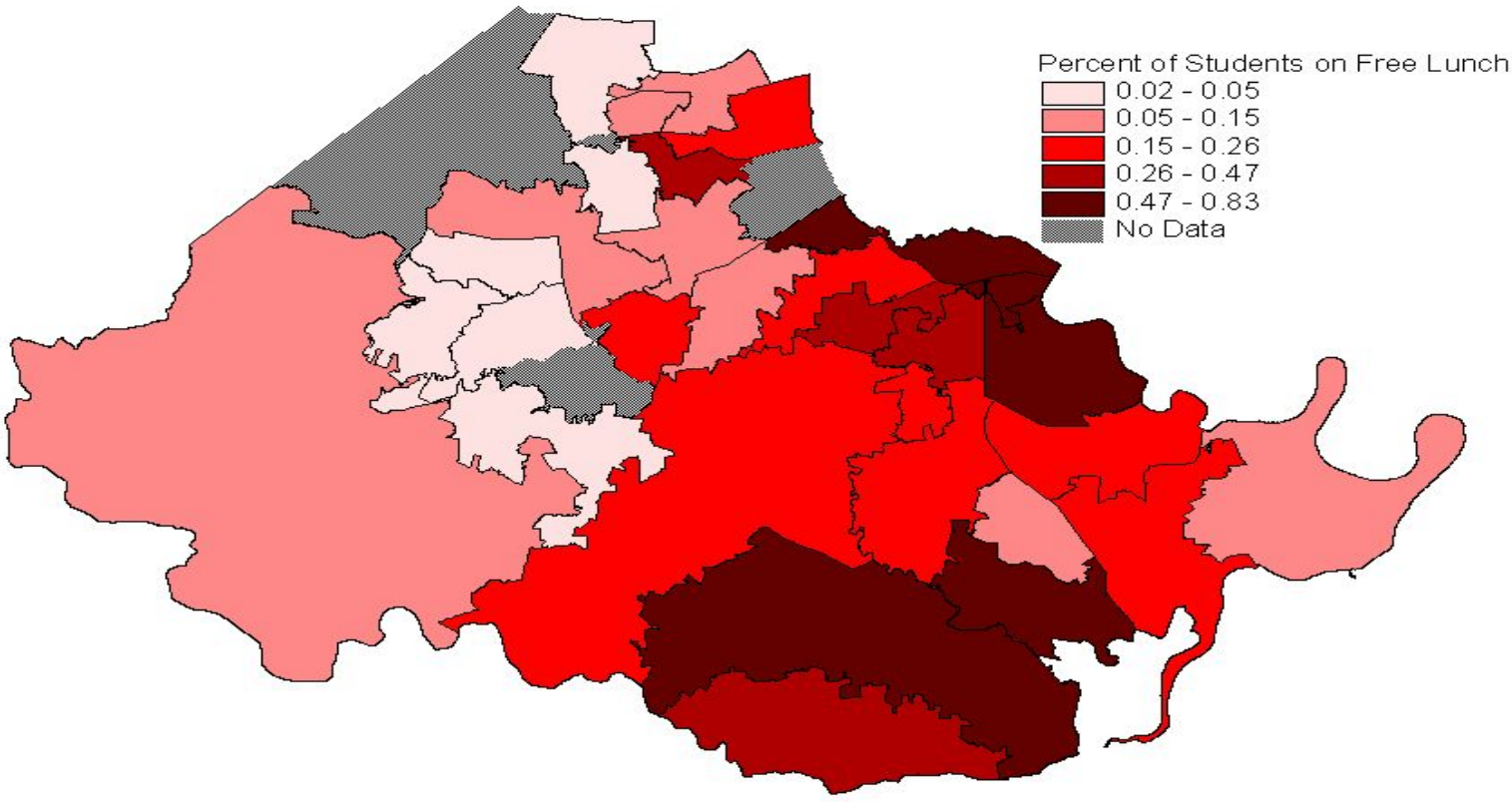
Descriptions of the Participating Elementary Schools

Descriptor (per school)	No. of schools	Min. statistic	Max. statistic	*M*	*SD*	Skewness	Standard error
No. of students	32	370	1,099	666.75	164	0.533	0.414
Kindergartners underweight (%)	36	0	7.4	3	2	1.04	0.393
Kindergartners at normal weight (%)	36	51.4	81	69	7	- 0.189	0.393
Kindergartners at risk for overweight status (%)	36	6.6	25.7	16	4	- 0.175	0.393
Kindergartners overweight (%)	36	3.1	22.1	12	4	.008	0.393
Third graders underweight (%)	36	0	28	3	5	5.164	0.393
Third Graders at normal weight (%)	36	48.7	75.2	62	7	- 0.112	0.393
Third graders at risk for overweight status (%)	36	11.3	31.2	18	4	0.793	0.393
Third graders overweight (%)	36	4.3	31.2	18	6	.030	0.393

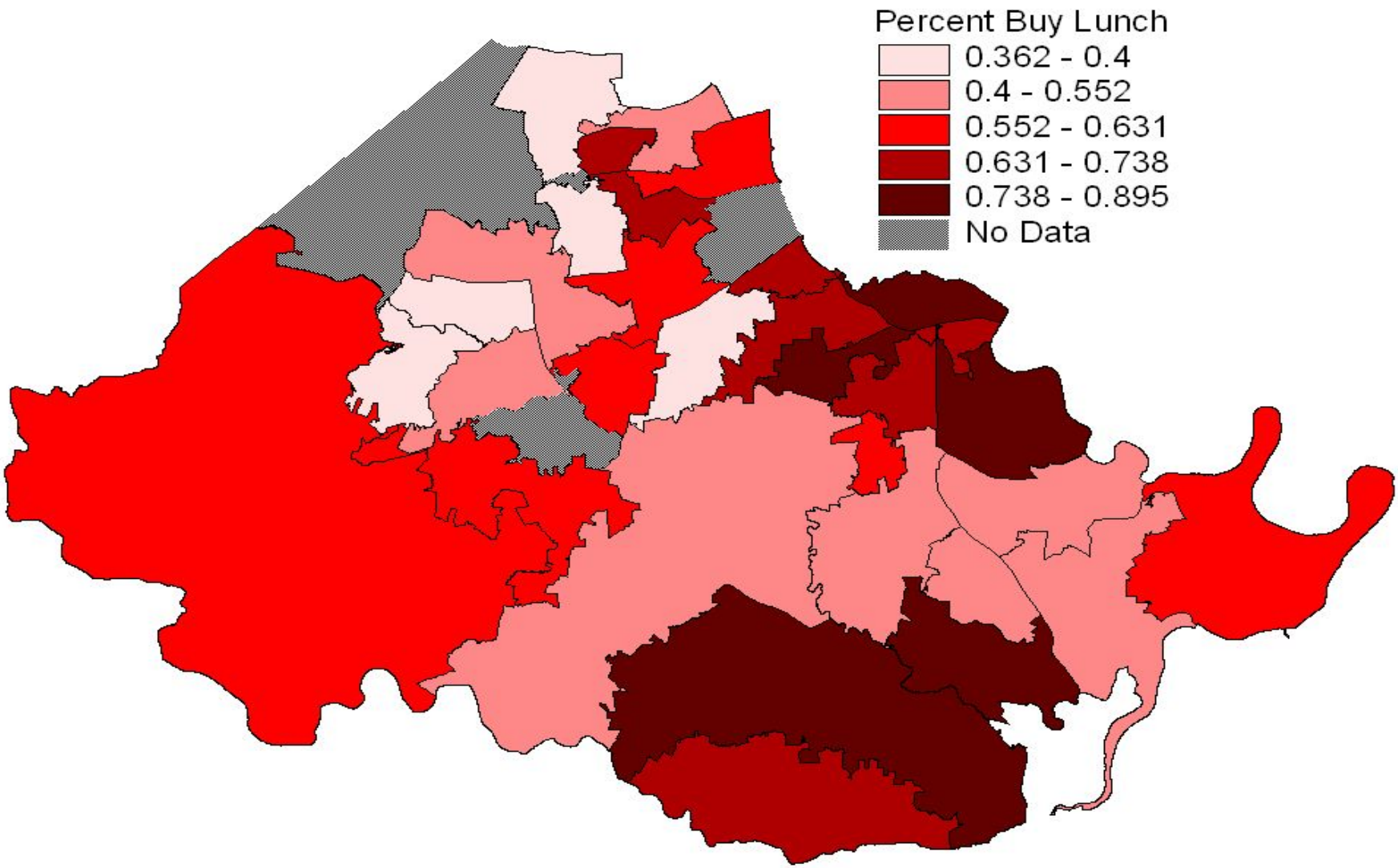
Description of Schools (cont)

Descriptor (per school)	No. of schools	Min. statistic	Max. statistic	*M*	*SD*	Skewness	Standard error
Students in free- or reduced lunch programs(%)	32	2	83	26	22	1.103	0.414
White students (%)	32	13	91	66	23	- 0.935	0.414
African American students (%)	32	6	76	26	20	1.046	0.414
Asian students (%)	32	0	6	3	1	0.316	0.414
Hispanic students (%)	32	1	23	5	6	1.878	0.414
American Indian students (%)	32	0	1	4	18	5.652	0.414
Third-grade SOL reading scores	36	48.28	95.24	77	12	- 0.458	0.393
Third-grade SOL math scores	36	78.22	100	94	4	- 1.629	0.393
Kindergarten PALS-K scores	36	3	36	14	7	0.948	0.393
Students purchasing school lunches	32	36.3	89.5	60	14	.071	0.414
Valid number of schools in analysis	32						

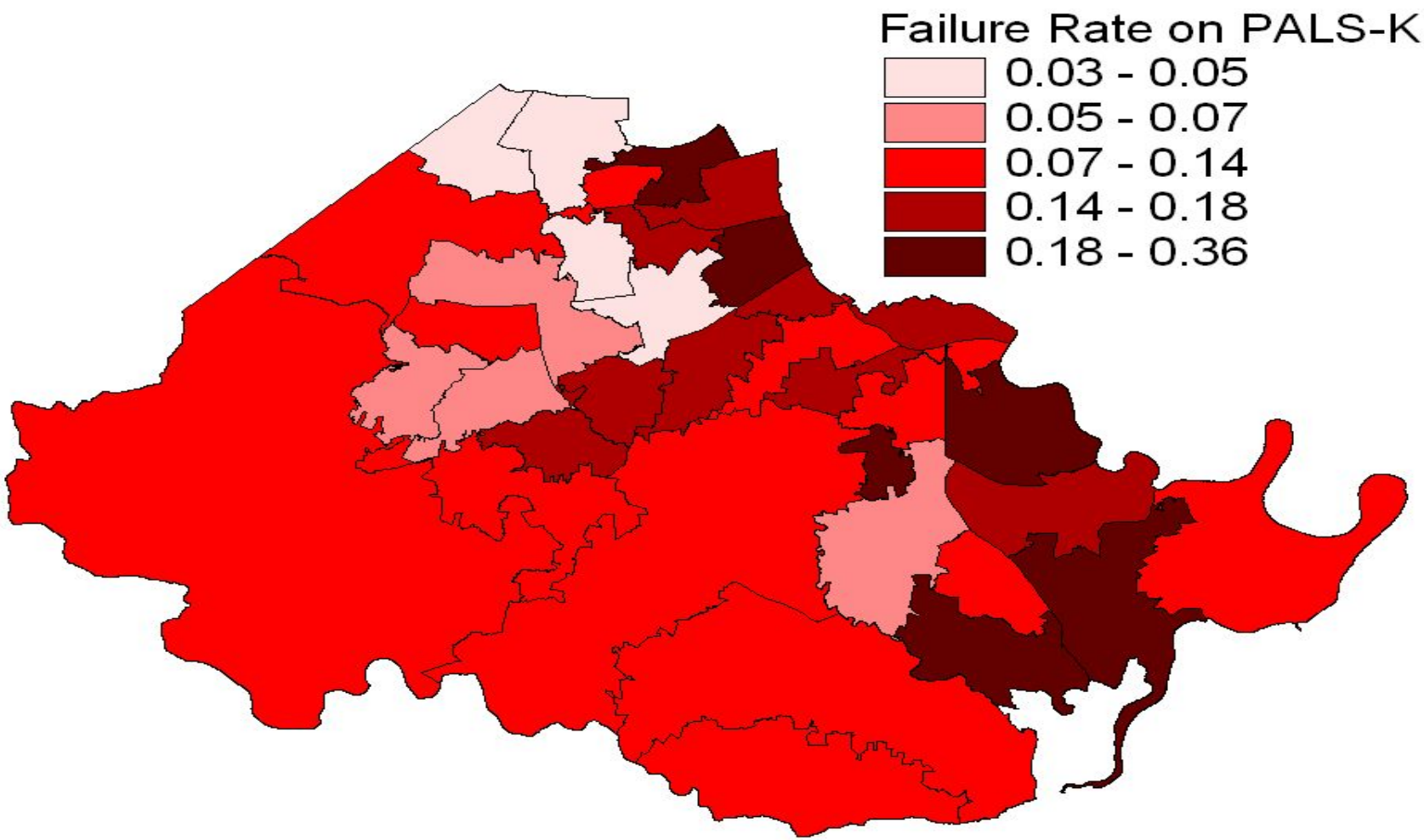
Socioeconomic Status- SES



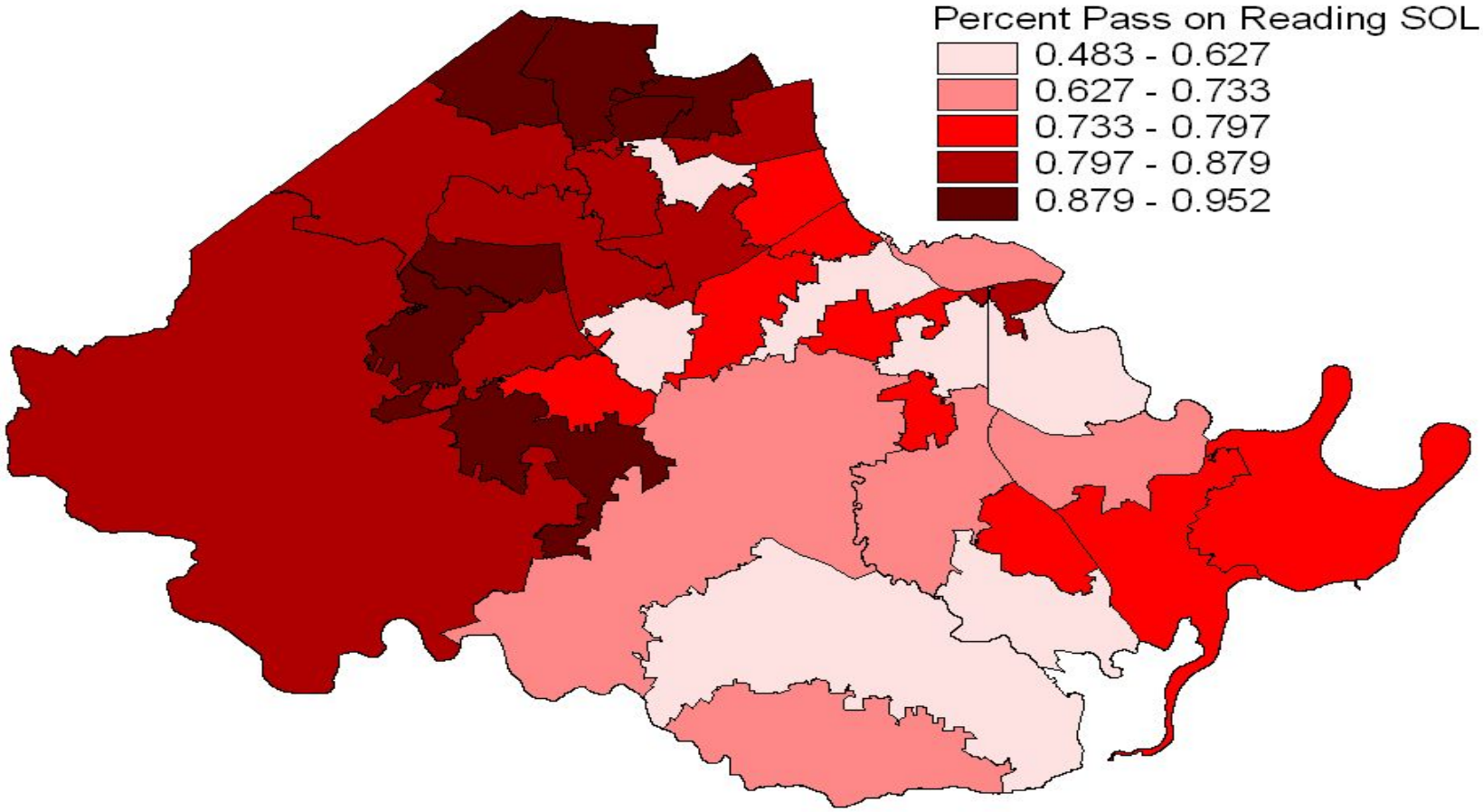
Percent of Students Who Buy Lunch



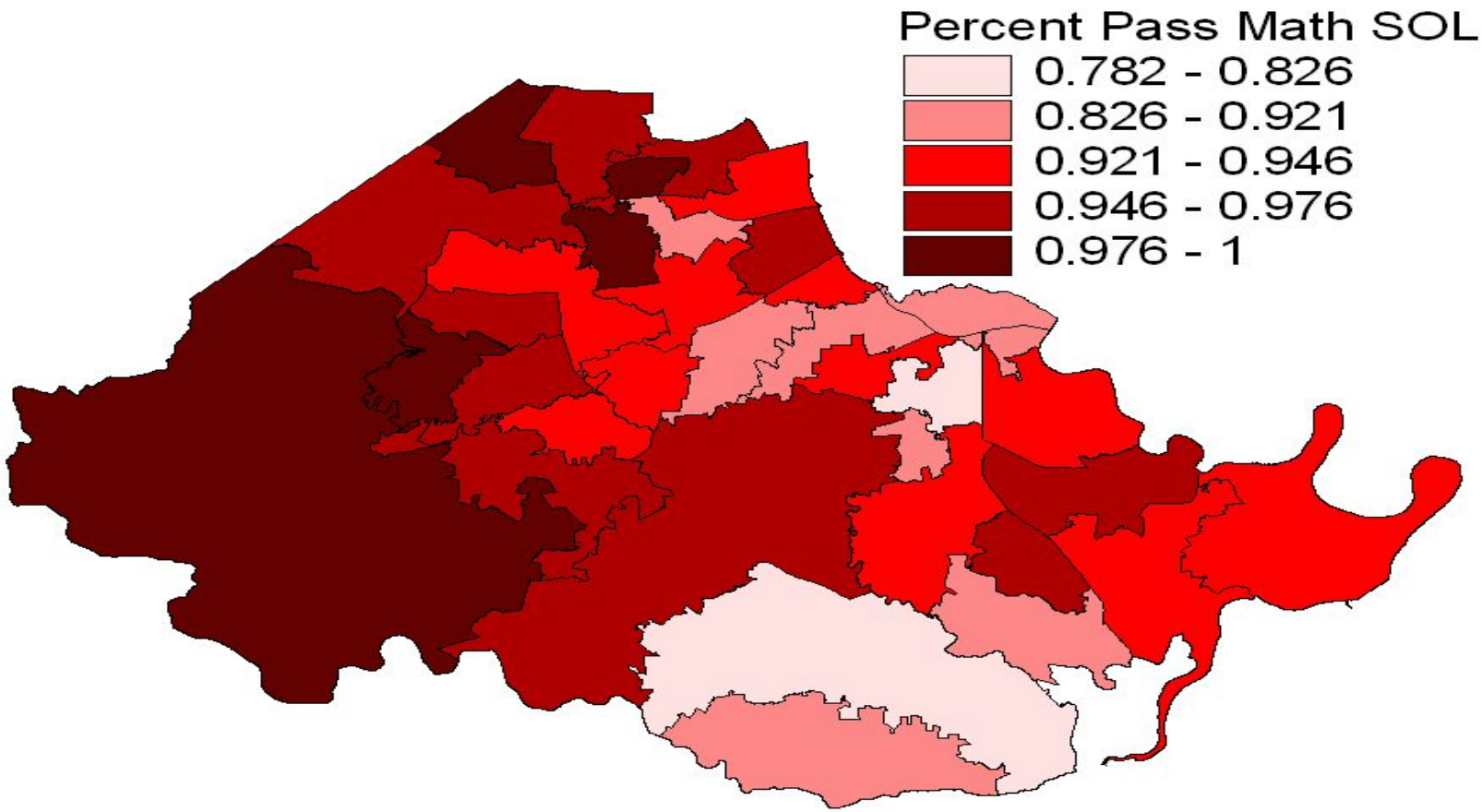
Achievement Scores- Kindergarten



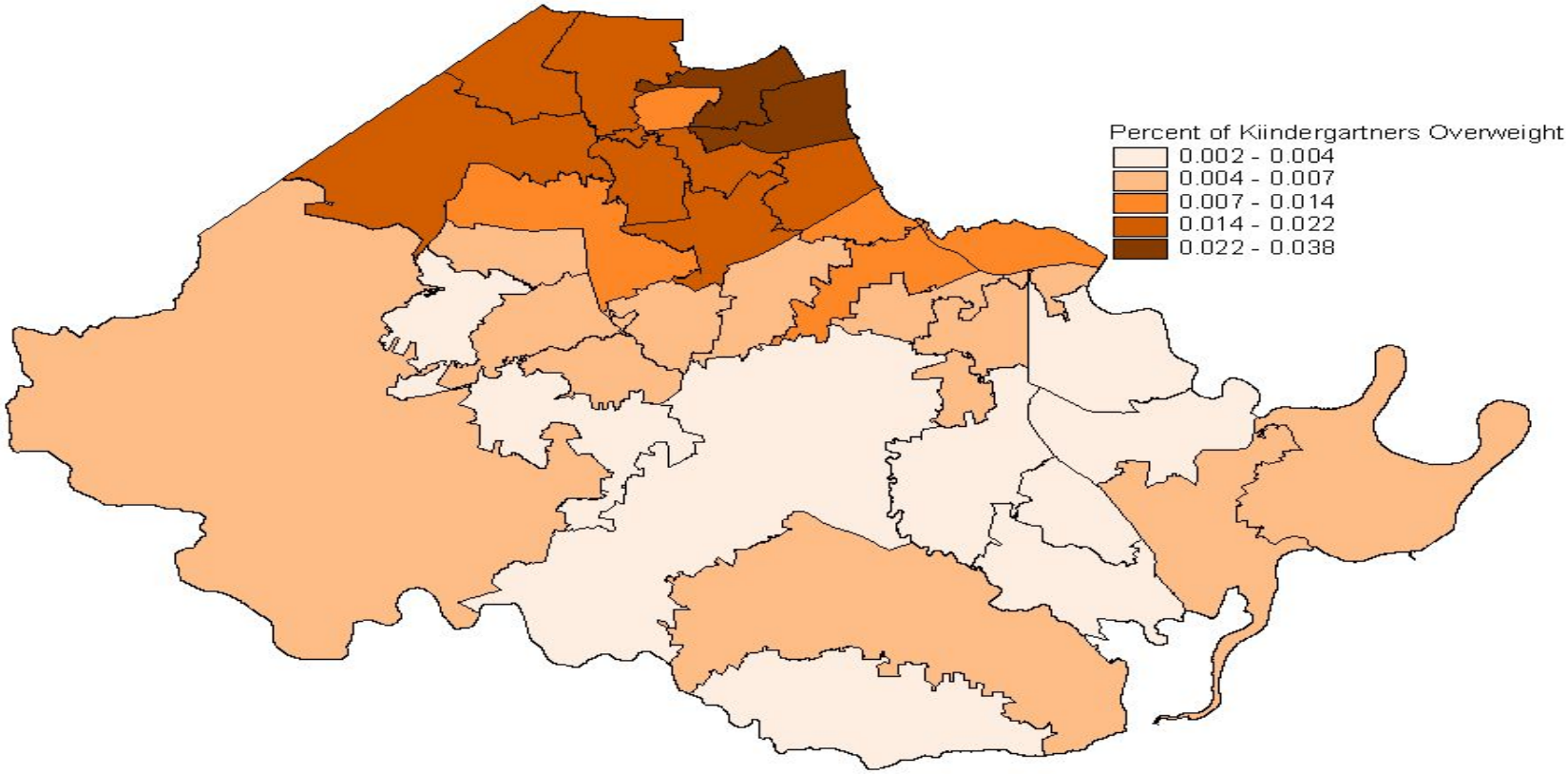
Achievement Scores-Reading SOL Third Graders



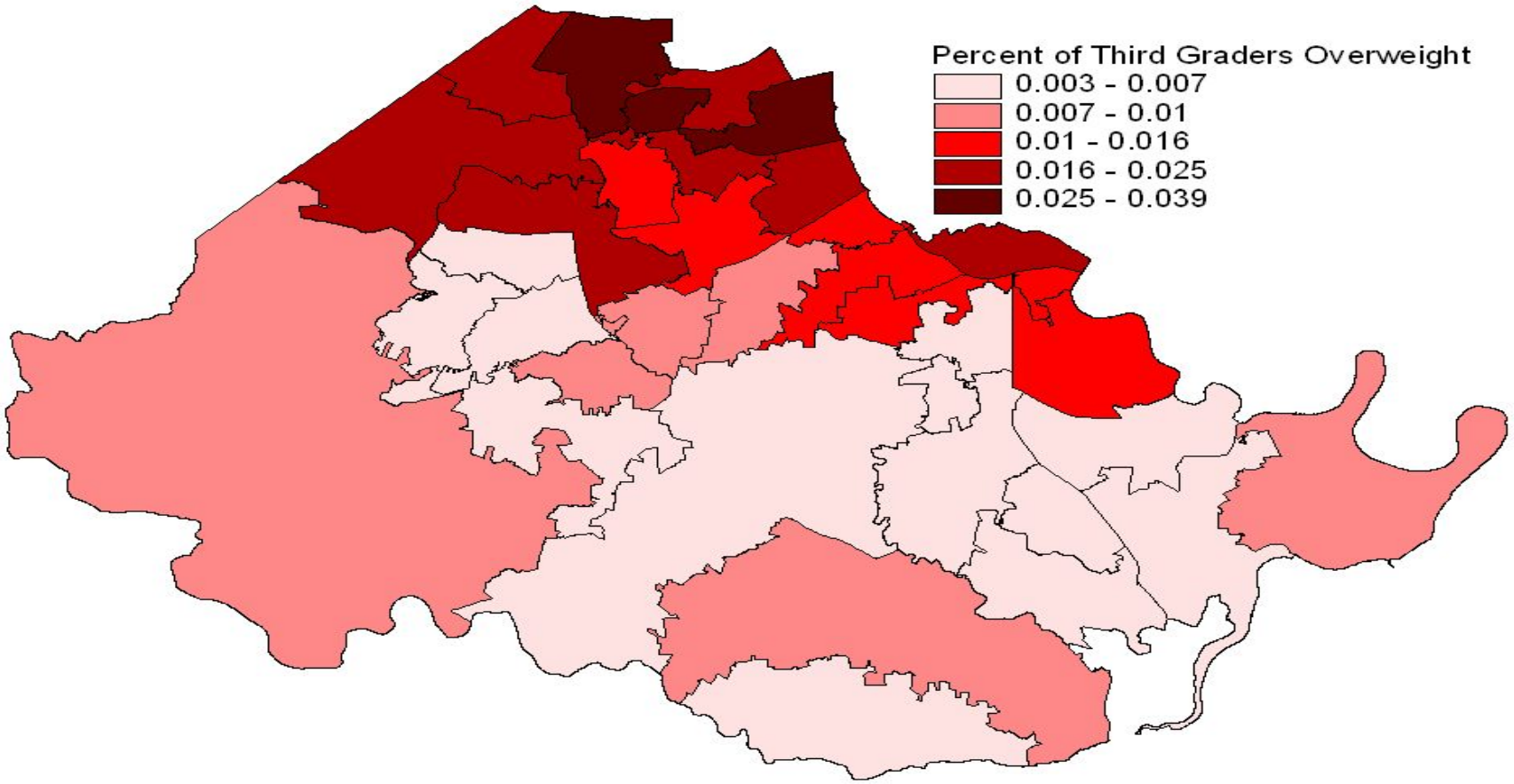
Achievement Scores- Math SOL Third Graders



Percent of Students Overweight for Kindergarten



Percent of Students Overweight for Third Grade



RQ1. Does regularly eating a school purchased lunch affect a child's BMI?

Table 4: Pearson Correlation of Kindergarten and Third Grade Weight Status and the Percent of Students Buying Lunch

Variable	Percent Buying Lunch	Underweight	Normal Weight	At Risk for overweight	Overweight
Percent Buying Lunch	1.00				
Kindergarten Underweight	.10	1.00			
Kindergarten Normal Weight	-.61***		1.00		
Kindergarten At Risk for Overweight	.54 ***			1.00	
Kindergarten Overweight	.37*				1.00
Third Grade Underweight	.11	1.00			
Third Grade Normal Weight	-.49**		1.00		
Third Grade At Risk for Overweight	-.17			1.00	
Third Grade Overweight	.68***				1.00

Note. n=32.
*p< .05, two-tailed.
** p< .01, two-tailed.
***p< .001, two-tailed.

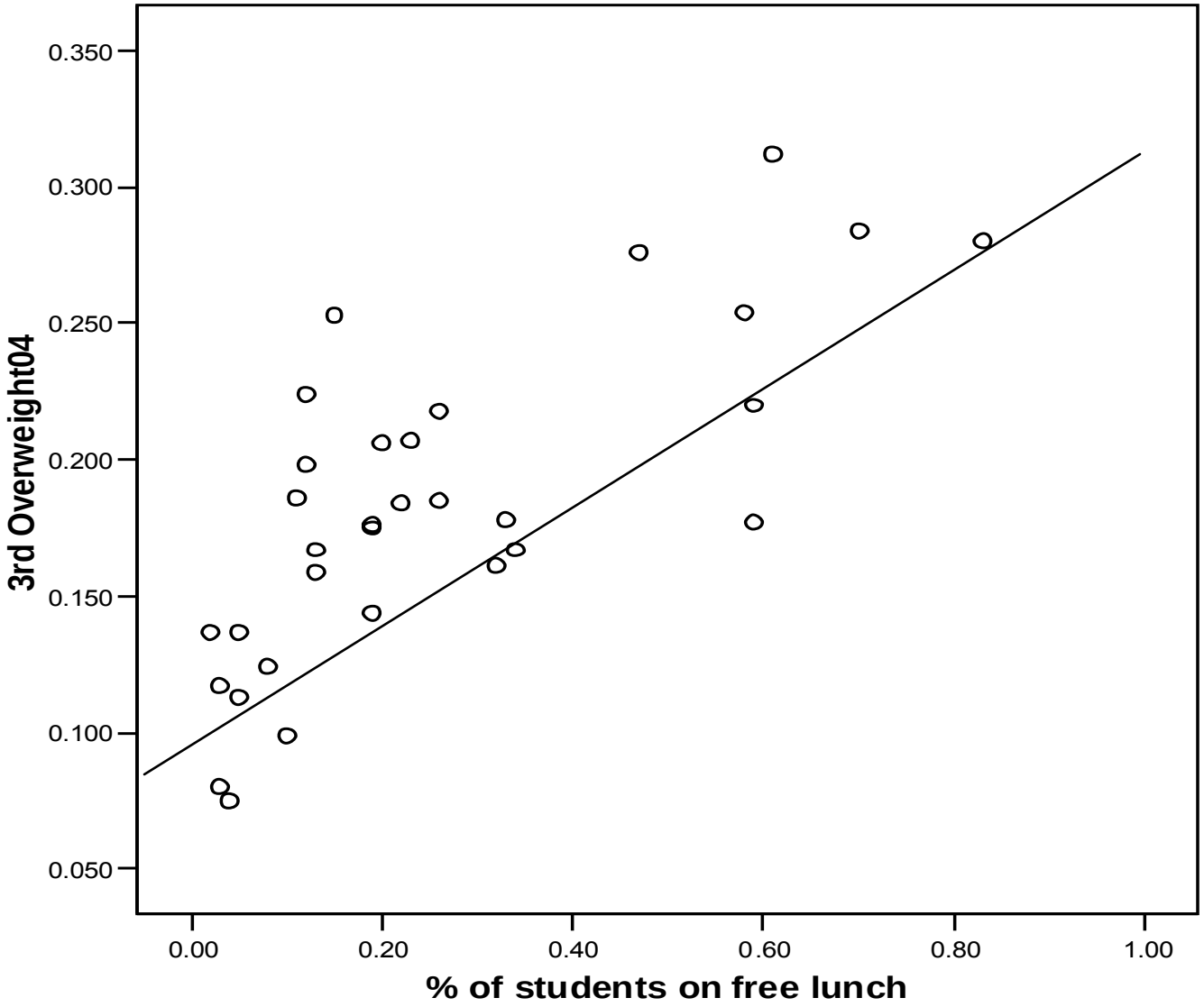
RQ1. Does regularly eating a school purchased lunch affect a child's BMI?

Table 5: Multiple Regression for Model of Predictors Determining Third Grade Overweight

Predictor	Summary Statistic
R	.766
R Square	.587
Adjusted R Square	.559
Std. Error of the Estimate	.039574
F	20.624 (DF 2,29) ***
Constant Unstandardized Coefficients (B)	.089
Constant Standardized Coefficients (Beta)	
t	2.246 *
% buy lunch Unstandardized Coefficients (B)	.089
Constant Standardized Coefficients (Beta)	.218
t	1.096
Students on Free Lunch Unstandardized Coefficients (B)	.157
Constant Standardized Coefficients (Beta)	.581
t	2.928 **

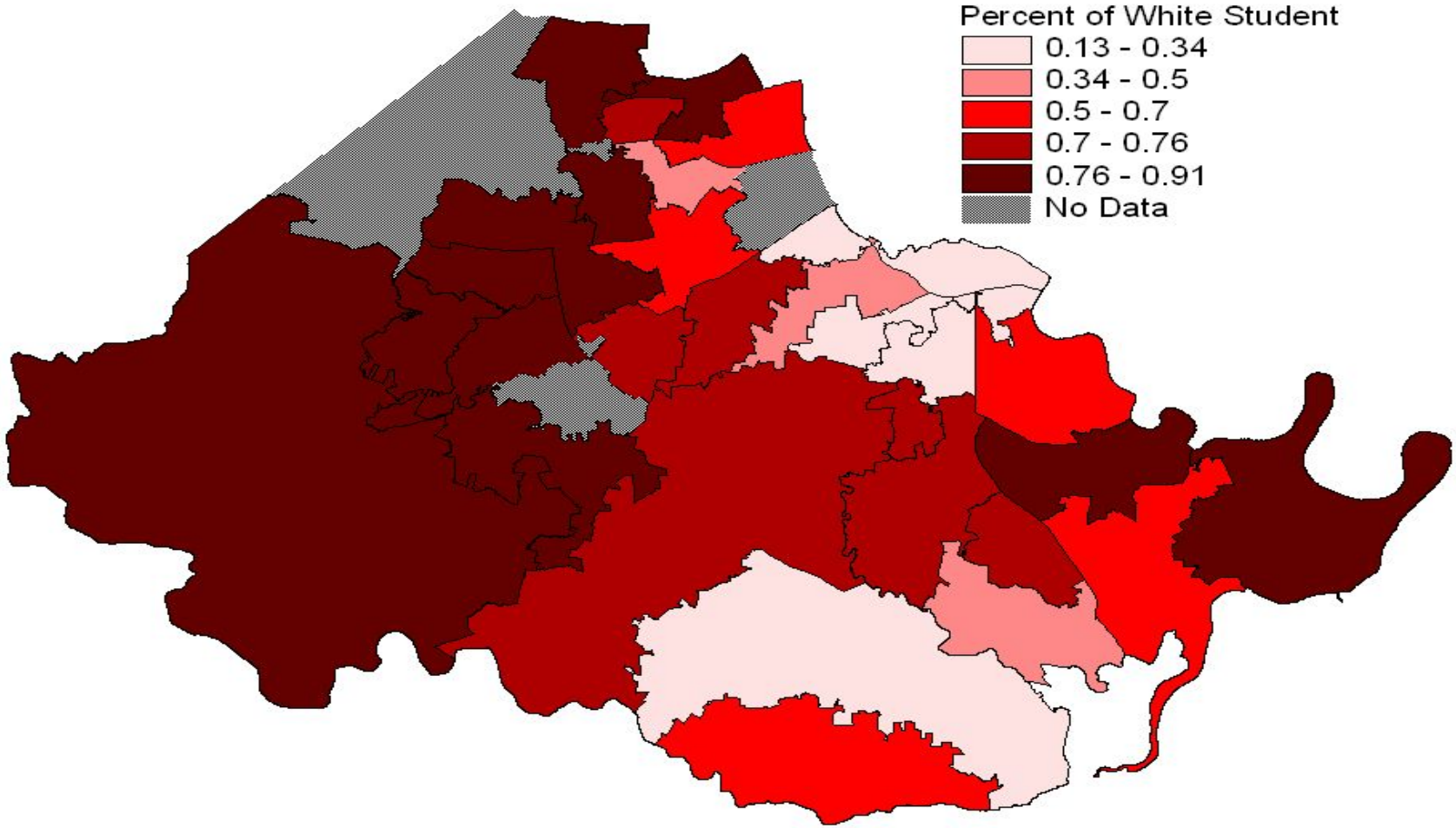
Note. n=32.
*p<.05.
**p<.01.
***p<.001

RQ1. Does regularly eating a school purchased lunch affect a child's BMI?



$\hat{Y}$=.089+.157(x)
r=.77***
***p<.001

RQ2. Among elementary schools, are there ethnic differences in the number of children who are overweight?



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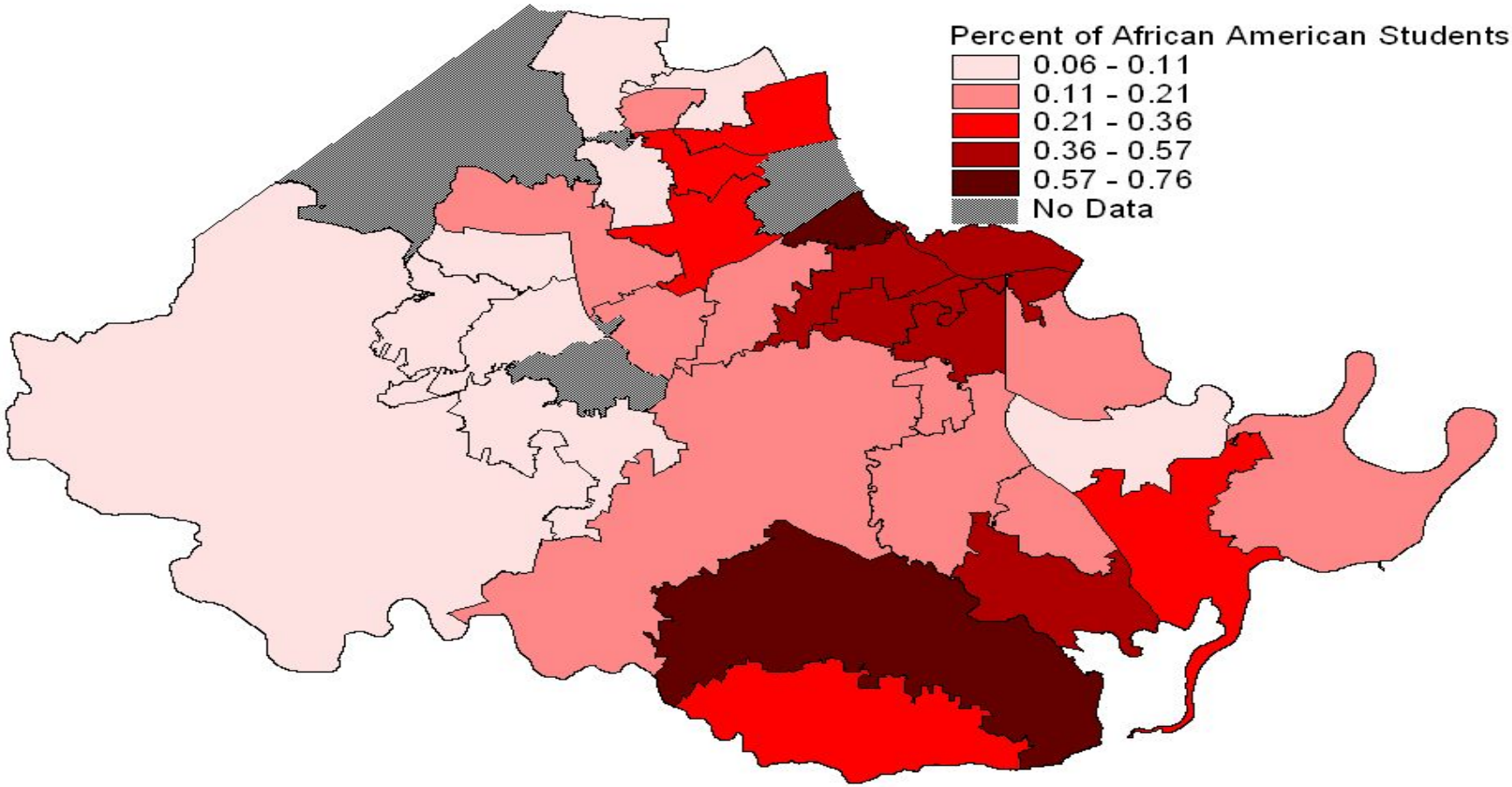

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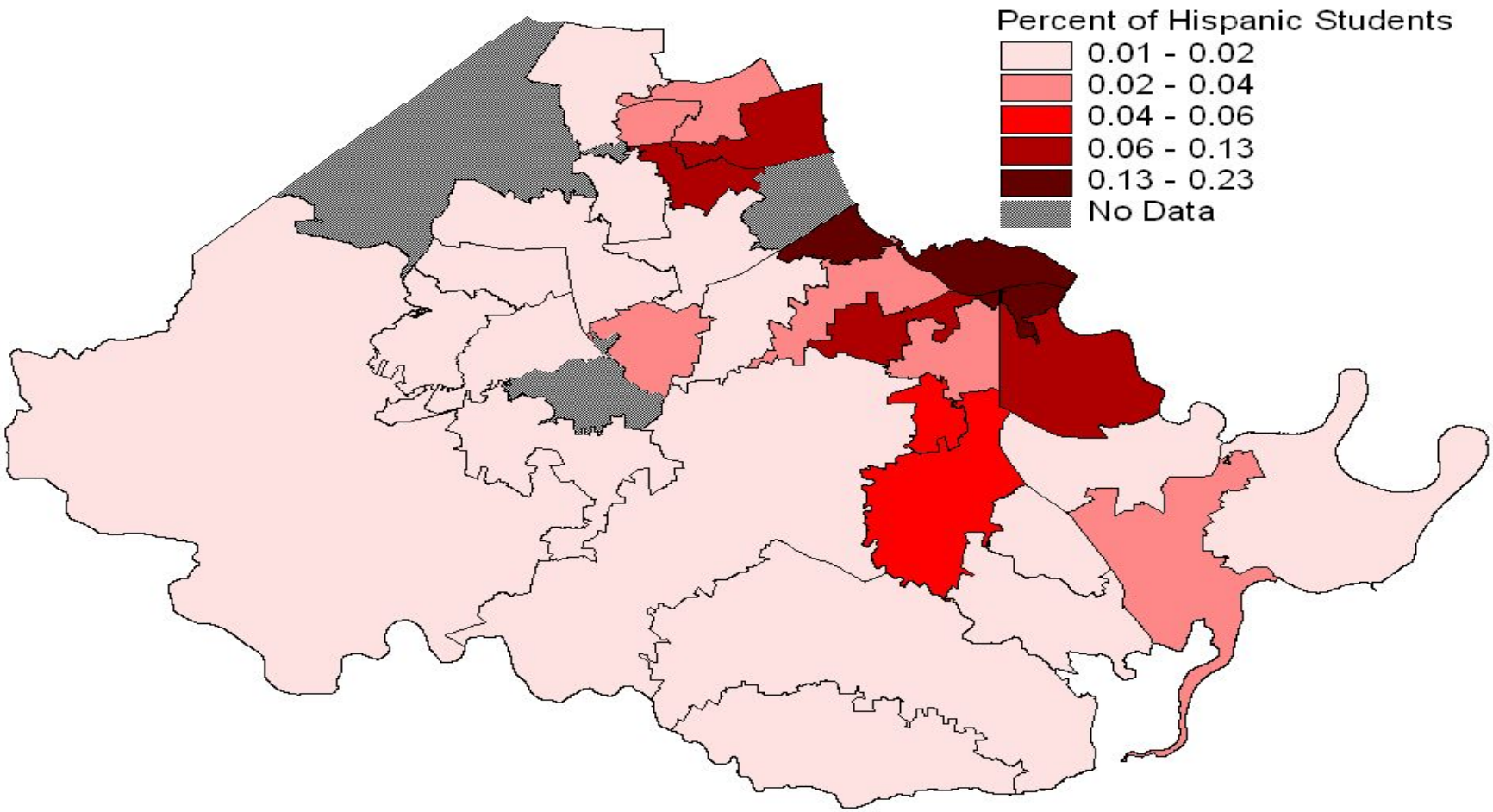

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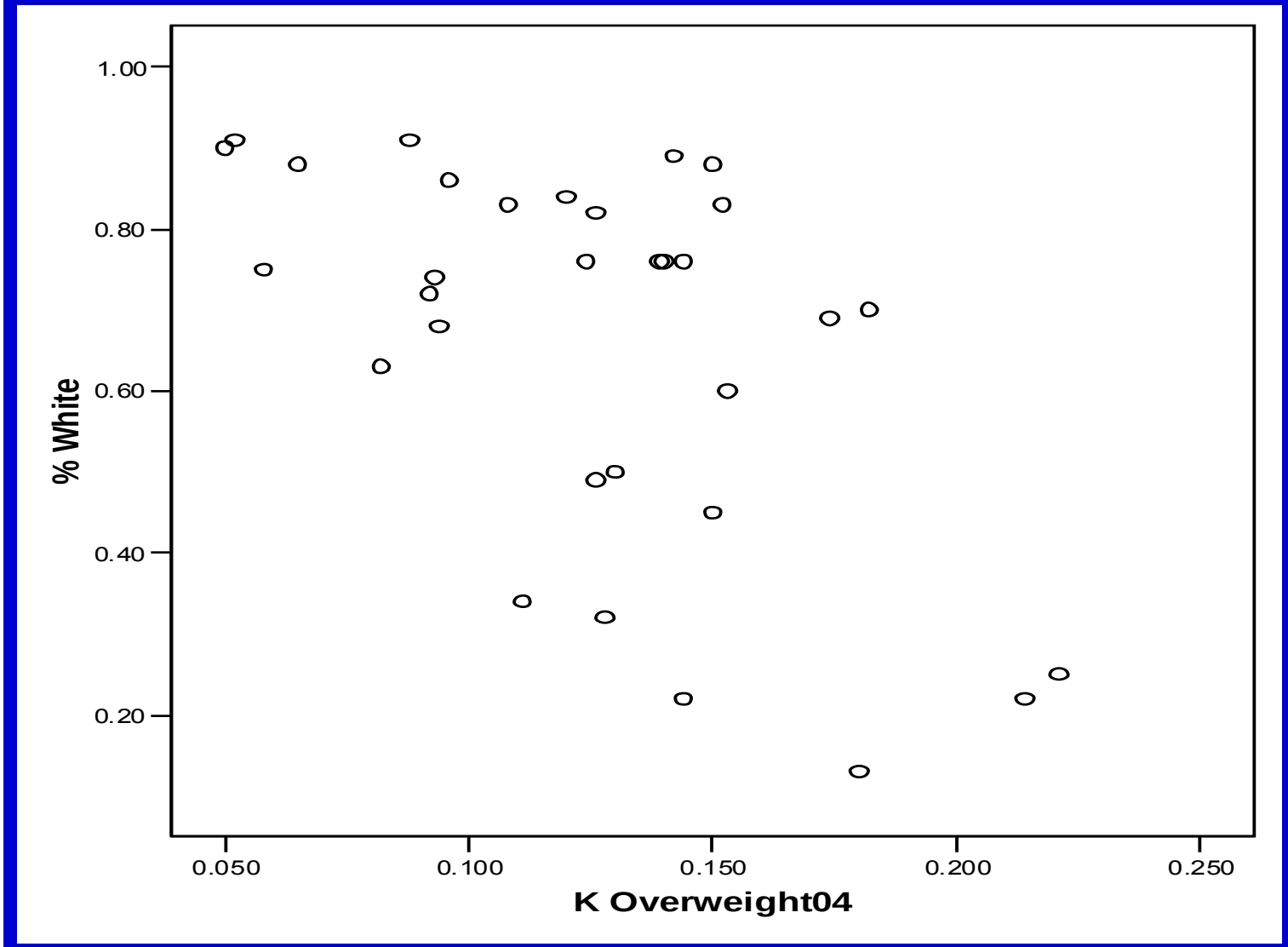
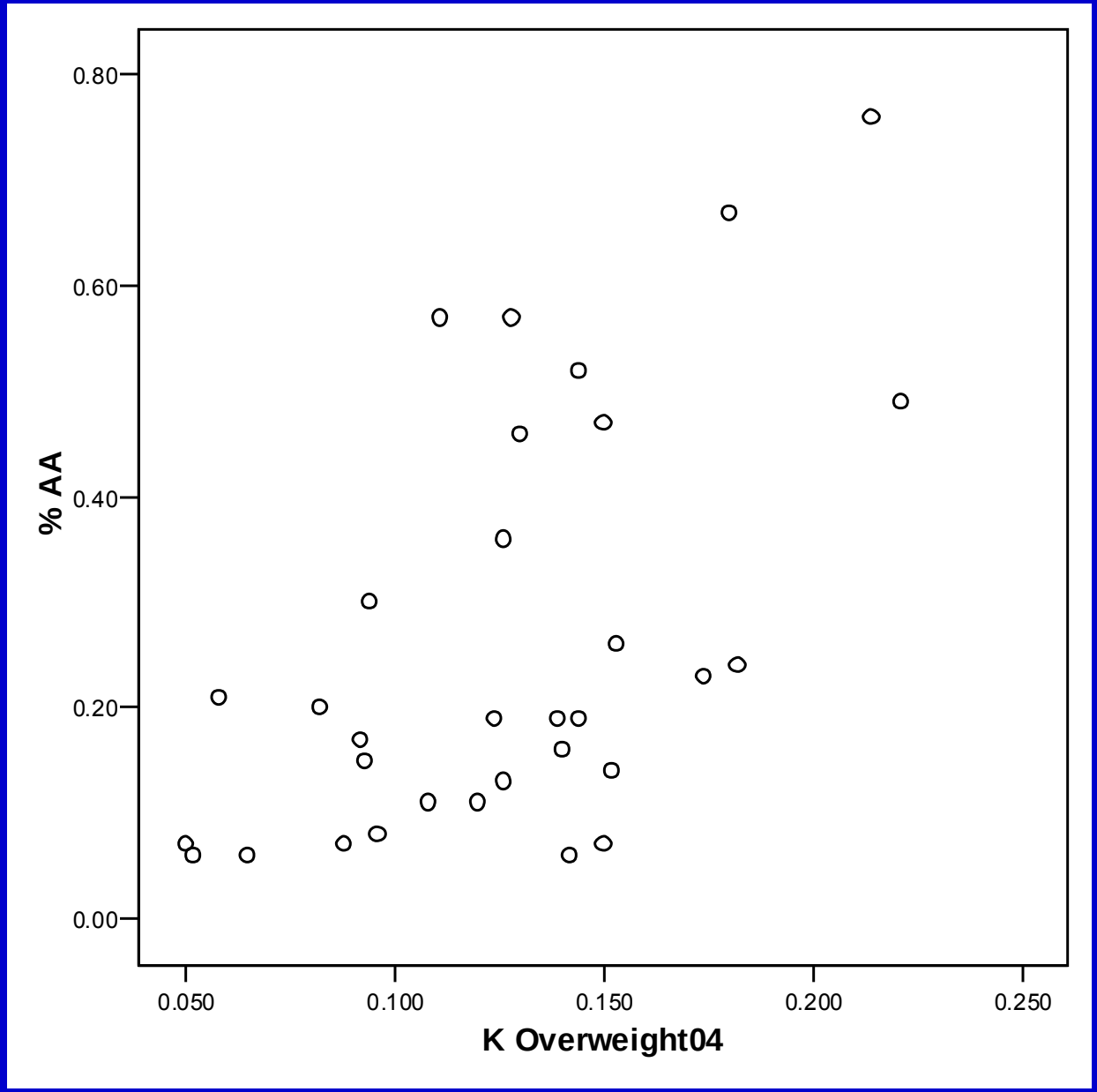


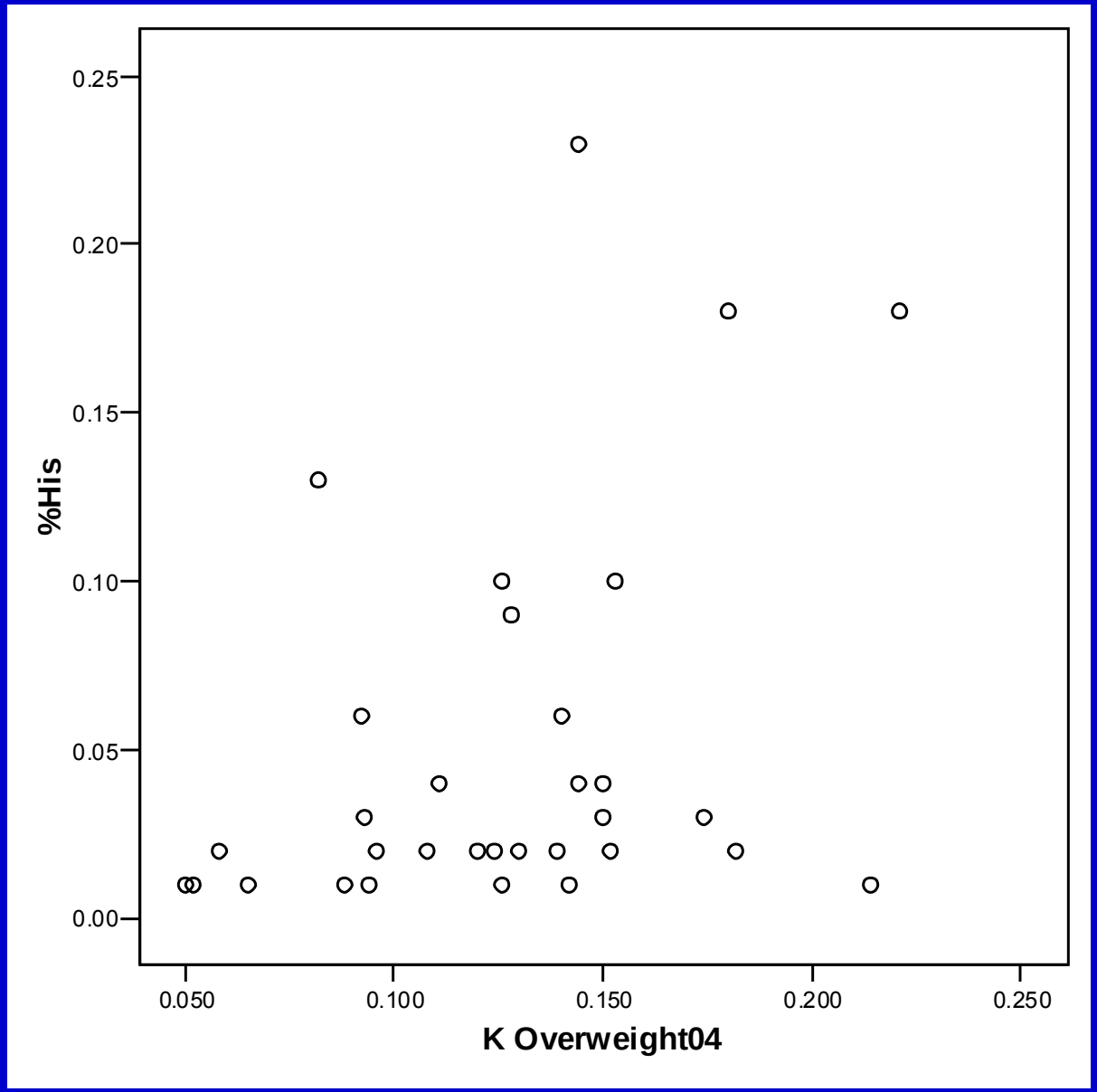
r=-.57**
**p=.01, two-tailed.

RQ2. Among elementary schools, are there ethnic differences in the number of children who are overweight?



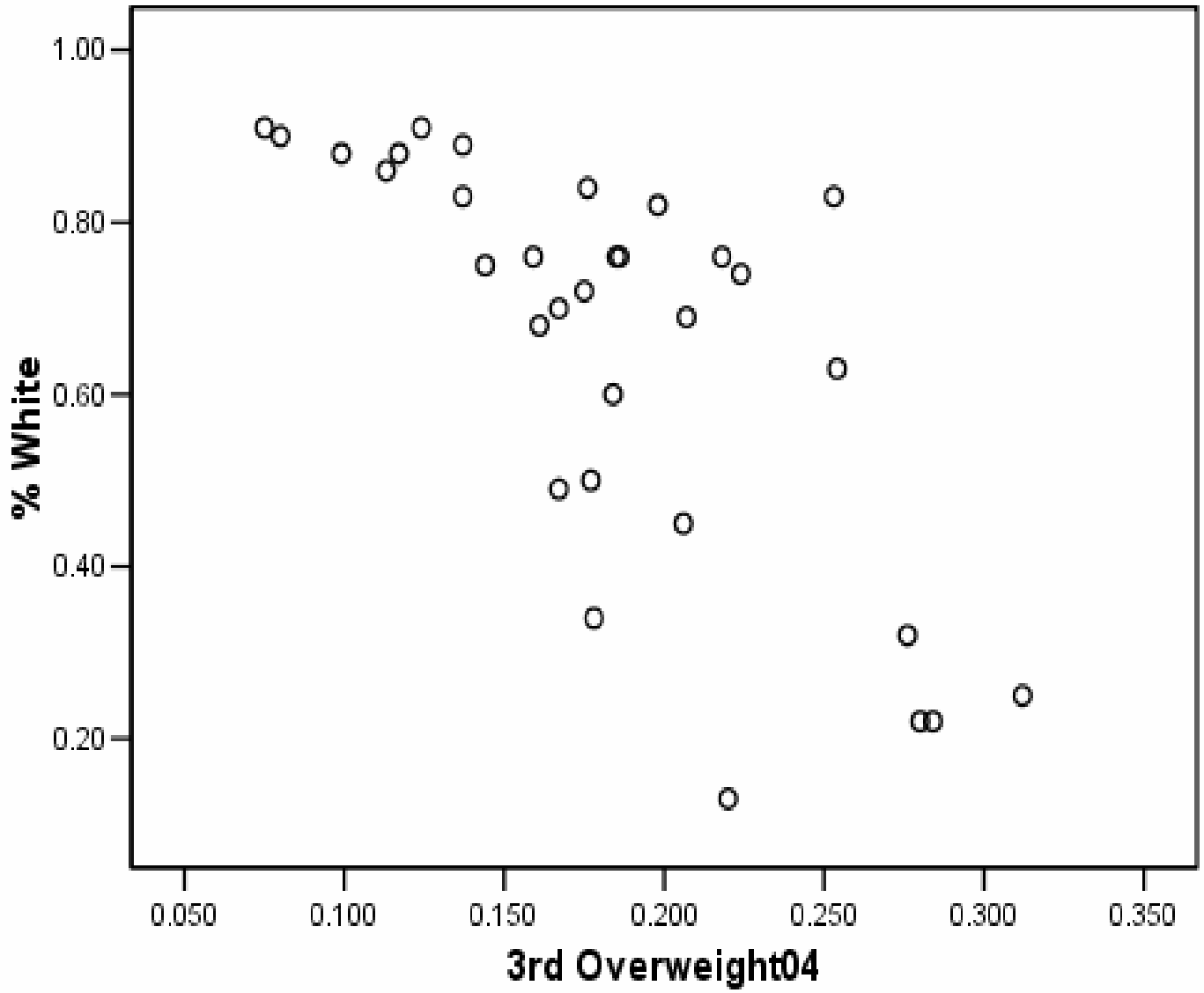
R=.56**
P=.01, two-tailed.

RQ2. Among elementary schools, are there ethnic differences in the number of children who are overweight?



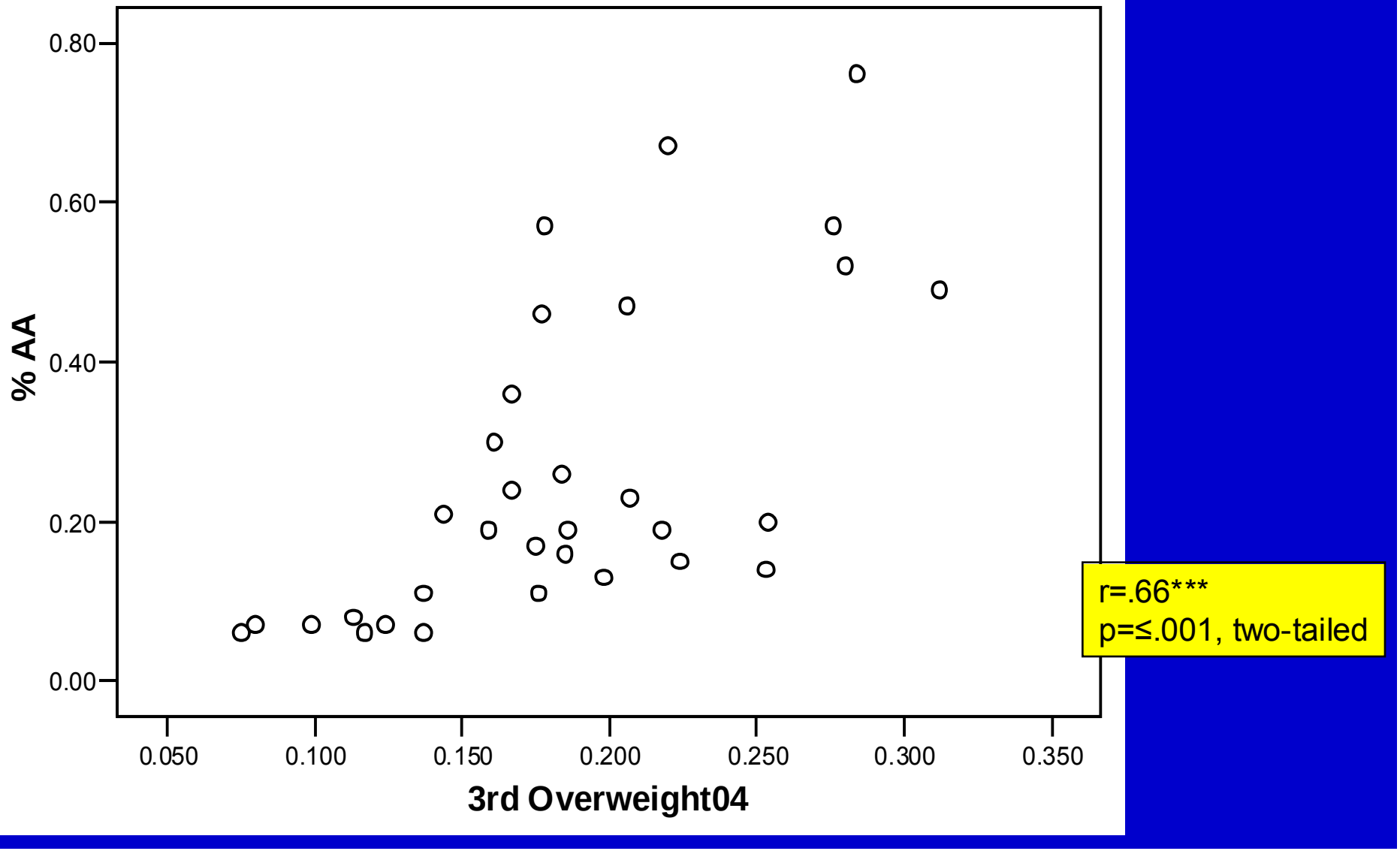
r=.36**
p=.01, two-tailed.

RQ2. Among elementary schools, are there ethnic differences in the number of children who are overweight?



r=-.72***
p=≤.001, two-tailed.

RQ2. Among elementary schools, are there ethnic differences in the number of children who are overweight?



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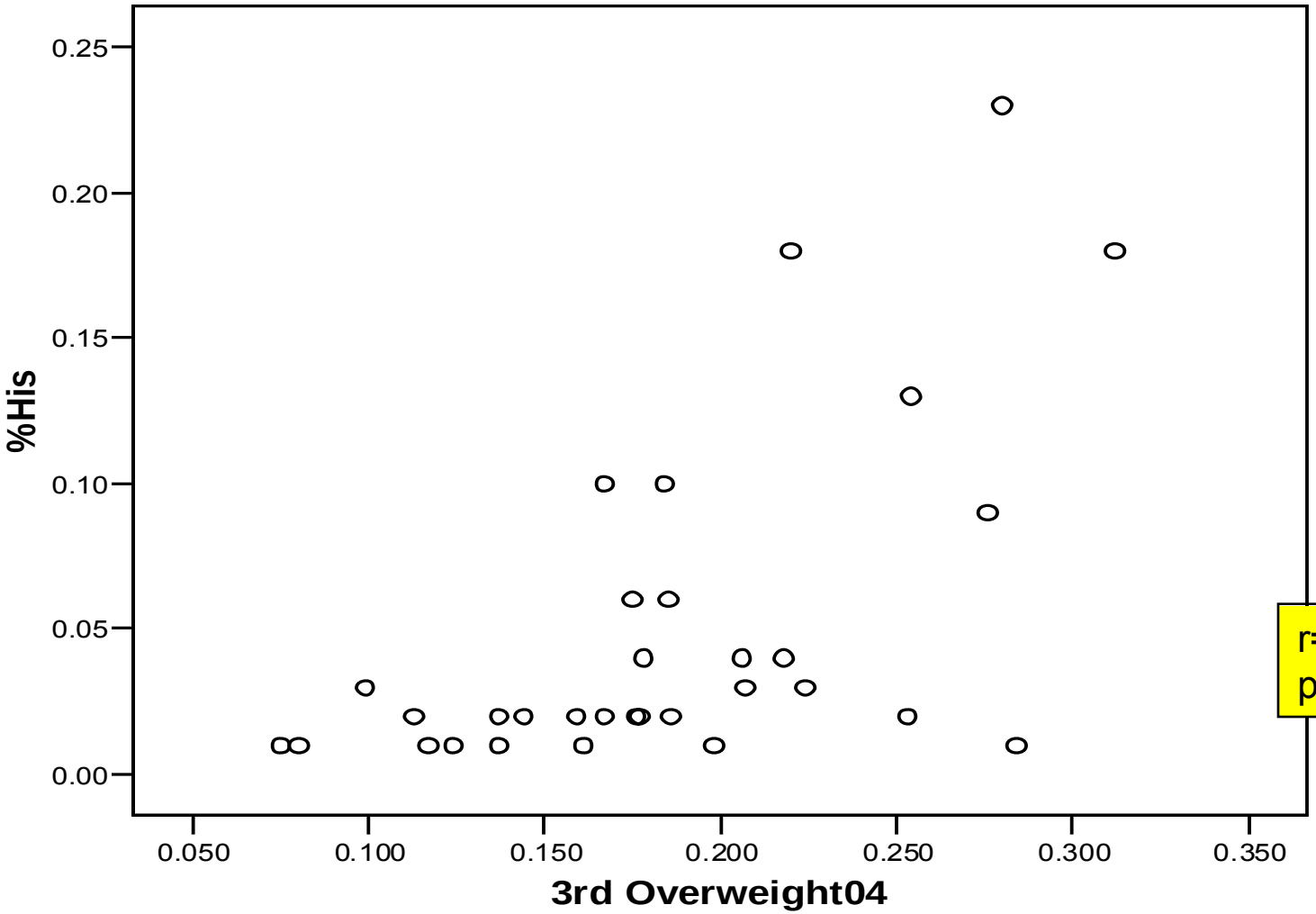


r=.60***
p=≤.001, two-tailed

RQ3. Does the playground physical environment affect the child's ability to be physically active?

•N=22

• 14 out of the 22 (64%) reported no track

•19 out of the 22 (86%) reported no fitness area.

•Out of the 5 elementary schools with the highest prevalence of overweight for third graders:

-1 had no reported fitness area, track or playground equipment

- 1 had no fitness area or jog track but reported having one climbing structure; however the blacktop was reported to be in poor shape

-1 reported having wooden equipment that was in need of replacement as well as their blacktop in need of repair. In addition, this school reported having no fitness area or jog track and eight pieces of metal equipment that was not suitable for kindergartners through second graders.

- The other two schools did not report the status of their playground equipment.

- Another school with a moderate prevalence of obesity for third graders reported having no fitness area or jog track but did have climbers, ladders, beams and volleyball available. However, this school also reported that the blacktop was in need of repairs.

RQ4. How many hours of nutrition education does a child receive during his/her elementary school years?

- 5.3 hours of health education focused on nutrition and physical activity is received during the elementary school years K-5.
- Less than 1 hour of formal instruction a year.

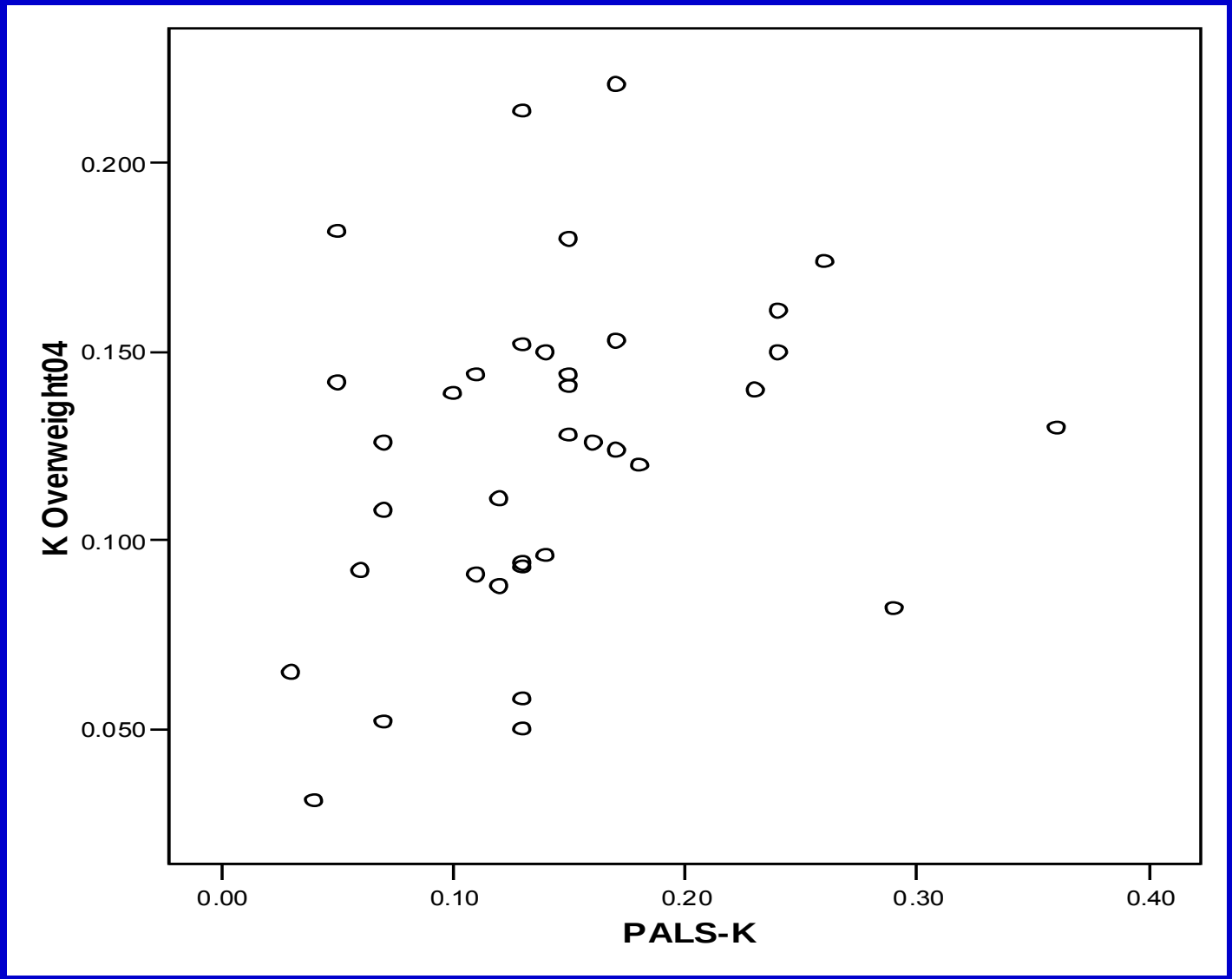
Association between Kindergarten Academic Achievement and Percent of Students Overweight

Table 6: Pearson Correlations for Kindergarten Overweight and Failure Rate on PALS-K test

Variable	Kindergarten Overweight	Kindergarten PALS-K
Kindergarten Overweight	1.00	.29
Kindergarten PALS-K	.29	1.00

Note. n=36

Association between Kindergarten Academic Achievement and Percent of Students Overweight



r=.29

Association between Third Grade Academic Achievement and Overweight Status of Students

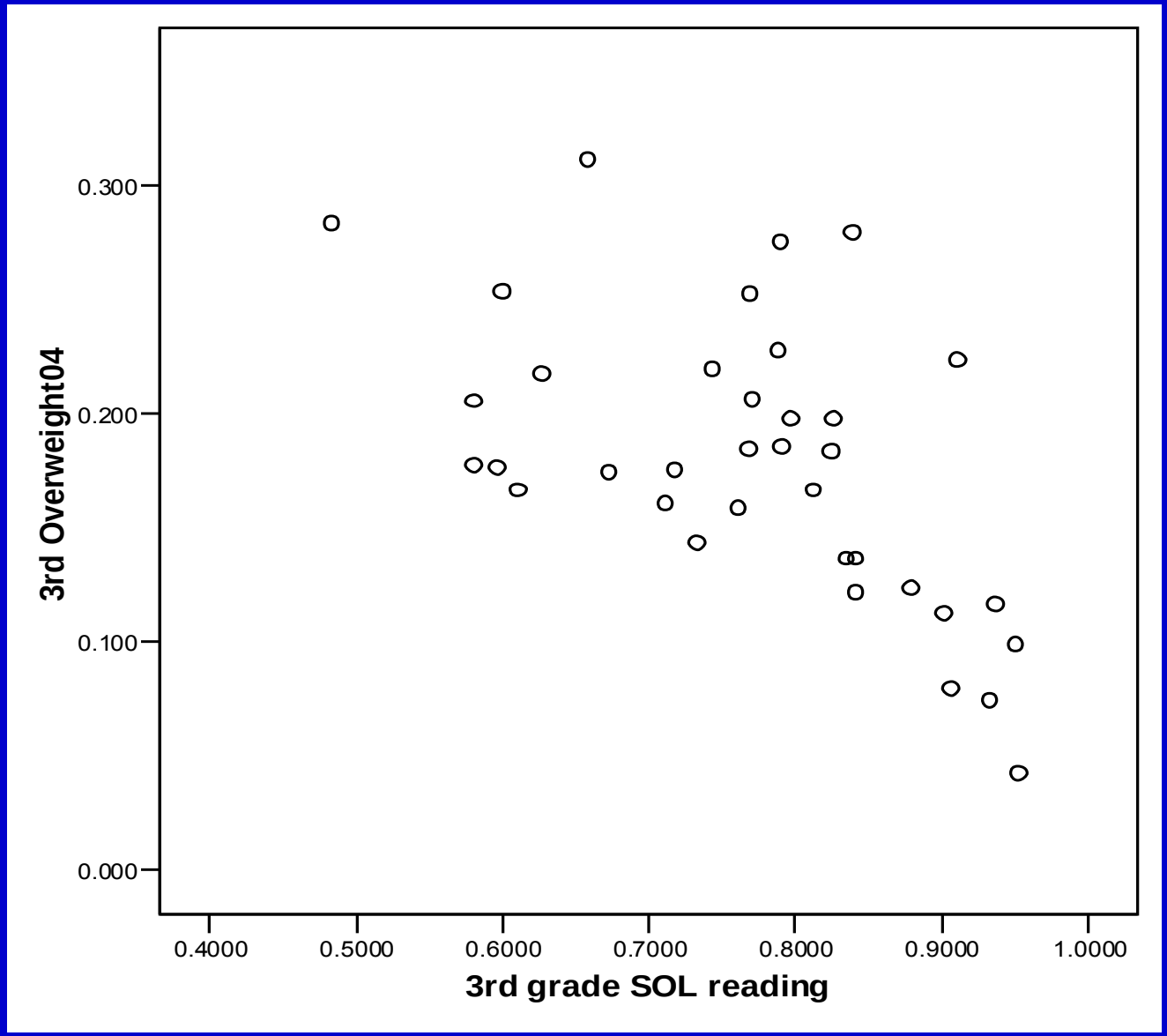
Table 7: Pearson Correlations for Third Grade Overweight and Third Grade Pass Rate on Reading and Math SOL

Variable	Third Grade Overweight	Third Grade Reading SOL	Third Grade Math SOL
Third Grade Overweight	1.00	-.577***	-.511***
Third Grade Reading SOL	-.577***	1.00	
Third Grade Math SOL	-.511 ***		1.00

Note. n=36

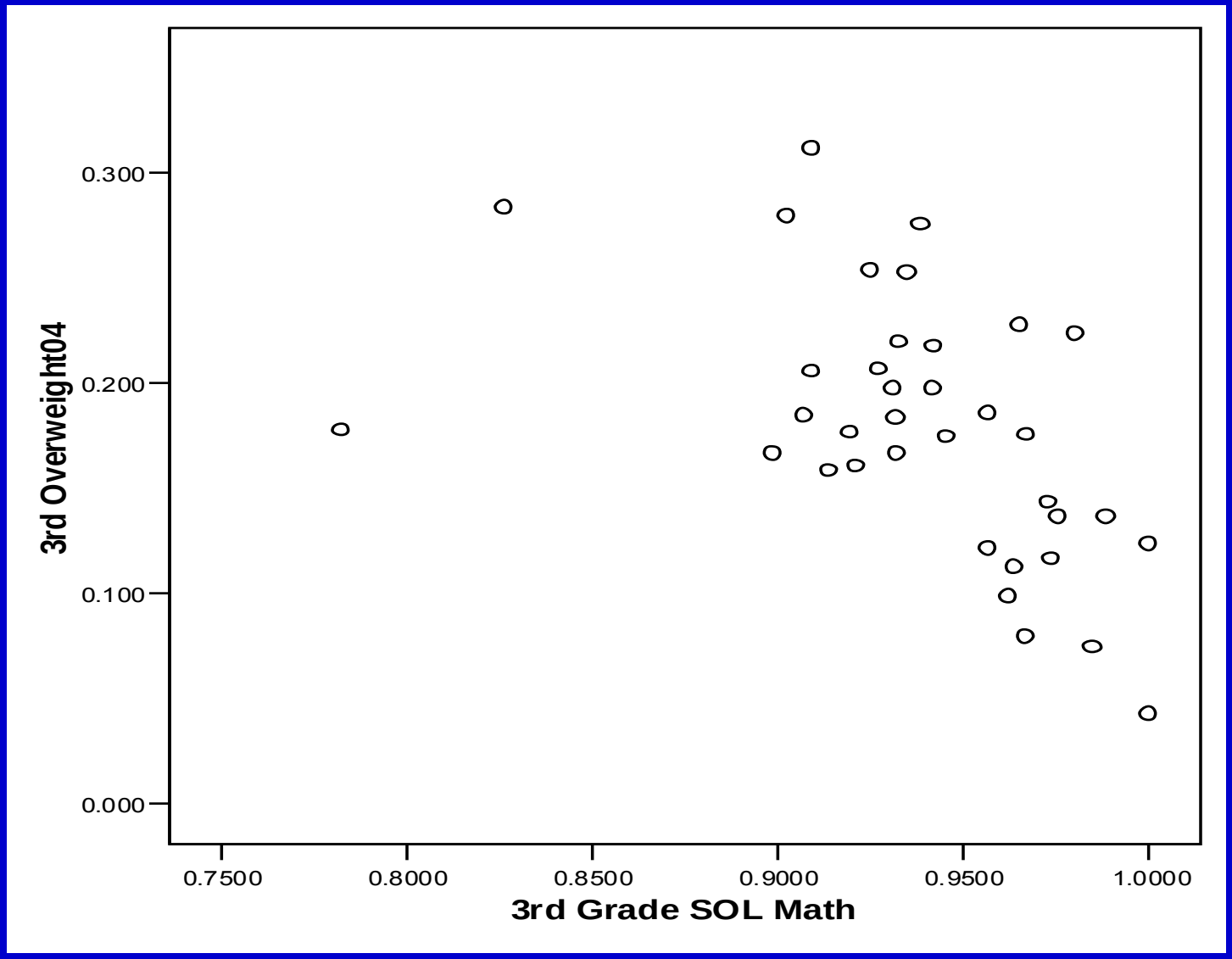
***p≤.001,two-tailed.

Association between Third Grade Academic Achievement and Overweight Status of Students



r= -.577***
p≤.001, two-tailed.

Association between Third Grade Academic Achievement and Overweight Status of Students



r= -.511***
p≤.001, two-tailed.

Results of Nutritional Analysis of School Lunches

Nutrients	Range of School Lunch Values per week on a per meal bases	Requirements for 4-8 year olds per day	Requirements for 9-13 year olds per day
KCal **	550 to 809	1400-1600	Girls: 1600-2000 Boys: 1800-2200
Carbohydrates (g) **	50.9 - 101.45 (31%-63%)	130 (40%)	130 (40%)
Protein (g) **	16.22 - 35.11 (11%-24%)	0.95g/kg/day or 19 grams per day	0.95g/kg/day or 34 grams per day
Fat (g) **	17.11 to 36.06 (25% to 49%)	39-62 (25-35% of calories)	62-85 g (25-35% of calories)
Calcium (mg) **	360 - 453	800	1300
Iron (mg)	2.45 - 4.14	10	8
Sodium (mg) **	966 - 1212	1200-1900	1500-2200
Potassium (mg)	830 - 1230	3800	4500
Folate (mcg)	75 - 130	200	300
Thiamine (mg)	.1370 - .565	0.6	0.9
Vitamin C	8.0 - 15.2	25	45

Hypotheses

1. A child's propensity for being overweight or at risk for being overweight is influenced by the school lunch program.

- Children classified as normal weight were less likely to have purchased a school lunch in kindergarten and third grade. Children classified as overweight were more likely to have purchased a school lunch in kindergarten and third grade.
- The only variable predictive of being classified as overweight in the third grade was the percent of students on free lunch

Hypotheses (cont)

2. Among these specific elementary schools, there are ethnic differences in the number of children who are overweight or at risk for being overweight:

- Correlational analysis demonstrated:

  - There was a strong positive association between the percentage of children classified as overweight in kindergarten and third grade and the percent of African American students.

  -There was a negative association between the children classified as overweight in kindergarten and third grade and the percent of white students.

  - There was a weak association between the children classified as overweight in kindergarten and third grade and the percent of Hispanic students.

Hypotheses (cont)

3. The playground physical environment influences the child's ability to be physically active:

   - Of the reported equipment from the schools many schools lack equipment or space for the children to be physically active. This was especially noted for several of the schools that had the higher percentage of students classified as overweight, lower academic achievement scores, and a higher percent of students on free lunch.

Hypotheses (cont)

4. The number of instructional hours in nutrition that a child receives during his/her elementary school years influences his/her propensity to being overweight or being at risk for being overweight:

   - All schools were reported to receive the same amount of instructional time in nutrition and physical activity throughout their elementary school years therefore no analysis could be completed to see if the amount education influenced the child's weight. However, the children in this school district are reported to receive only 5.3 hours of instruction time over their elementary education period.

Findings

•This study has demonstrated, at the elementary school level for this county, that the school lunch program, the ethnic makeup of the school and the percent of students on free lunch are associated with the percent of children overweight in kindergarten and third grade.

•In addition, the study found that the outside playground areas as well as school nutrition and health instruction are not adequate at many of the schools.

•Furthermore, associations were found between the percent of overweight students and the performance of the elementary schools on the standardized test to determine the readiness to learn and the acquired learning for kindergartners and third graders.

"This generation of children will be the first ever with a lower life expectancy than their parents" (Washington Post, 2005).

Limitations

- The school programs of routes of transportation to school, time spent in active physical activity and what a child actually consumed during lunch were unable to be fully accessed for their respective impact.

- All the data was obtained at the school level- the unit of measurement had to be changed from individual student to school level.

- A small sample size (N=36).

- The playground information was data that was obtained from facility management therefore, not all the schools had reports on the status of their playgrounds. The report was also from 2002 with a note that a new review was to take place in the summer of 2005. Due to the timing of the new report, it was not provided to the researcher to see what improvements if any had been made to the playgrounds.

Recommendations For Nursing Practice

School, community and public health nurses should work together to develop health promoting strategies for the school age child which include:

-Working with schools to develop strategies which increase the amount of time that children spend in active physical education class to meet the CDC guidelines as well as the National Physical Fitness Council recommendations of 150 minutes per week.

- Assisting nutritional services to reevaluate their meal plans to ensure that the school purchased lunch contain the age appropriate amounts of sodium, fat, calcium, protein, carbohydrates and calories.

-Assisting school personnel to make playgrounds safe and highly interactive play areas

- Develop plans with school and transportation personnel to provide school transportation for after-school activities which promote active physical activity and healthy eating

- Develop plans of instruction which increase the content and amount of time spent in learning the health promoting behaviors of nutrition and physical activity.

Recommendations For Health Policy

School, community and public health nurses in conjunction with the community at large should work together to support:

- Healthy Virginian Program and The Scorecard for public schools.

- Bills such as House Joint Resolution 260 and Senate Bill 1130 which support healthy nutrition and physical activity for children

- Informing parents of the results of the School Health Report Card sponsored by CDC.

Recommendations for Future Nursing Research

- The amount of appropriate content, instructional approaches and instruction time necessary for the concepts of healthy lifestyle choices to be learned and incorporated into one's life at the elementary school level.
- The best methods that schools can use to assist students in incorporating more physical activity into the school day.
- The impact the suggested interventions have on the prevalence of overweight in kindergartners and third graders and for the kindergartners and third graders who are at risk for being overweight.

Future Nursing Research (cont)

- The impact the availability of ala carte items has on the nutritional value of the school served lunch.
- This study should be replicated using the individual student as the unit of measurement.
- The concept of transportation to and from school as a means of expanding the availability of physical activity to children should be explored.