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INCENTIVES IN OBESITY AND HEALTH INSURANCE

Inas Rashad
Sara Markowitz

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ABSTRACT

The percentage of those uninsured in the U.S. has risen in recent years, although out-of-pocket expenditures have declined. At the same time, the obesity rate has significantly risen. We look at obesity in the context of a model in which the status of health insurance might play a role in influencing body weights. In this context, adverse selection is likely to be an issue, as those with ailments are more likely to sort themselves into being covered by insurance, or to be shut out of the health insurance market. At the same time, those who are insured might be more likely to be negligent when it comes to their health, or to be more careful due to the services they are receiving. Using 1993-2002 BRFSS data, we aim to isolate these opposing factors in determining the potential effect of health insurance status on obesity. We control for a variety of confounding factors that may influence obesity prevalence and address the endogenous nature of health insurance. We focus on isolating the effect of ex ante moral hazard rather than ex post moral hazard, and find little evidence of moral hazard in this context.

Inas Rashad
Georgia State University
AYSPS 529
P.O. Box 3992
Atlanta, GA 30302-3992
and NBER
irashad@gsu.edu

Sara Markowitz
Rutgers University
Department of Economics
360 Dr. Martin Luther King Jr. Blvd.
Newark, NJ 07102
and NBER
smarkow@rutgers.edu

"No sight so sad as that of a naughty child," he began, "especially a naughty little girl. Do you know where the wicked go after death?"
"They go to hell," was my ready and orthodox answer.
"And what is hell? Can you tell me that?"
"A pit full of fire."
"And should you like to fall into that pit, and to be burning there forever?"
"No, sir."
"What must you do to avoid it?"
I deliberated a moment; my answer, when it did come, was objectionable: "I must keep in good health, and not die."
- ***Chapter 4, Jane Eyre, by Charlotte Brontë***

I. Introduction

Health insurance is widely regarded as a vital input in the production of good health, but is insurance always beneficial for our health? Insurance reduces the monetary cost that individuals pay for health care, but this reduction can also lead individuals to change their behaviors. This "moral hazard" associated with health insurance can manifest itself not only by altering purchasing decisions, but also by changing other health-related behaviors. These two types of behavioral changes are termed "ex post moral hazard" and "ex ante moral hazard," respectively (Ehrlich and Becker 1972). It is this ex ante moral hazard in particular that may be bad for one's health. In the absence of insurance, individuals have strong incentives to engage in behaviors that help prevent injury and illness – for example, eating nutritious foods, exercising regularly, and avoiding risky activities. In the presence of insurance, however, the incentives to engage in health promoting behaviors are lessened as the costs incurred from being sick are lowered.

In the United States, the percentage of health care expenditures paid directly by consumers has been declining fairly consistently since the 1960s. Figure 1 shows this decline by examining the share of total personal health care expenditures paid for by different sources: consumers, private sources, and governments. Personal health expenditures include payments for hospital, physician and other professional care, nursing home and home health care, durable medical equipment, and prescription drugs. At the same time, health care costs are increasing (now estimated to be rising twice as fast as inflation) and fewer people are being covered by health insurance. Our concern in this paper, however, is whether, as consumers have become insured and less responsible for paying for health care, they have changed their preventative behaviors. We use the case of obesity in the United States to answer this question.

Obesity is a desirable outcome to study for it may be plausibly affected by the availability of health insurance and the ex ante moral hazard problem. Most experts agree that body weight can be lowered with proper diet and exercise, making obesity and its associated conditions preventable by a change in behaviors not directly related to the receipt of medical care. Although the "disease" status of obesity is still debated, health insurance for the most part does not cover weight-loss treatment and only in isolated cases does it cover gastric bypass surgery, which carries with it many risks and is only recommended for the morbidly obese.[1] One caveat to note is that obesity can be related to the ex post moral hazard problem if insurance coverage encourages people to visit the doctor and they receive and follow advice to lose weight (Dave and Kaestner 2006). However, the extent to which physician advice is given and followed is debatable. Some studies have shown such counseling to be effective in promoting weight loss strategies (Kant and Miner 2007; Loureiro and Nayga 2006), while others have shown physician counseling to have a minimal effect on the actual behavior of patients (Wee et al. 1999; Conway et al. 1995; Nagasawa et al. 1990; Clark 1991; Eraker et al. 1984; Ammerman et al. 1993). Since patients exhibit certain characteristics atypical of nonpatients, and because physician counseling is not consistent across different demographic groups that exhibit similar ailments (Abid et al. 2005; Taira et al. 1997; Kreuter et al. 1997), we explore models where we account for physician visits.

[1] In November of 2005, the Centers for Medicare & Medicaid Services proposed national Medicare coverage for bariatric surgery procedures. See the U.S. Department of Health and Human Services website at http://www.cms.hhs.gov/apps/media/press/release.asp?Counter=1733 for more details.

Obesity is defined by the National Institutes of Health as having a body mass index of 30 kg/m^2 or greater. The percentage of individuals classified as obese has risen dramatically, particularly in the 1980s (Figure 2). Estimates using the National Health Examination Survey show that 12.7 percent of the U.S. population aged 18 and over were obese in the early 1960s. The proportion rose slightly to 13.9 in the early 1970s and to 14.0 in the late 1970s. By the late 1980s and early 1990s, however, 21.6 percent of the population was classified as obese, and this number grew to an astounding 31.7 percent by 2004. Obesity carries many risks for a host of disorders, including heart disease, hypertension, stroke, cancer, depression, and blindness (Must et al. 1999; Mokdad et al. 2003; RNIB 2006).

Obesity is a national and global epidemic and has in its roots many potential causes. A variety of economic causes have been explored including reductions in job strenuousness (Philipson 2001; Lakdawalla and Philipson 2002), technological innovation in food processing and preparation (Cutler et al. 2003), the growing availability of restaurants (Chou et al. 2004; Rashad et al. 2006), urban sprawl (Ewing et al. 2003), and time preference for the present (Komlos et al. 2004; Smith et al. 2005; Zhang and Rashad forthcoming). Relatively few studies, however, have focused on the possible role of health insurance as a contributing factor to rising rates of obesity. We examine obesity in the context of a model in which status of health insurance might play a role in determining body weights.

As discussed in more detail below, the relationship between health insurance and obesity status is complicated by structural endogeneity and the potential influence of other confounding factors such as work status and income. For example, individuals with higher incomes are less likely to be obese yet more likely to have health insurance. Is it the case that these people would be even thinner had they no health insurance, as they would not discount the future heavily when they are without insurance? Or would they instead be heavier without health care, as medical services are believed to improve health outcomes? In this example, the net effect of health insurance on body weight is ambiguous. In general, existing theories regarding the production of health in the context of insurance may help guide predictions, but ultimately this is an empirical question. If health insurance has a causal negative influence on good health, then moral hazard may be a true concern. Yet if the opposite holds, this might lend further support for expanded or universal health insurance due to the benefits that health insurance yields.

Using data from the Behavioral Risk Factor Surveillance System (BRFSS) from 1993 to 2002, we aim to uncover the effect that health insurance has on an individual's obesity status. We employ instrumental variables techniques to address the endogeneity of health insurance status and stratify the sample into groups based on health status to mitigate the effects of ex post moral hazard and adverse selection. To account for variables affecting caloric intake and expenditure, which are likely to affect obesity, we control for state-level variables such as fast-food and food at home prices, in line with recent work by Chou et al. (2004) and Rashad et al. (2006).

II. Literature Review

The literature examining ex ante moral hazard is somewhat limited, with many of the studies examining the effects of health insurance coverage on the receipt of preventative services (Roddy et al. 1986; Lillard et al. 1986; Cherkin et al. 1990; Card et al. 2004). A few studies have examined health behaviors directly. For example, using data from the RAND Health Insurance Experiment, Newhouse (1993) examines differences in BMI, levels of physical activities, smoking, and alcohol consumption among individuals enrolled in cost sharing insurance plans and free plans. The results show no difference in these behaviors between the two groups. Kenkel (2000) also finds little evidence of a moral hazard effect in his analysis of individual behaviors using the 1990 National Health Interview Survey. His analysis suggests that people with private health insurance are more likely to engage in health promoting behaviors than those without insurance, with the one exception that men with health insurance are more likely to be obese. Kenkel does acknowledge that his results may be biased if omitted factors jointly determine insurance status and health practices.

Courbage and Coulon (2004) examine the ex ante moral hazard question using data from the 2000/2001 wave of the British Household Panel Survey. Their outcomes of interest include smoking and frequency of exercising which is defined as walking, swimming, or playing sports. Insurance in the U.K. is provided nationally to all residents; however, a secondary market exists where residents buy private insurance to avoid the waiting lists prevalent in the national insurance market. The authors use the purchase of this secondary insurance as their test of ex ante moral hazard. Using probits and an instrumental variable strategy, the authors find that having secondary insurance does not reduce preventative efforts and in fact may increase them. However, given that all residents are covered by the national insurance, these results are not surprising. Their analysis essentially tests the speed of receiving care, not the presence of or generosity of insurance.

Card et al. (2004) take a unique approach to examining the relationship between health behaviors and insurance by looking at smoking, exercise, and obesity among the near-elderly and the elderly. Eligibility for Medicare at age 65 is used as an exogenous measure of insurance coverage. Using data from the 1999-2002 BRFSS surveys, they find that, in general, these health behaviors do not change with Medicare eligibility. They do, however, show that being age 65 or older is associated with a rise in the probability of being obese among men, blacks, and low-educated minorities. Such a result is consistent with the ex ante moral hazard problem, but is not consistent with the authors' supposition that increased access to medical care will reduce poor health habits as doctors dispense advice on the health consequences of the behaviors. The authors dismiss the positive coefficients as a product of misspecification or sampling error as the results seem to be driven by a downward dip in obesity just prior to age 65.

Battacharya and Sood (2005) address the obesity externality by looking at the current scenario where health insurance is not risk rated for obesity, showing that coverage would therefore shield people from the full costs of an unhealthy lifestyle. They estimate the welfare cost of obesity using the 1998 Medical Expenditure Panel Survey and the 1997 National Health Interview Survey. Excluding the uninsured, who "do not face the obesity externality," they estimate the increase in medical expenditures for insured persons shifting from their optimal weights and compare this value with predetermined costs for the uninsured. The authors suggest increasing the coinsurance rate, and also hint at subsidizing a healthy lifestyle by reducing the welfare loss through technological change that decreases the costs of engaging in a healthy lifestyle. The authors claim that the "primary mechanism by which obesity is subsidized is through health insurance."

III. Methodology

Zweifel and Manning (2000) describe a model for the ex ante moral hazard and discuss the determinants of the optimal amount of preventive effort exerted by an individual. This effort is determined by the probability of illness, the monetary loss from illness, labor supply, wages, health insurance coverage, sick pay, and insurance premiums. The benefit of engaging in prevention efforts is the decreased probability of suffering losses from illness, while the costs of prevention efforts are the opportunity costs of engaging in prevention. In this model, prevention is measured in time units and monetary costs of these efforts are ignored. However, such monetary costs would be included in the opportunity cost of prevention. One important result that comes from this model is the theoretical ambiguity of the effects of health insurance on the prevention effort. The level of insurance coverage affects premiums and these changes alter both the marginal costs and benefits of prevention. The net effect is ambiguous and therefore becomes an empirical question.[2]

The possibility of ex post moral hazard also must be considered in making predictions of the effects of health insurance on obesity status. This may arise if insurance coverage encourages people to visit the doctor, and the treatment they receive (perhaps in the form of advice) encourages weight loss (Dave and Kaestner 2006; Kant and Miner 2007; Loureiro and Nayga 2006). In this case, a negative relationship would arise between insurance coverage and obesity. On the other hand, there is some evidence of the minimal effectiveness of physician counseling on the diet and exercise behaviors of patients (Wee et al. 1999; Clark 1991; Ammerman et al. 1993). Nevertheless, we present some models below that omit patients who had seen doctors recently (within the past year) to help guard against this potential confounding effect.

Lastly, results from the Grossman (1972) model further complicate the relationship between obesity and health insurance in that health status may determine insurance status, and other factors may influence or be influenced by both body weight and health insurance. For example, those who are obese are more likely to have certain illnesses or to seek insurance against their potential future maladies. Alternatively, obese persons may have a time preference

[2] See Zweifel and Manning (2000) for details.

for the present (or discount the future more heavily than non-obese persons) and choose not to have insurance. We use instrumental variables to avoid these confounding effects.

The regression in which we are most interested is of the following form:

(1) $$Obese_i = \gamma_0 + \gamma_1 HealthIns_i + \gamma_2 X_i + \gamma_3 \alpha_i + \varepsilon_1$$

where *i* indexes individual observations, *obese* represents the probability of being obese, or having a body mass index greater than or equal to 30 kg/m^2, *Healthins* is a dichotomous indicator for health insurance, and X_i represents the vector of other relevant variables such as the probability of illness, the potential monetary loss from illness, labor supply, and wages. As discussed below, we include measures for income and education, but unfortunately, some of the variables that are important in the theoretical model are not available in existing data sets. While demographic and socio-economic variables will help control for some of these unobserved factors, we recognize that many of these factors will remain unobserved in the error term.

Another problem to consider occurs when health insurance status is determined by obesity status:

(2) $$HealthIns_i = \beta_0 + \beta_1 Obese_i + \beta_2 X_i + \beta_3 Z_i + \beta_4 \alpha_i + \varepsilon_2$$

Given this, a simple estimation of the obesity equation (1) will yield a biased estimate of the coefficient on health insurance if there are common unobservable factors (α_i) influencing both obesity ($\gamma_3 \neq 0$) and health insurance ($\beta_4 \neq 0$), which is analogous to an omitted variable bias, or if obesity is a determinant of health insurance ($\beta_1 \neq 0$), which is the case when we have adverse selection. We address these sources of endogeneity using instrumental variable models with the percentage of the state workforce employed in different sized firms as the instruments (Z_i). Details are discussed below.

In the models below, we empirically estimate equation (1) using a pooled cross-section of individuals over time. Our goal is to obtain a consistent estimate the effect of health insurance on obesity status. Assuming we are able to avoid the problems of endogeneity discussed above, a positive coefficient is indicative of the presence of ex ante moral hazard; that is, having health insurance leads to unhealthy behaviors that contribute to obesity. A zero or negative coefficient will indicate the absence of any ex ante moral hazard effect.

IV. Data

Ten years of individual-level data from the Behavioral Risk Factor Surveillance System (BRFSS), 1993-2002, are used in our analysis. As the largest telephone-based health survey available, the BRFSS has tracked health conditions and risk behaviors for adults in the U.S. since 1984. The survey is conducted by state health departments in collaboration with the Centers for Disease Control. Not all states are included in the early years of the data; however, forty-nine states plus the District of Columbia are included by 1993, our first year of analysis. We begin in 1993 and end in 2002 since these are the years for which information is available on all of our variables of interest. These data are publicly available from the Centers for Disease Control.

Information on self-reported body weight and height are available in all years of data. Using this information, we create a measure of obesity using the body mass index, defined as weight in kilograms divided by height in squared meters, which is what the National Institutes of Health use to track obesity over time. The dichotomous indicator of obesity is equal to 1 for individuals with a body mass index greater than or equal to 30 kg/m^2. While some measures of obesity, such as biometrical impedance analysis (BIA), may be more superior measures of obesity (Cawley and Burkhauser 2006; Wada 2005), they are costly and are not routinely measured in physical examinations. The body mass index is a nationally representative measure that fairly accurately measures weight changes over time. To somewhat mitigate error due to self-reports, we use objective measures of weight and height from the third National Health and Nutrition Examination Survey (NHANES) to construct an adjusted, more accurate measure of obesity. Because NHANES gathers information on both self-reported and actual weight and height, we adjust BMI in the BRFSS using this information. This is done separately by age, gender, and race, and has previously been used (Chou et al. 2004; Cawley 1999).[3] Health insurance is measured by a dichotomous indicator for whether or not the individual has any kind of health care coverage, be it from private or public sources.

The BRFSS data also include information on personal characteristics. We include in all models the following variables: Age and age squared; gender; race as represented by indicators for white (the omitted reference category), black, Hispanic, and other race; level of education as represented by dichotomous indicators for less than high school (the omitted reference category), some high school, high school degree, and college degree; family income and income squared; and marital status. We limit our sample to individuals between the ages of 25 and 55 who are employed. We exclude those under age 25 because the time preferences of these individuals may make their incentives and outcomes very different from older individuals. We exclude those older than 55 to avoid potential changes in behaviors brought on by the anticipated receipt of Medicare.

Following Chou et al. (2004) and Rashad et al. (2006), we also include in all models some state-level variables that have been shown to be important determinants of obesity status and body weights. These are state-level food, soft drink, and cigarette prices. These prices are

[3] We find that the correlation between BMI and adjusted BMI is 0.99. Regression results using BMI and adjusted BMI are also very similar.

obtained from ACCRA and are given for various cities across the U.S. every quarter. The ACCRA food-at-home price is made up of a weighted average of thirteen food prices, in which the weights are the reported average expenditure shares of these food items by consumers according to ACCRA. These thirteen foods are: steak, beef, sausage, chicken, tuna, milk, eggs, margarine, cheese, potatoes, bananas, lettuce, and bread. The ACCRA fast-food price is formed by taking the average prices of a hamburger (McDonald's), a pizza (Pizza Hut), and fried chicken (KFC).[4] The price of a 2-liter bottle of Coca Cola is included as a proxy for soft drink prices. Cigarette prices are included due to the metabolic and appetite suppressing effects that smoking may have. A cost of living index is also reported for each city. Before averaging prices in each state by quarter, we divide each price by the city's cost of living to account for regional variation in prices. The four quarters are then averaged, yielding a price for each state in each year. All annual prices are divided by the consumer price index, generating real prices in 1982-84 dollars.

All models also include state and year indicator variables. The state indicators will help to capture any unobserved time-invariant state effects which may influence obesity and may be correlated with health insurance status. Time dummies are included to capture secular trends in obesity.

The instrumental variables used in this study are the percentage of each state's workforce employed in firms of different size. The included firm sizes are 5-99 employees, 100-499 employees, and 500+ employees. These annual data come from the U.S. Small Business Administration. We believe that firm size is a useful instrument on a theoretical basis, as health insurance is strongly tied to employment in the United States, and firm size is a known predictor

[4] More detail on these variables can be found in Chou et al. (2004).

of whether health insurance is offered to employees, with individuals in large firms more likely to have health insurance (Fronstin 2006).

V. Estimation

We use a variety of techniques and restrictions on the data to address the problems of endogeneity of health insurance in the obesity equation and the confounding effects of ex post moral hazard. In all tables below, ordinary least squares (OLS) models provide baseline estimates. These are compared with two-stage least squares (TSLS) models that use firm size as instruments.[5] Because of our reliance on firm size as the instrument, we restrict the main analysis sample to those individuals reporting working at the time of the survey. This restriction excludes approximately 16 percent of the respondents.

Each table includes OLS and TSLS models for the full sample of working individuals along with a second restricted sample that includes only "healthy" individuals. Healthy individuals are defined as those who report that their general health is very good or excellent, and they do not report diabetes, high cholesterol, or any heart problems. The healthy sample is considered because this is a group for which reverse causality, or structural endogeneity, is less likely to be an issue since healthy persons are unlikely to purchase insurance for health reasons.

Next, a further restriction is placed in that only individuals who did not visit a doctor in the past year are included in the sample.[6] This restriction represents an alternative way to help mitigate the influence of illness status in determining insurance status (the reverse causality

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[5] Due to the large sample size, we estimate linear probability models rather than logit or probit models. All regressions apply heteroskedasticity-robust variance estimators. Justification for using linear probability for estimating simultaneous equations with dichotomous dependent variables is provided by Heckman and MaCurdy (1985) and Angrist (2001).

[6] We realize that this is not a perfect stratification, as respondents may not be fully aware of their health status if they have not seen a doctor in the year prior to being interviewed.

effect) and to help eliminate the possibility of doctor advice in influencing body weight (the ex post moral hazard effect).

VI. Results

Weighted means of the variables are shown in Table 1. Eighty-seven percent of our sample of employed individuals has some kind of health insurance coverage. Note that restricting the sample to working individuals does not alter this proportion much. Eight-five percent of individuals of any working status have health insurance in the BRFSS data.

The proportion of the sample that is obese and without health insurance is slightly higher than that of the sample that is obese with health insurance. A similar statement can be made for those with lower levels of income and education. Those who are married, who may receive health insurance through their spouses, are highly likely to have health insurance. Not surprisingly, Table 1 also reveals that those who are healthier are more likely to have health insurance.

Table 2 shows results from regressions of obesity on health insurance status. The OLS results suggest that having some kind of health insurance coverage is associated with an increase in obesity of approximately 1.3 percentage points (column 1) in the full sample and a decrease of 0.7 percentage points in the healthy sample (column 3). Those with a college education have substantially lower obesity probabilities, as are those of younger ages, those who are divorced, and those who have higher levels of income.

Those who are obese might sort themselves into health insurance plans due to the higher probability of needing medical care. Once we account for the endogeneity of health insurance using IV techniques in columns 2 and 4, the positive effect of health insurance on obesity disappears. In the full sample (column 2), health insurance coverage is associated with a statistically insignificant 8 percentage point reduction in the probability of being obese and a marginally significant 32.6 percent reduction in obesity in the healthy sample of column 4. The magnitude of this latter effect is implausibly large, which may be indicative of problematic instruments. Statistics evaluating the validity of the instruments are presented in the last three rows of Table 2. For the full sample, the value of the F-test on the instruments in the first stage is large (30.02) and significant at the 1 percent level. The overidentification test indicates that the instruments are uncorrelated with the error term and are properly excluded from the second stage equation. The Hausman test rejects the null of the consistency of the health insurance coefficient in the OLS equation at the 5 percent level. Taken together, these three tests provide strong evidence for the validity of the instruments and the believability of the TSLS results. In the sample of healthy individuals, the statistics are not quite as compelling. The F-test on the instruments in the first stage is significant at the 1 percent level, and the overidentification test implies the instruments are valid. However, the Hausman test rejects the exogeneity of health insurance at the 10 percent level, but not at the 5 percent level. It is therefore not clear which results to believe in the sample of healthy individuals.

The models in Table 3 take an alternative approach to avoiding the problems of adverse selection and ex post moral hazard and restrict the sample to those individuals who have had no physician visits in the year prior to interview. The results presented here reveal health insurance to have little, if any, effect on obesity in all models. The insured and uninsured groups are most comparable in the healthy sample, which reveals health insurance coverage to have no significant effect on the probability of being obese, whether or not insurance is treated as exogenous or endogenous. In all models, the F-tests on the instruments in the first stage are significant at the 1 percent level, and the overidentification test implies the instruments are valid. The Hausman test cannot reject the exogeneity of health insurance at conventional levels. These results indicate that limiting the sample to those individuals without physician visits may be sufficient to alleviate the confounding effects of ex post moral hazard or adverse selection and make the OLS results trustworthy.

VII. Discussion

Since obesity is largely affected by environmental factors, there has been much debate over whether those who are obese should be penalized in some way through the health insurance system, such as through the charging of higher premiums. There has not been much support for this proposition by those in the policy arena, particularly due to the equity concerns it raises. More proactive measures such as subsidizing other inputs in the health production function have been proposed. Our aim in this paper has been to address the potential moral hazard problem that might arise through the presence of health insurance, in that persons might engage in riskier behaviors that lead to poor health or obesity. This may have implications in terms of proposals suggesting limitations on health insurance in efforts to encourage people to lead a healthier lifestyle. Using the Behavioral Risk Factor Surveillance System from 1993 to 2002 and taking the endogeneity of the health insurance variable into account, we do not find overwhelming evidence of this type of behavior. In particular, taking physician visits into account, we do not find a causal positive effect of health insurance status on the probability of being obese.

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Table 1
Weighted Sample Means/Proportions
(Standard Deviations)

Variable	Description	All	With HI	Without HI
Health insurance	Dichotomous variable that equals 1 if respondent has some form of health insurance coverage	0.87	--	--
Obese	Dichotomous variable that equals 1 if BMI is equal to or greater than 30	0.23	0.23	0.24
Some high school	Dichotomous variable that equals 1 if respondent completed at least 9 years but less than 12 years of formal schooling	0.05	0.04	0.13
High school	Dichotomous variable that equals 1 if respondent completed exactly 12 years of formal schooling	0.29	0.28	0.37
Some college	Dichotomous variable that equals 1 if respondent completed at least 13 years but fewer than 16 years of formal schooling	0.28	0.28	0.25
College	Dichotomous variable that equals 1 if respondent graduated from college	0.35	0.38	0.16
Age	Age of respondent	39.14 (8.38)	39.43 (8.35)	37.12 (8.30)
Age squared	Age of respondent squared	1602.0 (666.8)	1624.6 (667.0)	1446.5 (644.7)
Black	Dichotomous variable that equals 1 if respondent is black but not Hispanic	0.10	0.09	0.12
Hispanic	Dichotomous variable that equals 1 if respondent is Hispanic	0.10	0.08	0.23
Other race	Dichotomous variable that equals 1 if respondent is not white, black, or Hispanic	0.05	0.05	0.05
Male	Dichotomous variable that equals 1 if respondent is male	0.57	0.56	0.61
Real family income	Real household income in thousands of 1982-84 dollars	37.22 (27.92)	39.89 (28.17)	18.85 (17.21)
Real family income squared	Real household income in thousands of 1982-84 dollars squared	2164.9 (2990.1)	2384.5 (3080.8)	651.4 (1588.7)
Married	Dichotomous variable that equals 1 if respondent is married	0.67	0.70	0.48
Divorced	Dichotomous variable that equals 1 if respondent is divorced or separated	0.14	0.13	0.22
Widowed	Dichotomous variable that equals 1 if respondent is widowed	0.01	0.01	0.02
Food at home price	Real state ACCRA food at home price divided by (the cost of living*the CPI) in 1982-84 dollars	1.02 (0.05)	1.02 (0.05)	1.02 (0.05)

Fast food price	Real state ACCRA fast food price divided by (the cost of living*the CPI) in 1982-84 dollars	2.68 (0.19)	2.68 (0.19)	2.69 (0.19)
Soda price	Real state ACCRA Coke price divided by (the cost of living*the CPI) in 1982-84 dollars	0.69 (0.10)	0.69 (0.09)	0.69 (0.10)
Cigarette price	Real state ACCRA cigarette price divided by (the cost of living*the CPI) in 1982-84 dollars	13.98 (3.74)	13.97 (3.74)	14.06 (3.78)
Healthy	Dichotomous variable that equals 1 if respondent's general health is very good or excellent, and if respondent does not have diabetes, high cholesterol, or any heart problems	0.59	0.61	0.48
Visited physician	Dichotomous variable that equals 1 if respondent visited a physician in the past year	0.62	0.65	0.42

Note: BRFSS sample weights are used in calculating the means, proportions, and standard deviations. Difference between those with health insurance and those without health insurance is statistically significant at the 1% level for all variables.

Table 2
Effects of Health Insurance on Obesity among Employed Individuals

	Full Sample		Healthy Sample	
	OLS	TSLS	OLS	TSLS
Health insurance	0.013	-0.083	0.007	-0.326
	(7.17)	(-0.59)	(3.26)	(-1.73)
Some high	0.010	0.013	0.008	0.004
	(1.68)	(1.75)	(0.92)	(0.41)
High	-0.007	0.006	-0.011	0.021
	(-1.40)	(0.30)	(-1.36)	(1.05)
Some college	-0.007	0.009	-0.014	0.025
	(-1.25)	(0.38)	(-1.73)	(1.06)
College	-0.059	-0.041	-0.056	-0.009
	(-11.24)	(-1.59)	(-6.97)	(-0.33)
Age	0.009	0.009	0.007	0.007
	(14.61)	(14.25)	(8.72)	(8.38)
Age squared	-0.0001	-0.0001	-0.00004	-0.00005
	(-7.57)	(-7.55)	(-4.60)	(-4.77)
Black	0.107	0.108	0.095	0.099
	(47.22)	(38.80)	(32.99)	(28.58)
Hispanic	0.033	0.030	0.036	0.030
	(12.91)	(6.07)	(11.22)	(6.65)
Other race	-0.019	-0.021	-0.020	-0.026
	(-7.11)	(-5.23)	(-6.17)	(-5.32)
Male	0.018	0.015	0.032	0.023
	(16.76)	(3.69)	(25.34)	(4.47)
Income	-0.002	-0.001	-0.002	0.003
	(-19.73)	(-0.36)	(-12.35)	(1.12)
Income squared	0.00001	0.000001	0.00001	-0.00003
	(13.25)	(0.08)	(8.45)	(-1.28)
Married	0.0005	0.004	0.007	0.019
	(0.29)	(0.74)	(4.00)	(2.78)
Divorced	-0.044	-0.043	-0.033	-0.030
	(-23.86)	(-18.82)	(-15.21)	(-11.03)
Widowed	0.001	0.004	0.009	0.015
	(0.27)	(0.59)	(1.39)	(2.05)
Food at home price	0.004	0.0004	0.006	-0.009
	(0.17)	(0.02)	(0.25)	(-0.36)
Fast food price	-0.002	-0.001	0.003	0.003
	(-0.25)	(-0.15)	(0.37)	(0.32)
Soda price	0.010	0.013	0.006	0.026
	(0.60)	(0.75)	(0.29)	(1.09)
Cigarette price	0.001	0.001	0.00003	0.0002
	(0.89)	(0.92)	(0.03)	(0.21)
N	599,291	599,291	360,941	360,941
F-test on instruments		30.020		16.410
		[0.000]		[0.000]
Overid test		0.324		4.168
		[0.850]		[0.124]
Hausman test		4.105		3.130
		[0.043]		[0.077]

Note: T-statistics in parentheses, p-values in brackets, and intercept not shown. Models also include state and year indicators.

Table 3: Effects of Health Insurance on Obesity among Employed Individuals with No Physician Visits in the Past Year

	Full Sample		Healthy Sample	
	OLS	TSLS	OLS	TSLS
Health insurance	0.002	0.160	0.004	0.159
	(0.71)	(0.88)	(1.12)	(0.69)
Some high	-0.004	-0.008	-0.012	-0.009
	(-0.43)	(-0.78)	(-0.83)	(-0.61)
High	-0.019	-0.041	-0.031	-0.046
	(-2.25)	(-1.55)	(-2.31)	(-1.77)
Some college	-0.015	-0.041	-0.032	-0.051
	(-1.75)	(-1.33)	(-2.42)	(-1.66)
College	-0.059	-0.090	-0.068	-0.092
	(-6.74)	(-2.45)	(-5.09)	(-2.43)
Age	0.007	0.006	0.004	0.003
	(5.69)	(4.81)	(2.97)	(1.96)
Age squared	-0.00005	-0.00004	-0.00002	-0.00001
	(-3.08)	(-2.69)	(-1.06)	(-0.53)
Black	0.086	0.088	0.077	0.078
	(16.69)	(15.78)	(11.70)	(11.17)
Hispanic	0.029	0.034	0.036	0.038
	(6.24)	(4.67)	(6.15)	(5.53)
Other race	-0.040	-0.036	-0.035	-0.031
	(-8.03)	(-5.00)	(-6.00)	(-3.75)
Male	-0.006	-0.006	0.008	0.009
	(-2.96)	(-2.50)	(3.48)	(3.23)
Income	-0.002	-0.005	-0.001	-0.004
	(-8.04)	(-1.30)	(-6.01)	(-1.01)
Income squared	0.00001	0.00004	0.00001	0.00003
	(5.69)	(1.21)	(4.43)	(0.95)
Married	0.005	-0.003	0.009	0.001
	(1.87)	(-0.32)	(2.95)	(0.10)
Divorced	-0.038	-0.039	-0.030	-0.030
	(-11.41)	(-10.62)	(-7.91)	(-7.84)
Widowed	-0.002	-0.006	0.006	0.004
	(-0.23)	(-0.55)	(0.52)	(0.32)
Food at home price	0.026	0.032	0.010	0.021
	(0.60)	(0.71)	(0.20)	(0.40)
Fast food price	0.026	0.027	0.035	0.039
	(1.68)	(1.73)	(2.00)	(2.06)
Soda price	0.035	0.032	0.046	0.037
	(1.09)	(0.99)	(1.26)	(0.95)
Cigarette price	0.001	0.001	0.0003	-0.0002
	(0.84)	(0.57)	(0.17)	(-0.11)
N	164,789	164,789	104,686	104,686
F-test on instruments		12.700		7.620
		[0.000]		[0.000]
Overid test		2.558		0.498
		[0.278]		[0.779]
Hausman test		0.755		0.354
		[0.385]		[0.552]

Note: T-statistics in parentheses, p-values in brackets, and intercept not shown. Models also include state and year indicators.

Figure 1

Share of All Health Expenditures by Source, 1960-2004
Centers for Medicare and Medicaid Services
U.S. Department of Health and Human Services

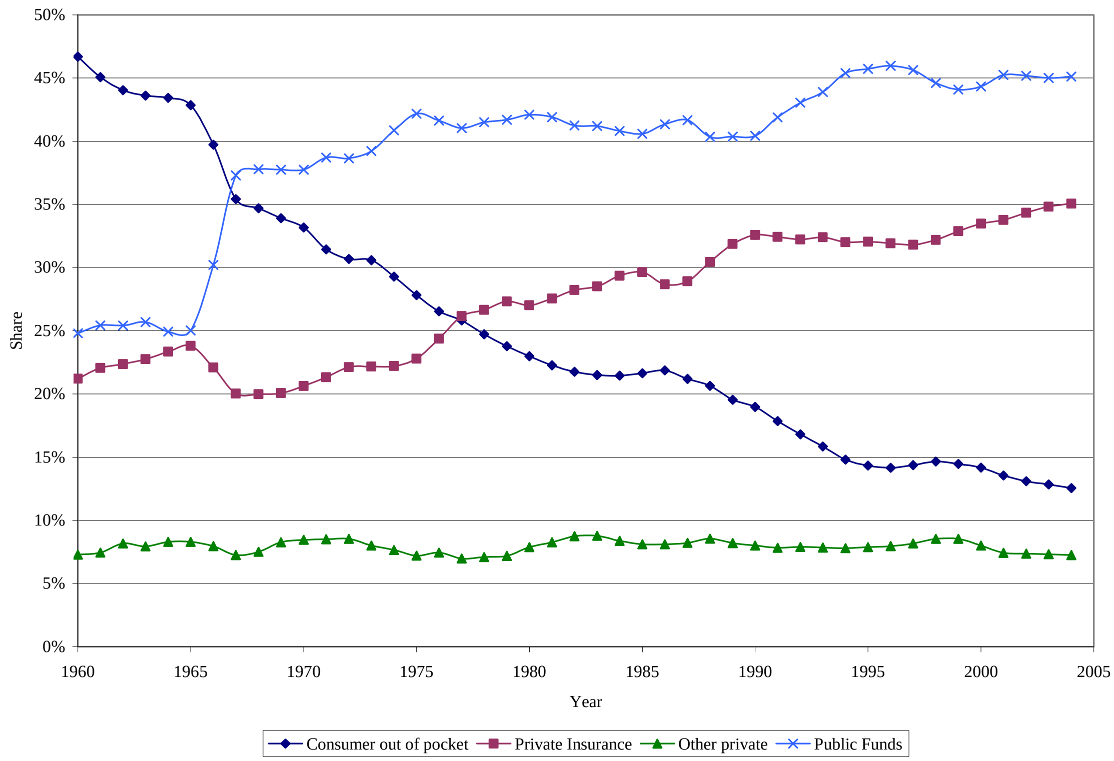

Figure 2

Obesity Prevalence, 1959-2000
National Health and Nutrition Examination Survey, 18 years of age and older

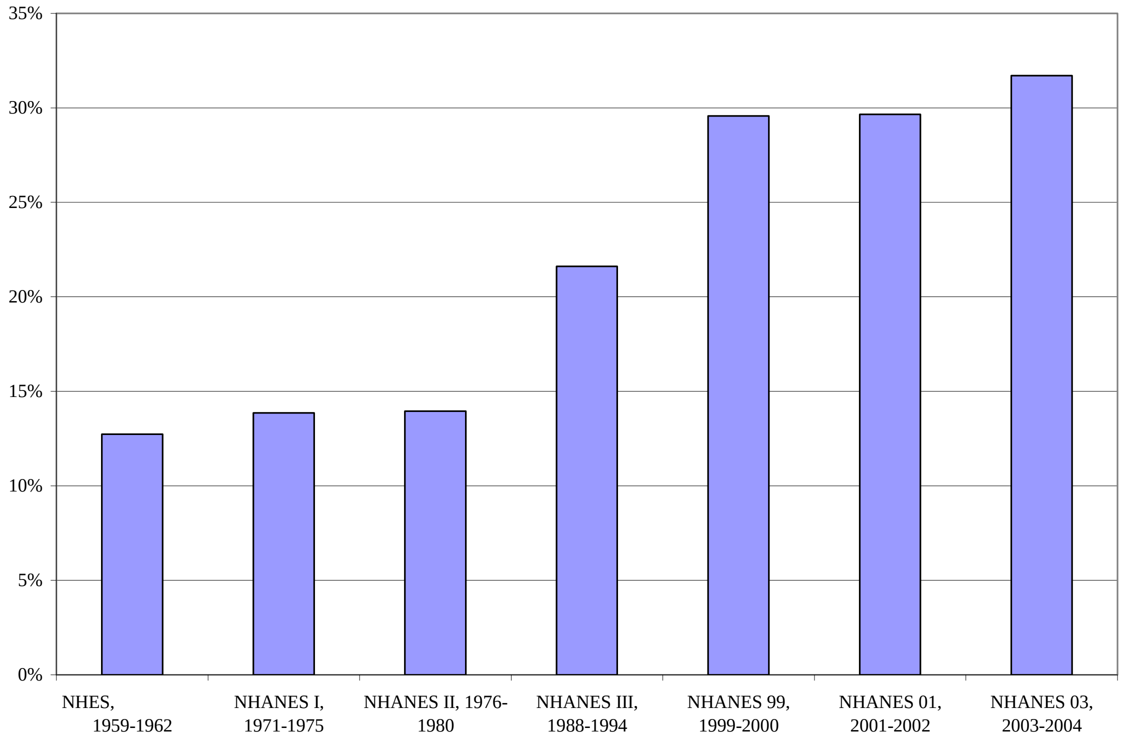

Figure 3

Obesity Prevalence & Health Insurance Coverage, 1991-2004
Behavioral Risk Factor Surveillance System, 18 years of age and older