The Effect of Spending per Pupil on State Overweight and Obesity Rates

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Introduction

The current obesity problem in the United States has worsened in recent years as obesity has increased, especially among men and minority groups. Obesity has risen by 7% from 2000 through 2010 (Olson. 2014). It is leading to the U.S. being one of the most obese countries in the world, ranking among the first quarter of most obese countries in the world. An estimated 41.64% of all adult males in the United States are obese as of 2022, and an estimated 20.54% of all children in the United States are obese (Obesity. 2024).

The current school expenditure per pupil significantly contributes to the current norm. School funding often impacts educational resources and programs related to physical health, nutrition, and overall well-being. Public school expenditure may influence academic outcomes, health awareness, and access to healthier meal choices among students. A lower spending per pupil can lead to dietary constraints, including a smaller selection of nutritious food options through school meals and a lower understanding of what health entails.

Furthermore, tackling the issue of overweight and obesity during childhood and adolescence is crucial since creating healthy habits early on can lead to continuing healthy habits later in life. In contrast, overweight and obese children are twice as likely to maintain those unhealthy habits and become overweight and obese adults (Singh et al., 2008).

Ultimately, obesity leads to major health issues not only in childhood and adolescence but also through adulthood. The prevalence of obesity can cause major health and clinical issues, including diabetes, cardiovascular diseases, respiratory anomalies, and more (Kyrou et al., 2010). This study contributes to previous related literature by estimating the effect of public school, K through 12, spending per pupil on state-specific obesity rates.

Literature Review

More research is needed to identify the causal effect of spending per pupil on obesity. While some literature highlights the influence of educational funding on health outcomes, the direct impact on obesity remains largely unexplored. This includes educational funding for physical education. All 50 states directly fund some sort of multicomponent physical education (Roundtable on Obesity Solutions et al. 2014). Despite this, the prevalence of obesity among children has doubled and/or tripled among most industrial countries from the 1990s through the 2010s, with up to 40% of all North American children being obese (Han et al. 2010).

Empirical Model

This Linear Regression model is used to estimate the relationship between state obesity rates and K through 12 spending per pupil. In this research paper, the following regression model is used to estimate the relationship.

$$\text{Overweight} \wedge \text{Obesity rate} = \alpha + \beta 1\text{Spending per Pupil} + \beta 2\text{Income} + \beta 3\text{Uninsured} + \beta 4\text{Region} + u$$

In the following model, the dependent variables measure the proportion of the population that is overweight and obese. The spending per pupil variable measures the amount each state spent per pupil on their K through 12 education. The median annual income variable for each state is measured in dollars. The uninsured variable measures the proportion of the total state population without health insurance. Finally, the Midwest region is excluded to control for a geographic region.

Data

The data for state and overweight and obesity rates was retrieved from the publicly available data from the Kaiser Family Foundation (KFF): Distribution of Body Mass Index Among Adults | KFF

The Kaiser Family Foundation's overweight and obesity rates data uses body mass index (BMI) data to calculate overweight and obesity rates per state. These estimates are derived from the Behavioral Risk Factor Surveillance System, an ongoing telephone survey conducted with randomly selected non-institutionalized civilian adults aged 18 and older. The dependent variable includes three categories: the percentage of adults who are overweight (BMI between 25 and 29.9), obese (BMI between 30 and 39.9), and severely obese (BMI over 40).

The independent variable of interest measures the spending per pupil on K through 12 education by state in 2022-2023. The state-level data was obtained from the National Center for Education Statistics, available at Elementary and Secondary Education, Public School Expenditures.

Other state-level variables include annual median income and the proportion of the state population that is uninsured. These other state-level variables were acquired from the 2021-22 Kaiser Family Foundation data: Demographics and the Economy | KFF.

Table 1: Descriptive Statistics

Variable	Mean	Minimum	Maximum
Overweight & Obesity	68.75	56.7	75
Spending per Pupil ($)	18,986.27	11,700	37,800
Median Income ($)	69,439.84	48,716	90,203
Uninsured (%)	7.29	2.4	16.6
West	0.25	0	1
South	0.33	0	1
Midwest	0.24	0	1
Northeast	0.18	0	1

Table 1 demonstrates the mean and the variance between the independent variable, spending per pupil, and the dependent variables. The mean Overweight and Obesity percentage is 68.75%, with a minimum value of 56.7% in the District of Columbia and a maximum value of 75% in West Virginia. The mean Spending per Pupil in dollars is $18,986, with a minimum expenditure value of $11,700 by the state of Idaho and a maximum expenditure value of $37,800 by the District of Columbia.

Empirical Results

The regression results from Table 2 demonstrate that as spending per pupil increases by $1,000, state overweight and obesity decreases by 0.21% (p-value<0.05). The spending per pupil data was modified by dividing each observation by 1000 to determine the effect of an additional $1,000 instead of an additional $1 in expenditure. Ultimately, this demonstrates that spending per pupil significantly affects state overweight and obesity rates. Higher spending per pupil leads to lower obesity rates.

Table 2. Regression Results

OLS Regression Results

Dep. Variable:	Overweight_Obese_2022	R-squared:	0.647
Model:	OLS	Adj. R-squared:	0.599
Method:	Least Squares	F-statistic:	13.47
Date:	Sun, 15 Sep 2024	Prob (F-statistic):	1.33e-08
Time:	22:54:29	Log-Likelihood:	-114.53
No. Observations:	51	AIC:	243.1
Df Residuals:	44	BIC:	256.6
Df Model:	6		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	82.8592	3.222	25.718	0.000	76.366	89.352
Spending_per_Pupil_1000	-0.2108	0.101	-2.088	0.043	-0.414	-0.007
Median_Income_2021	-0.0001	4.27e-05	-3.008	0.004	-0.000	-4.24e-05
Uninsured_2022	0.1256	0.166	0.758	0.452	-0.208	0.459
West	-4.5007	1.082	-4.158	0.000	-6.682	-2.319
South	-1.7756	0.988	-1.797	0.079	-3.767	0.216
Northeast	-1.9991	1.267	-1.578	0.122	-4.553	0.555

Omnibus:	4.120	Durbin-Watson:	1.693
Prob(Omnibus):	0.127	Jarque-Bera (JB):	3.037
Skew:	-0.532	Prob(JB):	0.219
Kurtosis:	3.545	Cond. No.	6.62e+05

Other variables, such as West, South, and Northeast, which are regions, are important determinants of obesity rates. The empirical results demonstrate that West, South, and Northeast regions have lower overweight and obesity rates than Midwestern states (p<0.01).

Alternative Specifications

The results shown in Table 2 may vary depending on how unhealthy weight is defined and the fact that the data is self-reported. To address this, the model was re-run using 2022 obesity rates as the dependent variable, using the CDC's Behavioral Risk Factor Surveillance System data. The effect of spending per pupil remained positive and statistically significant (p-value < 0.05), reinforcing the confidence that the findings are robust to changes in the definition of unhealthy weight and alternative data sources.

Conclusions and Policy Implications

The empirical results demonstrate the potential impact of increasing spending per pupil on reducing overweight and obesity rates. This suggests that targeted expenditure, such as investing in healthier school meal options and enhancing health and wellness education funding, can significantly influence overweight and obesity rates per state. Notably, funding healthier school meal options emerges as a direct and effective strategy, enabling schools to provide nutritious, balanced meals that foster healthier eating habits among students.

Significant limitations arise from this study, primarily involving the state obesity rates since obesity rates are calculated with self-reported BMI data. This highlights significant concerns relating to error and bias in the results. Additionally, the data does not account for the diet or energy expenditure habits of the surveyed individuals. These lifestyle factors may correlate with spending per pupil. The results might overestimate or underestimate the impact that spending per pupil has on obesity rates.

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