Do Recessions Improve the Teenage Obesity Rate?

Amy (Xiaoyue) Zhang

Professor Tracy Falba, Faculty Advisor

Professor Michelle Connolly, Seminar Instructor

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Abstract

Recent evidence reveals an interesting relationship between macroeconomic conditions and population health/health behaviors: economic downturns have been correlated with positive effects on overall health and health behaviors, while economic booms have been correlated with the negative effects on overall health and health behaviors. Although studies have established associations between adult health conditions with periods of economic fluctuations, I am interested in how the economy affects the obesity rate of teenagers, a unique age group that captures the transition from puberty to young adulthood—a period of increased independence, decreased parental supervision, and entry into work force. My study helps identify potential behavioral mechanisms behind teenage weight fluctuations and the groups of teenagers most at risk of becoming overweight or obese, requiring the most attention in future efforts to reduce the teenage obesity rate. My analysis does not find overwhelming evidence of healthier behaviors in teenagers in bad economies, except that males are more inclined to enroll in more physical education classes. On the contrary, I find that smoking worsens in both genders. I do find that male weight outcomes improve when the economy declines, reinforcing the relationship between the economy and health that we have yet to better understand.

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I. Introduction

It is no secret that America has become the most obese nation in the world. Obesity rates in the U.S. have skyrocketed in all age groups since the 1980s and have become a major public health issue. The National Health and Nutrition Examination Survey reports that the percentages of adults who are obese[1] increased substantially from 15% in 1976-1980 to 35% in 2005-2006. In the same time frame, the percentages of overweight[2] children, adolescents, and preschool-age[3] children also increased, most notably with the percentage of preschool-age children doubling from 5% to 11% (CDC). According to the National Institute of Health, excess body weight is associated with higher rates of mortality and increased risk of heart disease, stroke, diabetes, and other diseases (Health, United States, 2009).

Recent evidence reveals an interesting relationship between macroeconomic conditions/population health and health behaviors. Specifically, economic downturns have been correlated with positive effects on overall health and health behaviors, and

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[1] According to the CDC, overweight and obesity describe the ranges of weight that are greater than what is generally considered healthy for a given height, measured by a number called the "body mass index" (BMI). BMI is calculated by dividing ones weight by height. An adult who has a BMI of 30 or higher are considered obese. An adult who has a BMI between 25 and 29.9 is considered overweight. For instance, an adult male with a height of 6'0'' would be considered obese if he weighed more than 221 lbs. http://www.cdc.gov/obesity/defining.html

[2] BMI is calculated the same way for children and adults, but the interpretations are different. The BMI of a child or adolescent is translated into age and sex specific percentiles to account for the amount of body fat discrepancies between age and sex. A child or adolescent (2-19 years old) who has a BMI at or above the 85th percentile and lower than the 95th percentile of the same age and sex is considered overweight. A child or adolescent who has a BMI at or above the 95th percentile of the same age and sex is considered obese.

[3] Children are defined as 6-11 years old, adolescents are 12-17 years old, and preschool-age children are 2-5 years old.

economic booms have been correlated with the negative effects on overall health and health behaviors. For example, adult obesity levels has been shown to decrease during recessions, partly explained by increased levels of healthy behaviors such as exercising more and decreased frequency of eating out as time and energy is shifted from work to home and leisure activities (Ruhm, 2000). Do these trends hold for all age groups, including children and teenagers that may not be involved in the job force? Could recessions be the secret solution to a healthier and skinnier America?

In this paper, I examine the relationship between economic fluctuations and teenage obesity and health behaviors from 1999 to 2009. Teenagers are a unique age group that captures the transition from puberty to young adulthood. The teenage years mark the period of increased independence, decreased parental supervision, and entry into the work force. My research helps identify the potential determinants of teenage weight gain and targets the groups of teenagers most at risk of becoming obese. These steps are instrumental towards future efforts in lowering the teenage obesity rate. Additionally, my analysis adds to the existing literature that has focused mainly on adult health behaviors, and provides a better understanding of how family consumption and behavioral patterns are affected by the macroeconomy. Ultimately, this knowledge will be valuable in guiding welfare policies such as the food stamps and other income transfers programs, nutrition requirements in school lunches, and state and national health initiatives for youth.

The structure of this paper is organized in the following way: Section II discusses the existing body of literature relevant to my research. Section III describes the theoretical framework of my analysis. Section IV provides an overview of the datasets

and the limitations that they impose on my research. Section V explains the empirical methodology and discusses the regression results. Section VI concludes the paper and discusses areas for future research.

II. Literature Review

Beyond a myriad of health implications, obesity is also an economic phenomenon. While biological factors such as genetics are certainly significant contributors to one's health, they cannot sufficiently explain the increasing rate of obesity seen in the past decades. Obesity is ultimately a product of individual choices and behaviors: individuals aim to optimize their utility by constantly trading off health for other goods including pleasure, income, and time. The economic consequences include rising medical expenditures associated with chronic and non-chronic diseases linked to obesity, reductions in productivity in the workplace, and an increased reliance on government and the public sector to bear the costs. To the extent that obesity generates social and private costs, economists must analyze the costs and benefits regarding alternative methods of public intervention, and determine the optimal amount that the government should intervene (Philipson & Posner, 2008). The underlying causes of the significant increase in the weight of Americans in the past decades are unclear. Some believe the epidemic is primarily a result of the increase in fast food restaurants and decrease in smoking (Chou et al., 2004), while others are convinced that it is due to technological progress in the food and media industry leading to cheaper fattening foods and more sedentary lifestyles (Philipson & Posner, 2008).

Economists have been interested in the relationship between macroeconomic conditions and population health since the 1920s, when Dorothy Thomas revealed procyclical trends in mortality rates in Great Britain and the US.[4] Although the trends were confirmed by later studies, the results garnered little attention, probably due to their counterintuitive nature (Granados, 2005).[5] On the contrary, studies conducted by Harvey Brenner during the 1970s and 1980s found more intuitive evidence that variations in admissions to mental hospitals, infant mortality rates, and mortality as consequences of cardiovascular disease, cirrhosis, suicide, and homicide were countercyclical. However, Ruhm and others argue that Brenner's aggregate time-series methods were unreliable due to statistical flaws, which include omitted variables bias, a characteristic typical of lengthy time-series data, and sensitivity to the choice of country, time period, and outcome (Ruhm, 2000).

In contrast, Christopher Ruhm's widely cited analysis in 2000 utilizes improved methods by exploiting within state changes in a fixed-effect model and found that a one-percentage point rise in unemployment reduces the total death rate by 0.5% (Ruhm, 2000). Although his study was criticized because the drop in mortality rate was largely due to a decrease in automobile fatalities, an economic externality (Miller et al., 2009), other factors such as cardiovascular diseases and influenza or pneumonia suggest improved morbidity as well. While identifying short-term trends on an outcome such as mortality and even morbidity are difficult, short-term effects on important health

[4] Procyclical: any economic quantity that is positively correlated with the overall state of the economy. For example, population health improves as the overall state of the economy improves.

[5] Many would assume that the stress of dealing with a recession leads to bad health outcomes such as increased mortality rates.

behaviors may be more readily identifiable—health behaviors and physiological markers such as BMI have long-term effects on health. By incorporating national microdata for adults from the Behavioral Risk Factor Surveillance System (BRFSS), Ruhm also found that economic downturns are associated with a decrease in smoking in heavy smokers, a drop in body weight in the most obese, and an increase in exercise in the least active, which may partially explain the procyclical relationship of the mortality rate during recessions. Ruhm hypothesizes that individuals may live healthier lifestyles during recessions because the opportunity cost of pro-health activities such as exercising or cooking at home decreases (Ruhm 2005). It is unclear whether these changes in opportunity costs observed in adults are similar in children and teenagers.

Other studies have also documented an increase in health-related activities or improved health outcomes during times of high unemployment. Rajeev Dehejia and Adriana Lleras-Muney (2004) use state-level data to show that babies conceived during periods of high unemployment have a reduced incidence of low birth weight, fewer congenital malformations, and lower post-neonatal mortality. These improvements are partly explained by changes in health behaviors such as an increase in prenatal care visits during economic downturns, demonstrating that the substitution effect of the decreased opportunity cost of time dominates the income effects of lowered wages. The health improvements are also attributed to changes in the composition of women giving birth.[6]

[6] When the economy is weak, they found that black mothers tend to be of higher socioeconomic status and white mothers are less educated. Their results were consistent to their hypothesis that low-skill women are less likely to have human capital that depreciates quickly, and so during times of unemployment, those who are not credit constrained would substitute into fertility. Low-education black mothers are generally more likely to be credit constrained than whites or more educated blacks, and so they substitute away from fertility.

A 2009 study by Jeremy Arkes uses data from the 1997 U.S. National Longitudinal Survey of Youth (NLSY) to explore the relationship between economic with teenage weight gain changes from 1997 to 2004. He found that an increase in the state unemployment rate of one-percentage point causes the BMI distribution to rise 1.8 percentiles in female teenagers, but decrease by 2.0 percentiles in male teenagers, significant at the 1% confidence level. This discrepancy between genders most likely cannot be explained by family income or parent employment status since members of the same family are subject to the same environmental conditions. However, Arkes contends that one potential explanation lies in the relative physical activity level of jobs and leisure activities across gender. This has yet to be examined in further detail (Arkes 2009). Using the results from the 2001 Youth Risk and Behavioral Survey, the same source that I work with, Arkes also found that teenage males exercise more than females, suggesting that females may gain more weight in weaker economic times because males substitute into physical activities in their extra leisure time. An older study by Arkes (2007) found strong evidence that a weaker economy leads to higher levels of drinking, marijuana use, and cocaine/hard drug use.

Although studies have investigated the interaction between health and the economy for both adults and teenagers, there has yet to be any research on teenage weight and health behavior during the most recent and devastating financial crisis. The recent recession from December 2007 to June 2009 has been the longest and worst economic downturn for the US since the Great Depression, with national unemployment rate peaking at 10.1% in October 2009 after the official end of the recession. It is interesting to see whether the previously documented relationships between health

behaviors and obesity rates and macroeconomic conditions remain true through this period of high unemployment.

My analysis investigates how macroeconomic conditions might affect teenage obesity from 1999 to 2009, and reveals potential behavioral mechanisms that contribute to the relationship. I use microdata from the Youth Risk Behavior Surveillance System (YRBSS) for information on weight outcomes, nutrition, physical activity, smoking, and drug use on an individual level for high school students between the ages 12 through 18. As in previous studies, I will be using state unemployment rates from the Bureau of Labor Statistics Local Area Unemployment Statistics (LAUS) Database as the proxy for macroeconomic conditions.

My study differs significantly from Arkes' because we study teenagers during different time periods and utilize data from separate surveys. Although my data from the YRBS are not longitudinal, I have a significantly greater number of observations than the NLSY. Additionally, there are no NLSY surveys monitoring teenagers from the recent time period that I am interested in. The YRBS is also considered the most comprehensive survey of youth for indicators of at-risk behaviors in the United States, so I am able to study a wider range of variables including tobacco use and physical inactivity, which are not available in the NLSY.

III. Theoretical Framework

Weight Change:

While a number of factors including age, gender, race, ethnicity, and genetic makeup contribute to one's weight, the two key proximate determinants are the amount

and quality of calories consumed and the amount of calories expended. Given that the former factors are constant, fluctuations in weight outcomes are ultimately a result of one's cumulative energy balance between calorie consumption and calorie expenditure across time periods. Calorie consumption is largely affected by the foods we choose to purchase, the methods of we prepare them, and the foods we consume are all factors that affect our energy intake. For example, one can choose to bring home high-fat foods, prepare them in slabs and butter, and proceed to feed them to his or her family. Calorie expenditure depends on the time one allocates towards physical activity or sedentary behaviors. Thus, in my analysis I focus mostly on behaviors associated with diet, nutrition, and physical activity.

Depending on a teenager's substitution pattern, two main factors that affect the energy balance are the number of meals eaten away from home, TV viewing and electronic media use (Arkes, 2009). Although there exists a range in the quality of restaurant foods, Putnam et al. reports that meals eaten away from home are generally higher in fat and sugar than meals cooked at home (2002). On the other hand, TV and internet use is considered to have a significant influence on one's physical activity levels as people substitute away from an active lifestyle and adopt a more sedentary lifestyle prone to weight gain. Moreover, TV can also increase one's caloric intake because eating and TV viewing has shown to be complimentary, and TV advertisements may influence one's choice of food (Arkes, 2009).

The Role of the Economy in Teenage Weight Gain:

There are several mechanisms through which economic conditions may play a distal role in the behaviors of teenagers, thus affecting weight outcome. As discussed

earlier, studies focusing on adult behavior conclude that in weaker economies, adults are more likely to undertake time-intensive health-related activities because their opportunity cost of time decreases. Under these circumstances, if adults spend more time cooking at home, then it is likely that teenagers would eat out less and adopt a more nutritious diet. The additional supervision of a newly unemployed parent could decrease risky behaviors in teenagers such as smoking, drinking, or drug use, which have varying affects on weight. Parents may have more time to drive their children to after-school or sports related activities, especially important in the younger age group of teenagers who cannot drive. But along those same lines, the negative income effect on adults during recession can also mean that some families can no longer afford to send their children to these activities at all, decreasing their level of physical activity. The same effect may also limit the family's access to television cable and Internet access, which could decrease the number of sedentary hours of a teenager. Finally, it is important to consider teenager's own employment status. Having a source of income may lead to some degree of freedom and independence from parents. During economic downturns, the low-skill jobs that teenagers hold are affected dramatically, with unemployment rates peaking at nearly 28% in October 2009. Depending on the type of job in terms of working hours and activity level, one's weight could increase or decrease as a result of unemployment. In light of these potential mechanisms in which the economy may impact teenage obesity rates, we see that teenage weight may increase or decrease depending on the strength and direction of each mechanism.

I use the following model in my analysis:

$$Y_{ijt} = \alpha + \beta \mathbf{X}_{ijt} + \gamma UE_{jt} + IncomeProxies + \delta_j + \lambda_t + \varepsilon_{ijt} \quad (1)$$

Where Y_{ijt} is the outcome of interest, which will be obesity and weight-related behaviors for the individual *i* from state *j* in year *t*. $\boldsymbol{X}_{ijt}$ is a vector of individual characteristics including age, grade, sex, race/ethnicity. UE_{jt} is the unemployment rate in state *j* in year *t*. γ represents the impact that the unemployment rate has on the outcome Y_{ijt}. IncomeProxies contain the controls for socio-economic variation and come from relevant survey questions regarding school safety. These controls are discussed in greater detail in the next section. δ_j is the state fixed effect which accounts for constant differences across states, like the differences in the food culture between Louisiana and Montana. λ_t is the year fixed effect which represents factors that affect all states uniformly, such as a decrease in the price of sugar. ε_{ijt} is the error term.

IV. Data

Youth Risk Behavior Surveillance System (YRBSS):

The YRBSS is designed to monitor obesity and asthma among 9-12th graders, as well as the following six categories of priority health-risk behaviors: behaviors that contribute to unintentional injuries and violence, tobacco use, alcohol and other drug use, sexual behaviors that contribute to unintended pregnancy and sexually transmitted diseases (STDs), unhealthy dietary behaviors, and physical inactivity. It is composed of a national school-based survey (YRBS) conducted every other year by the Center for Disease Control (CDC). The YRBS questions include demographic data on age, grade, sex, race/ethnicity, and state, all of which I control for in my analysis.[7]

[7] Data on state identifiers is not available to the public from the CDC website. I requested and received datasets containing FIPS codes (state identifiers) from the CDC, which I merged with the YRBS dataset.

The primary limitation for the purpose of my study is a lack of socio-economic information of individuals. There are also number of other characteristics that may vary between households that are not collected in the survey, such as the number of siblings and the number of employed parents. The YRBS is only administered every other year, unlike the BRFSS, which is administered annually. Finally, the YRBSS does not monitor the employment status or type of employment of the individuals.

The YRBS dataset from the CDC website had to be renamed and relabeled so that variables from different years correspond to the same survey question. The earlier years, 1999-2003, did not have the BMI, BMI percentile, obese, or overweight variables. I created them with a SAS program provided by the CDC. I also recoded many of the variable responses to make the responses increase linearly so that the regressions can be interpreted meaningfully, i.e., if q1 == 1 corresponds to 2-5 days and q1 == 2 corresponds to 6-10 days, I would recode it as q1 == 3.5 days and q1 == 8 days respectively.

Bureau of Labor Statistics (BLS) data:

State unemployment rates are used as proxies for economic conditions. The BLS provides monthly unemployment rates at the state level from the Current Population Survey (CPS). CPS defines unemployed as "[…] all persons who had no employment during the reference week, were available for work, except for temporary illness, and had made specific efforts to find employment some time during the 4 week-period ending with the reference week. Persons who were waiting to be recalled to a job from which they had been laid off need not have been looking for work to be classified as

unemployed."[8] The unemployment rate is the percent of the unemployed with respect to the civilian labor force. I use state unemployment rate as opposed to county unemployment rate because the YRBS data is limited at the state level. Most literature surrounding health and the economy are also limited to using state level unemployment data.

Socio-economic Control Variables:

For the purpose of my study, it is important to control for income levels because families from varying socio-economic backgrounds respond differently to economic fluctuations. Prior to 2005, the CDC derived and supplied metropolitan status (urban, suburban, and rural) information of the individuals, but unfortunately, the CDC stopped producing these values in 2007. Therefore the most specific level of geographic information of the individuals is on a state level.

To estimate the socio-economic backgrounds of the students, I first merged state median income levels to the dataset. However, because unemployment data is also measured at the state level, the variation of individual responses within a state becomes limited, producing problems with collinearity. After my initial regressions, I decided to drop this variable.

Instead of assigning each individual with a state specific income level, I utilize survey questions that potentially provide insight on socio-economic levels on a local level rather at the state level. I used a combination of the following questions: 1. "Did you carry a weapon (such as a gun, knife, or club) in the past 30 days?" 2. "Did you skip school because you felt that you would be unsafe at school or on your way to or from

[8] http://www.bls.gov/lau/laufaq.htm#Q3

school in the past 30 days?" 3. "Were you threatened at school with a weapon in the past 30 days?" The 2nd and 3rd questions are combined into one variable so they account for four different scenarios. For example, a student who skipped school for safety reasons and was threatened at school might come from a different socio-economic background than a student who also skipped school for safety reasons but was not threatened at school. I chose this question because there is no direct relationship between these characteristics and obesity or overweight statuses, yet there is a clear correlation between safety and socio-economic levels. By adding this variable, I am able to better control the socio-economic variations within states. I do realize, however, that it is possible these controls are weakly correlated with obesity and overweight statuses; a student who is obese might be bullied and either skip school because he feels unsafe or carry a weapon to defend himself. For this reason, I include all regressions without these control variables in the appendix Tables 2-5. The results without income control variables are similar, but the magnitudes of the coefficients are slightly smaller.

Summary Statistics

Figure 1 displays trends in national teenage obesity and overweight rates and the national unemployment rate in the sample period. The top panel illustrates the annual averages. In the lower panel, the variables are detrended and normalized by subtracting the mean of the detrended variable and dividing by the standard error. The obesity rate and overweight rate began increasing dramatically around 2001. Around 2006, the overweight rate begins to plateau, and the obesity rate surprisingly begins to fall. I would be curious to see whether this downward trend can be attributed to the recent recession,

or if it is the result of other variables such as state or national level healthy living initiatives or an increase in price of fast food.

Detailed information on variable names and definitions are presented in Appendix Table 1. Number of observations, means, and standard deviations of all variables employed in the regression are contained in Table 1. The means and standard deviations in the table are computed based on YRBSS sampling weights and are representative of the high school population in the United States.

Figure 1. Trends in Teenage Obesity and Overweight and Unemployment

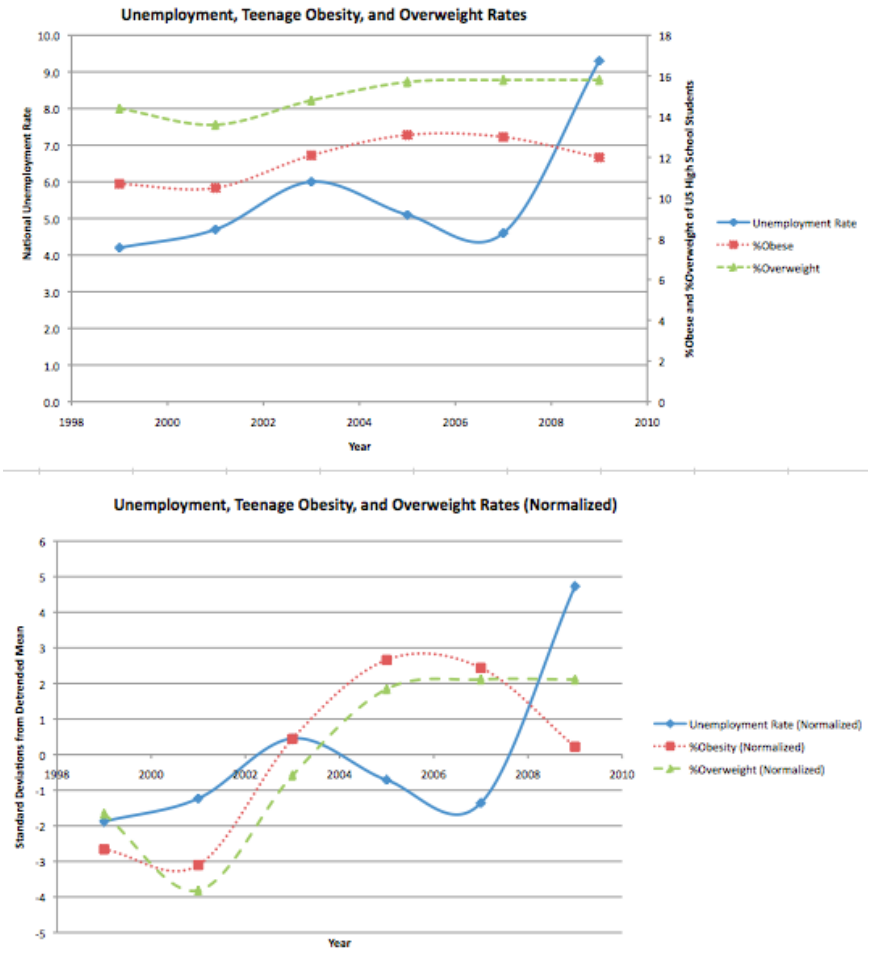

Table 1. Summary Statistics of all variables used in analysis, except the state and year dummy variables.

	Males			Females		
	N	Mean	SD	N	Mean	SD
Individual Characteristics						
Age	43157	16.229	1.226	44752	16.109	1.222
American Indian/Alaska Native	42642	0.014	0.116	44323	0.010	0.101
Asian	42642	0.035	0.184	44323	0.032	0.177
Black or African American	42642	0.218	0.413	44323	0.231	0.421
Native Hawaiian/other Pacific Islander	42642	0.009	0.097	44323	0.008	0.090
White	42642	0.430	0.495	44323	0.421	0.494
Hispanic/Latino	42642	0.199	0.399	44323	0.196	0.397
Multiple races and is Hispanic	42642	0.068	0.252	44323	0.069	0.253
Multiple races and is non-Hispanic	42642	0.027	0.162	44323	0.032	0.177
Carried a weapon in the past 30 days	41747	0.275	0.447	44003	0.072	0.259
Missed school due to safety concerns and was threatened	43018	0.029	0.167	44667	0.018	0.132
Missed school due to safety concerns, but not directly threatened	43018	0.036	0.186	44667	0.052	0.222
Did not miss school due to safety concerns, but was threatened	43018	0.077	0.267	44667	0.040	0.197
Dependent Variables						
BMI	40655	23.778	4.717	41506	23.086	4.695
BMI Percentile	40655	64.442	28.370	41506	61.181	27.266
Obese (binary)	42008	0.187	0.390	43176	0.130	0.336
Overweight (binary)	42008	0.152	0.359	43176	0.152	0.359
Smoking 10+ per day in past month (q31)	40480	1.218	3.390	42764	0.821	2.513
Drinking 5+ drinks in a row in past month (q42)	41887	1.291	3.571	43993	0.713	2.410
Marijuana usage in past month (q47)	42053	6.272	13.587	44145	3.675	10.766
Cocaine usage in past month (q50)	41537	0.997	5.883	43454	0.499	4.168
Servings of fruit per day (q73)	42319	0.865	1.052	44248	0.815	0.980
Servings of green salad per day (q74)	41872	0.393	0.684	43842	0.399	0.607
Servings of milk per day (q79)	42185	1.290	1.256	44127	0.842	1.026
Hours of TV per day (q81)	42127	1.154	0.913	44068	1.126	0.923
Number of sports teams in past year (q84)	41358	1.154	1.116	43244	0.801	0.996
Days of vigorous activity per week (q91)	40708	4.130	2.492	42483	3.026	2.433
Days of moderate activity per week (q92)	40768	2.690	2.600	42623	2.395	2.394
State Economic Conditions	N	Mean	SD			
Unemployment rate	88538	5.805	2.007			
Income in thousands	88538	44.816	6.646			

V. Results:

Regressions are run as ordinary least squares models with robust standard errors for all dependent variables except the binary variables. Obese and overweight variables are estimated using linear probability models. In my preliminary regressions, I found significant differences between male and female teenagers in the majority of my specifications. Since I have a large sample size, I decided to stratify my regressions by gender to simplify interpretations. The adjusted R^2 values are low in this analysis, but this is to be expected. As discussed earlier, there are many factors that I cannot account for in my regressions such as genetic components, family income levels, and parent's education levels that affect weight and other dependent variables, so it is not surprising that the explanatory power of my regressions is low. All specifications include year and state dummy variables. For all specifications, I drop the dummy variable "white," so white teenagers are set as the baseline for comparison among teenagers of other races and ethnicities.

Weight Outcomes

Econometric estimates of BMI, BMI percentiles, the probability of being obese, and the probability of being overweight are displayed in Table 2. Weight outcomes are negative and statistically significant only for male teenagers. We see that a one-percentage point increase in the unemployment rate decreases the BMI by 0.0981 and BMI percentile of male teenagers by 0.604, both significant at the 1% level. In other words, a 10 percentage point rise in the unemployment rate would decrease BMI of males by about one unit and BMI percentile by about 6 percentiles. This result is comparable to Arkes' findings that male weight outcomes improve in weaker economies. The

overweight coefficient is negative, but not significant. This may be attributed to obese teenagers losing weight and entering the overweight category, while overweight teenagers losing weight and leaving the overweight category. Effects for females are not significant, but the coefficients for BMI, BMI percentile, and overweight are negative, while the obese coefficient is positive.

Table 2. Coefficient estimates for weight outcomes.

	Males				Females			
	BMI	BMI Percentile	Obese	Overweight	BMI	BMI Percentile	Obese	Overweight
Unemployment rate	-0.0981**	-0.604**	-0.00673*	-0.00312	-0.0252	-0.0581	0.00127	-0.00168
	(-2.66)	(-2.72)	(-2.26)	(-1.08)	(-0.72)	(-0.28)	(0.52)	(-0.60)
Age	0.490***	-1.673***	-0.0106***	-0.00861***	0.395***	-1.365***	-0.00567***	-0.00448**
	(25.29)	(-14.27)	(-6.65)	(-5.75)	(20.76)	(-12.47)	(-4.16)	(-3.08)
American Indian/Alaska Native	0.719**	2.831*	0.0833***	0.0231	0.980***	6.684***	0.0667***	0.0568**
	(3.04)	(2.06)	(4.36)	(1.38)	(4.09)	(4.58)	(3.70)	(2.97)
Asian	-0.663***	-4.488***	-0.0162	0.00356	-0.785***	-5.735***	0.0127	-0.0357***
	(-5.75)	(-5.19)	(-1.70)	(0.37)	(-7.43)	(-7.26)	(1.53)	(-4.42)
Black or African American	0.759***	4.987***	0.0368***	0.0172***	2.021***	11.73***	0.0817***	0.0786***
	(11.13)	(12.42)	(6.63)	(3.39)	(29.08)	(31.34)	(16.84)	(15.21)
Native Hawaiian/other Pacific Islander	0.715**	3.922*	0.0542*	0.0394*	1.297***	6.609***	0.0876***	0.0374
	(2.70)	(2.44)	(2.55)	(1.98)	(4.47)	(4.03)	(4.17)	(1.89)
Hispanic/Latino	1.204***	6.998***	0.0754***	0.0452***	1.345***	9.265***	0.0586***	0.0553***
	(16.48)	(15.80)	(12.46)	(8.15)	(19.62)	(22.30)	(11.78)	(10.20)
Multiple races and is Hispanic	0.717***	4.325***	0.0449***	0.0347***	1.322***	8.327***	0.0592***	0.0490***
	(6.87)	(6.86)	(5.27)	(4.23)	(12.96)	(14.51)	(8.34)	(6.17)
Multiple races and is non-Hispanic	0.313*	2.210*	0.0160	0.0219	0.752***	5.192***	0.0127	0.0333**
	(2.16)	(2.43)	(1.33)	(1.89)	(5.91)	(6.70)	(1.46)	(3.27)
Missed school due to safety concerns and was threatened	-0.0660	-0.885	0.0487***	-0.00333	0.799***	1.951	0.0699***	-0.00665
	(-0.37)	(-0.84)	(3.33)	(-0.26)	(3.39)	(1.73)	(4.45)	(-0.46)
Missed school due to safety concerns, but not directly threatened	0.167	-0.173	0.0455***	-0.0264**	0.714***	2.651***	0.0451***	0.00378
	(1.18)	(-0.21)	(3.87)	(-2.78)	(5.93)	(4.33)	(5.30)	(0.46)
Did not miss school due to safety concerns, but was threatened	0.158	0.686	0.0237**	-0.00382	0.205	0.866	0.00986	0.0180
	(1.69)	(1.24)	(3.04)	(-0.55)	(1.67)	(1.24)	(1.13)	(1.86)
Carried a weapon in the past 30 days	0.335***	1.798***	0.0212***	0.0127**	0.541***	3.234***	0.0268***	0.0170*
	(6.00)	(5.42)	(4.63)	(2.99)	(5.52)	(6.28)	(3.82)	(2.30)
Constant	16.31***	93.66***	0.331***	0.408***	15.00***	72.20***	0.184**	0.156**
	(19.33)	(16.59)	(5.11)	(5.57)	(21.58)	(13.00)	(3.04)	(2.85)
N	38784	38784	39988	39988	40364	40364	41916	41916
adj. R^2	0.034	0.021	0.018	0.005	0.057	0.051	0.030	0.013

t statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Nutrition and Physical Activity

Tables 3 and 4 display the results for nutrition[9] and physical activity in both genders. We see that the number of servings of fruits, green salad, and milk consume per week are not significant for either genders, but are negative across the board for females. The number of hours of TV that teenagers watch is also insignificant, but the coefficient is negative for males and positive for females. Surprisingly, the number of days spent in physical education (PE) class per week increases by 0.0706 days for males as the unemployment rate increases by one-percentage point. This result is odd because many schools have state or local requirements that dictate the amount of PE classes students are required to take, regardless of gender. However, the unemployment rate shows no significant effect for females, so it is possible that teenagers have some freedom in selecting high school classes, and males are more likely to take extra PE classes when the economy declines. The number of sports teams that student participate in is not significantly affected by the unemployment rate, though the coefficient is negative for both genders. Finally we see that females exhibit lower levels of vigorous and moderate activity in weaker economic times, significant at the 5% level.

[9] The survey questions I used for nutrition (amount of fruits, green salad, and milk) measure a narrow scope of food groups, and are not a comprehensive evaluation of "nutrition."

Table 3. Coefficient estimates for nutrition and physical activity for males.

Male Nutrition and Physical Activity								
	Fruits	Green salad	Milk	TV	PE Class	Sports	Vigorous Activity	Moderate Activity
Unemployment rate	-0.000473	0.00636	0.00319	-0.00199	0.0706***	-0.00133	-0.0177	-0.0205
	(-0.06)	(1.22)	(0.34)	(-0.30)	(3.96)	(-0.15)	(-0.89)	(-0.96)
Age	-0.0192***	0.00544	-0.0647***	-0.0462***	-0.358***	-0.0596***	-0.173***	0.000338
	(-4.43)	(1.95)	(-12.78)	(-12.88)	(-39.22)	(-12.94)	(-16.69)	(0.03)
American Indian/Alaska Native	0.163**	0.0645	-0.139*	0.177***	0.0738	-0.105*	-0.275*	-0.176
	(3.17)	(1.77)	(-2.42)	(4.39)	(0.72)	(-2.09)	(-2.34)	(-1.44)
Asian	0.108***	0.0672**	-0.337***	0.0300	-0.0833	-0.330***	-0.612***	-0.464***
	(3.67)	(3.21)	(-10.80)	(1.28)	(-1.38)	(-11.32)	(-8.49)	(-6.29)
Black or African American	0.122***	-0.0380***	-0.397***	0.599***	0.154***	0.00800	-0.256***	-0.382***
	(8.06)	(-4.05)	(-22.99)	(43.51)	(4.76)	(0.50)	(-6.96)	(-10.08)
Native Hawaiian/other Pacific Islander	0.232***	0.0974*	-0.253***	0.321***	0.114	-0.0862	-0.230	-0.384**
	(3.54)	(2.00)	(-3.60)	(6.22)	(0.92)	(-1.39)	(-1.57)	(-2.68)
Hispanic/Latino	0.129***	-0.0105	-0.204***	0.252***	0.132***	-0.160***	-0.340***	-0.504***
	(7.99)	(-1.02)	(-10.94)	(19.25)	(3.85)	(-9.49)	(-8.91)	(-12.65)
Multiple races and is Hispanic	0.125***	0.0292	-0.103***	0.228***	0.0502	-0.0493*	-0.123*	-0.312***
	(5.27)	(1.79)	(-3.76)	(12.08)	(1.04)	(-2.00)	(-2.20)	(-5.25)
Multiple races and is non-Hispanic	0.144***	0.0439	-0.0886*	0.228***	0.0568	0.0539	0.0209	-0.0871
	(4.15)	(1.89)	(-2.16)	(7.80)	(0.81)	(1.47)	(0.26)	(-1.01)
Missed school due to safety concerns and was threatened	0.264***	0.296***	0.0160	0.256***	0.151*	0.0823*	-0.181*	0.206*
	(5.90)	(8.16)	(0.34)	(7.07)	(1.98)	(2.09)	(-1.99)	(2.27)
Missed school due to safety concerns, but not directly threatened	0.131***	0.0918***	-0.0378	0.0686*	0.0979	-0.0502	-0.272***	-0.0265
	(3.98)	(4.08)	(-1.08)	(2.57)	(1.56)	(-1.62)	(-3.84)	(-0.38)
Did not miss school due to safety concerns, but was threatened	0.103***	0.104***	0.0857***	0.00474	0.00785	0.102***	0.0749	0.212***
	(4.66)	(6.55)	(3.40)	(0.27)	(0.18)	(4.62)	(1.53)	(4.08)
Carried a weapon in the past 30 days	0.101***		0.0940***	0.0388***	0.00739	-0.0310*	0.0950**	0.271***
	(8.03)	0.0723*** (8.65)	(6.40)	(3.80)	(0.28)	(-2.38)	(3.27)	(8.80)
Constant	1.211***	0.0667	3.079***	1.405***	7.736***	2.203***	6.598***	3.428***
	(5.96)	(0.47)	(10.64)	(9.17)	(26.01)	(9.52)	(13.02)	(7.00)
N	40197	39791	40213	40108	37721	39411	38735	38770
adj. R^2	0.017	0.019	0.046	0.089	0.090	0.019	0.016	0.016

t statistics in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001

Table 4. Coefficient estimates for nutrition and physical activity for females.

Female Nutrition and Physical Activity								
	Fruits	Green salad	Milk	TV	PE Class	Sports	Vigorous Activity	Moderate Activity
Unemployment rate	-0.00610	-0.0035	-0.0115	0.00822	0.00451	-0.00319	-0.0448*	-0.0449*
	(-0.83)	(-0.80)	(-1.54)	(1.28)	(0.28)	(-0.43)	(-2.40)	(-2.41)
Age	-0.0145***	0.00517*	-0.0462***	-0.0450***	-0.493***	-0.0911***	-0.292***	-0.0612***
	(-3.67)	(2.07)	(-11.50)	(-13.00)	(-59.78)	(-23.20)	(-30.28)	(-6.38)
American Indian/Alaska Native	0.108*	0.00543	-0.0645	0.202***	0.128	-0.100	-0.239	-0.179
	(2.06)	(0.16)	(-1.15)	(4.71)	(1.21)	(-1.91)	(-1.95)	(-1.47)
Asian	0.0989***	0.00728	-0.274***	0.0834***	-0.156**	-0.388***	-0.831***	-0.553***
	(3.43)	(0.37)	(-11.13)	(3.82)	(-2.73)	(-15.21)	(-12.12)	(-7.95)
Black or African American	-0.00140	-0.113***	-0.310***	0.806***	0.0659*	-0.244***	-0.628***	-0.599***
	(-0.11)	(-14.01)	(-23.60)	(62.03)	(2.33)	(-18.54)	(-18.72)	(-18.20)
Native Hawaiian/other Pacific Islander	0.0238	0.0271	-0.296***	0.259***	-0.0924	-0.218***	-0.386*	-0.313*
	(0.42)	(0.60)	(-6.00)	(5.18)	(-0.82)	(-3.89)	(-2.52)	(-2.12)
Hispanic/Latino	0.0366*	-0.0557***	-0.114***	0.341***	0.101**	-0.327***	-0.554***	-0.621***
	(2.44)	(-6.01)	(-7.56)	(27.11)	(3.12)	(-22.38)	(-15.14)	(-17.03)
Multiple races and is Hispanic	0.00469	0.000749	-0.0689**	0.281***	0.0384	-0.148***	-0.355***	-0.372***
	(0.22)	(0.05)	(-3.18)	(15.73)	(0.86)	(-7.05)	(-6.71)	(-7.05)
Multiple races and is non-Hispanic	0.0435	-0.0419*	-0.0705*	0.291***	-0.0919	-0.0738*	-0.157*	0.0124
	(1.54)	(-2.49)	(-2.33)	(11.45)	(-1.57)	(-2.51)	(-2.28)	(0.17)
Missed school due to safety concerns and was threatened	0.258***	0.208***	0.186***	0.0874*	0.151	0.0333	0.231*	0.119
	(5.25)	(5.81)	(3.70)	(2.30)	(1.66)	(0.84)	(2.34)	(1.22)
Missed school due to safety concerns, but not directly threatened	0.143***	0.100***	0.0334	0.0939***	0.0882	0.00946	0.0674	-0.0511
	(5.75)	(5.85)	(1.40)	(4.48)	(1.85)	(0.44)	(1.23)	(-0.96)
Did not miss school due to safety concerns, but was threatened	0.0897***	0.0701***	0.0406	0.0196	0.0642	0.0636*	0.157*	0.219***
	(3.31)	(3.91)	(1.51)	(0.87)	(1.20)	(2.47)	(2.54)	(3.44)
Carried a weapon in the past 30 days	0.109***	0.0685***	0.0769***	0.0540**	-0.0137	-0.0500**	0.0679	0.145**
	(5.12)	(4.76)	(3.66)	(2.97)	(-0.34)	(-2.63)	(1.44)	(3.05)
Constant	1.275***	0.650***	1.804***	1.504***	10.98***	2.198***	8.332***	3.731***
	(6.34)	(3.94)	(9.98)	(8.91)	(42.94)	(11.43)	(18.22)	(7.91)
N	42890	42521	42932	42825	40692	42065	41235	41340
adj. R^2	0.018	0.017	0.045	0.145	0.176	0.044	0.049	0.027

t statistics in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001

Smoking and Drug Use among Smokers and Users

For this section, I use a subsample[10] of observations that only include students who have ever tried the respective substance in their lifetime. Thus, we are only examining whether habits improve or worsen among students who have ever tried cigarettes, marijuana, or cocaine in response to economic conditions. The results are displayed in table 5. I find strong countercyclical variation with teenage smoking. A one-percentage point increase in the unemployment rate is associated with an additional 0.0841 days per month for males and an additional .0923 days per month for females in which teenagers smoke 10 or more cigarettes a day. The increase in smoking may be a manifestation of elevated stress. Given these results, I suspect that supervision might not be a significant factor during recessions since we see that teenage smoking worsens rather than improves. Since smoking and weight loss are correlated, the decrease in male obesity and BMI levels may be partially explained by increased smoking. The weight loss associated with the increase in smoking may counteract any weight gain resulting from a decrease in exercise may, thus possibly explaining the lack of significance in female weight variables. This finding contradicts the results of Ruhm, who found a strong procyclical smoking pattern in adults.

I do not find any significant results for drinking, marijuana use, or cocaine use for either gender. However, with the exception of male cocaine use, all the coefficients are positive, again suggesting that drug behaviors among those that use drugs worsen as the unemployment rate rises. These results somewhat parallel Arkes' findings that teenagers

[10] Smoking and drug use regressions among all teenagers are included in appendix Table A6. The results have similar coefficients.

Table 5. Coefficient estimates for smoking and drug use among smokers/users.

	Males				Females			
	Smoking	Drinking	Marijuana	Cocaine	Smoking	Drinking	Marijuana	Cocaine
Unemployment rate	0.0841*	0.0255	0.289	-0.0741	0.0923**	0.00798	0.0744	0.306
	(1.98)	(0.78)	(1.44)	(-0.18)	(2.96)	(0.35)	(0.37)	(0.73)
Age	0.403***	0.419***	0.823***	-0.00692	0.160***	0.113***	-0.323**	-0.0459
	(16.77)	(20.49)	(7.65)	(-0.03)	(8.31)	(7.64)	(-2.99)	(-0.21)
American Indian/Alaska Native	-0.147	0.0873	1.916	4.198	-0.140	-0.415*	1.060	2.427
	(-0.59)	(0.35)	(1.81)	(1.92)	(-0.65)	(-2.54)	(0.92)	(1.18)
Asian	-0.491**	-0.879***	-2.598**	1.007	-0.627***	-0.709***	-2.687**	2.741
	(-2.82)	(-6.98)	(-2.69)	(0.61)	(-3.96)	(-7.62)	(-2.63)	(1.21)
Black or African American	-1.715***	-1.079***	0.742*	7.565***	-1.891***	-0.970***	-1.769***	2.443
	(-23.56)	(-16.82)	(2.09)	(5.91)	(-34.76)	(-24.13)	(-5.18)	(1.67)
Native Hawaiian/other Pacific Islander	-0.0795	-0.136	0.237	3.629	-0.403	-0.0607	-0.538	3.950
	(-0.23)	(-0.46)	(0.16)	(1.22)	(-1.64)	(-0.26)	(-0.39)	(1.50)
Hispanic/Latino	-1.314***	-0.371***	-2.081***	1.174	-1.255***	-0.398***	-1.643***	0.826
	(-17.40)	(-5.24)	(-5.48)	(1.77)	(-21.71)	(-8.01)	(-4.30)	(1.26)
Multiple races and is Hispanic	-0.640***	-0.0776	-0.224	0.431	-0.693***	-0.219**	-1.576**	1.813
	(-5.21)	(-0.72)	(-0.42)	(0.43)	(-7.35)	(-3.03)	(-3.13)	(1.92)
Multiple races and is non-Hispanic	-0.318	-0.0801	-0.427	5.007**	-0.593***	-0.448***	-0.950	-1.784
	(-1.60)	(-0.49)	(-0.54)	(3.01)	(-4.52)	(-4.81)	(-1.40)	(-1.42)
Missed school due to safety concerns and was threatened	3.707***	3.709***	8.259***	10.82***	1.607***	1.339***	3.655***	7.236***
	(12.72)	(12.98)	(11.47)	(10.05)	(6.79)	(6.62)	(4.17)	(4.86)
Missed school due to safety concerns, but not directly threatened	0.769***	0.757***	2.506***	2.116	0.348***	0.143	1.113*	1.379
	(4.84)	(4.92)	(3.70)	(1.81)	(3.86)	(1.95)	(2.05)	(1.24)
Did not miss school due to safety concerns, but was threatened	0.937***	1.007***	2.764***	4.157***	0.826***	0.663***	1.920**	1.692
	(8.32)	(9.41)	(6.25)	(5.29)	(6.43)	(6.26)	(3.26)	(1.80)
Carried a weapon in the past 30 days	1.428***	1.628***	5.750***	4.859***	1.505***	1.469***	7.365***	6.535***
	(22.83)	(27.80)	(20.92)	(9.44)	(15.77)	(16.62)	(17.15)	(8.88)
Constant	-3.843*	-5.681***	2.421	9.502	0.157	-1.319**	22.84***	18.40***
	(-2.36)	(-4.94)	(0.40)	(1.11)	(0.16)	(-3.23)	(4.20)	(3.41)
N	22318	27984	18251	3832	22617	30495	16005	3041
adj. R^2	0.112	0.100	0.050	0.108	0.101	0.054	0.036	0.084

t statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

tend to use more marijuana, hard-drugs, and alcohol in weaker economic times, though his estimates were significant.

VI. Conclusion:

In sum, I do not find overwhelming evidence of healthier behaviors in teenagers as the economy declines. It is interesting to note, however, that I do find significant weight improvements for males; a one-percentage point increase in the unemployment is associated with a reduction of 0.604 in BMI percentiles. This reinforces the relationship between the economy and population health that we have yet to fully understand.

Based on my analysis, the increase in smoking and PE classes would both contribute to weight loss during economic downturns. While the coefficients are small, the effects accumulate over time. Of course, the issue with representing health using weight outcomes is that we do not explicitly see the underlying mechanism. If smoking is one of the more prominent factors in the improvement of weight outcomes during recessions, then we cannot attribute the drop in obesity rate to "healthier behaviors."

My analysis suggests that teenagers are affected differently from adults as well as between genders. Perhaps the opportunity cost of time in teenagers is not a function of economic conditions, or at least is not as sensitive as it is for adults. Even for teenagers who are involved in the work force and are directly affected by the state of the economy, at the end of the day, most teenagers are still financially reliant on their parents. Although Ruhm shows that adults tend to exercise more, eat healthier, drink less, and smoke less, I do not find these general patterns in teenagers, perhaps reflecting on their independence from family activities. Based on my findings, it appears that males

generally react more slightly more positively than females during recessions, reflected by both the physical activity level and weight outcomes, plausibly explained by gender differences in how males and females deal with stress and their preferred hobbies and activities in their extra leisure time.

The implications of this analysis suggest that reducing teenage smoking habits during economic downturns should be a primary policy objective. However, a drop in teenage smoking would likely contribute to weight gain, so efforts addressing obesity should be bolstered during these periods of high unemployment. High schools should also encourage female students to increase their physical activity levels by enrolling in more PE classes or joining more sports teams. Future research should expand these findings by merging additional state level data that have direct links to the obesity epidemic and weight outcomes. This could include, but is not be limited to, the prices of sugar, high fructose corn syrup, and oil, per capita number of restaurants, prices of fast-food meals, and dummies for state initiatives addressing obesity.

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Appendix

Table A1. Definition of Variables

Variable Label	Variable	Definition
Individual Characteristics		
Age	age	Age of Respondent
Female	female	Dichotomous variable that equals 1 if respondent is female.
Race and Ethnicity	raceeth	
	raceeth=1	Respondent is American Indian/Alaska Native
	raceeth=2	Respondent is Asian
	raceeth=3	Respondent is black or African American
	raceeth=4	Respondent is Native Hawaiian/other Pacific Islander
	raceeth=5	Respondent is White
	raceeth=6	Respondent is Hispanic/Latino
	raceeth=7	Respondent selected multiple races and is Hispanic
	raceeth=8	Respondent selected multiple races and is non-Hispanic
Carried a weapon in the past 30 days	qn12	Dichotomous variable that equals 1 if respondent carried a weapon (gun, knife, club, etc.) in the past 30 days
Missed school due to safety concerns and was threatened	qn15==1 & qn16==1	In the past 30 days, respondent skipped school because he/she felt unsafe at school, going to school, or leaving school. Respondent has also been threatened at school.
Missed school due to safety concerns, but not directly threatened	qn15==1 & qn16==0	In the past 30 days, respondent skipped school because he/she felt unsafe at school, going to school, or leaving school. Respondent has not been threatened at school.
Did not miss school due to safety concerns, but was threatened	qn15==0 & qn16==1	In the past 30 days, respondent did not skip school because he/she felt unsafe at school, going to school, or leaving school. Respondent has been threatened at school.
Dependent Variables		
Body Mass Index (BMI)	bmi	Weight in kilograms divided by height in meters squared
BMI Percentile	bmipct	
Obese	qnobese	Dichotomous variable that equals 1 if respondent is obese
Overweight	qnowt	Dichotomous variable that equals 1 if respondent is overweight
Smoking 10+ per day in past month	q31	Number of days that respondent smoked 10+ cigarettes in the past month.
Drinking 5+ drinks in a row in past month	q42	Number of days that respondent had 5+ alcoholic drinks in a row in the past month.
Marijuana usage in past month	q47	Number of times respondent used marijuana in the past month.
Cocaine usage in past month	q50	Number of times respondent used cocaine in the past month.
Servings of fruit per day	q73	Average servings of fruit eaten per day.
Servings of green salad per day	q74	Average servings of green salad eaten per day.
Servings of milk per day	q79	Average servings of milk drank per day.
Hours of TV per day	q81	Number of hours respondent watches TV on an average school day.
Number of sports teams in past year	q83	Number of sports that respondent participated in in the past year.
Days of vigorous activity per week	q91	Number of days in the past week respondent engaged in physical activity for 20+ minutes that made him/her sweat and breathe hard.
Days of moderate activity per week	q92	Number of days in the past week respondent engaged in physical activity for 30+ minutes that did not make him/her sweat and breathe hard.
State level Characteristics		
Unemployment rate	urate	State unemployment rate
Income level in thousands	income	State median income level in thousands

Table A2 Coefficient estimates for weight outcomes without socio-economic controls.

	Males				Females			
	BMI	BMI Percentile	Obese	Overweight	BMI	BMI Percentile	Obese	Overweight
Unemployment rate	-0.0859*	-0.540*	-0.00685*	-0.00207	-0.0226	-0.0645	0.00128	-0.00131
	(-2.37)	(-2.48)	(-2.34)	(-0.73)	(-0.65)	(-0.31)	(0.53)	(-0.47)
Age	0.491***	-1.694***	-0.0105***	-0.00864***	0.385***	-1.402***	-0.00638***	-0.00448**
	(25.79)	(-14.71)	(-6.66)	(-5.89)	(20.42)	(-12.95)	(-4.69)	(-3.13)
American Indian/Alaska Native	0.730**	3.073*	0.0854***	0.0269	1.033***	6.842***	0.0698***	0.0565**
	(3.19)	(2.31)	(4.59)	(1.63)	(4.37)	(4.74)	(3.92)	(2.99)
Asian	-0.705***	-4.865***	-0.0171	-0.000192	-0.802***	-5.821***	0.0134	-0.0370***
	(-6.10)	(-5.68)	(-1.79)	(-0.02)	(-7.61)	(-7.42)	(1.62)	(-4.64)
Black or African American	0.722***	4.787***	0.0371***	0.0152**	2.065***	11.93***	0.0848***	0.0788***
	(10.83)	(12.18)	(6.82)	(3.07)	(30.05)	(32.18)	(17.64)	(15.45)
Native Hawaiian/other Pacific Islander	0.798**	4.185**	0.0703***	0.0341	1.315***	6.530***	0.0961***	0.0392*
	(3.01)	(2.68)	(3.30)	(1.77)	(4.57)	(3.99)	(4.57)	(2.01)
Hispanic/Latino	1.200***	6.930***	0.0777***	0.0436***	1.385***	9.422***	0.0613***	0.0549***
	(16.70)	(15.93)	(13.00)	(8.01)	(20.39)	(22.91)	(12.42)	(10.24)
Multiple races and is Hispanic	0.748***	4.307***	0.0493***	0.0337***	1.394***	8.621***	0.0642***	0.0497***
	(7.25)	(6.96)	(5.89)	(4.19)	(13.69)	(15.14)	(9.06)	(6.33)
Multiple races and is non-Hispanic	0.345*	2.379**	0.0219	0.0206	0.857***	5.512***	0.0197*	0.0345***
	(2.43)	(2.68)	(1.85)	(1.82)	(6.66)	(7.18)	(2.25)	(3.43)
Constant	15.42***	89.18***	0.331***	0.403***	14.63***	69.46***	0.103*	0.194***
	(20.06)	(17.00)	(5.25)	(5.60)	(23.61)	(13.27)	(2.45)	(4.34)
N	40158	40158	41461	41461	41107	41107	42722	42722
adj. R^2	0.033	0.02	0.016	0.004	0.055	0.05	0.028	0.012

t statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A3. Coefficient estimates for nutrition and physical activity for males without socio-economic controls.

Male Nutrition and Physical Activity								
	Fruits	Vegetables	Milk	TV	PE Class	Sports	Vigorous Activity	Moderate Activity
Unemployment rate	0.000219	0.00439	0.00231	-0.00187	0.0644***	-0.00113	-0.0193	-0.0188
	(0.03)	(0.84)	(0.25)	(-0.28)	(3.68)	(-0.13)	(-0.98)	(-0.90)
Age	-0.0196***	0.00326	-0.0665***	-0.0454***	-0.357***	-0.0583***	-0.170***	-0.00139
	(-4.58)	(1.15)	(-13.34)	(-12.79)	(-39.92)	(-12.89)	(-16.68)	(-0.13)
American Indian/Alaska Native	0.159**	0.0704	-0.126*	0.178***	0.0798	-0.115*	-0.254*	-0.147
	(3.19)	(1.94)	(-2.22)	(4.54)	(0.80)	(-2.33)	(-2.25)	(-1.24)
Asian	0.0961***	0.0566**	-0.356***	0.0282	-0.0844	-0.336***	-0.628***	-0.499***
	(3.30)	(2.70)	(-11.55)	(1.21)	(-1.41)	(-11.71)	(-8.82)	(-6.83)
Black or African American	0.124***	-0.0347***	-0.401***	0.592***	0.161***	0.0143	-0.290***	-0.408***
	(8.36)	(-3.69)	(-23.61)	(43.90)	(5.08)	(0.91)	(-8.08)	(-11.01)
Native Hawaiian/other Pacific Islander	0.279***	0.176***	-0.224**	0.346***	0.147	-0.0770	-0.194	-0.318*
	(4.31)	(3.36)	(-3.19)	(6.77)	(1.21)	(-1.26)	(-1.35)	(-2.26)
Hispanic/Latino	0.134***	-0.00609	-0.212***	0.255***	0.140***	-0.161***	-0.360***	-0.511***
	(8.41)	(-0.59)	(-11.54)	(19.82)	(4.16)	(-9.71)	(-9.58)	(-13.06)
Multiple races and is Hispanic	0.154***	0.0558***	-0.0996***	0.236***	0.0582	-0.0489*	-0.146**	-0.285***
	(6.50)	(3.34)	(-3.68)	(12.66)	(1.23)	(-2.02)	(-2.65)	(-4.88)
Multiple races and is non-Hispanic	0.156***	0.0558*	-0.0923*	0.249***	0.0755	0.0621	0.0276	-0.0458
	(4.58)	(2.38)	(-2.30)	(8.58)	(1.09)	(1.73)	(0.35)	(-0.54)
Constant	1.288***	0.351***	2.559***	1.562***	8.210***	2.200***	5.099***	3.254***
	(9.23)	(4.66)	(10.35)	(10.03)	(32.47)	(9.71)	(17.70)	(9.14)
N	41688	41275	41559	41502	38999	40750	40152	40188
adj. R^2	0.012	0.014	0.045	0.084	0.088	0.018	0.017	0.013

t statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A4. Coefficient estimates for nutrition and physical activity for females without socio-economic controls.

Female Nutrition and Physical Activity								
	Fruits	Vegetables	Milk	TV	PE Class	Sports	Vigorous Activity	Moderate Activity
Unemployment rate	-0.00493	-0.00346	-0.0101	0.00902	0.00847	-0.00524	-0.0418*	-0.0434*
	(-0.67)	(-0.78)	(-1.37)	(1.42)	(0.53)	(-0.70)	(-2.25)	(-2.36)
Age	-0.0173***	0.00256	-0.0480***	-0.0461***	-0.491***	-0.0908***	-0.290***	-0.0656***
	(-4.42)	(1.01)	(-12.00)	(-13.44)	(-60.06)	(-23.34)	(-30.48)	(-6.92)
American Indian/Alaska Native	0.118*	0.0196	-0.0613	0.202***	0.111	-0.109*	-0.230	-0.142
	(2.30)	(0.57)	(-1.11)	(4.77)	(1.05)	(-2.11)	(-1.90)	(-1.17)
Asian	0.101***	0.00675	-0.275***	0.0788***	-0.156**	-0.384***	-0.830***	-0.551***
	(3.50)	(0.35)	(-11.24)	(3.62)	(-2.73)	(-15.06)	(-12.21)	(-7.99)
Black or African American	0.0129	-0.103***	-0.303***	0.808***	0.0680*	-0.244***	-0.619***	-0.590***
	(0.97)	(-12.74)	(-23.09)	(62.84)	(2.42)	(-18.63)	(-18.64)	(-18.14)
Native Hawaiian/other Pacific Islander	0.0489	0.0327	-0.294***	0.262***	-0.0539	-0.193***	-0.380*	-0.310*
	(0.87)	(0.74)	(-6.02)	(5.31)	(-0.48)	(-3.46)	(-2.54)	(-2.15)
Hispanic/Latino	0.0468**	-0.0500***	-0.115***	0.342***	0.102**	-0.329***	-0.553***	-0.621***
	(3.14)	(-5.38)	(-7.68)	(27.47)	(3.19)	(-22.72)	(-15.27)	(-17.24)
Multiple races and is Hispanic	0.0219	0.0155	-0.0595**	0.287***	0.0545	-0.146***	-0.332***	-0.362***
	(1.04)	(1.05)	(-2.77)	(16.20)	(1.23)	(-7.00)	(-6.34)	(-6.95)
Multiple races and is non-Hispanic	0.0533	-0.0323	-0.0661*	0.299***	-0.0778	-0.0753**	-0.130	0.0278
	(1.91)	(-1.91)	(-2.21)	(11.88)	(-1.33)	(-2.59)	(-1.91)	(0.39)
Constant	1.217***	0.692***	1.838***	1.572***	10.90***	2.200***	7.998***	3.498***
	(6.27)	(4.29)	(10.19)	(9.55)	(42.78)	(11.50)	(18.68)	(7.87)
N	43721	43350	43605	43547	41349	42737	42017	42127
adj. R^2	0.015	0.017	0.044	0.143	0.174	0.043	0.049	0.026

t statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A5. Coefficient estimates for smoking and drug use among users without socio-economic controls.

	Males				Females			
	Smoking	Drinking	Marijuana	Cocaine	Smoking	Drinking	Marijuana	Cocaine
Unemployment rate	0.0530	0.00297	0.202	-0.330	0.0925**	0.00265	0.0796	0.306
	(1.19)	(0.09)	(1.00)	(-0.80)	(2.90)	(0.11)	(0.39)	(0.70)
Age	0.332***	0.361***	0.524***	-0.552*	0.119***	0.0899***	-0.540***	-0.577*
	(12.90)	(16.52)	(4.82)	(-2.55)	(5.93)	(5.79)	(-4.95)	(-2.50)
American Indian/Alaska Native	-0.0251	0.261	2.914**	4.942*	-0.0744	-0.306	1.364	2.481
	(-0.10)	(1.02)	(2.69)	(2.29)	(-0.34)	(-1.85)	(1.19)	(1.18)
Asian	-0.563**	-0.953***	-2.426*	1.461	-0.537**	-0.699***	-2.076	5.052*
	(-2.98)	(-7.04)	(-2.52)	(0.86)	(-3.02)	(-6.97)	(-1.93)	(2.00)
Black or African American	-1.765***	-1.077***	0.800*	8.751***	-1.796***	-0.863***	-0.998**	5.848***
	(-23.68)	(-16.23)	(2.24)	(7.28)	(-32.69)	(-21.09)	(-2.90)	(3.77)
Native Hawaiian/other Pacific Islander	0.484	0.303	1.969	8.391**	-0.307	0.0473	0.930	6.069*
	(1.14)	(0.89)	(1.31)	(2.99)	(-1.17)	(0.20)	(0.65)	(2.22)
Hispanic/Latino	-1.281***	-0.349***	-1.696***	1.650*	-1.226***	-0.354***	-1.104**	1.429*
	(-16.63)	(-4.79)	(-4.45)	(2.46)	(-21.02)	(-7.01)	(-2.87)	(2.11)
Multiple races and is Hispanic	-0.459***	0.151	0.671	2.879**	-0.502***	-0.0961	-0.700	3.249***
	(-3.57)	(1.35)	(1.25)	(2.79)	(-4.96)	(-1.26)	(-1.36)	(3.33)
Multiple races and is non-Hispanic	-0.188	0.120	0.407	5.679***	-0.478***	-0.331***	-0.0293	-0.630
	(-0.90)	(0.70)	(0.51)	(3.42)	(-3.61)	(-3.48)	(-0.04)	(-0.52)
Constant	-3.552***	-3.171*	6.666	19.11*	0.537	-0.685	27.33***	8.836
	(-3.30)	(-2.54)	(1.34)	(2.18)	(0.51)	(-1.87)	(5.30)	(1.96)
N	23063	28847	18931	4102	22977	30923	16289	3141
adj. R^2	0.049	0.030	0.008	0.029	0.068	0.021	0.007	0.026

t statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A6. Coefficient estimates for smoking and drug use among all teenagers with the full specifications.

	Males				Females			
	Smoking	Drinking	Marijuana	Cocaine	Smoking	Drinking	Marijuana	Cocaine
Unemployment rate	0.0374	0.0196	0.203*	0.0755	0.0507**	-0.00156	0.0692	0.0435
	(1.52)	(0.81)	(2.00)	(1.83)	(3.03)	(-0.09)	(0.88)	(1.53)
Age	0.321***	0.356***	1.173***	0.142***	0.152***	0.116***	0.409***	0.0177
	(22.31)	(24.46)	(22.51)	(5.72)	(14.09)	(10.94)	(9.81)	(0.93)
American Indian/Alaska Native	0.0926	0.0455	2.541***	0.628*	0.0759	-0.324**	1.792**	0.287
	(0.53)	(0.24)	(3.91)	(1.98)	(0.50)	(-2.70)	(2.84)	(1.13)
Asian	-0.393***	-0.704***	-2.776***	0.0631	-0.586***	-0.651***	-2.730***	-0.0733
	(-4.85)	(-9.70)	(-10.16)	(0.47)	(-9.87)	(-12.92)	(-13.39)	(-0.72)
Black or African American	-1.105***	-0.902***	1.082***	-0.196**	-1.161***	-0.778***	-0.884***	-0.395***
	(-24.88)	(-20.33)	(5.69)	(-3.01)	(-35.25)	(-26.73)	(-6.11)	(-9.20)
Native Hawaiian/other Pacific Islander	-0.150	-0.239	0.164	0.750	-0.203	-0.106	-0.194	0.491
	(-0.75)	(-1.21)	(0.22)	(1.73)	(-1.39)	(-0.66)	(-0.33)	(1.51)
Hispanic/Latino	-0.711***	-0.271***	-0.412*	0.541***	-0.686***	-0.301***	-0.800***	0.224***
	(-15.23)	(-5.12)	(-2.08)	(5.81)	(-20.79)	(-8.15)	(-5.06)	(3.37)
Multiple races and is Hispanic	-0.348***	-0.0490	0.698*	0.314*	-0.348***	-0.150**	-0.355	0.340**
	(-4.82)	(-0.60)	(2.40)	(2.20)	(-6.56)	(-2.67)	(-1.58)	(3.00)
Multiple races and is non-Hispanic	-0.209	-0.0544	0.305	0.575*	-0.347***	-0.335***	-0.0277	-0.289**
	(-1.72)	(-0.43)	(0.71)	(2.57)	(-4.49)	(-4.67)	(-0.09)	(-3.13)
Missed school due to safety concerns and was threatened	3.235***	3.172***	8.723***	6.780***	1.453***	1.260***	3.986***	2.849***
	(13.29)	(12.95)	(14.35)	(13.41)	(7.91)	(7.13)	(6.89)	(6.87)
Missed school due to safety concerns, but not directly threatened	0.634***	0.532***	1.826***	0.699***	0.308***	0.155**	1.023***	0.175
	(5.75)	(4.69)	(4.55)	(3.49)	(5.25)	(2.78)	(3.94)	(1.59)
Did not miss school due to safety concerns, but was threatened	0.812***	0.926***	3.316***	1.453***	0.800***	0.628***	2.296***	0.954***
	(9.90)	(10.45)	(11.14)	(8.92)	(8.62)	(7.12)	(6.87)	(5.52)
Carried a weapon in the past 30 days	1.312***	1.542***	5.911***	1.599***	1.382***	1.389***	7.330***	2.270***
	(28.87)	(31.61)	(33.86)	(19.90)	(18.16)	(17.87)	(24.23)	(13.93)
Constant	-4.699***	-3.734***	-12.36***	-1.682	-0.274	-1.237***	1.309	-1.122**
	(-7.04)	(-4.45)	(-3.74)	(-1.29)	(-0.31)	(-3.71)	(0.46)	(-2.71)
N	38728	40000	40134	39584	41637	42771	42884	42207
adj. R^2	0.107	0.103	0.078	0.067	0.086	0.054	0.048	0.041

t statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$