Examining Demographic, Economic, and Educational Factors

Overweight Children in Pennsylvania

The number of overweight children and adolescents in the U.S. has reached epidemic proportions, according to the Centers for Disease Control and Prevention (CDC). In 2000, the CDC estimated that 15 percent of the nation's youth were overweight.

Overweight children and adolescents are exposed to many health risks, most notably the increased risk for high cholesterol, high blood pressure and Type 2 diabetes. And over the long run, overweight children have a 70 percent chance of becoming overweight or obese adults and experiencing many other health risks.

Over the past 10 years, there has been a flood of academic and governmental research on the issue of overweight children, most of which documents the surge in overweight children and the potential health impacts and risks of being overweight. There has been little research, however, on rural overweight children, especially children in rural Pennsylvania.

To address the information gap, the Center for Rural Pennsylvania analyzed weight data covering a three-year period from the Pennsylvania Department of Health. The data involved the same groups of students from 151 school districts throughout the state. The analysis showed that in 2001, rural school districts had a higher percentage of overweight students than urban districts and that the problem of overweight rural students was increasing. Between 1999 and 2001, the number of overweight students increased faster in rural schools than in urban schools.

To better understand the characteristics of schools with overweight students, the Center also used data from the Pennsylvania Department of Education and the U.S. Census Bureau to analyze 27 demographic, economic, and educational indicators, such as population, income and test scores. For rural schools, the results generally showed a weak statistical relationship between the indicators and the number of overweight students. The opposite was found for urban schools, however, where the majority of indicators were related to the number of overweight students. The weak relationship for rural schools may be attributed to the fact that rural schools share many of the same characteristics. From a policy perspective, more study is needed to identify indicators that may affect overweight children and their families.

TABLE 1: The Study Group of Districts and Students, 2001

	SCHOOL DISTRICTS			STUDENTS		
	# School Districts	# School Districts in Study Group	% Total	Total # 7th Graders	# 7th Grade Students in Study Group	% Total
Pennsylvania	501	151	30.1%	144,288	25,038	17.4%
Rural School Districts	243	92	37.9%	42,769	11,298	26.4%
Urban School Districts	258	59	22.9%	101,519	13,740	13.5%

Method of Analysis

In 2003, the Pennsylvania Department of Health initiated a project to measure the prevalence of overweight youth in Pennsylvania. The department, through a contract with Penn State Harrisburg's Center for Survey Research, collected 2001 data on the height, weight, gender and birth date of approximately 25,266 7th grade public school students in 160 school districts. The median age of the students was 12 years old.

The same types of data on the same students were compiled for 2000 and 1999.

The school districts were selected using a stratified random sample and, afterward, on their willingness to participate in the project. Because of the latter factor, the data presented here represents a "sample of convenience," so caution should be used in generalizing the results to the entire rural or urban populations.

Through an agreement with the Pennsylvania Department of Health, the Center for Rural Pennsylvania obtained a copy of this database so that it could track the weight of the study group students from the 5th to the 7th grade.

Data Limitations

As with all surveys and analyses, the data have several limitations that may affect data interpretation. Below is a description of the limitations associated with the data used for this analysis.

Sample of Convenience: Despite the detailed sampling method used by the Pennsylvania Department of Health and the Center for Survey Research, school district participation was voluntary. As a result, the analysis presented here may be skewed towards the participating school districts. This bias, however, is likely offset by the large sample size (25,000+, or 17 percent of all 7th graders). In addition, further statistical analysis comparing the school districts that participated with those that did not, showed no statistically significant difference in the demographic, economic, and education indicators.

Data Collection: The data collected lacked quality assurance measures. Differences in data collection methods and the lack of protocol for how height and weight were to be measured may threaten the validity of the results. Again, this threat to validity may be counter-balanced by the relatively large sample of students (25,000+).

Regional Differences: Because of the relatively small sample size of school districts, the data was not analyzed from a regional perspective. As a result, this study may have overlooked important regional differences that may explain why some indicators have a greater influence on overweight children than others. Future studies should increase the sample size of school districts and analyze the data both from a rural-urban perspective and a regional perspective.

Level of Analysis: This study examined indicators at the school district level to determine if they had any relationship to the percentage of overweight children. By doing so, it was implicitly assumed that the demographic, economic and education characteristics of the school districts are reflective of the majority of residents-including those whose sons or daughters are overweight. This assumption was made because the overweight children data were only available at the school district level. In the future, more in-depth analysis is needed of family and individual data to better understand their impact on overweight children.

Limited Indicators: The indicators examined here had to be available at the school district level and for each of the school districts in the study. As a result, some indicators that may affect or contribute to overweight children could not be analyzed. Some examples of other indicators include the presence of soft drink vending machines, the number of students who walk to school, and the number of children with health insurance.

Overrepresentation of Rural School Districts: Of the 151 school districts in the study group, 92 were rural (61 percent). These 92 rural districts represent 38 percent of all rural districts and the students in the study group represent 26 percent of all rural 7th graders. In comparison, the 59 urban school districts in the study group comprised only 23 percent of all urban school districts and only 14 percent of all urban 7th graders. Because of this overrepresentation of rural school districts and rural students, the data results may be skewed towards rural. To minimize this, there were very few rural/urban comparisons made. In most instances, rural districts were compared with other rural districts.

In addition to analyzing the prevalence of overweight rural students, the Center analyzed the demographic, economic, and educational factors that may contribute to the incidence of overweight in rural students and compared them to the same data for urban areas.

The Center for Rural Pennsylvania first merged the 1999 and 2001 datasets into a single database. For analytical simplicity, the 2000 data was not used. The 1999 and 2001 data were merged using the unique code number that was assigned to each child. Students that were not in both datasets were re-moved from the database, as were students that had incomplete records or biologically implausible values. Next, the data were grouped by school district. Again, records that were incomplete or inaccurate based on the county code number were removed from the database. As a result of the database clean up, 25,038 students in 151 school districts became the Center's study group.

Throughout this study, the principal focus was on the 2001 data. The 1999 data was used to identify and compare the rates of change in rural and urban school districts over time.

Next, students were classified as rural or urban, depending on which school district they attended. Rural students were in districts that had a population density below the statewide level of 274 persons per square mile, while urban students were in districts with densities at or above 274 persons per square mile.

It is important to note that this definition differs significantly from the Department of Health's definition. The department identified rural and urban schools according to the population of the municipalities that "most represented" the school district. This definition was not used for the

Glossary of Terms

Analysis of Correlation (or Pearson's product-moment correlation coefficient): A statistical method used to measure the association between two indicators.

Analysis of Variance (ANOVA): A statistical test of the difference of means of two or more groups. This test was used in this analysis to determine whether there was a statistically significant difference between and among rural and urban school districts with differing percentages of overweight students.

Body Mass Index (BMI): According to the federal Centers for Disease Control and Prevention (CDC), BMI is a common measure expressing the relationship (or ratio) of weight-to-height. It is a mathematical formula in which a person's body weight in kilograms is divided by the square of his or her height in meters (i.e., $wt/(ht)^2$). The BMI is more highly correlated with body fat than any other indicator of height and weight. In children and teens, body mass index is used to assess underweight, overweight, and risk for being overweight. Because children's body mass changes over the years as they grow, and girls and boys differ in their body mass as they mature, BMI for children, also referred to as BMI-for-age, is gender and age specific. BMI-for-age is plotted on gender specific growth charts. These charts are used for children and teens age two to 20 years old.

Children At Risk of Being Overweight: A statistical determination for children whose BMI-for-age is between the 85th and 94th percentile.

Overweight Children: A statistical determination for children whose BMI-for-age is at or above the 95th percentile.

Percentile: A statistical method used to compare an individual to the rest of the population. Using the CDC example, a 12-year-old boy whose BMI is at the 75th percentile has a BMI that is higher than 75 percent of all 12-year-old boys.

Statistically Significant: Term used to describe a relationship that is valid. In this study, a correlation is considered statistically significant only at the 0.05 level. This means that we are 95 percent sure the correlation is not the result of chance.

Underweight Children: A statistical determination for children whose BMI-for-age is less than the 5th percentile.

TABLE 2: School Districts by Percentage of Overweight Students, 2001

	Percent of Study Group in School District that are Overweight	# School Districts	Total # Students in Study	# Students Classified as Overweight	% Students Classified as Overweight
Low	<16%	50	10,056	1,323	13.2%
Medium	16% to 21%	50	8,315	1,533	18.4%
High	>21%	51	6,667	1,610	24.1%
Total		151	25,038	4,466	17.8%

Center for Rural Pennsylvania's analysis because the Center could not determine the process that was used to identify the municipalities that "most represented" each school district.

The third step was to classify the students according to their Body Mass Index (BMI). BMI is used as a broad screening tool to identify individuals as under- or overweight. BMI for adults is calculated by dividing weight by the square of the individual's height. This information is then compared to the larger population.

In 2000, the CDC developed growth charts for students. Using BMI and growth charts, students are grouped according to gender and age-specific percentiles. As a statistical measure, percentiles rank the position of an individual by the percent of the reference population that the individual would equal or exceed. For example a 12-year-old boy whose BMI is at the 75th percentile would have a BMI that is higher than 75 percent of all 12-year-old boys.

Using the CDC's age- and gender-specific growth charts, the Center for Rural Pennsylvania grouped the students into four CDC categories: students that had BMI values below the 5th percentile were classified as being "underweight"; students from the 5th to the 85th percentile were classified as having "acceptable weight": students in the 85th to 95th percentile were identified as being "at risk for being overweight"; and students that were above the 95th percentile were classified as being "overweight."

We should note that no child is considered "obese." The CDC uses the term obese to describe only adults, who are 20 years old and older, since adults usually stop growing by age 20. Children, on the other hand, continue to grow, so BMI-for-age is plotted on gender specific growth charts. These charts are used for children and teens age two to 20 years old.

The number of students in each percentile range was then aggregated by school district to create a new database. Using the percent of overweight students in each reporting school district, the Center grouped the school districts into three equal categories: high, medium, and low. (See Table 2)

The final step in preparing the database for analysis was to join the school district data with economic, demographic and educational data from the 2000 Census and the Pennsylvania Department of Education. (See Table 3 on page 5) The indicators selected were based on the following:

o Availability of data at the school district level.
o Ability to provide a broad description of the demographic, economic, and educational environment within the school district.
o Existence of a statistical difference between rural and urban school districts that participated in the study as determined by the analysis of variance (ANOVA).

Two statistical tests were performed on this database to identify which, if any, demographic, economic, and educational factors may contribute to overweight students:

o Analysis of Variance (ANOVA): This statistical test was used to determine if there was a statistically significant difference among rural and urban school districts that had a low, medium, and high percentage of overweight children. The three categories in Table 2 were compared with the indicators in Table 3. The more dissimilar the district types, the greater the likelihood that these indicators contribute to the incidence of students being overweight or not being overweight.
o Analysis of Correlation: This statistical test was used to determine if there was a statistically significant relationship between the indicators identified in Table 3 and the percentage of overweight students in 2001. If the indicators are

TABLE 3: Indicators Analyzed

Demographic Indicators	Economic Indicators	Education Indicators
Minority population: Percent of population that is non-White or White Hispanic/Latino, 2000.[1]	**Homeownership**: Percent of occupied housing units that are owner-occupied, 2000.[1]	**School lunch**: Percent of students eligible for the free and reduced school lunch program, 2001.[2]
School-age population: Percent of population between 5 and 17 years old, 2000.[1]	**Housing values**: Median values of specified owner-occupied housing units, 2000.[1]	**Extra-curricular expenditures**: School district extra-curricular expenditures per student, 2000-2001.[2*]
In-migration: Percent of population 5 years old & older that lived outside Pennsylvania in 1995, 2000.[1]	**Income**: Median household income, 1999.[1]	**Reading test scores**: District level reported 8th Grade PSSA Reading Test Scores, 2000-2001.[2]
Married with children: Percent of households that are married couples with children, 2000.[1*]	**Poverty rate**: Percent of total population identified by the U.S. Census Bureau as being below the poverty threshold, 2000.[1]	**Math test scores**: District level reported 8th Grade PSSA Math Test Scores, 2000-2001.[2]
Single parents: Percent of households that have children but no spouse, 2000.[1*]	**Children in poverty**: Percent of persons under 18 years old identified by the U.S. Census Bureau as being below the poverty threshold, 2000.[1]	**Student/teacher ratio**: Ratio of students to full-time classroom teachers, 2000-2001.[2]
Working parents: Percent of children between the ages of 6 and 17 years old who: (a) live with two parents, both of whom are in the workforce; or (b) live with one parent who is in the workforce, 2000.[1]	**Commuting times**: Mean travel time to work, 2000.[1]	**Student/building ratio**: Ratio of students to school buildings, 2000-2001.[2]
College education: Percent of persons 25 years old and older with a bachelor's degree or higher, 2000.[1]	**Local revenues**: Percent of school district's total revenues from local sources, 2000-2001[2]	**Postsecondary participation rate**: Percent of high school seniors planning to attend a postsecondary institution, 2000-2001.[2]
	State revenues: Percent of school district revenues from state sources, 2000-2001.[2]	**Drop-out rate**: Percent of students that drop out of school between 7th and 12th grades, 2000-2001.[2*]
	Taxes per student: Total local tax revenue per student, 2000-2001.[2]	**School violence**: Percent of students that received an out-of-school suspension, 2000-2001.[2*]
	Expenditures per student: Total school district expenditures per student, 2000-2001.[2]	
	Transportation costs: School district transportation expenditures per student, 2000-2001.[2]	

*No statistical difference between rural and urban school districts but was included for descriptive purposes.
1 Data source: U.S. Census Bureau
2 Data source: PA Department of Education

significant, then it is likely that they contribute to students being overweight.

So, the ANOVA tests for differences while the Analysis of Correlation tests for relationships.

It is important to note that neither test can show causality. None of the indicators analyzed here will conclusively prove why a child is overweight. Instead, the indicators and statistical tests identify factors that contribute to or are the result of being overweight. This approach was taken because there is a strong likelihood that there are many factors contributing to the incidence of overweight children.

For ease of reading, the Center used the last date of the school year to represent the entire school calendar year. For example, the 2000-2001 school year is shown throughout this analysis as 2001.

Findings: Overall

o In 2001, the average 7th grade rural male was 0.4 inches taller and 0.8 pounds heavier than the average 7th grade rural female. A similar pattern was observed between average 7th grade urban males and females.

o The average 7th grade rural male weighed four pounds more the average 7th grade urban male.

o The average 7th grade rural female weighed nearly four pounds more than the average 7th grade urban female.

o Between the 5th and 7th grades (1999 to 2001), the average rural male grew about five inches and gained 27 pounds. During the same time period, the average urban male gained 26 pounds and grew five inches. (See Table 4)

o Rural and urban females, on average, had a similar pattern to the males. Between the 5th and

TABLE 4: Average Age, Weight, Height and BMI by Gender for Rural and Urban Students 1999 and 2001

	MALES		FEMALES	
	Rural	Urban	Rural	Urban
1999				
Average Age	10.9 years	10.8 years	10.8 years	10.7 years
Average Weight	93.2 lbs	90.5 lbs	93.2 lbs	90.1 lbs
Average Height	57.1 inches	56.9 inches	57.1 inches	56.8 inches
Average Body Mass Index (BMI)	20.1	19.7	20.1	19.6
2001				
Average Age	12.9 years	12.8 years	12.8 years	12.7 years
Average Weight	120.6 lbs	116.5 lbs	119.8 lbs	115.9 lbs
Average Height	62.3 inches	62.0 inches	61.9 inches	61.6 inches
Average Body Mass Index (BMI)	21.8	21.3	22.0	21.5

7th grades, both rural and urban females grew about 4.8 inches, but the average rural female gained nearly one pound more than the average urban female. (See Table 4)

o Among the entire study group, in 2001, about 18 percent of 7th graders were considered overweight. Among 7th graders in rural school districts, nearly 20 percent were overweight. In urban districts, 16 percent were overweight. (See Table 5)

o Among the rural 7th graders classified as overweight, 54 percent were male and 46 percent were female. Among urban overweight students, 56 percent were males and 44 percent were females.

o Among rural school districts, 42 percent were classified as having a high percentage of overweight students (more than 21 percent). Twenty percent of urban districts were classified as having a high percentage of overweight students.

Findings: Demographic Indicators
Overview

Demographically, rural school districts in the study had an average of 12,000 residents in 2000, and had a 6 percent gain in population between 1990 and 2000. In comparison, urban districts had an average of 29,600 residents and a 2 percent increase in population during the 1990s. Within rural districts, about 4 percent of the population were minorities, while in urban districts nearly 14 percent were minorities.

In terms of age cohorts, in both rural and urban districts, approximately 19 percent of the population was school-aged (five to 18 years old, 2000). In rural districts, 6 percent of the population moved in to the district from another state between 1995 and 2000. In urban districts, 8 percent of the population moved into the district from another state.

Rural and urban areas had very similar household characteristics, especially in the area of single parents. In both rural and urban districts, approxi-

TABLE 5: Percent of Students by Weight Percentile, 2001

	Statewide (n=151)	Rural School Districts (n=92)	Urban School Districts (n=59)
# Students in Project	25,038	11,298	13,740
% Students Underweight (BMI is below the 5th percentile)	2.7%	2.7%	2.6%
% Students with Acceptable Weight (BMI is between the 5th and 84th percentile)	61.8%	59.8%	63.5%
% Students at Risk for Being Overweight (BMI is between the 85th and 94th percentile)	17.6%	17.8%	17.5%
% Students Overweight (BMI is at or above the 95th percentile)	17.8%	19.7%	16.3%

TABLE 6: Differences Between Demographic Characteristics of Rural and Urban School Districts by Percent of Overweight Students

	RURAL DISTRICTS			URBAN DISTRICTS		
	Low Districts (<16% Students are Overweight)	Medium Districts (16% to 21% Students are Overweight)	High Districts (>21% Students are Overweight)	Low Districts (<16% Students are Overweight)	Medium Districts (16% to 21% Students are Overweight)	High Districts (>21% Students are Overweight)
SCHOOL DISTRICTS (2001)						
# School Districts	19	34	39	31	16	12
POPULATION						
Avg. # Residents Per School District, 2000	10,875	14,165	10,669	25,077	27,254	44,668
% Change, 1990-2000	6.4%	3.6%	7.8%	10.0%	1.1%	-6.8%
MINORITIES (2000)						
% Minorities (Non-White & White Hispanic)	2.9%	3.8%	5.9%	7.9%	7.5%	27.0%
AGE COHORTS (2000)						
% Under 5 Years Old	5.9%	5.3%	5.5%	5.8%	5.3%	5.7%
% School Age (5 to 18 Years Old)	20.3%	19.0%	19.8%	19.3%	17.7%	17.4%
% 19 to 64 Years Old	59.7%	59.5%	59.4%	59.9%	59.4%	60.0%
% 65+ Years Old	14.1%	16.3%	15.3%	15.1%	17.6%	16.9%
MIGRATION (2000)						
# Persons 5 Years Old & Older	194,470	456,015	393,075	732,535	413,010	505,695
% Who Lived in Same House in 1995	67.6%	68.0%	66.3%	60.0%	63.5%	59.0%
% Who Lived in Same State, but Different House in 1995	27.9%	27.1%	26.3%	31.3%	29.6%	32.8%
% Who Lived in Different State in 1995	4.5%	4.9%	7.4%	8.7%	6.9%	8.2%
TYPES OF HOUSEHOLDS (2000)						
Total # Households	78,270	184,985	157,190	297,915	175,260	223,430
% Married Couples With Children	27.1%	23.2%	24.9%	26.2%	21.4%	14.3%
% Single Parent Households	6.1%	6.7%	7.0%	5.5%	6.5%	10.3%
LIVING ARRANGEMENTS (2000)						
# Children Between 6 and 17 Years Old	34,900	73,675	67,890	122,865	63,115	72,040
% Living with Both Parents	81.7%	78.8%	78.6%	82.5%	76.0%	57.2%
% Living with One Parent	18.3%	21.2%	21.4%	17.5%	24.0%	42.8%
WORKING PARENTS (2000)						
% Children Living With Both Parents: Both in Labor Force	54.9%	51.9%	50.0%	55.6%	52.2%	35.7%
% Children Living With One Parent: Parent in Labor Force	15.3%	17.3%	17.3%	15.2%	19.6%	32.3%
HIGHEST LEVEL OF ADULT EDUCATION ATTAINMENT (2000)						
# Persons 25+ Years Old	140,800	325,130	279,295	522,370	301,410	354,295
No High School Degree	19.8%	19.8%	20.2%	11.4%	17.3%	20.9%
High School Graduate (Includes Equivalency)	45.8%	46.9%	46.7%	31.1%	38.8%	36.4%
Some College, No Degree	13.9%	13.5%	14.0%	16.6%	16.7%	15.7%
Associate Degree	6.0%	5.9%	5.4%	6.3%	6.5%	5.9%
Bachelor's Degree or Higher	14.5%	13.8%	13.7%	34.5%	20.7%	21.0%

See Table 3 for data sources.

TABLE 7: Relationship Between Demographic Indicators and Percent of Overweight Students

DEMOGRAPHIC INDICATORS	Rural School Districts (n=92)	Urban School Districts (n=59)
	(Direction of statistically significant correlation in parentheses)	
Minorities	No	Yes (+)
School-Age Population	No	No
In-Migration	No	No
Married with Children	No	Yes (-)
Single Parents	No	Yes (+)
Working Parents	No	Yes (-)
College Education	No	Yes (-)

Yes = Variables are significantly correlated at the 0.05 level, either positively or negatively, with the percent of overweight students.

No = Variables are not significantly correlated at the 0.05 level, either positively or negatively, with the percent of overweight students.

(For a description of the indicators, see Table 3)

mately 7 percent of households were single parent households.

Rural school districts had a lower percentage of adults with a four-year college degree (14 percent) compared to urban districts, where nearly 27 percent of the adults had a four-year college degree.

Analysis of Variance

For rural school districts, there were no demographic indicators to illustrate a difference between the districts with low, medium and high percentages of overweight students. Among urban districts, however, the indicators that differed significantly between school districts with low percentages of overweight children and those with a high percentage of overweight children were the: percent of minorities, percent of single parent households, percent of parents that were in the labor force, and percent of adults with a college degree. (See Table 6 on page 7)

Analysis of District Correlation

For rural school districts, none of the indicators showed a statistically significant correlation with the percentage of overweight students.

For urban schools, however, five indicators, most of which centered on household relationships and educational attainment, had a significant relationship to the percentage of overweight students. (See Table 7)

Conclusion

For rural school districts in the study, demographic indicators appear to be poorly correlated with overweight students. In urban school districts, the opposite is true. One possible explanation for the difference is that rural school districts tend to be more demographically homogenous than urban districts. While there are stark demographic differences between rural and urban districts and among urban districts, there are few demographic differences among rural districts.

Findings: Economic Indicators
Overview

Rural school districts in the study were generally less affluent than their urban counterparts. In the rural districts, the average housing value was $32,800 less than in urban districts. There was a $10,000 average household income gap between rural and urban districts. Rural districts had a lower labor force participation rate than urban districts. However, there was no statistically significant difference in the unemployment rate between the two types of districts.

To finance public education, rural districts are more dependent on the state than urban districts. During the 2001 school year, rural districts received nearly 50 percent of their revenues from the state, while urban districts received 31 percent. The total expenditures per student in rural districts were an average of $1,300 lower than urban districts. Rural districts, however, did spend more for transportation per student than urban districts.

Analysis of Variance

For rural school districts, there were no economic indicators that showed a significant difference between the districts with low, medium and high percentages of overweight students.

Among urban districts, nearly all of the economic indicators showed a significant difference among districts with low, medium and high percentages of overweight students. The four indicators that were not statistically significant were: homeownership rates, average time to work, total school expenditures per student, and school transportation expenditures per student. (See Table 8)

Analysis of District Correlation

For rural districts, only one indicator, median household income, had a statistically significant correlation with the percentage of overweight children. This relationship was negative, meaning

TABLE 8: Differences Between Economic Characteristics of Rural and Urban School Districts by Percent of Overweight Students

	RURAL DISTRICTS			URBAN DISTRICTS		
	Low Districts (<16% Students are Overweight)	Medium Districts (16% to 21% Students are Overweight)	High Districts (>21% Students are Overweight)	Low Districts (<16% Students are Overweight)	Medium Districts (16% to 21% Students are Overweight)	High Districts (>21% Students are Overweight)
SCHOOL DISTRICTS (2001)						
# School Districts	19	34	39	31	16	12
HOMEOWNERSHIP (2000)						
% Owner-Occupied Units	81.7%	77.9%	78.8%	73.9%	66.6%	57.3%
% Renter-Occupied Units	18.3%	22.1%	21.2%	26.1%	33.4%	42.7%
HOUSING VALUES/HOUSEHOLD INCOME (2000)						
Avg. Values for Specified Owner-Occupied Housing Units	$107,219	$91,384	$97,072	$164,785	$113,847	$81,036
Avg. Household Income	$48,556	$43,921	$44,179	$68,507	$49,441	$41,160
POVERTY RATE (2000)						
Total Poverty Rate	7.9%	11.0%	10.9%	5.9%	9.2%	18.3%
Poverty Rate for Persons Under 18 Years Old	11.1%	14.0%	14.4%	5.7%	11.5%	25.9%
EMPLOYMENT (2000)						
Labor Force Participation Rate (Total Population)	50.6%	47.6%	47.4%	52.0%	50.4%	47.3%
Unemployment Rate	4.3%	5.6%	5.4%	3.8%	5.2%	8.9%
COMMUTING TIME (2000)						
Avg. Time to Work (Minutes)	26.0	24.1	26.6	23.6	21.5	22.6
SCHOOL REVENUES (2000-2001)						
Avg. Revenue Per District ($1,000)	$14,472	$16,762	$14,169	$33,083	$32,124	$59,667
Total Revenues from Local Sources	48.6%	45.8%	46.8%	73.2%	64.8%	53.0%
Total Revenues from State Sources	47.8%	50.2%	48.2%	24.1%	32.3%	39.8%
Total Revenues from Federal Sources	2.3%	3.0%	2.9%	1.1%	2.6%	6.4%
Total Other Funding Sources	1.4%	1.0%	2.1%	1.7%	0.3%	0.9%
TAXES (2000)						
Local Taxes Per Student	$3,712	$3,453	$3,585	$6,430	$5,546	$5,261
EXPENDITURES PER STUDENT (2000-2001)						
Adjusted Total Expenditures Per Student	$8,075	$7,997	$8,016	$9,019	$8,971	$10,243
Student Transportation Expenditures Per Student	$473	$537	$521	$459	$399	$483

See Table 3 for data sources.

that the lower the household income, the higher the percentage of overweight children in rural districts.

For urban districts, seven of the 11 indicators showed a statistically significant correlation with the percentage of overweight students. In general, districts with lower incomes and lower school finances had higher percentages of overweight children. (See Table 9 on page 10)

Conclusion

Like demographic indicators, economic indicators also appear to be poorly correlated with the occurrence of overweight rural students. Again, in urban school districts, the opposite is true. The likely reason is that rural school districts tend to be more economically homogenous than urban districts. Rural school districts are less wealthy than urban

TABLE 9: Relationship Between Economic Indicators and Percent of Overweight Students

ECONOMIC INDICATORS	Rural School Districts (n=92)	Urban School Districts (n=59)
	(Direction of statistically significant correlation in parentheses)	
Homeownership	No	No
Housing Values	No	Yes (-)
Income	Yes (-)	Yes (-)
Poverty Rate	No	Yes (+)
Children in Poverty	No	Yes (+)
Commuting Times	No	No
Local Revenues	No	Yes (-)
State Revenues	No	Yes (+)
Taxes per Student	No	Yes (-)
Expenditures per Student	No	No
Transportation Cost	No	No

Yes = Variables are significantly correlated at the 0.05 level, either positively or negatively, with the percent of overweight students.

No = Variables are not significantly correlated at the 0.05 level, either positively or negatively, with the percent of overweight students.

(For a description of the indicators, see Table 3)

districts, and the wealth within rural districts is more evenly distributed than it is in urban districts. Among urban districts, there tends to be greater disparity between suburban and inner city school districts.

Findings: Educational Indicators
Overview

In 2001, rural school districts in the study had an average enrollment of nearly 1,900 students, while urban districts had an average of 4,000 students. Between 1999 and 2001, rural districts had a 1 percent decline in enrollment, while enrollment in urban districts remained unchanged. The student/ teacher ratio in rural and urban schools was nearly identical. Rural schools had an average of 16.0 students per classroom teacher; the urban district ratio was 15.8 students per teacher. Although the student/teacher ratios were similar, the average rural school building had 90 fewer students than the average urban school building. In one measure of educational outcome, more than 60 percent of the rural school district PSSA scores were below the state average in 8th grade reading and math tests. Among urban districts, only 35 percent scored below the state average in these two tests.

Another measure of educational outcome is postsecondary participation rates. In rural districts, 63 percent of seniors in 2001 said they were planning to pursue a postsecondary degree, while in urban districts, 78 percent said they were planning to continue their education after graduation.

The rural high school dropout rate was only slightly below the urban rate. In 2001, 1.9 percent of rural secondary students (7th-12th grade) dropped out of school compared to 2.1 percent of urban secondary students. In rural districts there were fewer reported incidents of in-school violence than in urban districts. In 2001, there were 19 reported incidents per 1,000 students, while urban districts had 25 reported incidents per 1,000 students. Rural districts also had fewer out-of-school suspensions than urban districts.

Finally, rural school districts had a slightly higher percentage of students eligible for the free and reduced school lunch program than urban districts. In 2001, 30 percent of rural students were eligible for this program, while in urban districts, 28 percent were eligible.

Analysis of Variance

Among rural districts, the only significant differences between districts with low, medium and high percentages of overweight students were 8th grade PSSA math scores and out-of-school suspensions per 1,000 students.

For urban schools, the only significant differences were the number of students eligible for the school lunch program, 8th grade reading and math test scores, postsecondary participation rates and dropout rates. (See Table 10)

Analysis of District Correlation

Three educational indicators had a statistically significant correlation with the percentage of overweight rural children, including the percent of students eligible for the free and reduced school lunch program, school violence indicators, and 8th grade math scores.

Five of the nine educational indicators examined had a statistically significant correlation with the percentage of overweight urban children. One indicator, the percent of students eligible for the school lunch program, was positively correlated,

TABLE 10: Differences Between Educational Characteristics
of Rural and Urban School Districts by Percent of Overweight Students

	RURAL DISTRICTS			URBAN DISTRICTS		
	Low Districts (<16% Students are Overweight)	Medium Districts (16% to 21% Students are Overweight)	High Districts (>21% Students are Overweight)	Low Districts (<16% Students are Overweight)	Medium Districts (16% to 21% Students are Overweight)	High Districts (>21% Students are Overweight)
SCHOOL DISTRICTS (2001)						
# School Districts	19	34	39	31	16	12
ENROLLMENT						
Avg. Enrollment (Avg. Daily Membership) Per District, 2000-2001	1,798	2,093	1,745	3,615	3,612	5,541
% Change, 1999-2001	-1.6%	-2.2%	-0.4%	1.7%	-0.5%	-1.8%
EXTRA CURRICULAR EXPENDITURES (2000-2001)						
Total Extra Curricular Expenditures Per Student	$140	$141	$127	$171	$129	$109
Athletic Extra Curricular Expenditures Per Student	$110	$109	$99	$125	$101	$55
Student Activity Extra Curricular Expenditures Per Student	$30	$31	$28	$46	$28	$54
FREE & REDUCED SCHOOL LUNCH						
% Student Eligible for Free & Reduced School Lunch, 1999	20.6%	29.0%	30.7%	11.3%	24.3%	56.5%
% Student Eligible for Free & Reduced School Lunch, 2001	23.5%	30.1%	32.1%	11.6%	25.9%	56.2%
STUDENT/TEACHER RATIO (2000-2001)						
Avg. # Classroom Teachers Per District	111	129	110	224	224	368
Ratio of Students to Teachers	16.2	16.2	15.8	16.1	16.1	15.1
STUDENT/BUILDING RATIO (2000-2001)						
Avg. # School Buildings per District	4	4	4	6	6	11
Ratio of School Buildings to Teachers	468	487	469	633	572	485
TEST SCORES (2000-2001)						
% Districts Above Statewide Avg. in 8th Grade PSSA Reading Test Scores	57.9%	44.1%	28.2%	87.1%	62.5%	33.3%
% Districts Above Statewide Avg. in 8th Grade PSSA Math Scores	47.4%	44.1%	20.5%	80.6%	50.0%	41.7%
DROPOUT RATE (2000-2001)						
Dropout Rate	1.9%	1.9%	1.8%	1.3%	1.7%	4.0%
POSTSECONDARY PARTICIPATION RATES (2000-2001)						
Postsecondary Participation Rates	68.1%	67.5%	54.4%	80.4%	77.4%	72.8%
SCHOOL VIOLENCE (2000-2001)						
# Out-of-School Suspensions Per 1,000 Students	7.1	9.9	19.8	9.2	10.0	56.5

See Table 3 for data sources.

TABLE 11: Relationship Between Education Indicators and Percent of Overweight Students

EDUCATIONAL INDICATORS	Rural School Districts (n=92)	Urban School Districts (n=59)
	(Direction of statistically significant correlation in parentheses)	
School Lunch	Yes (+)	Yes (+)
Extra Curricular Expenditure	No	Yes (-)
Reading Test Scores	No	Yes (-)
Math Test Scores	Yes (-)	Yes (-)
Student/Teacher Ratio	No	No
Student/Building Ratio	No	No
Postsecondary Participation Rate	No	Yes (-)
Dropout Rate	No	No
School Violence	Yes (+)	No

Yes = Variables are significantly correlated at the 0.05 level, either positively or negatively, with the percent of overweight students.

No = Variables are not significantly correlated at the 0.05 level, either positively or negatively, with the percent of overweight students.

(For a description of the indicators, see Table 3)

while the remaining four indicators were negatively correlated. This suggests that the less money urban districts spend on extra curricular activities, the higher the percentage of overweight students. Similarly the lower the math and reading test scores and the lower the postsecondary education rate in urban districts, the higher the percentage of overweight children. (See Table 11)

Conclusion

Of the three groups of indicators examined, the education group had the most statistically significant correlations with the percentage of overweight rural students. This may suggest that educational factors play a larger role in affecting overweight rural students than demographic or economic factors.

For urban schools, the results are more mixed, with education being one of many factors affecting overweight children.

Discussion

This analysis demonstrates that a variety of factors may be contributing to growing numbers of overweight rural children.

Overweight Children: Rural Not Immune

This study found that in 2001, the average rural 7th grade student, both male and female, weighed four pounds more than their urban counterparts. It also found that 20 percent of rural students are overweight compared to 16 percent of urban students.

This finding suggests that rural Pennsylvania is not immune from the so-called "childhood overweight epidemic." With one in five rural 7th graders identified as being overweight, the problem is not limited to just a handful of rural districts. Forty-two

percent of rural school districts reported that 21 percent or more of their 7th graders were overweight.

Overweight rural children are part of a more pervasive statewide problem of overweight adults. According to CDC estimates, in 2001, more than 38 percent of Pennsylvania adults were overweight and 22 percent were obese. Nationally, the CDC estimated that 37 percent of adults were classified as overweight and another 21 percent were classified as obese. Recognizing the pervasive nature of overweight children and adults is the first step in developing effective policies and programs to address the problems of overweight children.

More Rural Students are Becoming Overweight

This analysis found that between 1999 and 2001, the average rural student, male and female, gained 27 pounds, or one more pound than the average urban student. In addition, during this period, the number of rural students that were identified as being overweight increased nearly 5 percent, while there was a 2 percent increase among urban students.

This finding further strengthens the argument that rural Pennsylvania is in the midst of a growing epidemic of overweight children. Again, this epidemic is not unique to rural Pennsylvania school children. According to CDC estimates, there was a 7 percentage point increase in obese adults in Pennsylvania between 1991 and 2001; nationally, the increase was 8 percentage points. These increases suggest that the problem of overweight children and obese adults will not be going away anytime soon or by itself. It also suggests that new and innovative methods are needed to address this growing epidemic.

Homogeneity of Rural School Districts

This analysis found that rural schools share very similar demographic, economic, and educational characteristics. Of the 27 indicators analyzed, only two indicators showed a statistically significant difference among rural school districts by the percentage of overweight students: 8th grade PSSA math scores and out-of-school suspensions. Among the remaining variables, there was no statistically significant difference.

When compared to urban school districts, however, rural districts had a statistically significant difference in all the indicators except for the percentage of single parent households, extra-curricular expenditures per student, out-of-school suspensions per 1,000 students, and the dropout rate.

The similarities among rural school districts, the differences between rural and urban school districts, and the pervasive nature of overweight students suggests that rural-specific programs may be needed to address overweight rural children. Programs that address the issue on a statewide basis may be less successful in rural areas than in urban areas because of the differences in demography, economy, and education.

Few Environmental Factors are Related to Overweight Rural Students

This study found that within rural schools only four of the 27 demographic, economic, and educational indicators analyzed had a statistically significant correlation with overweight students. The four indicators were: household income, the percent of students eligible for free and reduced school lunch, 8th grade PSSA math scores, and the number of out-of-school suspensions per 1,000 students.

Among these four indicators, three had a statistically significant correlation with the others; the only indicator that did not have a significant correlation with the others was the number of out-of-school suspensions.

For urban school districts, 15 of the 27 indicators had a statistically significant correlation with the percent of overweight students. Except for extra-curricular expenditures per student, all the indicators were significantly correlated with the others.

One possible reason why rural districts had only a few indictors correlated with overweight students is the homogeneity of rural districts. As discussed above, there was little demographic, economic, and educational diversity among rural school districts. The lack of a statistical "smoking gun" suggests that factors affecting overweight rural students may be less institutional and more personal or family-related.

Pennsylvania Department of Health's Pennsylvania Nutrition and Physical Activity Plan

To address the problems of overweight children in Pennsylvania, the Pennsylvania Department of Health has initiated the Pennsylvania Nutrition and Physical Activity Plan to Prevent Obesity and Related Chronic Diseases (PaNPA Plan). The three-point plan aims to increase physical activities through:

o Informational Approaches: These focus on community information campaigns, classroom health education, and media campaigns.

o Behavioral and Social Approaches: These focus on school-based physical education, classroom-based health education to reduce television viewing, and family-based social support initiatives.

o Environmental and Policy Approaches: These focus on the creation of enhanced access to places for physical activities, transportation policy and infrastructure changes to promote non-motorized transit, and urban planning approaches to zoning and landuse.

In addition, in 2003, the department undertook an assessment of competitive foods sold in high schools across the state. As defined by U.S. Department of Agriculture, "competitive foods" are foods that students purchase in addition to or in place of a reimbursable school meal, such as a la carte sales and other foods and beverages purchased from vending machines, school stores, and snack bars. The assessment found that 94 percent of the high schools surveyed had vending machines accessible to students. It also found that many of the top-selling a la carte items in the school cafeteria had low nutrient densities.