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THE INCIDENCE OF THE HEALTHCARE COSTS OF OBESITY

Jay Bhattacharya
M. Kate Bundorf

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ABSTRACT

The incidence of obesity has increased dramatically in the U.S. Obese individuals tend to be sicker and spend more on health care, raising the question of who bears the incidence of obesity-related health care costs. This question is particularly interesting among those with group coverage through an employer given the lack of explicit risk adjustment of individual health insurance premiums in the group market. In this paper, we examine the incidence of the healthcare costs of obesity among full time workers. We find that the incremental healthcare costs associated with obesity are passed on to obese workers with employer-sponsored health insurance in the form of lower cash wages. Obese workers in firms without employer-sponsored insurance do not have a wage offset relative to their non-obese counterparts. Our estimate of the wage offset exceeds estimates of the expected incremental health care costs of these individuals for obese women, but not for men. We find that a substantial part of the lower wages among obese women attributed to labor market discrimination can be explained by the higher health insurance premiums required to cover them.

Jay Bhattacharya
117 Encina Commons
Center for Primary Care and Outcomes Research
Stanford University
Stanford, CA 94305-6019
and NBER
jay@stanford.edu

M. Kate Bundorf
Health Research and Policy
Stanford University
HRP T152
Stanford, CA 94305-5405
and NBER
bundorf@stanford.edu

1.0 Introduction

Annual medical expenditures are $732 higher on average for obese than normal weight individuals (Finkelstein, Flebelkorn et al. 2003).[1] But who bears the costs of medical care associated with obesity? In competitive health insurance markets, equilibrium prices never ignore relevant and easily observable data about the insured (Arrow 1963). Because obesity is easily observable by insurers[2], obese individuals who obtain health insurance in private markets are likely to pay for their higher utilization of medical care in the form of higher health insurance premiums. While the vast majority of the under-65 population in the U.S. obtains health insurance from private insurers, most coverage is obtained through employers. As a result, the incidence of the health care costs of obesity for the under-65 population is largely a question of the incidence of the costs of employer-sponsored coverage.

Premiums for employer-sponsored coverage could potentially reflect differences across individuals in observable risk factors through two mechanisms. First, workers often make an out-of-pocket contribution to the premium for coverage from an employer. Although these employee premium contributions could, in theory, vary by employee characteristics, they are rarely risk adjusted for obesity or any other observable risk factor (Keenan, Buntin et al. 2001). Alternatively, variation in individual expected expenditures could be passed on to individual workers in the form of differential wage offsets for employer-sponsored coverage. In the absence of risk-adjusted premium payments by workers, if wages did not adjust, firms in a competitive industry could make positive profits by hiring only thin workers. Equilibrium wage offsets based on weight eliminate such arbitrage opportunities. The existing literature, however, does not provide evidence on whether the incidence of the costs of employer-sponsored coverage varies by individual risk factors.

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[1] Differences in payments by insurers for obese and non-obese individuals are limited to some extent by coverage exclusions; for example, many insurers do not cover bariatric surgery or drugs to aid dieting.

[2] Even if weight and height are not currently reported in claims records, it would be a small change to require medical providers to report such information. Most providers already collect weight information during routine office visits, so the costs to providers would be low. Adult height does not change, so collecting such information would impose a one-time cost.

The absence of risk adjustment of health insurance premiums for observable risk factors like obesity potentially creates two sources of inefficiency. First, the absence of risk adjustment may lead to inefficient quantities of insurance coverage. In a population of heterogeneous risks, a movement of premiums away from the actuarially fair rate toward the average of the group distorts the quantity of health insurance purchased by consumers, potentially leading to adverse selection (Pauly 1970; Rothschild and Stiglitz 1976). Second, a lack of risk rating of premiums may even lead to higher rates of obesity by creating moral hazard in risky behaviors that affect health expenditures (Ehrlich and Becker 1972). In other words, the failure of the obese to pay for their higher medical care expenditures through higher health insurance premiums may reduce incentives for individuals to maintain a normal weight (see (Bhattacharya and Sood 2006)). In summary, insurance underwriting procedures that ignore body weight potentially yield inefficient outcomes for both the obese and non-obese.

In this paper, we examine whether obese individuals receiving employer provided health insurance pay for their higher medical costs through reduced wages. Our empirical work is based upon a simple idea: all else equal, obese individuals with health insurance from an employer should receive lower wages relative to their similarly insured non-obese colleagues, while there should be no difference between the wages of obese and non-obese individuals in jobs without health insurance. We find that, while obese individuals who receive health insurance through their employer earn lower wages than their non-obese colleagues, obese individuals who receive health insurance through other sources or are uninsured earn about the same as their thinner colleagues. Furthermore, we show that a substantial part of these wage penalties at firms offering insurance can be explained by the difference between obese and non-obese individuals in expected medical care costs. Finally, we show that obese individuals pay no wage costs for other employer-provided fringe benefits, where obesity is not a relevant risk factor in price setting.

By providing evidence consistent with the risk rating of premiums for obesity through differential wage offsets, our findings reduce concerns over the possibility that inefficiencies in insurance markets are (in part) responsible for rising rates of obesity.

Our results suggest that the obese, at least those with employer-sponsored coverage, bear the full cost of the incremental medical care associated with obesity.

Our results also provide evidence on the validity of two controversial and important findings in economics, each of which has generated a large literature. The first is that even if employers nominally pay for health insurance premiums, it is really employees who bear the cost of employer-sponsored insurance. While there is only limited empirical evidence demonstrating the existence of *any* wage offset for health insurance, even less evidence is available on whether the wage offset varies across workers. Many studies, in fact, have produced estimates of either no relationship or a positive relationship between wages and the provision of health insurance (Gruber 2000). The few studies that produce evidence consistent with the theory of compensating differentials leave open the question of whether incidence is at level of the individual or the group (Gruber 1994; Pauly and Herring 1999; Sheiner 1999). Our results indicate that, in the case of obesity, these wage offsets not only exist, but also vary by individual characteristics.

The second finding is that the wages of obese workers are lower than those of their normal weight peers, and in the case of white women, the relationship appears to be causal (Cawley 2004). While obesity could cause lower wages through either invidious workplace discrimination or a negative effect of obesity on worker productivity, the absence of an effect of obesity on wages for either men or black women casts doubt on lower productivity as the explanation. In other words, the literature leaves open the possibility that white women experience significant labor market discrimination in the form of lower wages due to obesity. Our results suggest a reinterpretation of this literature. The lower wages of obese white women appear to be due, at least in part, to the higher cost of insuring these workers.

2.0 Empirical Framework

Standard economic theory predicts that jobs that provide fringe benefits provide correspondingly lower cash wages, reflecting the costs to employers and the value to workers of the fringe benefit (Rosen 1986). Although theory predicts that workers, not employers or firms, bear the incidence of the costs of fringe benefits, less is known about how these costs are allocated across workers when the cost of providing the fringe benefit varies across individuals. Individual-specific incidence requires that employers effectively risk rate premiums at the individual level and adjust the components of the compensation package correspondingly. Under these conditions, the wage differential for health insurance will be equal to the cost of providing health insurance to a particular worker. In practice, however, it is difficult to see how firms could appropriately set worker specific compensating differentials (Gruber 2000). Yet, the alternative - that employers pass on the average cost of providing health insurance to workers within a firm - is also potentially problematic in theory. Under this assumption, a worker's total compensation, the total cash wages and the value of the fringe benefits, would be dependent upon the health status of coworkers. Yet, in competitive labor markets, these types of differences across firms would not be sustainable.

In a job with no fringe benefits, in a competitive spot labor market the wages of worker *i*, w_i, will equal her marginal revenue product, MRP_i.[3] In firms that provide health insurance to their employees, this equality between wages and marginal product will be modified in equilibrium by the fact that health insurance provision is costly to firms. Suppose that health insurance premiums are actuarially fair and that workers within a firm vary in their expected health expenditures.[4] In that case, the premium charged to the firm for the coverage of worker *i*, say p_i, will exactly equal the expected medical costs of coverage, Em_i.[5] If incidence is specific to the individual worker, the equilibrium condition is:

$$(1) \qquad w_i = MRP_i - p_i = MRP_i - Em_i.$$

[3] By focusing on spot labor markets, we are abstracting away issues of investment in job-specific human capital which can also lead to differences between wages and marginal revenue product.
[4] This assumption could be relaxed to permit fixed loading charges without altering our main points.
[5] We assume for the sake of staying focused on our point that there are no employee out-of-pocket contributions to enroll in the employer provided health plan.

Equation (1) implies that the worker pays the full cost of health insurance coverage through decreased wages, even though the employer nominally provides the coverage, and that the wage offset varies by individual risk. Suppose instead that firms pool risk among workers, and that the wage offset for each employee is the mean cost of insuring each member of the firm: $\frac{1}{K}\sum_k Em_{kt} = \overline{p}$. In this second case, the equilibrium condition is:

(2) $$w_{it} = MRP_{it} - \frac{1}{K}\sum_k Em_{kt} = MRP_{it} - \overline{p}$$

To estimate the model, we parameterize the worker's marginal revenue product as a linear function of observable characteristics, X_i, that are correlated with productivity:

(3) $$MRP_i = \alpha + X_i\beta$$

Substituting this into equation (1), we obtain

(4) $$w_i = \alpha + X_i\beta - p_i$$

If we had information on p_i and $\overline{p}$ we could test directly whether wage offsets operate at the level of the individual or the group by estimating the following model:

(5) $$w_i = \alpha + X_i\beta - \overline{p} - \left(p_i - \overline{p}\right)$$

However, in our data we observe neither p_i nor $\overline{p}$. Instead, we observe whether an individual is enrolled in health insurance through her employer and whether the individual is obese, which is associated with higher expected health expenditures. Let ε_i represent a zero mean and orthogonal regression error and let α, β, δ, γ, and λ represent the parameters of the regression. Our empirical model is:

$$(6) \qquad w_i = \alpha + X_i\beta + \delta HI_i + \gamma O_i + \lambda HI_i \cdot O_i + \varepsilon_i$$

where HI_i indicates whether worker i enrolls in health insurance through her employer, O_i represents whether worker i is obese, and X_i represents a set of observable covariates that determine either labor market productivity, expected medical costs of insurance coverage, or both. λ represents the difference-in-difference estimate of the wage offset attributable to insuring obesity.

A key assumption underlying our identification strategy is that the factors that contribute to the observed negative relationship between obesity and wages (other than the higher cost of health insurance) are similar between workers in insured and uninsured jobs. One source of these types of differences is unobserved productivity differences between obese and non-obese workers. But such productivity differences by themselves are not enough to bias our estimates. Rather, our estimates will be biased only if such productivity differences differ between firms that do and do not provide health insurance. For example, one possibility is that health insurance increases the marginal productivity of obese workers by improving health.[6] We test whether differential productivity differences can explain our results by conducting a falsification exercise. In particular, we estimate a version of equation (6) in which we replace employer health insurance (*HI*) by indicators for other fringe benefits whose value depends weakly or not at all on body weight. If differential productivity differences are driving our main results, then we should find wage differentials ($\lambda < 0$) in our falsification exercise as well.

We conduct a similar falsification test by examining the relationship between the availability of health insurance through sources other than the workers' own employer and wages. If our estimate of the wage offset for obesity is biased by differences in the

[6] The empirical literature suggests that health insurance coverage does not have a large marginal effect on worker health. For example, in the RAND Health Insurance Experiment, the marginal health effects of generous first-dollar health insurance coverage over more stingy insurance are small (Newhouse, 1993). Levy and Meltzer (2004) survey the literature on the health effects of health insurance coverage and also conclude that the effects are small on the margin.

effect of obesity on worker productivity between insured and uninsured workers, we would expect to see similar wage offsets for workers with coverage from sources other than their own employer. Evidence that wage offsets do not exist for workers obtaining coverage through their spouse's employer, for example, would reduce this concern.

If workers with higher expected medical expenditures pay for employer-provided health insurance through lower wages, then we should find that wage offsets vary by the level of expected medical expenditure. Because expected health care expenditures increase with BMI, we expect that the wage offsets should also increase with BMI (Finkelstein, Flebelkorn et al. 2003). Thus, as an additional robustness check, we estimate a version of equation (6) that includes separate dummy variables and interaction terms for overweight (25<=BMI<30), mildly obese ($30 \leq BMI < 35$), and morbidly obese ($BMI \geq 35$) individuals.

Finally, we test for differences between small and large firms in the magnitude of the wage offset for obesity. Equation (2) implies that all the workers within the firm pay, in part, for the high medical costs of one of the employees. A one dollar increase in medical expenditures for worker *i* will decrease her wages by only $\$ 1/K$. Obviously, under pooling, as the firm size grows large, the marginal costs to any particular worker of higher expected medical costs tend toward zero. An implication of this is that, even if pooling exists at the level of the firm, we may observe wage offsets associated with obesity driven by limitations in pooling among small firms. In this case, it would not be possible to differentiate between firm level pooling, with differences by firm size in the extent of pooling, and individual incidence. We examine this by testing for differences in the magnitude of the wage offset by firm size. If the wage offsets we observe operate at the level of the firm, but emerge through this mechanism, we should find that they exist in small but not large firms. Alternatively, if the wage offsets operate at the level of the individual, they should exist in both small and large firms.

We estimate all of our models using ordinary least squares, applying the NLSY sample weights and allowing for within-person clustering when calculating the standard errors.

3.0 Data

The empirical work in this paper is based on two data sources, including the NLSY, collected by Bureau of Labor Statistics, for our analysis of obesity and worker wages, and the Medical Expenditure Panel Survey (MEPS) for our analysis of obesity and medical expenditures.

3.1 National Longitudinal Survey of Youth

The NLSY is a nationally representative sample of 12,686 people aged 14-22 years in 1979. The survey was conducted annually until 1994, and biennially through 2004. The NLSY retention rates are high and attrition has not been found to be systematic.[7] Our study uses NLSY data from 1989-2002. We use only post-1988 data because earlier years of the survey did not include questions on health insurance status or other types of fringe benefits offered by employers. We omit 1991 from our analyses due to the lack of information on health insurance status for that year. After these restrictions on the survey years, 88,412 person-year observations are eligible to be included in the study sample.

We further restrict the sample to individuals employed full-time in either a private or non-profit firm in a given year, defining full-time workers as those who indicate they usually worked 7 or more hours a day at their primary job (N = 52,594 person-years).[8] We exclude 770 observations of pregnant women from our study sample. Our main analysis sample is further limited to workers indicating they either had employer-sponsored health insurance in their own name from their current employer or were uninsured. After exclusions for missing data for control variables and key study variables (hourly wage, BMI, and insurance coverage), this sample includes 31,176 observations. We also construct an alternative analysis sample for our robustness check involving workers who receive health insurance from sources other than their employer. This

[7] Looking for evidence of differential attrition on the basis of wages, earnings, and education, MaCurdy, Mroz, et al. (1998) conduct an exhaustive examination of the NLSY 1979. They conclude that their "analysis offers little basis for suspecting that the NLSY79 presents an inaccurate picture of youths' labor market experiences."

[8] We exclude workers employed by the government as well as those who were either self-employed or employed in a family business due to differences in these types of employment situations in the wage setting process.

alternative sample includes all the workers in our main sample in addition to those with health insurance from other sources, so the sample size rises to 38,645 observations. Descriptive statistics for each sample are presented in Table 1.

The dependent variable in our analysis is the worker's hourly wage, which is the hourly rate of pay for the respondent's current or most recent job. We top and bottom code the wage at $1 and $290 per hour, respectively to correct errors in coding.[9] The NLSY includes measures of individual self-reported weight in each year and height in 1985 for each respondent.[10] We use these measures to calculate body mass index[11] (BMI) and indicators for overweight (25<=BMI<30) and obesity (BMI >=30). In some specifications, we distinguish mild obesity ($30 \le BMI < 35$) from morbid obesity ($BMI \ge 35$).

Health insurance status is defined in the NLSY questionnaire as coverage "by any kind of private or government health or hospitalization plans or health maintenance organization (HMO) plans."[12] Health insurance sources are identified for those with health insurance as either current employer, other employer (former employer coverage or spouse's current or former employer coverage), individually purchased, public (Medicaid, Medi-Cal, Medical Assistance, Welfare, Medical Services), or other source. Survey respondents are able to indicate more than one source of coverage, and we classify those indicating more than one source into a single source based on the following hierarchy: employer-sponsored coverage in own name, other source of employer-sponsored coverage, individual coverage, public coverage, and, finally, other coverage.

[9] Cawley (2004) follows this same procedure.
[10] In both the NLSY and MEPS data we use for the project, weight is self-reported. Although both men and women systematically misreport their weight,
Lakdawalla and Phillipson (2002) find that this misreporting is small enough that it does not affect the qualitative conclusions of their empirical work.
[11] BMI is weight, measured in kilograms, divided by height, measured in meters squared.
[12] The NLSY question on health insurance does not specify any particular time period of coverage, but in the context of the rest of questionnaire, it seems likely that respondents are giving information about their current health insurance coverage.

The control variables that we include in X_{it} are the survey year, gender, race (white, black, and other), an indicator of whether there are any children in the household and its interaction with gender, marital status (never married, married with spouse present, and other), age, age squared, education level measured by highest grade completed (0-8 years, 9-12 years, and 13 or more years), AFQT score (0-24th percentile, 25th-50th percentile, 51st-75th percentile, 76th-100th percentile), job tenure (less than 48 weeks, 48-143 weeks, 144-287 weeks, and 288 or more weeks), location of residence (urban or rural), number of employees at workplace (less than 10 people, 10-24 people, 25-49 people, 50-999 people, and 1000 or more people), industry category (agriculture; forestry and fisheries; mining; construction; manufacturing; transportation, communications, and other public utilities; wholesale trade; retail trade; finance, insurance and real estate; business and repair services; personal services; entertainment and recreation services; professional and related services; and public administration), and occupation category (managerial and professional specialty; technical and sales; administrative support; service; farming, forestry, and fishing; precision, production, craft, and repair; operators, fabricators, and laborers; and armed forces). Summary statistics for each analysis sample are presented in Table 1.

3.2 Medical Expenditure and Obesity Data

Because the NLSY does not report information on medical expenditures, we use an alternative data source to examine the relationship between obesity and medical expenditures. The 2003 Medical Expenditure Panel Survey (MEPS) collects nationally representative data on how much non-institutionalized Americans spend on medical care.[13] The MEPS tabulates expenditures on a comprehensive set of categories including inpatient care, outpatient care, and prescription drugs. The MEPS is the best available source of data on medical expenditures for a broad population because it combines a detailed survey of respondents along with an audit of those responses conducted by

[13] In an earlier draft of this paper, we also examined data from the 1998 MEPS. The results using 1998 data are substantively similar to the ones we report here. The main advantage of using the 2003 data is that unlike 1998, MEPS respondents were directly asked about their height and weight. To get such information for the 1998 sample, we had to link together the MEPS and 1996 and 1997 National Health Interview Survey data (where some MEPS respondents were asked about height and weight). Thus, the height and weight data for the 1998 MEPS come from 1997, while medical expenditure information comes from 1998. In 2003 height, weight, and expenditures are contemporaneously measured.

consulting the administrative records of health insurance companies, pharmacies, and hospitals. We exclude people who received health insurance through the Veterans' Administration or through Workers' Compensation programs from our analysis as well as children (under age 18) and pregnant women.

4.0 Results

4.1 Difference in Difference Estimates

Table 2 presents the difference-in-difference estimates of the effect of obesity on hourly wages using our main sample. When the data are pooled across all the years (1989-2002), the unadjusted difference-in-difference estimate of the incidence of obesity on wages for workers insured through their employer is -$1.68, and the estimate is statistically significant at the 1% level. The results indicate that the magnitude of the wage offset for obesity among those insured through their employer increased over time. The unadjusted estimate for 1989 is positive (+$0.28) and not statistically significant, while the direction of the effect changes and its magnitude becomes larger over time. By 2002, the unadjusted estimate is -$3.37 and statistically significant.

This trend in the difference-in-difference estimate emerges primarily because the wages of obese workers with health insurance grew less quickly than those of thinner workers with health insurance. The difference in average wages between the obese and the non-obese with health insurance grew from -$1.09 in 1989 to -$4.87 in 2002. Among workers without health insurance, in contrast, we do not observe a consistent time trend in the relative wages of the obese and the non-obese. While in most years, obese individuals earned less than non-obese individuals, this difference is rarely statistically significant, and in 1992, 1998, and 2000, obese individuals earned more than non-obese individuals in our sample. When we adjust for an extensive set of control variables, the estimate of the wage incidence of obesity declines in magnitude to -$1.45, but remains statistically significant.[14] Our qualitative results for the time trend in the wage differential also remain the same.

There are at least three plausible explanations for the time trend in the obesity wage penalty. First, the costs of treating obesity may have increased over time. Better, but more costly, treatments for the health consequences of obesity may have diffused into standard medical practice during this period, raising the cost of treatment conditional on being obese. In addition, those classified as obese may have become increasingly disabled, requiring more medical care. This explanation is consistent with evidence that body weight at the 95th percentile of the weight distribution has increased more rapidly than median body weight (Anderson, Butcher et al. 2003). Second, the trend may be attributed to the aging of the panel since the incremental medical expenditures associated with obesity increase with age (Finkelstein, Flebelkorn et al. 2003). The average age of individuals in the panel increased from 28 to 41 years from 1989 to 2002. Finally, the mechanism by which wages adjust may be that the wages of obese workers with health insurance rise more slowly than other workers. This is explanation is consistent with the structure of our panel data in the sense that they enter the study near the beginning of their working years and are tracked over time.

In Table 3, Model 1 presents the regression results we use to develop the adjusted estimate from the pooled sample in Table 2. The key coefficient is the interaction term between obesity and employer coverage, which represents our adjusted difference-in-difference estimate. Unsurprisingly, in Model 1, we find a large, positive relationship between employer-sponsored coverage and wages. Because we believe this is driven primarily by unobserved characteristics of worker productivity that are correlated with compensation in the form of both wages and health insurance, we do not interpret this as an estimate of employee incidence. We also find no evidence of an obesity wage penalty among workers without employer-sponsored insurance in this model.

4.2 Wage Offsets for Obesity among Workers with Alternative Sources of Coverage

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[14] The list of control variables is described at the end of Section 3.1.

We next examine whether we see similar wage offsets for obesity among workers with health insurance from sources other than their own employer (Table 3 – Model 2). We expect that these workers, even though they are insured, should not experience a similar wage offset since their coverage is not part of their compensation package. Correspondingly, we expand our sample to include all eligible workers regardless of health insurance status and include both the main effects of different types of coverage (health insurance through a different employer, individual coverage, public coverage, and other source) and their interactions with obesity.

In Model 2, we find the same statistically significant health insurance induced wage offset for obesity as we find in Model 1: -$1.44. By contrast, for health insurance through each of the other sources, the estimate of the wage offset is not statistically significant. Obese workers who receive employer-provided health insurance from other sources (such as their spouses) receive a statistically insignificant -$0.87 wage offset. Similarly, for obese workers who receive health insurance from the government, from other private sources, or from unknown sources, we find a statistically insignificant wage offset, even if the point estimates for such wage offsets are in places uncomfortably large.

Our favored explanation for the large point estimates for the wage-offset in the case of public insurance and other non-employer-based private sources is that in the NLSY, the timing of the insurance coverage information does not match perfectly with that of the reported wage. In the subset of full-time workers that we examine, coverage by public insurance or non-employer provided private insurance is a transitory phenomenon, used to bridge temporal gaps in employer-sponsored coverage (Ziller, Coburn et al. 2004). Many of the full time workers in our sample who report having non-employer provided insurance, for instance, will have moved on to employer-provided coverage by the time their wages are measured. The measured wage-offset due to coverage by an alternative employer is less likely to be affected by the asynchronous measurement of insurance coverage and wage since coverage by a spouse's employer tends not to be transitory. Consequently, our preferred test of the effects of alternative coverage is based on coverage through an alternative employer. The absence of differential wage offsets among the obese with coverage from an alternative employer provides evidence that our results are not driven by unobserved characteristics correlated with both health insurance and obesity. Furthermore, it lends support to our interpretation of the interaction term between employer-provided insurance and obesity as a measure of the wage-offset due to obesity at firms that provide health insurance.

4.3 Wage Offsets for Overweight and Obesity

Models 3 and 4 in Table 3 return to our main sample of full-time workers either covered by their employer or uninsured. In Model 3, we include an indicator of overweight ($25 \leq BMI < 30$) and distinguish mild obesity ($30 \leq BMI < 35$) from morbid obesity ($BMI \geq 35$), interacting each of these variables with the indicator of employer-provided health insurance. In the literature on medical costs of obesity, overweight individuals typically have much lower expenditures than the obese, and often have expenditures that do not differ substantially from normal weight individuals (Finkelstein, Flebelkorn et al. 2003). If the wage offsets we have observed for the obese do reflect increased medical expenditures, the relatively low medical expenditures of the overweight suggests there should be little or no wage offset for overweight in jobs that provide health insurance. In addition, because the health care expenditures of the morbidly obese are larger than those of the mildly obese, we expect their wage offset to be larger. The results from Model 3 are consistent with these relationships. We find no evidence of a wage offset for overweight workers. Overweight workers in jobs that provide health insurance earn a statistically insignificant $0.35 less than normal weight workers in similar jobs. We also find evidence suggesting that the wage offset for health insurance increases with obesity. The estimates of the wage offset is a statistically significant -$1.27 for mildly obese workers and -$2.22 ($p \leq 0.11$) for morbidly obese workers.[15]

4.4 Log Transformed Wage

In Model 4 (Table 3), we re-estimate Model 1 using a log transformation of the hourly wage. While most studies of the wage offset for obesity use a log transformation, we do

[15] Although we cannot reject the hypothesis that the estimates of the wage offset for mildly and morbidly obese workers are the same, the small number of morbidly obese, uninsured workers limits our ability to detect this effect.

not because it is not the correct specification to test the hypothesized relationship between obesity and wages in our study. In particular, the wage offset represents the incremental health care costs of obesity, and its magnitude should be independent of, not proportional to, the worker's wage. Using a log specification would be equivalent to parameterizing the health care costs of obesity as a percent of worker wages, and we see no *a priori* theoretical justification for this relationship. Nonetheless, we test this version of the model in order to provide estimates that are more comparable with the existing literature on the effects of obesity on wages. In this model, the point estimate indicates a statistically significant 5% average wage reduction. While our results our robust to this test, this is not our preferred specification because the theory of equilibrium wage-setting (Equation 1) suggests a linear decrease in wages with respect to the premium for health insurance as opposed to a proportional reduction relative to wages.

4.5 Obesity and Other Fringe Benefits

Health insurance is not the only fringe benefit that employers sometimes provide to their employees. The NLSY also asks survey respondents about the availability of other types of fringe benefits including life insurance, dental insurance, maternity leave, retirement benefits, profit-sharing, vocational training, child care, and flexible hours. Because the value of these benefits, for the most part, does not vary with worker weight, they provide an additional opportunity to test our empirical specification. While obese individuals do have shorter life spans than non-obese individuals (Flegal, Graubard et al. 2006), life insurance premium differences are substantially smaller than differences in medical expenditures. Obese workers should suffer little or no extra wage penalty if employers provide these benefits. This test allows us to determine if the results we find for health insurance are driven by omitted factors relating to worker productivity that affect the availability of all types of benefits.

We use the same differences in differences approach to test the incidence of other types of employer-sponsored benefits on worker wages. In other words, we regress hourly wage on indicators of obesity, the availability of a particular type of fringe benefit, and interaction of the two as well as the control variables included in the main models. The results in Table 4 indicate no wage penalty for the obese when employers offer any of the other fringe benefits that we consider, whether we adjust for covariates or not. For all the benefits listed, with the exception of health insurance, the survey does not provide information about whether the worker was enrolled, so we unfortunately cannot check whether the same results hold for enrollment for the other fringe benefits. Overall, these results provide strong evidence that our main findings are not driven by omitted variables that affect the availability of many types of benefits, such as unobserved productivity differences.

4.6 Gender Differences in Obesity Wage Penalties

One important finding of the obesity-wage literature is that it is women, rather than men, who suffer the greatest wage penalty from being obese.[16] In Table 5, we analyze the effects of including the insurance coverage variables in the wage regressions on the estimate of the effect of obesity separately for men and women. We find that obese men earn \$1.21 per hour less than non-obese men, while obese women earn \$1.66 less than non-obese women (Model 1 for men and women, respectively). Model 2, which includes enrollment in employer-provided health insurance (HI_{it}) as an additional control produces essentially the same results as Model 1 for both men and women. However, the results change considerably in Model 3, which includes an interaction term between obesity and HI_{it}. For women, we find that the wage penalty for obesity is concentrated in firms where employers provide health insurance—a \$2.64 penalty. In firms that do not provide health insurance, obese women earn 43 cents more than non-obese women, though the estimate is not statistically significant. For men, by contrast, while the wage penalty for obesity is no longer statistically significant in Model 3, the interaction between obesity and employer-provided insurance is also not statistically significant. In other words, the wage

[16] The most robust version of this finding is presented by Cawley (2004). Using the same dataset as our study, Cawley estimates wage regressions including individual fixed effects and finds evidence that the wage penalty for obesity is concentrated among white women. When we estimate our models like Cawley's—including fixed effects and a subset of time varying control variables—we do not find evidence of the wage offset for health insurance among the obese. However, we also do not find any evidence that obese individuals earn less than thinner individuals in the case of either male or female workers. These results, not included here, are available upon request from the study authors. Because the results presented by Cawley are based on a much longer panel (he includes NLSY data from before 1988 when respondents were not queried about health insurance) we believe that our inability to replicate Cawley's (2004) findings with our sample is driven by a lack of statistical power.

penalty associated with obesity is concentrated among workers with coverage from their employer for women, but not for men.

The results in Table 5 present important new evidence that suggests a rethinking of the conclusion that the obesity wage penalty for women is due mostly to discrimination. However, our finding of a substantial obesity wage-offset for women but not for men is potentially inconsistent with our interpretation that the differential wage-offset is due to the provision of health insurance. An important premise of this argument, however, is that obese individuals spend more on health care than do non-obese individuals. While results from the studies we discussed earlier indicate that this is indeed the case, we know of no estimate in the literature from nationally representative data that reports yearly medical expenditures for obese and non-obese separately for men and women.

Table 6 reports our calculations from 2003 MEPS which includes all adult Americans in its sample frame. The difference in the average health expenditures between the obese and the non-obese is larger for adult women than for adult men. Obese women spent $1,457 more per year on healthcare than did non-obese women; the analogous difference for men is $405. When we examine adults 20-50 and privately insured adults 20-50, the difference is even more striking. For these groups, obese men do not have greater medical expenditures than non-obese men. For privately insured women, however, the incremental medical expenditures associated with obesity are $583. These differences indicate that the absence of the wage offset for obesity among those with employer-provide insurance for men can be explained by the fact that the medical expenditures are not higher for obese men than for their normal weight counterparts.

Though a complete examination of the differences in medical expenditures between thin and obese men and women is beyond the scope of this paper, in Table 7 we provide some information on the sources of the medical expenditures differences that we report in Table 6. MEPS respondents are asked whether a doctor has diagnosed them to have (or have had) a number of common medical conditions, including diabetes, asthma, hypertension, coronary artery disease, angina, myocardial infarction, other disease, stroke, emphysema, non-specific joint pain, and arthritis.[17] In the left columns in Table 7, we report the prevalence of each condition among thin and obese workers aged 20-50.[18] Among both men and women, obese individuals are more likely to be afflicted with a wide variety of conditions. These differences are both statistically and medically significant. Of particular note is the fact that obese women are 9.89 percentage points more likely to have an arthritis diagnosis than thin women, while obese men are only 6.06 percentage points more likely than thin men. This is of particular note because, among the set of conditions we consider, arthritis is the only one in which obese individuals with the condition spend (statistically significantly) more than thin individuals. For female workers with arthritis, the medical expenditure difference between obese and thin individuals is $1,956; for male workers with arthritis, the difference is $1,224. Clearly, differences between men and women in the connection between obesity and arthritis are an important part of the reason why obese female workers spend so much more on medical care than thin female workers, while obese male workers spend about the same as thin male workers. The story is certainly more complicated than just arthritis, though, and deserves a more careful treatment than what we can afford here.

Workers in both small and large firms with employer-sponsored health insurance experience a wage offset for obesity (Table 8), and the wage offset for obesity is concentrated among women with employer-sponsored coverage among workers in both small and large firms.[19] The existence of a wage offset in large firms suggests that our findings are driven by individual incidence rather than group incidence. If the incidence of premiums were at the level of the group, we would expect to see little evidence of an obesity wage offset among insured workers in large groups. This is because the health care costs of an individual would have little effect on the average premium of the group.

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[17] Of course, respondents may have been diagnosed with more than one condition.

[18] All of the estimates and statistical tests in Tables 6 and 7 take account of the complex sampling stratified scheme used by the MEPS.

[19] These results are not sensitive to the definition of firm size. The NLSY divides firms with 50 or more employees into two categories: 50-999 and 1000+. When we define a large firm as one with 1000+ workers, the results are substantively the same, although the sample size in the largest category is relatively small.

Our estimates of the incremental medical care costs associated with obesity allow us to make a “back of the envelope” calculation to determine whether the incremental medical expenditures of the obese can explain the wage offset we observe. In the NLSY, obese women who work full-time and enroll in employer provided health insurance work an average of 2,191 hours per year. Thus, the yearly income penalty from being obese is $5,784= 2,191 * $2.64. The results from the MEPS indicate that approximately $600 of this penalty can actually be attributed to higher expected medical expenditures. Although the difference between these estimates is large, the calculation is subject to a number of qualifications. First, the estimates are from different samples covering different time periods which may contribute to the differential. In addition, premiums are unlikely to be actuarially fair and accounting for the loading of insurance in our estimate of medical expenditures would bring the estimates closer. Finally, it is possible that only part of the wage differential we observe is due to the higher expected medical spending of the obese and the remainder is due to residual discrimination.

Though we cannot rule out residual discrimination as an explanation for the calculation in the previous paragraph, some of our other findings suggest that it is not a likely explanation. First, because we find no evidence of similar wage discrimination for obese women without health insurance or obese men with coverage, attributing the residual difference to discrimination requires an explanation of why discrimination exists only for obese, insured women. Second, we find no evidence of similar wage offsets for different types of benefits or for the working obese with coverage from alternative sources. Maintaining an explanation based upon discrimination thus requires potentially ad hoc reasoning about obese women outside of work settings where employers provide health insurance.

5.0 Conclusions

Our results indicate that obese workers with employer-sponsored health insurance pay for their higher expected medical expenditures through lower cash wages. This conclusion is strengthened by our findings that these types of wage offsets do not exist either for obese workers with coverage through alternative sources or for other types of fringe benefits for which the cost to the employer of providing is less likely to be affected by BMI.

Although the existence of a wage offset for health insurance is the standard theoretical prediction from economic models of worker compensation, this finding is noteworthy given the dearth of empirical evidence of the existence of these types of wage offsets. Not only do our findings provide evidence supporting the few existing studies that find that these types of wage offsets exist, but they also provide new evidence on the level at which they occur. We find that the magnitude of the wage offset for employer-sponsored coverage varies by individual characteristics that affect expected medical expenditures, in this case obesity. The fact that we find evidence for the existence of the wage offset in both small and large firms indicates that this wage-offset is not a firm level effect that emerges through differences between small and large employers due to the inability of small employers to effectively pool premiums. Assuming that obese workers are not highly concentrated within particular firms, this suggests that the wage offset for health insurance varies across individuals within a firm based on their health risk.

Nevertheless, our results do not provide direct evidence that employees bear the full incidence of the cost of employer-sponsored coverage. Our empirical specification leaves open the possibility that employers either partially or fully subsidize the average premium. The evidence we generate provides support for a weaker version of employee incidence—that employees pay for individual characteristics that make them high cost to insure. Nonetheless, our results imply that having insurance provided through an employer does not guarantee the pooling of health risks across employees. Because obesity is arguably an unusual indicator of health status, future research should examine whether similar types of wage offsets exist for other conditions.

Our findings on the incidence of obesity-related medical care costs among workers with employer-sponsored coverage have important implications for research on the relationship between obesity and wages. While these studies have provided evidence consistent with the proposition that obese, particularly white women, experience significant labor market discrimination in the form of lower wages, our results point to and provide empirical evidence supporting an alternative explanation. We find that the wage penalty for obesity among women is concentrated in firms providing health insurance. We also find that, among relatively young people, obese women, but not obese men, have higher health care expenditures than their non-obese counterparts. Taken together, these results suggest that the wage penalty for obesity among women can be explained, at least in part, by their higher health care expenditures.

While our findings provide a strong case that wage offsets for health insurance are a cause of lower wages among obese women, alternative explanations do exist. For example, among obese workers, those with relatively low productivity due to the health consequences of obesity may consume more medical care and, as a result, self select into firms offering health insurance. In this case, the observed relationship may represent both the lower productivity and greater demand for health insurance among these workers. The absence of a wage-offset for obese male workers, however, weakens this explanation. For this alternative explanation to be true we would have to assume that only obese women are subject to this type of selection. Presumably, similar differences among obese men in their productivity exist.

Other alternative explanations for our empirical findings include invidious discrimination against the obese mainly in high end jobs that provide health insurance, job sorting of the obese into relatively low wage occupations among the high end jobs, and perhaps even productivity differences between the obese and non-obese in high end but not low end jobs. In each case, however, these explanations would have to characterize obese women, but not obese men. None of these alternative explanations are inconsistent with our favored explanation of obesity induced wage-offsets at firms that provide health insurance.

The findings of our study raise the obvious question of the mechanism by which these wage offsets occur. While our analysis does not provide direct evidence on this point, it does suggest that perhaps these wage offsets emerge slowly over time in the form of less rapid wage increases for obese workers insured through their employer than obese workers without this coverage.

It is also possible that labor market discrimination against the obese and the higher costs of providing health insurance to these workers are not mutually exclusive explanations for the obesity wage penalty. In theory, competitive labor markets make invidious discrimination costly to the discriminator (Becker 1971). This is because firms have strong incentives to hire workers for whom the prevailing wage is less than their marginal productivity; this type of competition among firms for workers will eliminate wage disparities unrelated to worker productivity. In the case of the wage penalty associated with obesity, the differential costs of insuring the obese may be a mechanism that allows labor market discrimination to persist in competitive markets. Firms that do not make these types of wage offsets and instead enforce the pooling of premiums among obese and non-obese workers will be at a competitive disadvantage relative to those who are able to provide non-obese workers with a cash wage and benefits combination that better reflects the costs of insuring these workers.

Finally, our results have implications for the policy debate over what to do about the obesity crisis. Some have suggested that the right response is a tax on fast food and junk food (Brownell and Horgan 2003). Whether such a tax is a good idea depends, mainly, upon the extent to which individuals pay fully for the consequences of their decisions about diet and exercise.[20] If there are no externalities in these decisions, then “twinkie” taxes will only distort already optimal decisions. But if employer-provided insurance pools the health risk of the obese and non-obese, it will create an externality that reduces incentives to maintain a normal weight. Our evidence on the incidence of the obesity wage premium suggests that pooling of the obese and non-obese does not occur in the employer-sponsored insurance market; hence the externalities caused by health insurance on decisions about body weight are small.

[20] Other authors, like Cutler, Glaeser, et al. (2003) have suggested that self control problems on the part of individuals represent an “internality” that make body weight decisions inefficient. Time-inconsistent individuals do not take into account the future health implications of the food choices they make in the current period. Bhattacharya and Lakdawalla (2004) argue that even in the presence of such “internalities,” sin taxes such as a “twinkie” tax will not, in general, improve the welfare of obese individuals.

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Table 1: Descriptive Statistics for Study Samples

Variable	Full-time workers either with employer-sponsored coverage in own name or uninsured: Mean	Std. Dev.	All full-time workers: Mean	Std. Dev.
N	31,176		38,645	
Hourly wage	14.98	15.58	14.57	15.31
Employer coverage (own)	0.80		0.64	
Employer coverage (other)	-		0.14	
Individual coverage	-		0.03	
Public coverage	-		0.02	
Uninsured	0.20		0.16	
Unknown source of coverage	-		0.01	
Non-employer coverage	-		0.06	
Obese (BMI>30)	0.19		0.19	
Mildly obese (BMI>30 and <35)	0.13		0.13	
Morbidly obese (BMI>=35)	0.06		0.06	
Overweight	0.37		0.36	
Obese*Employer coverage (own)	0.15		0.12	
Female	0.37		0.41	
Any children in household	0.54		0.57	
Race - Black	0.13		0.12	
Race - Other	0.02		0.02	
Never Married	0.25		0.22	
Formerly Married	0.21		0.19	
Age	34.23	4.81	34.32	4.80
Education: <9	0.02		0.02	
Education: 9-12	0.53		0.53	
Education: 13 and over	0.45		0.45	
AFQT: 0-25	0.15		0.14	
AFQT: 25-50	0.22		0.23	
AFQT: 50-75	0.29		0.29	
AFQT: 75-100	0.34		0.34	
Urban residence	0.75		0.75	
Job tenure: 0-1 years	0.20		0.21	
Job tenure: 1-3 years	0.23		0.24	
Job tenure: 3-6 years	0.21		0.21	
Job tenure: 6+ years	0.36		0.34	
Employer size: 0-9	0.18		0.21	
Employer size: 10-24	0.14		0.15	
Employer size: 25-24	0.12		0.12	
Employer size: 50-999	0.42		0.40	
Employer size: 1000+	0.14		0.12	
N	31,176		38,645	

Note: Weighted Estimates

Table 2: Difference-in Difference Estimates of the Wage Offset for Obesity

Sample: Full-time workers either with employer-sponsored coverage in their own name or uninsured

	Insured			Uninsured			Difference-in-Difference	
	Obese	Not Obese	Difference	Obese	Not Obese	Difference	Unadjusted	Adjusted
All years	15.22	16.64	-1.42	9.47	9.21	0.25	-1.68	-1.45
			[0.40]***			[0.50]	[0.63]***	[0.57]**
1989	10.83	11.93	-1.09	6.42	7.79	-1.38	0.28	0.8
			[0.81]			[0.76]*	[1.11]	[1.11]
1990	10.36	13.10	-2.74	7.10	7.89	-0.79	-1.95	-1.07
			[0.55]***			[0.51]	[0.75]***	[0.73]
1992	13.01	13.92	-0.9	11.28	8.80	2.49	-3.39	-2.64
			[1.41]			[3.84]	[4.09]	[3.98]
1993	12.47	14.69	-2.22	7.82	8.41	-0.59	-1.63	-1.68
			[0.51]***			[0.56]	[0.75]**	[0.66]**
1994	12.83	15.24	-2.41	9.05	9.39	-0.34	-2.07	-1.74
			[0.49]***			[1.19]	[1.29]	[1.18]
1996	14.27	16.72	-2.45	9.58	9.83	-0.26	-2.19	-1.47
			[0.50]***			[0.84]	[0.98]**	[0.92]
1998	16.05	19.38	-3.33	9.68	9.63	0.05	-3.38	-1.55
			[0.76]***			[0.62]	[0.98]***	[1.04]
2000	17.69	22.29	-4.6	11.66	10.75	0.91	-5.51	-4.27
			[0.76]***			[1.03]	[1.28]***	[1.28]***
2002	20.37	25.24	-4.87	10.59	12.08	-1.49	-3.37	-2.27
			[1.03]***			[0.69]**	[1.24]***	[1.20]*
N	4,955	19,059		1,427	5,735			

*significant at 10%; **signficant at 5%, ***significant at 1%

Note: Standard errors in parentheses are adjusted for repeated obeservations of individuals. Adjusted estimates include controls for sex, children in the household and its interaction with female, race, marital status, age, education, urban residence, job tenure, employer size, year (for pooled estimate), industry, and occupation.

Table 3: Estimates of the Obesity Wage Offset for Health Insurance

	(1)	(2)	(3)	(4)
	Main Study Sample	Alternative Sources of Coverage	Overweight, Obese, and Morbidly Obese	Log Transformed Wage
Obese	-0.2	-0.15		-0.03
	[0.49]	[0.48]		[0.02]
Employer coverage (own)	2.37	2.48	2.47	0.23
	[0.26]***	[0.25]***	[0.34]***	[0.01]***
Obese*Employer coverage (own)	-1.45	-1.44		-0.05
	[0.57]**	[0.56]**		[0.02]**
Employer coverage (other source)		0.62		
		[0.37]*		
Obese*Employer coverage (other source)		-0.87		
		[0.70]		
Individual coverage		1.38		
		[0.49]***		
Obese*Individual coverage		-0.92		
		[1.06]		
Public coverage		0.94		
		[1.29]		
Obese*Public coverage		-1.94		
		[1.47]		
Unknown source of coverage		2.39		
		[0.66]***		
Obese*Unknown source of coverage		-1.54		
		[1.31]		
Overweight (25<=BMI<30)			-0.35	
			[0.38]	
Mildly obese (30<=BM1<35)			-0.53	
			[0.39]	
Morbidly obese (BMI >=35)			0.02	
			[1.31]	
Overweight*Employer coverage (own)			-0.18	
			[0.50]	
Mildly obese*Employer coverage (own)			-1.27	
			[0.53]**	
Morbidly obese*Employer coverage (own)			-2.22	
			[1.38]	
Constant	23.27	21.95	14.17	2.13
	[7.27]***	[6.73]***	[7.31]*	[0.22]***
Observations	31,176	38,645	31,176	31,176
R-squared	0.18	0.17	0.18	0.5

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: Estimates are weighted and standard errors in parentheses are adjusted for repeated obeservations of individuals. Adjusted estimates include controls for sex, children in the household and its interaction with female, race, marital status, age, education, urban residence, job tenure, employer size, year, industry, and occupation.

Table 4: Estimates of the Obesity Wage Offset for Other Fringe Benefits

Fringe Benefit	n	Unadjusted	Adjusted
Life Insurance	30,469	-0.1	0.12
		[0.52]	[0.43]
Dental Insurance	30,700	-0.47	-0.47
		[0.58]	[0.49]
Maternity Benefits	28,682	-0.24	-0.31
		[0.63]	[0.55]
Retirement	30,362	-0.51	-0.59
		[0.57]	[0.49]
Profit Sharing	30,476	-0.42	-0.49
		[0.66]	[0.53]
Training/Education	30,354	0.13	0.17
		[0.58]	[0.48]
Childcare	30,114	1.1	0.86
		[1.54]	[1.38]
Flexible Working Hours	30,781	-0.33	0.15
		[0.58]	[0.46]

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: Estimates are weighted and standard errors in parentheses are adjusted for repeated obeservations of individuals. Adjusted estimates include controls for sex, children in the household and its interaction with female, race, martial status, age, education, urban residence, job tenure, employer size, year, industry, and occupation.

Table 5: Analysis of the Wage Offset for Obesity by Age and Sex

	All Ages					
	Men			Women		
	(1)	(2)	(3)	(1)	(2)	(3)
Obese	-1.21	-1.27	-0.79	-1.66	-1.66	0.43
	[0.39]***	[0.39]***	[0.48]	[0.39]***	[0.39]***	[0.98]
Employer coverage (own)		2.3	2.4		1.81	2.37
		[0.33]***	[0.35]***		[0.39]***	[0.33]***
Obese*Employer coverage (own)			-0.58			-2.64
			[0.63]			[1.00]***
Constant	22.36	20.22	20.12	15.35	9.83	9.51
	[9.47]**	[9.51]**	[9.50]**	[10.89]	[10.81]	[10.81]
Observations	19,183	19,183	19,183	11,993	11,993	11,993
R-squared	0.19	0.19	0.19	0.14	0.14	0.14

	Age <=35					
	Men			Women		
	(1)	(2)	(3)	(1)	(2)	(3)
Obese	-0.42	-0.45	-0.11	-1.38	-1.37	1.08
	[0.42]	[0.42]	[0.57]	[0.54]**	[0.54]**	[1.84]
Employer coverage (own)		1.77	1.83		1.32	1.88
		[0.39]***	[0.42]***		[0.58]**	[0.41]***
Obese*Employer coverage (own)			-0.43			-3.19
			[0.76]			[1.82]*
Constant	9.13	9.45	9.41	20.04	18.69	19.08
	[18.15]	[18.06]	[18.08]	[26.95]	[26.96]	[26.96]
Observations	12,585	12,585	12,585	7,755	7,755	7,755
R-squared	0.10	0.10	0.10	0.07	0.08	0.08

	Age >35					
	Men			Women		
	(1)	(2)	(3)	(1)	(2)	(3)
Obese	-2.06	-2.21	-0.48	-1.83	-1.85	0.49
	[0.60]***	[0.60]***	[0.78]	[0.51]***	[0.51]***	[0.50]
Employer coverage (own)		3.84	4.3		2.8	3.56
		[0.53]***	[0.57]***		[0.41]***	[0.49]***
Obese*Employer coverage (own)			-2.04			-2.87
			[1.00]**			[0.75]***
Constant	0.35	-1.12	0.32	-10.07	-14.78	-15.44
	[65.41]	[65.10]	[65.03]	[48.72]	[48.60]	[48.57]
Observations	6,598	6,598	6,598	4,238	4,238	4,238
R-squared	0.24	0.25	0.25	0.27	0.27	0.27

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: Estimates are weighted and standard errors in parentheses are adjusted for repeated obeservations of individuals. Adjusted estimates include controls for sex, children in the household and its interaction with female, race, martial status, age, education, urban residence, job tenure, employer size, year, industry, and occupation.

Table 6: Total Medical Expenditures

Women

	Non-Obese	Obese	Difference
18-64	$2,718	$4,175	$1,457
20-50	$2,406	$3,193	$787
20-50 Privately Insured	$2,586	$3,169	$583

Men

	Non-Obese	Obese	Difference
18-64	$2,498	$2,904	$405
20-50	$1,719	$1,881	$162
20-50 Privately Insured	$1,896	$1,949	$52

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7: Expenditure and Prevalence Differences by Condition

Women

	Disease Prevalence				Expenditures Conditional on Disease			
Condition	Non-Obese	Obese	Difference		Non-Obese	Obese	Difference	
Diabetes	1.15%	4.64%	3.49%	***	$4,246	$5,769	$1,522	
Asthma	9.29%	14.58%	5.30%	***	$3,805	$4,147	$342	
Hypertension	6.18%	22.14%	15.96%	***	$3,834	$4,278	$444	
Coronary Artery Disease	0.13%	0.68%	0.56%	***	$19,274	$6,641	-$12,633	
Angina	0.18%	0.46%	0.29%	*	$2,637	$8,574	$5,937	
Myocardial Infarction	0.22%	0.69%	0.48%	**	$6,709	$8,240	$1,531	
Other Heart Disease	3.26%	4.46%	1.21%	*	$4,333	$3,900	-$433	
Stroke	0.44%	0.62%	0.17%		$10,728	$7,969	-$2,760	
Emphysema	0.10%	0.24%	0.14%		$13,712	$8,851	-$4,861	
Joint Pain	22.53%	35.57%	13.04%	***	$3,740	$4,726	$987	
Arthritis	8.07%	17.96%	9.89%	***	$4,141	$6,097	$1,956	**

Men

	Disease Prevalence				Expenditures Conditional on Disease			
Condition	Non-Obese	Obese	Difference		Non-Obese	Obese	Difference	
Diabetes	1.23%	6.60%	5.38%	***	$5,425	$4,623	-$802	
Asthma	7.99%	6.66%	-1.33%		$2,043	$2,533	$490	
Hypertension	9.76%	26.84%	17.08%	***	$3,276	$2,996	-$280	
Coronary Artery Disease	0.50%	1.15%	0.64%	**	$12,618	$6,959	-$5,658	
Angina	0.28%	0.74%	0.46%	**	$7,766	$9,610	$1,844	
Myocardial Infarction	0.54%	1.06%	0.52%	*	$11,812	$6,123	-$5,690	
Other Heart Disease	2.03%	2.75%	0.72%		$2,440	$4,014	$1,574	
Stroke	0.15%	0.56%	0.41%	**	$5,635	$12,730	$7,095	
Emphysema	0.11%	0.20%	0.09%		$1,781	$106	-$1,675	
Joint Pain	24.93%	31.53%	6.59%	***	$4,514	$3,215	-$1,298	
Arthritis	6.54%	12.60%	6.06%	***	$2,926	$4,150	$1,224	*

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 8: Estimates by Firm Size

	Small Firms (0-49)			Large Firms (50+)		
	All	Women	Men	All	Women	Men
Obese*Employer coverage (own)	-1.59	-3.78	-0.36	-1.54	-1.6	-1.35
	[0.80]**	[1.49]**	[0.85]	[0.60]***	[0.59]***	[0.94]
Observations	13,625	4,498	9,127	17,551	7,495	10,056
R-squared	0.14	0.13	0.15	0.21	0.17	0.22

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: Estimates are weighted and standard errors in parentheses are adjusted for repeated obeservations of individuals. Adjusted estimates include controls for sex, children in the household and its interaction with female, race, marital status, age, education, urban residence, job tenure, employer size, year, industry, and occupation.