The Physical, Social, and Cultural Determinants of Obesity: An Empirical Study of the U.S.

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1. Introduction

The average Body Mass Index (BMI)[1] in America has increased by 15% from 1970 to 2003, from 25.4 kg/m^2 to 29.1 kg/m^2. The percentage of obese people increased from 16% to 40% of the population, with 64% of them being overweight. The incidence of excess weight has increased faster for women, faster for the least educated and for those who are married. Currently, the United States leads the world in per capita incidence of obesity (Cutler, 2003).

Obesity is significantly correlated with coronary heart disease, hypertension, hypercholesterolemia, gall bladder disease, stroke, and type-2 diabetes (Wann, CDC, 2005). These illnesses have a substantial impact on U.S. health care costs. In 1995, health-care costs associated with excess weight were $51.6 billion or 5.7 % of the total U.S. health care expenditures. Also, excess weight decreases productivity and leads to loss of work time (Peralta-Alva, et al., 2005).

1.1 Causes of Weight Increase in the last 30 years

Many factors, such as family lifestyles, physical inactivity, psychological disturbances, and occupational problems can potentially contribute to the development of obesity (Flegal et al., 2002, Hedley et al.,2004). Obesity is strongly influenced by demographic and social-economic factors (Flegal et al., 2002, Bray, 1980). Productivity improvements, in particular in agriculture and through the reduction of trade barriers have led to decreases in commodity prices (Alston et al., 2005). Fast-food restaurants marketed a combination of soft drinks, fries and burger at a low price. In 1999, the total advertising expenditures for US food products was $7.3 billion, of which $765 million was spent to advertise candy and gum, $549 million to advertise soft drinks,

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[1] Body Mass Index (BMI) is defined as weight in kilograms divided by the square of height in meters. Individuals with a BMI of 25 kg/m^2 to 29.9 kg/m^2 are overweight, while individuals with a BMI of 30 kg/m^2 or more are obese.

and $330 million was spent on snacks (Story et al., 2004). Scientists from WHO suspect that high-fructose corn syrup (HFCS) plays an essential role in obesity (Bray, 1980). The has bee a significant rise in the consumption of HFCS and in particular, there has been a rise in the consumption of soft drinks which use HFCS (USDA, 2000). HFCS is highly correlated with obesity in children (Morrill, 2004).

Technology innovations produced many time and labor-saving products, including computers, dishwashers, and televisions, which contribute to the reduced calorie expenditures (U.S. Department of Energy). Americans currently walk and bike less than ever, while their mode of transportation is more often driving even for short distance trips (BLS, Time Use Survey). In 2000, more than 26% of adults reported no leisure time physical activity (Chou et al., 2004). There has been as substantial increase in time spent watching television and playing computer games (U.S. Department of Labor, Time Use Survey, 2006). As a consequence, children exercise less. One theory suggests that the major reason for the increase in excess weight in the U.S. is changes that occurred in the technology for cooking and preparing food leading to an increase in the number of meals Americans consume (Cutler, 2003). Ownership of microwave ovens increased from 0% of households in 1960 to over 80% today (US DOE, 2006). The number of households that own television sets rose from a low of 10% in the 1950's to nearly 100% today (Nielson Media Research, 1995). Average time spent watching television has risen from 70 minutes per day in 1960 to 181 minutes per day in 2000 (Berg et al., 2002). Additionally, food consumption patterns have changed. Per capita consumption of both carbohydrates and fats as well as total energy (caloric) consumption in the last 30 years of the twentieth century have risen substantially (USDA, 2000).

While many studies have identified specific changes in the eating and energy expenditure habits, and changes in incomes in the U.S. population, none so far have attempted to assess the relative importance of each of these factors in determining the recent rise in body weight.

2. Empirical Analysis

OLS Regressions were run using three different left-hand-side variables: BMI, weight, and waist circumference. Logit and probit regressions are run to identify factors related to the likelihood of being above a healthy *BMI*; a final tobit regression identifies factors related to the amount by which a subject exceeds a healthy *BMI*.

2.1 The Data

Data are taken from the National Health and Nutrition Examination Survey, 2001-2002 (NHANES 2001-2002). This survey contains data for a total of 11,039 individuals representing all ages. Data was collected between January 2001 and December 2002. All dietary information was based on a 24-hour recall of food consumed the day prior to the survey. Food consumption was recorded in grams except for cholesterol which was recorded in milligrams. Water consumption was recorded in milliliters. All activity related questions referred to activity in the 30 days prior to the date the survey was taken by each individual. For example, the variable *dailytv* was phrased "Over the **past 30 days**, on average how many hours per day did you sit and watch TV or videos?" Physical measurements were obtained the same day that other data was collected. Weights were recorded in kilograms and heights were recorded in centimeters.

Descriptive statistics are presented in Table 1. The three OLS regressions were run using the left hand-side variables, *BMI*, *WAIST* and *WEIGHT*. The Tobit regression was run using the left-hand-side variable *BMIHigh* which is defined as 0 if *BMI* is less than 25 (corresponding to *BMI* for the non-overweight category) and *BMI* - 25 for those who have *BMI*>25.

Variable Name	Variable Type	Description	Obs	Mean	Std. dev	Min	Max
BMI	number	Current BMI (kg/m^2)	8618	24.8	7	8	65.4
Weight	number	Current Weight in (kg)	8618	64.5	27.1	9.8	196.8
Waist	Number	Waist circumference (cm)	8500	84.8	20.5	39.6	165.2
Bmihigh	0,number	0 if bmi<25 else 25-bmi	8618	2.7	4.6	0	40.4
BmiGT25	0/1	1 if bmi>25 else 0	8618	0.4	0.5	0	1
Addsalt	number	How often do you add salt to your meal each week	4786	1.9	0.8	1	9
Age	number	Current age in years	8618	31	23	2	85
Agecu	number	Age cubed	8618	85928	141759	8	614125
Agesq	number	Age squared	8618	1463	1855	4	7225
Alcho	0/1	Have you had more than 12 alcoholic drinks in the past year	4620	0.7	0.5	0	9
Born	0/1	1 indicates born in U.S.	8618	0.8	0.4	0	1
BWeight	Number	Birth Weights in ounces	4263	116	22	20	208
Carb	number	Total Carbohydrates per in grams	8618	276	135	0	1700
Chol	number	Total Cholesterol (mg)	8618	269	233	0	3052
College	0/1	1 if some or more college	7873	0.3	0.4	0	1
Dailytv	number	Daily Hours of TV, video or computer use	8569	1.8	1.8	0	7
Eatrest	number	How often do you eat in restaurants each week	6717	2.3	2.3	0	21
Fibe	number	Total Fiber per day grams	8618	15	9	0	128
Gender	0/1	1 if Male, 0 if Female	8618	0.5	0.5	0	1
Hgt	number	Current Height in centimeters	8618	157	23	79	199
Hgtsq	number	Height squared	8618	25175	6442	6241	39641
HIncome	number	Household Income	7885	7	3	1	11
Kcal	number	Average kilocalories consumed per day	8618	2127	1000	0	15594
Lessact	0/1	Do you engage in less activity than people your age	8618	0.3	0.4	0	1
Lessoth	0/1	Do you engage in less activity than you did 10 years ago	8618	0.1	0.3	0	1
Mar	0/1	1 if with a partner	6165	3	2.3	0	1
Modact	0/1	Have you regularly engaged in moderate physical activity in the past 30 days	8618	0.4	0.5	0	1
Moreact	0/1	Do you engage in more activity than people your age	8618	0.1	0.2	0	1
Moreoth	0/1	Do you engage in more activity than you did 10 years ago	8618	0.3	0.4	0	1
Muscle	0/1	Have you regularly engaged in Muscle building activity	8618	0.3	0.4	0	1
Numfoods	number	Average number of different types of foods per day	8618	15	6	0	46
Phyact	0/1	Have you regularly engaged in physical activity in the past 30 days	8618	0.1	0.4	0	1
Preg	0/1	1 if pregnant	8618	0	0.2	0	1
Protein	number	Average Protein in grams per day	8618	76	42	0	718
Water	number	Average Water in liters per day	8614	1015	1259	0	59472
Sugar	number	Average Total Sugar per day in grams	8618	26	16	0	228
Tasks	0/1	Have you regularly engaged in physical tasks around house in the last 30 days	8618	140	88	0	1142
Tfat	number	Average Total Fat per day in grams	8618	0.4	0.5	0	1
Vigact	0/1	Have you regularly engaged in vigorous physical in the past 30 days	8618	79	45	0	840
Vite	number	Average Vitamin E per day in milligrams	8618	0.3	0.5	0	1
Walkbike	0/1	Have you walked or biked in the last 30 days?	8618	0.2	0.4	0	1
Water	number	Water consumed (ml)	8618	254	124	0	2000
White	0/1	1 if White, 0 if nonwhite	8618	0.4	0.5	0	1

In this manner the data is censored and has positive values that correspond to the amount by which *BMI* exceeds a healthy *BMI* for the overweight population. For the probit and logit regressions the value *BMIGT25* was used, which is a dummy variable whose value is 1 for *BMI*>

25 and 0 otherwise. Those who have a value of 1 are by this definition overweight. In addition to the information in Table 1 the following descriptions are informative: *Addsalt* is the number of times that salt was added to a meal in the previous week. *Eatrest* is the number of times that the subject reported eating in a restaurant in the previous week.[2]

2.2 Model Specifications

OLS:

Three OLS models were specified. The three models differed based on the specification of left hand side (dependant) variables.

(1) $BMI = \alpha_1 + \beta_1 x + \varepsilon_1$

(2) $\text{WEIGHT} = \alpha_2 + \beta_2 x + \varepsilon_2$

(3) $\text{WAIST} = \alpha_3 + \beta_3 x + \varepsilon_3$

Logit:

BMIGT25 is defined as 1 for *BMI*>25 and 0 otherwise.

The multinomial logit model has the form:

(4) $P_j = \exp(\boldsymbol{\beta_k x})/\Sigma_k \exp(\boldsymbol{\beta_k x})$ **(j,k=0,1)**

Where P_j is the probability of the jth state occurring (in this case *BMIGT25*=1)

Normalizing for the normal weight category (i.e.*BMIGT25*=0, j=0) we have

(4') $\text{Log}(P_1/P_0) = \exp(\boldsymbol{\beta_1 x})$

[2] A number of variables were dropped from the analysis since they are highly correlated with other variables. In particular, activity variables that tracked the frequency of activities were dropped. Also, carbohydrate consumption is highly correlated with sugar and college is correlated with income.

As such the coefficients β_1 determines the relative probability of state 1 (overweight) to state 0 (not overweight). Positive (negative) values of β increase (decrease) the relative probability of being overweight**.**

Probit:

The probit regression is specified in the same manner as the logit. The core difference lies in the distribution of errors. In the logit model, errors are assumed to follow the standard logistic distribution. The errors of the probit model are assumed to follow the standard normal distribution.

Tobit:

The tobit is a censored normal distribution. Data is censored such that those who are not overweight such that the left-hand side variable *BMIHigh* is defined to be 0 for *BMI*<25 and *BMI* - 25 for subjects with *BMI*>25.

The right hand side variables for each of the regressions are listed in table 001. Each of these variables can be categorized as (a) Demographic characteristics previously reported as correlated with weight (e.g. gender, income etc). (b) Diet characteristics (e.g. sugar, water) and (c) activity related (e.g. dailytv).

3. Empirical Results[3]

Tables 2, 3, and 4 report the results of empirical estimations

Table 2. Determinants of BMI OLS

Adjusted R-squared 0.4287
Root Mean Squared Error 5.3202
F-stat (22,6079) 209.09

Variable	Coef.	t-ratio	P>|t|
Age ***	0.641	18.3	0
Agesq ***	-0.009	-9.28	0
(Agecu/1000) ***	0.033	4.57	0
Born ***	1.066	5.2	0
Chol ***	0.001	3.06	0.002
Dailytv ***	0.309	6.52	0
Eatrest	-0.048	-1.56	0.119
Gender ***	-0.403	-2.71	0.007
Hinc ***	-0.081	-3.33	0.001
(Kcal/1000) ***	-1.01	-4.11	0
Lessact	0.342	1.53	0.125
Lessoth ***	2.224	10.38	0
Moreact **	-0.766	-2.24	0.025
Moreoth ***	-1.251	-6.96	0
Numfoods ***	-0.075	-5.22	0
Preg ***	1.394	3.72	0
Protein ***	0.007	1.93	0.054
(Water/1000) ***	0.446	8.45	0
Sugar ***	0.004	2.97	0.003
Tfat ***	0.011	2.87	0.004
Vigact ***	0.561	3.4	0.001
White ***	-0.9	-5.76	0
Cons ***	15.224	36.32	0

Table 3 Determinants of Wgt OLS

Adjusted R-squared 0.7183
Root Mean Squared Error 14.436
F-stat (19,7836) 0.0000

Variable	Coef.	t-ratio	P>|t|
Age ***	0.963	21.479	0
Agesq ***	-0.009	-18.18	0
Chol ***	0.004	4.26	0
Dailytv ***	0.898	8.06	0
Gender ***	-1.563	-4.04	0
Hgt ***	-0.855	-10.578	0
Hgtsq ***	0.005	19.085	0
Hinc **	-0.122	-2.1	0.036
Kcal ***	-0.003	-4.86	0
Lessact **	1.255	2.49	0.013
Lessoth ***	6.235	12.13	0
Moreoth ***	-3.553	-8.27	0
Muscle ***	-1.147	-2.82	0.005
Numfoods ***	-0.151	-4.38	0
Protein	0.012	1.48	0.14
Water ***	0.001	9.14	0
Sugar **	0.007	2.24	0.025
Tfat ***	0.03	3.33	0.001
White ***	-1.455	-4.04	0
Cons ***	47.831	8.36	0

Table 4 Waistst – OLS

Adjusted R-squared 0.6218
Root Mean Squared Error 12.676
F-stat (21,7836) 0.0000

Variable	Coef.	t-ratio	P>|t|
Age ***	0.606	21.21	0
(Agecu/1000) ***	0.046	-12.8	0
Chol ***	0.005	4.53	0
Dailytv ***	0.798	7.12	0
Eatrest	-0.105	-1.44	0.15
Fibe *	0.045	1.86	0.063
Gender ***	-1.278	-3.3	0.001
Hgt **	0.244	2	0.003
(Hgtsq/1000)	0.468	1.63	0.103
Hinc ***	-0.266	-4.73	0
Kcal ***	-0.003	-4.19	0
Lessact	0.825	1.53	0.126
Lessoth ***	4.886	9.53	0
Moreact **	-1.766	-2.15	0.032
Moreoth ***	-3.681	-8.56	0
Muscle ***	-2.152	-5.28	0
Numfoods ***	-0.151	-4.26	0
Protein *	0.015	1.86	0.061
Water ***	0.001	8.37	0
Sugar ***	0.009	2.66	0.008
Tfat *	0.017	1.9	0.057
Cons ***	23.22	4.02	0

[3] *** Significant at 0.001, **Significant at 0.05, *Significant at 0.1

3.1 Results of OLS multivariate regression with BMI as the dependent variable

The results of the OLS regression are displayed in Table 2. *BMI* increases with age. All three components (*Age*, *Agesq* and *Agecu*) are significant, with the linear and cubic terms positive and the squared term negative. The linear and cubic terms are dominant implying that *BMI* increases as a function of age. The unfortunate implication of this is that with all else equal, if you live long enough you are likely to become overweight.

BMI increases with each daily hour of television or computer use. The coefficient on *Dailytv* is 0.309 implying that each additional daily hour will add 0.309 to one's *BMI* (on average). Consequently, this factor alone can make the difference between a healthy *BMI* (20 to 25) and a *BMI* considered overweight. Six hours per day spent on these activities would add 1.9 to *BMI* moving someone with a healthy *BMI* of 23.5 would into the overweight category. 15% of the sample reported *dailytv* of 5 or greater. Of these, 62% have *BMI* greater than 25.

The coefficient on *white* is -0.900 implying that Caucasians on average have a lower *BMI* of 0.900 compared to non-whites, ceteris paribus. Men (gender = 1) when controlling for other all other factors on average have a *BMI* 0.525 less than women, ceteris paribus. *Hincome* has a negative coefficient, implying high income have lower *BMI*. *Chol*, *sugar*, *Tfat* and *Protein* all add to *BMI* consistent with expectations. *Water* also added to *BMI*. Interestingly, the sign on *Kcals* (the number of kilocalories consumed in a day) was negative and highly significant ($p<0.001$), implying that an increase in kilocalories decreases *BMI*. This result is suspect since even the most naïve model suggests the opposite. However, when *BMI* is regressed against kcal alone the sign is very slightly positive. There may be systematic under-reporting of food consumption by those overweight, or at the time of the survey, those who were overweight responded to the survey by decreasing their consumption, biasing the results. *Numfoods* has a negative coefficient implying that a diverse diet leads to lower *BMI*. *Born* has a positive coefficient indicating that those born in the U.S. are more likely to have an elevated *BMI*. *Preg* has a positive coefficient indicating elevated *BMI* for pregnant women.

Moreoth and *Moreac*t decreased *BMI* and *Lessoth* increased *BMI*, implying that more activity relative to the past and to others decreases *BMI* and less activity relative to others increases *BMI*. The coefficient on *Lessact* was insignificant and the coefficient on *Vigact* was positive. This positive coefficient implies that vigorous activity increases *BMI*. This is opposite to our expectation; however vigorous activity can lead to muscle, which is denser than fat and consequently would elevate *BMI*. Unfortunately the coefficient on *muscle* was insignificant.

The coefficient on *Eatrest* was insignificant; as reported in the survey data eating in restaurants does not in itself lead to excess weight. This is contrary to our expectations.

3.2 Results of the OLS with *weight* and *waist* as the dependent variables

The results of the regressions for *weight* and *waist* are displayed in Tables 3 and 4. Results of the regressions with weight or waist as the dependent variable were consistent with the OLS regression on *BMI* except for the following:

Height and *Hgtsq* were added as independent variables. For both the *Weight* and *Waist* the impact of *Height* was positive as expected. The coefficient on *Born* was insignificant in both cases indicating that being born in the US did not have the same impact on *Weight* and *Waist* as it does on *BMI*. This may indicate that those born in the U.S. have higher *BMI* but not physical stature. *Lessact* was significant and negative for *weight* indicating that more activity than the past leads to less weight. *Muscle* decreases both *weight* and *waist* indicating that muscle building diminishes weight and waist circumference. *Preg* and *Vigact* were not significant for either regression.

3.3 Results for tobit regression

The tobit regression identifies factors that influence the degree of excess weight among those already defined as overweight (*Bmihigh*>0); 3874 subjects out of our sample of 8618 have *Bmihigh*>0. The results of this regression are displayed in Table 5.

Age contributes to an increase in excess weight. Each hour of television watching or computer use (*Dailytv*) adds 0.388 points to *Bmihigh*. This result is higher than the coefficient on dailytv (0.309) from the regression with *BMI* implying that the impact on *BMI* is more substantial for the population segment with elevated *BMI*. Muscle-building activity (*Muscle*) decreases *Bmhigi*. However, the results from the OLS regression of *BMI* on muscle-building activity were insignificant, implying that the impact of these activities, for those in the population who are not overweight is ambiguous, whereas for those who are overweight, the result is beneficial. *Lessoth*, *Moreoth* and *Moreact* all have coefficients larger than those in the OLS regression, indicating that activity and exercise (or lack of exercise) has a more pronounced impact on those who are overweight. The results for *Gender* and *White* were also greater for the tobit regression, suggesting that women and nonwhites, once overweight, are likely to be even more overweight than men and whites.

Table 5: Tobit Regression BMIHigh

Number of obs = 7836
LR chi2(18) = 2877.29
Prob > chi2 = 0.0000
Log likelihood = -13763.242
Pseudo R2 = 0.0946

Var	Coef.	T	P>|t|
(Agecu/1000) ***	0.073	6.7	0
Age ***	0.976	16.64	0
Agesq ***	-0.015	-10.38	0
Chol ***	0.002	4.27	0
Dailytv ***	0.388	6.36	0
Gender ***	-0.651	-3.12	0.002
Hinc ***	-0.078	-2.25	0.025
Kcal***	-0.001	-4.42	0
Lessoth ***	2.804	10.42	0
Moreact **	-1.047	-2.64	0.008
Moreoth ***	-1.741	-7.36	0
Muscle **	-0.581	-2.43	0.015
Numfoods ***	-0.104	-5.35	0
Sugar **	0.003	1.8	0.073
Water ***	0.001	7.77	0
Tfat ***	0.018	3.62	0
Vigact *	0.593	2.55	0.011
White ***	-0.929	-4.43	0
Cons ***	-13.919	-20.92	0

Table 6: Logit regression – BmiGT25

Number of obs = 8565
LR chi2(20) = 3175
Prob > chi2 = 0.0000
Log likelihood = -4306.2619
Pseudo R2 = 0.2694

Var	Coef.	t	P>|t|
Age ***	0.116	16.56	0
Agesq ***	-0.001	-13.39	0
Born *	0.131	1.75	0.08
(Chol/1000)***	0.417	3.04	0.002
Dailytv ***	0.059	3.63	0
Hgt ***	0.226	7.02	0
(Hgtsq/1000) ***	-0.641	-6.46	0
(Kcal/1000) ***	-0.199	-3.62	0
Lessact **	0.181	2.41	0.016
Lessoth ***	0.374	4.8	0
Moreoth ***	-0.37	-5.78	0
Muscle ***	-0.269	-4.19	0
Numfoods ***	-0.023	-4.35	0
Preg ***	0.702	5.38	0
(Water/1000) ***	0.139	5.77	0
Tasks *	0.118	1.91	0.056
Tfat *	0.002	1.73	0.083
Walkbike **	-0.134	-2.24	0.025
Vigact **	0.138	2.13	0.033
White ***	-0.379	-6.18	0
Cons ***	-21.781	-8.41	0

Table 7 Probit regression - BmiGT25

Number of obs = 8565
LR chi2(17) = 3158.42
Prob > chi2 = 0.0000
Log likelihood = -4314.85
Pseudo R2 = 0.2679

Var	Coef.	t	P>|t|
Age ***	0.071	17	0
Agesq ***	-0.001	-13.74	0
Born *	0.075	1.68	0.094
Chol/1000 ***	0.25	3.09	0.002
Dailytv ***	0.036	3.72	0
Hgt ***	0.101	6.16	0
Hgtsq/1000 ***	0.282	-5.49	0
Kcal/1000***	-0.125	-3.78	0
Lessact **	0.108	2.42	0.016
Lessoth ***	0.225	5.7	0
Moreoth ***	-0.219	-5.7	0
Muscle ***	-0.158	-4.08	0
Numfoods ***	-0.013	-4.17	0
Preg ***	0.446	5.69	0
Water/1000 ***	0.066	5.96	0
Tasks **	0.078	2.09	0.036
Tfat *	0.001	1.84	0.066
Walkbike **	-0.08	-2.21	0.027
Vigact **	0.087	2.24	0.025
White ***	-0.221	-6.132	0
Cons ***	-10.243	-7.85	0

3.4 Results of logit and probit

The major difference between the logit and probit regressions and the OLS is the interpretation of the coefficients. A factors with positive (negative) coefficients for probit or logit increase (decrease) the probability of high *BMI*. The results from these regressions are displayed in Tables 6 and 7. These results are almost completely consistent with the OLS and tobit regressions. The following are the differences:

The coefficient on *Walkbike* is negative suggesting that walking or biking decreases the probability of having *BMI*>25. The coefficient on *Tasks* is positive suggesting that doing house tasks increases the probability of having *BMI*>25. This is inconsistent with expectations although it may indicate housewives, which is consistent with expectations. The correlation between tasks and married females is high.

In general, eating more food leads to a greater tendency for high *BMI*. Being a woman, a non-white or poor will lead to an increase in *BMI*. Activity is generally beneficial, in particular activity and muscle building will benefit those who are overweight and decrease the probability of becoming overweight. Eating a diverse diet is beneficial and will diminish excess *BMI* and decrease the probability of becoming overweight. Television or computer use will increase the probability excess weight and increase *BMI* overall and is particularly detrimental to those who are already overweight.

Other than *Kcal* and *Vigact* having the opposite sign expected and *Eatrest* not being significant, there were no real surprises in the results. Certain demographic characteristics, including gender, ethnic background and income are associated with weight. Those who eat more and engage in less active lifestyles are more likely to be overweight.

4. Discussion

This study used nationally representative survey data to identify the effects of selected personal characteristics and habits on obesity. Several important results emerged, some of which are relevant for policy.

Since most Americans can currently have incomes sufficient to afford overeating and food as a share of overall all budget is small, price changes through taxes and subsidies alone may be insufficient to to decrease the incidence of obesity. Additional efforts aimed at behavior modification will also be needed. Our results suggest that activity levels in addition to food intake is important. As such, activity levels will need to be addressed. Some behavior modifications will be relatively easy (e.g., hours spent watching television appears to have peaked) while others will be more challenging (e.g., hours spent before computers and electronic games are on the rise, especially among the young).

Our results add to the research that demonstrates that some groups are much more at risk at becoming overweight and obese than others. In particular, we should pay particular attention to women, children, non-whites, those who are not college educated, and the poor.

These results suggest a number of areas to emphasize in any policy. Television watching and other sedentary activities such as video games are problematic. Also, considering the positive impacts of exercise, policies directed towards encouraging active lifestyles will be beneficial. Given the propensity of excess weight amongst certain groups (e.g. women, children etc.), programs that encourage exercise and activity in place of television and computer games for these individuals will be particularly beneficial.

Certainly exercise programs directed at those who are currently obese will be advantageous. The results on muscle building activities for those overweight, suggest that this type of exercise can be particularly valuable.

Diet is obviously important; however the surprising results on total calories consumed suggest that it may be more relevant to pay attention to how much of each type of food is being consumed rather than the overall level of consumption. In particular, sugar and fat are areas of concern. Particularly interesting is the result on the number of foods consumed in a day. The positive coefficient on this variable suggests that a diverse diet in itself is a good practice. Encouraging the young, women and other groups with a high incidence to obesity to increase the number of foods consumed will be helpful.

Finally, the results on age show that the older we get the higher the incidence of excess weight. This suggests that older folks should pay attention to their diet and exercise. Programs directed towards older segments of the population may produce positive results. In general, the results suggest that a specific programs directed toward specific segments of the population are likely to be constructive.

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