Physical Activity: Economic and Policy Factors

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Introduction

Obesity has risen to epidemic levels in the U.S. with the prevalence among adults increasing from 15 percent in 1976-1980 to 31 percent in 1999-2000 (Flegal et al., 2002). Both sedentary lifestyles and dietary changes, such as eating outside the home, have contributed to this public health crisis. Annual estimates of deaths attributable to obesity range from 112,000 (Flegal et al, 2005) to 365,000 (Mokdad et al, 1999). Health care spending on obese Americans accounted for 27 percent of the overall growth in health care spending between 1987 and 2001 (Thorpe et al, 2004). Obesity-attributable medical expenditures are estimated at $75 billion, with $17 billion and $21 billion financed by Medicare and Medicaid, respectively (Finkelstein et al, 2004). The economic effects of obesity may outweigh other health risk factors such as smoking and alcoholism (Sturm, 2002) as obesity (defined as a Body Mass Index, BMI >=30) is estimated to increase annual medical expenditures by 37 percent (Finkelstein et al. 2003). While much research has focused on the costs of obesity and economic factors that drive obesity growth, little economic research has examined the factors that contribute to obesity – physical inactivity and poor nutrition. This paper will examine correlates and predictors of physical activity over time with emphasis on economic factors. Using data for adults from the 2000-2005 Behavioral Risk Factor Surveillance System (BRFSS) survey, we examine the characteristics of individuals and their environments that determine their level of activity. Because BRFSS includes state and county codes for each individual, we are able to include additional information regarding economic variables such as area unemployment as well as price and supply variables.

Background

As more attention has been focused on the rising levels of obesity in the US, it is important to consider whether obesity trends are due rising caloric intake, falling levels of activity or both. Many studies have considered the economic factors that drive the obesity epidemic and caloric intake (Cutler et al. 2003, Anderson P, et al., 2003; Rashad, 2006; Smith et al, 2005; Bleich et al., 2007; Rashad and

Markowitz, 2007; Baum and Ruhm NBER 13289, 2007; Philipson, 2001; Chou et al., 2004), but the physical activity side of the equation has received comparatively little attention. Even if changes in physical activity are not to blame for the dramatic changes in obesity, policies aimed at increasing physical activity may be a part of the solution. Understanding the determinants of physical activity is an important first step in determining whether policies aimed at increasing physical activity levels can be useful levers in reducing overall obesity levels.

Physical Activity and Health

Physical activity has unique health consequences. Murphy et al (2007) find that activity as minimal as walking improves blood pressure control, lowers body fat percentages and decreases BMI. Church et al (2007) examines postmenopausal women with high blood pressure and finds that physical activity, even at low doses, improves cardiorespiratory fitness no matter the weight of the person. Other health research on the effects of obesity is starting to find that activity levels are important predictors of outcomes. Katzmarzyk et al (2004) find adding cardiorespiratory fitness to models comparing mortality (all cause and cardiovascular deaths) for men with metabolic syndrome to healthy men causes the association to be insignificant. They find that cardiorespiratory fitness provides a strong protective effect.

Besides examining health effects of physical activity, other researchers have estimated the impact of inactivity on medical expenditures. Keeler et al (1989) found that those with sedentary life-styles incur higher medical costs, but their life expectancy is less so they collect less public and private pensions. At a 5 percent rate of discount for future dollars, the lifetime subsidy from others to those with a sedentary life style was estimated at $1,900. One more recent study has examined the cost of inactivity to a health plan. Garret et al (2004) utilizing a cost of illness methodology finds that inactivity cost $86 million in one health plan. Another study utilizes the disease by disease approach examines the

impact of in activity in Canada. Katzmarzyk et al (2000) find that 2.5 percent of total direct health care costs in Canada in 1999 are attributable to physical inactivity. They further estimate that approximately 21,000 lives were lost prematurely in 1995 due to inactivity. Pratt et al (2000) use the 1987 National Medical Expenditure Survey to perform a stratified analysis of medical expenditures and find that people who were physically active report an adjusted average annual medical expenditure of $1,019 compared to $1,349 for those who report being inactive. Shinogle (2008) uses linked National Health Interview Survey to Medical Expenditure Panel Survey to estimate the inactivity attributable fraction of medical expenditures range from 11 percent to 16 percent. In these models, inactivity did not significantly increase the probability of a medical expenditure but did increase the level of expenditures. This result may reflect that physically active people have an unobserved taste for preventive health measures. This taste for prevention services is also indicated in the following analysis of 2000-2005 National Health Interview Survey (NHIS). Examining office based visits by physically active (defined as CDC) we find that active people are more likely to have 1 to 2 visits but less likely to have higher number of office based visits in the past 12 months. On the other hand, examining emergency room visits and number of overnight hospital days, we find the opposite association, physically active people have fewer of these more expensive medical use.

Number of Office Visits in Past 12 Months

	Other	Regularly Active
0	20.1%	17.8%
1	15.5%	18.7%
2 to 3	23.5%	28.0%
4 to 5	13.8%	13.8%
6 to 7	7.1%	6.6%
8 to 9	4.0%	3.2%
10 to 12	6.5%	5.0%
13 to 15	2.6%	1.9%
16 or more	6.9%	5.0%
	p<0.001	

Number of Times in ER in Past 12 Months

	Other	Regularly active
0	78.11%	81.81%
1	13.52%	12.81%
2 to 3	5.92%	4.23%
4 to 5	1.35%	0.65%
6 to 7	0.48%	0.21%
8 to 9	0.17%	0.09%
10 to 12	0.22%	0.10%
13 to 15	0.06%	0.03%
16 or more	0.15%	0.06%
p<0.001		

No. of Times in Hospital Overnight in Past 12 Months

	Other	Regularly Active
0	88.4%	92.8%
1	8.4%	5.9%
2	1.9%	0.9%
3	0.7%	0.2%
>3	0.6%	0.2%
p<0.001		

Source: Shinogle 2008.

Trends in Physical Activity

In light of the obesity epidemic, it is perhaps surprising that Americans are spending more of their time and income on leisure and at least some of that is going to physical activity (Sturm 2004). Between 1965 and 2000, industries catering to leisure activity are generally growing more quickly than

the overall economy, but a disproportionate share of this growth is in sedentary activities (such as cable t.v. viewing) rather than more active pursuits (sports clubs, dance studios). Nonetheless, time spent in physical activity is increasing. Sturm's analysis shows that between 1990 and 2000, the median increase in reported physical activity is 20 minutes per week. While most Americans still do not meet federal recommendations for physical activity, the CDC (2004) reports that between 1988 and 2002, there has been a 9 percentage point drop in the prevalence of no leisure-time physical activity. Estimates of physical activity trends vary depending on survey and questions used. As shown in table below, the National Health Interview Survey finds around 30 percent of the adult population is inactive. This can be compared to estimates from the BRFSS showing that approximately 75 percent of the adult population participates in any leisure time physical activity in the past 30 days. BRFSS estimates that approximately 25 percent of population is involved in vigorous physical activity while 45 percent are involved in moderate or vigorous physical activity.

Estimates of Physical Activity from Various Data Sources
Percent of Adult Population

	2001	2002	2003	2004	2005
NHIS estimate inactive	29.9	30.1	29.5	30.4	29.3
BRFSS any exercise	75.88	76.94	77.2	77.26	77.64
BRFSS vigorous PA			25.01		24.53
BRFSS moderate or vigorous PA			45.56		45.71

Source: Authors' tabulations from NHIS and BRFSS

Physical Activity and Economics

Perhaps the most intriguing evidence of a link between physical fitness, health, and economic factors comes from Chris Ruhm's studies of age-adjusted mortality over the business cycle (2005, 2000). Ruhm finds that declines in mortality during temporary economic downturns are accompanied by

increases in leisure time physical activity, declines in BMI and smoking. These changes disproportionately occur among the least active, most severely obese, and heaviest smokers, respectively. Ruhm's findings point to the important role that economic levers can have in shaping physical activity levels and the need to better understand the relationships between lifestyle behaviors such as physical activity and smoking. If there are economies of scope in reducing unhealthy behaviors, then policy makers may be able to exploit this when designing a policy that ostensibly targets only one of these behaviors.

More recently, using the BRFSS 1996 – 2000, Rashad (2007) develops a model of cycling propensity and the health gains that result. Cycling rates are lower for those who are working, those with higher incomes, and females. She also finds that cycling rates respond negatively to urban sprawl and real gas prices, and that increased cycling is associated with significant health gains.

Physical Activity and Policy

Policies directly aimed at promoting greater physical activity have almost exclusively focused on physical education in schools (Yancey et al., 2007). Increased physical education requirements generally do translate into more minutes of PE, but do not appear to alter obesity levels and do not clearly increase physical activity (Cawley, 2005). Policy targeting the built environment may also promote physical activity, given studies that find the proximity and attractiveness of recreational facilities does appear to promotes physical activity (Yancey et al., 2007). State and local spending on parks and recreation increases the likelihood and amount of participation in outdoor sports (Humphreys and Ruseki, 2007). Outdoor sports, however are a small component of physical activity (only 5 percent of BRFSS participants report participation in outdoor recreation such as backpacking, fishing, hiking, or waterskiing), and other more common forms of exercise, such as walking, were not affected by state spending levels.

Other government policies may have unintended spillover effects that indirectly promote or discourage physical activity levels. Rashad's study of cycling suggests that gas taxes may have an unintended benefit in terms of promoting physical activity. Other policies, such as those aimed at reducing smoking, may also have unintended consequences for physical activity. Clean indoor air policies and cigarette prices are both weakly associated with increased BMI (Cho, Grossman, and Saffer, 2004). Given possible interactions between lifestyle behaviors, the spillover effects from policies aimed at reducing smoking are difficult to predict. Former smokers and less intense smokers may find leisure physical activity more enjoyable and more necessary to compensate for weight gain. On the other hand, when mandated to reduce risk along one margin, individuals may choose to offset this by increasing risk along another margin (Pelzman, 1975). We discuss these effects in more detail below.

Basic Model

What are the economic determinants of physical activity? In a model of household production, the price of physical activity includes the opportunity cost of time and the cost of inputs to physical activity. Thus, we consider below factors that effect the individual's opportunity cost of time (such as education and income) as well as some input prices. We also consider whether environmental variables, such as availability of parks and crime rates have an effect on physical activity levels. Do other factors such transportation costs and availability affect PA? What about entertainment substitutes, such as movies or bowling? Are other health behaviors substitutes or complements with physical activity? For example if one thinks of smoking as a weight reduction device, would the decrease in smoking cause individuals to find other weight reduction behavior such as physical activity? On the other hand if smoking is an indicator for overall risky health behavior, a change in smoking would not affect physical activity. We make similar arguments for drinking.

Suppose that the individual receives utility from health *H*, physical activity *A*, and other goods *Z* as measured by the utility function *U(H, A, Z)*. Health depends on physical activity *A* and consumption

goods *Z: H(A, Z)*. Individuals produce physical activity by combining time and other exercise inputs (gym services, exercise equipment, natural amenities, physical trainer services, etc.): $A = A(x_A, t_A)$. Time inputs include the time spent in the activity as well as any travel time incurred to get to the bike path, gym, safe neighborhood for walking, or other exercise venue.

The vector *Z* includes goods that may be complements or substitutes for physical activity in two different pathways: i) consumption and ii) production of health. For a consumption example, a person might substitute an hour of drinking in a pub with friends for an hour of sailing depending on which is cheaper. On the production side, a person who does not value exercise for it's own sake, might increase activity levels if this were to enhance the productivity of other inputs to the health production. For example, reduced smoking may increase the productivity of exercise making the two complements in production. The consumer is assumed to maximize utility U(H, A, Z) subject to the time constraint and income constraints yielding the Langrangian

$$L = U(H(A, Z), A, Z) - \lambda_m[Income = p_A X_A + p_Z X_Z + wX_A + wX_Z] - \lambda_t[24 = t_A + t_w + t_z]$$

Assuming that both constraints are binding and treating A as the choice variable, we can write the Lagrangian in terms of the full income constraint as:

$$L = U(H(A, Z), A, Z) - \lambda[w24 = p_A X_A + p_Z X_Z + wt_A + wt_Z]$$

The first order condition for the level of physical activity is then:

$$U_H H_A + U_A = \lambda[p_A \partial X_A/\partial A + p_A \partial t_A/\partial A]$$

The left-hand side shows that the marginal benefit of physical activity includes the indirect effect through the health production as well as from the direct effect from enjoyment of the activity (or disutility as individual tastes dictate.) The right-hand side measures the full price of physical activity and includes the opportunity cost of time as well as the price of physical activity inputs. This first order

condition applies to individuals who engage in some physical activity, but a substantial fraction of the population will be at a corner solution with:

$$U_H H_A + U_A - \lambda[p_A \partial X_A/\partial A + p_A \partial t_A/\partial A] < 0$$

The first-order condition from this simple static model, suggests several ways in which policy and price changes affect an individual's level of physical activity.

Own price. Policies that affect the full price of exercise include anything that reduces the cost of inputs to physical activity or the time cost of engaging in exercise. For example, the construction of new parks will reduce the travel time of individuals who live near the park. The built environment, which may affect the cost of exercise as well as the enjoyment of exercise, has been the subject of much study and the results are mixed. For example, Forsythe et al (2007) find no relationship between residential density and overall physical activity. Decreases in physical activity on the job in combination with rising wages may both increase the opportunity cost of exercise (Phillipson 2001). Our model includes measures of education, income, employment status, and county unemployment as factors that affect the opportunity cost of time. Because factors may also affect the cost of missed work due to poor health and the efficiency of health production, we do not have an unambiguous prediction of sign.

Prices of related goods. In looking at the effects of alcohol and tobacco prices on BMI and obesity, Cho, Grossman, and Saffer (2002) find that both weight measures increase with cigarettes prices but decrease with alcohol prices. Thus, they suggest that calories and cigarettes are substitutes while calories and alcohol are complements. The weight changes found by Cho, Grossman, and Saffer may also reflect changes in activity levels in addition to changes in caloric intake. For example, since the health benefits from exercise may ameliorate the damages from smoking and drinking, exercise may be a complement in the production of health to smoking or drinking. If that is the case, then policies that decrease smoking and drinking may decrease exercise as they no longer see the need for this offsetting

health behavior. Alternatively, there may be complementarily in consumption. This may occur as one gets a pleasurable feeling from all three activities; thus, as the price increases for smoking, one may substitute with physical activity. Complementarities may also when individuals are trying to make behavioral changes. Changes in one health behavior may serve as a "gateway" for changes in other health behaviors (see Dutton et al. 2008 for an example). One may also have the "New Year's resolution effect" in that a person finds it easier to change a group of behaviors together and, thus, simultaneously decreasing smoking and drinking while increasing PA.

The above model is static and does not address the fact that some of the benefits and costs of physical activity are not immediately felt. The expression "no pain, no gain" illustrates the intertemporal tradeoffs that some people perceive in exercise. Other activities such as exercising, refraining from smoking, and controlling weight may share the characteristic of increasing short term disultility and long health. Hence, we might find a high degree of correlation among health behaviors due to the unobserved taste parameter of time preference in a cross-sectional analysis.

Data and Methods:

Data are from the Behavioral Risk Factor Surveillance System, a large nationally representative telephone survey of the non-institutionalized adult population administered by the Center for Disease Control and Prevention. Between 2001 and 2005 all states participated. We drop any pregnant women from the analysis as physical activity recommendations are dependent on prior physical fitness. Annual sample sizes range from approximately 112,000 to over 258,000 leading to a combined sample size of over 1 million observations when all four years are used.

We utilize three different measures of physical activity as BRFSS obtains different information each year. Annually, BRFSS asks if the person participated in ANY leisure time activity in the past 30 days. This measure is a weak measure as it could be as simple as walking once in the past thirty days.

Yet, this question is obtained annually to allow for times series estimation. The second and third measure follows the definitions created by the CDC. First measure – physical activity that is vigorous or moderate– is defined as engaging in light to moderate leisure time physical activity for great than or equal to 30 minutes at a frequency of greater than or equal to five times per week or engaging in vigorous leisure time physical activity for greater than or equal to 20 minutes at a frequency greater than or equal to three times a week. This measure is defined as vigorous or moderate physical activity. Our last measure examines those that only have vigorous physical activity. These last two measures of physical activity are only asked on odd years and thus drops our analysis to years 2001, 2003 and 2005. Basic demographic data include age, age squared, race (black, white, Asian, with other race as the omitted category), Hispanic ethnicity, education (high school graduate, some college, college plus, with the omitted category less than high school graduate), eight income categories (over $75,000 as omitted), married, and employment (unemployed, retired, student or homemaker with employed as omitted category). Data on the number of establishments and employment in recreational industries and parks will be obtained from the County Business Patterns Data Set from the Census. Data on state tax policy for alcohol and tobacco will be obtained from the Federation of Tax Administrators. We also added the American Chamber of Commerce Researchers' Association (ACCRA) data on pre-tax retail prices for tennis balls, bowling, movies, bus fare and gas. For the years 2001-2004 we have data on smoking bans in bars and restaurants.

We run four different models: The first only includes basic demographics. The second model adds area characteristics with the next model adding obesity and overweight variables. The final model adds a measure of risk behavior – did the person have a flu shot in the last 12 months. We then rerun these four models adding smoking ban variables.

Results

Table 1 presents the means and standard deviations for our data set. Table 2 present estimates from four models where the dependent variable is the probability of any leisure-time physical activity within the last 30 days. None of these models include the smoking bans variables. The demographic effects are highly significant and stable across the four specifications. We find males are more likely to exercise than females. Participation increases with income and education but declines with age. Retired individuals are the most likely to report some exercise followed by students/homemakers and unemployed individuals with working individuals the least likely to report some exercise. Whites are most likely to exercise of all racial groups, while Asians are the least likely, followed by Hispanics and blacks (omitted category is other races). We find that participation declines with age but the models are inconsistent with respect to the whether this effect is significantly non-linear. Our results can be compared to Rashad's (2007) analysis of cycling rates using the 1996-2000 BRFSS data and Humphrey and Ruseki's analysis of participation in five categories of leisure time physical activity (outdoor recreation, household activities, group sport, individual sport and walking) using the 1998 and 2000 BRFSS. While our demographic results are largely consistent with both studies, the Humphrey and Ruseki study shows that demographic effects can differ widely across activity categories.

The effects of area-specific variables are also largely consistent across our specifications. These coefficients must be interpreted with caution because individuals who are likely to exercise may choose to live in areas with certain amenities and characteristics. We do not find that exercise levels vary with the two direct "own" price measures (price of tennis balls and price of bowling balls). Nor do participation rates respond to bus fare or gas price. We find that an individual is more likely to participate in physical activity when unemployment in the county is low. This is surprising given Ruhm's (2005) results that leisure time physical activity increases during economic downturns; however, the results are not directly comparable. Ruhm uses average state unemployment levels in the previous three months while we use the annual county unemployment rate, and his measure of physical activity excludes those who engage in "irregular" exercise. When our dependent variable is vigorous exercise

(as in table 2, model 1) or moderate or vigorous physical activity (as in table 2, model 2), we find that the unemployment variable while still negative, is now no longer significant. We find a weak relationship between violent crimes and participation in exercise and no effect from property crime rates. Physical activity is more likely when there are more parks in a county, which is consistent with Humphrey and Ruseki's (2007) findings using state-level variation in total state and local spending on parks is positively associated with outdoor activity. In our subsequent models when we utilize per capita measures, we also find a significant and positive association with the number of gyms per capita or other recreation facilities per capita. Future drafts will use a consistent variable definition for these measures of access to parks, gyms and other recreational facility. Propensity for physical activity does not appear to vary with beer or cigarette taxes. While the signs are consistent with the notion that physical activity can compensate for increased calories associated with drinking and refraining from smoking. However, any spillover effects from reduced beer drinking or smoking due to higher taxes is negligible.

The results above are robust to the inclusion of weight and use of flu shots. Obese individuals are less likely to report some physical activity while overweight individuals are more likely than those with lower weights. Note that the overweight category includes obese individuals; hence the obese effect is the sum of the two coefficients. Future draft will correct this definition. Individuals who get flu shots are more likely to report some exercise. While these measures are likely endogenous, we find that their inclusion does not affect the other results. If the area variables above were measuring the reverse causation that people who are active move to areas with low crime rates and high spending on parks, then we might expect that adding measures of health status and taste for preventive medicine would reduce the effects of these variables.

Table 3 present estimates from the models with moderate and vigorous physical activities. These models are consistent with previous estimates with the exception of unemployment rate is now insignificant.

Conclusions:

Physical Activity is highly influenced by demographic factors including age, sex, education and income. We find that some time costs may be an issue to physical activity as those who work are less likely to have any exercise in the last 30 days. We also find that certain area characteristics such as gyms per capita increase the likelihood of any physical activity. The issue with these area variables is that people chose where they live and those people with unobserved tastes for prevention activities such as physical activity may search out areas with better access to gyms and parks. We attempt to control for this unobserved taste through the variable of flu shots. We find that adding this variable does not change our results.

Our results are limited by the measure of physical activity being self-report and not fitting normal CDC definitions. Future work will examine the effects of area variables on other data sets sucha the National Health Interview Survey to examine more appropriate definition of physical activity.

Policy Implications:

We find that certain area characteristics such as access to gyms, parks and other recreational facilities increase the probability of exercise for adults. These effects remain consistent even when we include measures for unobservable tastes such as flu shots. We find little evidence of a spill over effect of increased taxes of cigarettes or beer to increase physical activity.

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Table 1: Descriptive Statistics

	Means	Std Dev
Any Exercise	0.684	0.465
Vigorous Activity	0.102	0.303
Vigorous or Moderate	0.188	0.391
Age	48.505	16.608
Age- squared	2628.535	1722.206
Male	0.413	0.492
Hispanic	0.063	0.243
White	0.828	0.377
Black	0.080	0.272
Asian	0.020	0.140
Married	0.572	0.495
High School Diploma	0.291	0.454
Some College	0.277	0.447
College degree or more	0.342	0.474
Income <$10K	0.055	0.227
Income $10K<15K	0.059	0.235
Income $15K<20K	0.079	0.270
Income $20K<25K	0.100	0.299
Income $25K<35K	0.144	0.351
Income $35K<50K	0.179	0.383
Income $50K<75K	0.174	0.379
Unemployed	0.041	0.198
Student/ Homemaker	0.094	0.292
Retired	0.184	0.387
Insured	0.878	0.328
Price of Bowling	3.130	1.170
Price of Tennis Balls	2.401	0.437
Price of Gas	1.697	0.381
Price of Bus Fare	1.121	0.496
Unemployment Rate	5.060	1.590
Violent Crime Rate	4.324	3.199
Property Crime Rate	36.851	16.061
Number of Gyms	0.102	0.053
Number of Parks	0.003	0.009
Number of Other Rec Centers	0.148	0.136
Smoking Ban, Restaurants	0.083	0.276
Smoking Ban, Bars	0.050	0.218

Cigarette Tax Rate	0.604	0.459
Beer Tax Rate	0.247	0.182
Obese	0.351	0.477
Overweight	0.671	0.470
Flu Shot	0.315	0.464

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Table 2: Models Predicting the Probability of Any Exercise

	Model One - Basic Demographics			Model Two - Add area variables			Model Three - Add Weight Variables			Model Four - Add Flu Shot		
	Coef.	**z**	**P>|z|**	**Coef.**	**z**	**P>|z|**	**Coef.**	**z**	**P>|z|**	**Coef.**	**z**	**P>|z|**
Age	-0.014	-25.480	0.000	-0.013	-14.600	0.000	-0.012	-12.990	0.000	-0.012	-12.780	0.000
Age- squared	0.000	4.250	0.000	0.000	1.740	0.081	0.000	0.080	0.934	0.000	-0.640	0.522
Male	0.088	27.930	0.000	0.094	17.780	0.000	0.085	15.850	0.000	0.086	16.060	0.000
Hispanic	-0.149	-22.100	0.000	-0.157	-14.420	0.000	-0.161	-14.750	0.000	-0.162	-14.820	0.000
White	0.069	11.240	0.000	0.054	5.430	0.000	0.052	5.150	0.000	0.052	5.180	0.000
Black	-0.102	-13.000	0.000	-0.126	-9.370	0.000	-0.120	-8.920	0.000	-0.118	-8.790	0.000
Asian	-0.266	-20.930	0.000	-0.327	-16.830	0.000	-0.335	-17.230	0.000	-0.336	-17.280	0.000
Married	-0.052	-15.310	0.000	-0.060	-10.470	0.000	-0.060	-10.450	0.000	-0.061	-10.570	0.000
High School Diploma	0.201	38.130	0.000	0.218	23.810	0.000	0.216	23.570	0.000	0.216	23.510	0.000
Some College	0.412	74.410	0.000	0.429	44.860	0.000	0.428	44.750	0.000	0.427	44.590	0.000
College degree or more	0.639	109.180	0.000	0.659	65.380	0.000	0.654	64.840	0.000	0.651	64.530	0.000
Income <$10K	-0.731	-93.190	0.000	-0.734	-54.350	0.000	-0.722	-53.390	0.000	-0.722	-53.350	0.000
Income $10K<15K	-0.671	-88.430	0.000	-0.677	-51.910	0.000	-0.667	-51.080	0.000	-0.667	-51.040	0.000
Income $15K<20K	-0.594	-85.620	0.000	-0.601	-50.860	0.000	-0.593	-50.150	0.000	-0.593	-50.110	0.000
Income $20K<25K	-0.518	-80.640	0.000	-0.527	-48.760	0.000	-0.520	-48.030	0.000	-0.520	-48.010	0.000
Income $25K<35K	-0.411	-70.990	0.000	-0.416	-42.960	0.000	-0.412	-42.440	0.000	-0.412	-42.410	0.000
Income $35K<50K	-0.299	-55.660	0.000	-0.303	-33.820	0.000	-0.299	-33.300	0.000	-0.298	-33.240	0.000
Income $50K<75K	-0.180	-33.510	0.000	-0.189	-21.200	0.000	-0.186	-20.870	0.000	-0.186	-20.780	0.000
Unemployed	0.028	3.860	0.000	0.048	3.980	0.000	0.049	4.090	0.000	0.050	4.170	0.000
Student/ Homemaker	0.182	32.570	0.000	0.164	17.690	0.000	0.162	17.490	0.000	0.163	17.580	0.000

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Retired	0.257	47.700	0.000	0.247	26.740	0.000	0.247	26.760	0.000	0.243	26.260	0.000
Insured	0.057	12.250	0.000	0.055	6.840	0.000	0.057	7.080	0.000	0.051	6.360	0.000
Price of Bowling				-0.006	-0.470	0.636	-0.007	-0.570	0.569	-0.007	-0.610	0.544
Price of Tennis Balls				0.003	0.300	0.767	0.001	0.110	0.911	0.001	0.100	0.922
Price of Gas				-0.028	-1.240	0.215	-0.019	-0.850	0.395	-0.018	-0.780	0.436
Price of Bus Fare				0.010	0.600	0.549	0.010	0.590	0.559	0.010	0.590	0.557
Unemployment Rate				-0.019	-7.560	0.000	-0.019	-7.390	0.000	-0.018	-7.260	0.000
Violent Crime Rate				-0.002	-1.600	0.109	-0.002	-1.670	0.095	-0.002	-1.690	0.091
Property Crime Rate				0.000	-1.110	0.268	0.000	-1.040	0.297	0.000	-1.100	0.271
Number of Parks				0.008	2.800	0.005	0.008	2.790	0.005	0.008	2.780	0.005
Number of Gyms				0.000	-0.590	0.555	0.000	-0.670	0.503	0.000	-0.740	0.459
Number of Other Rec Centers				0.000	0.110	0.914	0.000	0.090	0.929	0.000	0.180	0.853
Cigarette Tax Rate				0.011	0.590	0.554	0.007	0.370	0.713	0.007	0.360	0.720
Beer Tax Rate				-0.059	-0.240	0.810	-0.091	-0.370	0.712	-0.101	-0.410	0.682
Overweight							0.048	8.620	0.000	0.048	8.560	0.000
Obese							-0.255	-25.430	0.000	-0.257	-25.600	0.000
Flu Shot										0.054	9.460	0.000

Table 3: Models Predicting the Probability of Any Exercise adding Bans Variables

	Model One - Basic Demographics			Model Two - Add area variables			Model Three - Add Weight Variables			Model Four - Add Flu Shot		
	Coef.	**z**	**P>|z|**	**Coef.**	**z**	**P>|z|**	**Coef.**	**z**	**P>|z|**	**Coef.**	**z**	**P>|z|**
Age	-0.014	-25.480	0.000	-0.013	-14.770	0.000	-0.012	-13.210	0.000	-0.012	-12.990	0.000
Age- squared	0.000	4.250	0.000	0.000	1.960	0.050	0.000	0.330	0.738	0.000	-0.400	0.689
Male	0.088	27.930	0.000	0.093	17.500	0.000	0.084	15.560	0.000	0.085	15.780	0.000
Hispanic	-0.149	-22.100	0.000	-0.154	-14.030	0.000	-0.158	-14.380	0.000	-0.158	-14.450	0.000
White	0.069	11.240	0.000	0.050	4.980	0.000	0.048	4.720	0.000	0.048	4.760	0.000
Black	-0.102	-13.000	0.000	-0.120	-8.830	0.000	-0.115	-8.470	0.000	-0.113	-8.350	0.000
Asian	-0.266	-20.930	0.000	-0.328	-16.780	0.000	-0.336	-17.190	0.000	-0.337	-17.230	0.000
Married	-0.052	-15.310	0.000	-0.061	-10.570	0.000	-0.061	-10.540	0.000	-0.061	-10.670	0.000
High School Diploma	0.201	38.130	0.000	0.219	23.730	0.000	0.217	23.480	0.000	0.216	23.430	0.000
Some College	0.412	74.410	0.000	0.429	44.660	0.000	0.429	44.550	0.000	0.427	44.390	0.000
College degree or more	0.639	109.180	0.000	0.658	64.970	0.000	0.654	64.450	0.000	0.651	64.140	0.000
Income <$10K	-0.731	-93.190	0.000	-0.737	-54.200	0.000	-0.725	-53.260	0.000	-0.725	-53.220	0.000
Income $10K<15K	-0.671	-88.430	0.000	-0.679	-51.830	0.000	-0.669	-51.010	0.000	-0.669	-50.970	0.000
Income $15K<20K	-0.594	-85.620	0.000	-0.603	-50.750	0.000	-0.595	-50.030	0.000	-0.595	-50.000	0.000
Income $20K<25K	-0.518	-80.640	0.000	-0.527	-48.530	0.000	-0.520	-47.810	0.000	-0.520	-47.790	0.000
Income $25K<35K	-0.411	-70.990	0.000	-0.416	-42.710	0.000	-0.412	-42.190	0.000	-0.412	-42.160	0.000
Income $35K<50K	-0.299	-55.660	0.000	-0.302	-33.480	0.000	-0.298	-32.960	0.000	-0.297	-32.900	0.000
Income $50K<75K	-0.180	-33.510	0.000	-0.189	-21.010	0.000	-0.186	-20.690	0.000	-0.185	-20.600	0.000
Unemployed	0.028	3.860	0.000	0.049	4.060	0.000	0.050	4.150	0.000	0.051	4.230	0.000

Student/ Homemaker	0.182	32.570	0.000	0.164	17.540	0.000	0.162	17.350	0.000	0.163	17.460	0.000
Retired	0.257	47.700	0.000	0.247	26.620	0.000	0.248	26.640	0.000	0.243	26.140	0.000
Insured	0.057	12.250	0.000	0.056	6.910	0.000	0.057	7.130	0.000	0.052	6.400	0.000
Price of Bowling				-0.006	-0.500	0.619	-0.007	-0.600	0.549	-0.007	-0.640	0.524
Price of Tennis Balls				0.000	0.030	0.976	-0.001	-0.100	0.919	-0.001	-0.120	0.903
Price of Gas				-0.029	-1.270	0.203	-0.020	-0.860	0.389	-0.018	-0.790	0.429
Price of Bus Fare				0.011	0.670	0.505	0.011	0.620	0.534	0.011	0.630	0.528
Unemployment Rate				-0.015	-5.730	0.000	-0.014	-5.570	0.000	-0.014	-5.450	0.000
Violent Crime Rate				-0.001	-0.390	0.699	-0.001	-0.560	0.577	-0.001	-0.560	0.578
Property Crime Rate				0.000	-1.220	0.223	0.000	-1.130	0.259	0.000	-1.170	0.241
Number of Gyms				0.337	5.200	0.000	0.320	4.930	0.000	0.321	4.940	0.000
Number of Parks				1.210	3.140	0.002	1.197	3.100	0.002	1.206	3.120	0.002
Number of Other Rec Centers				0.113	4.070	0.000	0.109	3.900	0.000	0.110	3.960	0.000
Cigarette Tax Rate				0.018	0.870	0.383	0.013	0.620	0.534	0.014	0.670	0.501
Beer Tax Rate				-0.040	-1.390	0.165	-0.038	-1.320	0.187	-0.038	-1.320	0.188
Smoking Ban, Restaurants				0.011	0.590	0.553	0.006	0.330	0.743	0.006	0.330	0.743
Smoking Ban, Bars				-0.064	-0.260	0.798	-0.105	-0.420	0.676	-0.112	-0.450	0.655
Overweight							0.049	8.780	0.000	0.049	8.720	0.000

Obese	-0.255	-25.120	0.000	-0.256	-25.300	0.000
Flu Shot				0.055	9.580	0.000

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Table 4: Models Predicting Moderate and Vigorous Physical Activity

	Model One - Vigorous Physical Activity				Model Two - Vigorous or Moderate Physical Activity			
	Coef.	**Std.**	**z**	**P>|z|**	**Coef.**	**Std.**	**z**	**P>|z|**
Age	-0.026	0.002	-15.090	0.000	-0.012	0.001	-7.730	0.000
Age- squared	0.000	0.000	3.400	0.001	0.000	0.000	-0.900	0.371
Male	0.211	0.009	22.570	0.000	0.069	0.009	8.110	0.000
Hispanic	-0.072	0.020	-3.640	0.000	-0.131	0.018	-7.280	0.000
White	-0.015	0.018	-0.840	0.401	0.024	0.016	1.520	0.128
Black	-0.096	0.025	-3.780	0.000	-0.165	0.023	-7.190	0.000
Asian	-0.397	0.034	-11.640	0.000	-0.376	0.030	-12.360	0.000
Married	-0.095	0.010	-9.440	0.000	-0.058	0.009	-6.320	0.000
High School Diploma	0.134	0.021	6.510	0.000	0.149	0.017	8.820	0.000
Some College	0.249	0.021	12.050	0.000	0.225	0.017	13.060	0.000
College degree or more	0.396	0.021	18.880	0.000	0.327	0.018	18.500	0.000
Income <$10K	-0.626	0.027	-23.300	0.000	-0.483	0.023	-21.240	0.000
Income $10K<15K	-0.545	0.026	-21.150	0.000	-0.425	0.022	-19.380	0.000
Income $15K<20K	-0.474	0.022	-21.320	0.000	-0.370	0.019	-19.070	0.000
Income $20K<25K	-0.397	0.019	-20.500	0.000	-0.302	0.017	-17.440	0.000
Income $25K<35K	-0.307	0.016	-18.760	0.000	-0.245	0.015	-16.370	0.000
Income $35K<50K	-0.247	0.014	-17.330	0.000	-0.187	0.013	-14.010	0.000
Income $50K<75K	-0.155	0.014	-11.510	0.000	-0.103	0.013	-7.980	0.000
Unemployed	0.058	0.021	2.720	0.006	0.110	0.019	5.640	0.000
Student/ Homemaker	0.147	0.016	9.450	0.000	0.236	0.014	16.330	0.000
Retired	0.144	0.018	7.870	0.000	0.262	0.015	17.100	0.000
Insured	-0.027	0.015	-1.840	0.065	-0.053	0.013	-4.020	0.000
Price of Bowling	-0.069	0.099	-0.700	0.484	-0.020	0.084	-0.230	0.815
Price of Tennis Balls	-0.170	0.139	-1.230	0.221	-0.120	0.126	-0.950	0.340
Price of Gas	-0.338	0.444	-0.760	0.447	-0.842	0.405	-2.080	0.038
Price of Bus Fare	-0.054	0.174	-0.310	0.755	0.121	0.158	0.760	0.446
Unemployment Rate	-0.003	0.004	-0.650	0.513	-0.002	0.004	-0.420	0.673
Violent Crime Rate	0.002	0.003	0.550	0.583	0.002	0.002	0.930	0.350
Property Crime Rate	0.000	0.000	-0.960	0.336	-0.001	0.000	-2.500	0.013
Number of Gyms	0.190	0.109	1.730	0.083	0.221	0.100	2.220	0.027
Number of Parks	0.128	0.535	0.240	0.811	1.230	0.497	2.480	0.013
Number of Other Rec Centers	0.192	0.050	3.810	0.000	0.140	0.046	3.030	0.002
Smoking Ban, Restaurants	-0.026	0.039	-0.660	0.507	-0.009	0.035	-0.270	0.790
Smoking Ban, Bars	-0.051	0.056	-0.920	0.358	-0.045	0.050	-0.890	0.375
Cigarette Tax Rate	0.052	0.496	0.110	0.916	0.289	0.432	0.670	0.504

Overweight	0.021	0.009	2.180	0.029	0.021	0.009	2.490	0.013
Flu Shot	0.037	0.010	3.740	0.000	0.024	0.009	2.700	0.007