

**One Pill Makes You Smaller:
The Utilization of Anti-Obesity Drugs¹**

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Abstract

Objective: To test for disparities in the utilization of anti-obesity prescription drugs.

Data Source: Our data consist of 78,992 person-year observations of adults aged 18 and over in the Medical Expenditure Panel Survey for 1996-2001.

Study Design: We estimate logit models of utilization, initiation, and quits of anti-obesity drugs. We also estimate OLS models for the number of scrips for anti-obesity drugs that were filled conditional on any use. The key independent variables are: race, ethnicity, gender, age, insurance status, income, education, and whether the respondent meets the medical criteria for using anti-obesity drugs.

Principal Findings: Our results reveal wide disparities in the use of anti-obesity drugs. African-Americans are only 52 percent as likely as whites to use them. Women are 181 percent more likely than men to use anti-obesity drugs. Those with prescription drug coverage are 57 percent more likely than those without such coverage to use them. We find that 41 percent of those taking anti-obesity drugs do not meet the medical criteria for their use. The well-publicized 1997 withdrawal of fenfluramine and dexfenfluramine reduced utilization of anti-obesity drugs.

Conclusions: There exist wide disparities in the use of anti-obesity drugs across race, gender, and insurance status. The finding that African-Americans are considerably less likely to use anti-obesity drugs is particularly striking, and merits further study, because rates of obesity are considerably higher among African-American than white females.

Key Words: utilization, socioeconomic disparities, obesity, pharmaceuticals

Introduction

In the last twenty-five years in the United States, the age-adjusted prevalence of obesity has more than doubled, from 15 percent to 30.4 percent (Hedley et al., 2004; Flegal et al., 2002). In response, the U.S. government set the goal of cutting the prevalence of obesity in half by 2010 (U.S. D.H.H.S., 2000). However, conventional methods of reducing body weight by exercise, diet, and behavior modification are generally ineffective; weight lost in the short term is usually regained (Arbeeny 2004; Yanovski and Yanovski, 2002; Manson and Faich, 1996). Bariatric surgery has shown effectiveness for long-term weight loss, but it is typically reserved for the morbidly obese who have repeatedly failed at other methods of weight loss; moreover it carries significant risks to the patient and is costly, making it unattractive or unavailable to many patients (Buchwald, 2004). Pharmacologic treatments for obesity offer hope for greater success than conventional treatments for a wider group of patients than is desirable for bariatric surgery.

Currently, there is little information in the health services research literature on who gets anti-obesity drug therapy and how such utilization varies by individual characteristics. This paper fills that void. Knowing the correlates of utilization is important for two reasons. First, to the extent that anti-obesity drugs are efficacious, inequities in their use could exacerbate inequities in health outcomes in the U.S. Second, most anti-obesity drugs involve adverse, even fatal, side effects (Bray, 2002), so it is important to understand which patients are exposed to this risk.

The Market for Anti-Obesity Drugs

Nine FDA-approved drugs for the treatment of obesity were available during the period we examine (1996-2001). Those drugs are (with brand names in parentheses): phentermine (Adipex), diethylpropion (Tenuate), phendimetrazine (Adipost), benzphetamine (Didrex), mazindol (Mazanor), fenfluramine (Pondimin), dexfenfluramine (Redux), sibutramine (Meridia), and orlistat (Xenical). The FDA approved these medications for use in obese patients with a body mass index (BMI) of at least 30 (i.e. the clinically obese) or for patients with a BMI between 27 and 30 if they also have at least one obesity-related comorbidity (Expert Panel on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults, 1998).² With the exception of orlistat, all of these drugs suppress appetite or increase satiety by modifying central nervous system neurotransmission (Padwal et al., 2003). Orlistat, in contrast, inhibits the absorption of dietary fat in the intestines (Ibid).

The effectiveness of these drugs is typically described as modest (Buchwald et al., 2004; Arbeeny, 2004; Gura, 2003; Farrigan and Pang, 2002),³ but even weight loss of 5-10 percent among obese patients is associated with improvements in health (Arbeeny, 2004; Fujioka, 2002), so anti-obesity drugs offer potential for health improvements and perhaps lower health care costs.

Because anti-obesity drugs tamper with the biochemistry of metabolism and/or affect neurotransmitters and receptors that control other body processes, the drugs frequently have adverse, even fatal, side effects (Gura, 2003). Fenfluramine and dexfenfluramine are the most infamous example of adverse side effects; both were pulled from the market in September 1997 because each damaged heart valves when taken in conjunction with phentermine, a combination nicknamed fen-phen (Jick, 2000).

Sales of anti-obesity prescription medications totaled \$317 million in 2003. With the growth in the prevalence of obesity, the U.S. market for anti-obesity drugs is expected to rise to \$1.3 billion by the year 2010 (Farrigan and Pang, 2002). Even after the harmful effects of fen-phen were well-publicized, an NIH report on obesity stated that “there is great interest in weight loss drugs among consumers” (National Heart, Lung, and Blood Institute, 1998, p. 86).

Little is known about the correlates of anti-obesity drug use. Stafford and Radley (2003) report national trends in the use of anti-obesity drugs using IMS Health data for 1991-2002 but do not report the characteristics of those who took the drugs. Khan et al. (2001) report unconditional tabulations using 1998 data from the Behavioral Risk Factor Surveillance System (BRFSS) that indicate that use of anti-obesity drugs was more common among women than men and more common among Hispanics than non-Hispanics. The present study is the first to estimate multivariate regression models of use and the first to study the MEPS data on anti-obesity drug use. In particular, we investigate whether race, ethnicity, gender, age, insurance status, education, and income are related to the use of anti-obesity drugs.

Methods and Hypotheses

In this paper we estimate logit models for use of an anti-obesity drug, and log-transformed OLS models of the number of scrips of anti-obesity drugs that a person fills in a year. Our hypotheses are listed below. As we will describe, there are sometimes opposing factors, forcing us to hypothesize which of the conflicting forces is stronger.

H1: Use of anti-obesity drugs is lower among African-Americans and Hispanics.

There are conflicting reasons to believe that use should be higher or lower among these groups. On the one hand, one might think that use would be greater because obesity tends to be a particularly significant problem among female members of disadvantaged minority groups (Fontaine and Bartlett, 2000; Sobal and Stunkard, 1989). In 1999-2000, 49.7% of African-American women and 39.7% of Mexican-American women were obese compared to 30.1% of non-Hispanic white American women (Flegal et al., 2002).

On the other hand, minorities may have a lower demand for anti-obesity drugs; African-American and Hispanic women report larger ideal body sizes than Caucasian women, and African-American men are more likely than Caucasian males to report a willingness to date heavy women (Williamson and O'Neil, 1998; Powell and Kahn, 1995), suggesting that heavy women in these groups face a lower social cost to being overweight and obese. Moreover, disadvantaged minorities may have less information about the availability of anti-obesity drugs and less access to providers who could furnish such information. On net, we hypothesize that use of anti-obesity drugs is less among African-Americans and Hispanics than among whites.

H2: Use of anti-obesity drugs is greater among women.

Research in sociology and psychology has consistently found that the obesity is associated with lower self-esteem in women than men (Williamson and O'Neil, 1998) and with greater social stigma for women than men (Sobal, 2004). As a result, the cost of obesity is higher for women than men and therefore we predict that women are more likely to use anti-obesity drugs.

H3: Use of anti-obesity drugs decreases at advanced ages.

We hypothesize that a major reason for using anti-obesity drugs is to be attractive to members of the opposite sex. As people age out of traditional childbearing years, the social cost of being unattractive may fall. While the health consequences of obesity worsen with age, we suspect that this will lead people to begin to consume drugs that treat the comorbidity (e.g. Type II diabetes, high cholesterol) rather than obesity itself.

H4: Use of anti-obesity drugs is greater among those with health insurance.

Health insurance coverage for physician office visits lowers the cost of visiting a doctor to get a scrip, and coverage of anti-obesity drugs lowers the cost of filling the scrip. Therefore, we expect the average out-of-pocket cost associated with purchasing anti-obesity drugs to be lower, and therefore consumption to be higher, among those who are insured and those who enjoy prescription drug coverage.

While the economic costs of obesity are substantial, many health insurers do not cover anti-obesity drugs because the ability of these drugs to reduce health care costs elsewhere in the system is uncertain. Managed care organizations may refuse to cover anti-obesity drugs because they suspect that, with high turnover of enrollees, they will pay the costs but that the benefits will be enjoyed by another managed care organization. The less-than-universal coverage of anti-obesity drugs by health insurers (even those with a prescription drug benefit) works against us finding statistically significant and positive coefficients on insurance status and prescription drug coverage.

H5: Use of anti-obesity drugs rises with education.

Education is strongly correlated with good health, as it leads people to choose a better mix of health inputs and to use those inputs more effectively in producing their health (Grossman and Kaestner, 1997). While better-educated people may be more likely

to avoid obesity, we hypothesize that educated people are more likely to be aware of anti-obesity drugs as an option and therefore that overall use will rise with education.

H6: Use of anti-obesity drugs rises with income.

We hypothesize that anti-obesity drugs are a normal good; all else equal, as income rises, people will tend to buy more of them.

Data: MEPS

This paper uses 1996-2001 data from the Medical Expenditure Panel Survey (MEPS), which is collected by the Agency for Healthcare Research and Quality (AHRQ). The MEPS database is drawn from the National Health Interview Survey (NHIS) sample, and each year of the MEPS data may be linked to information from the previous year's NHIS survey.

The MEPS has an overlapping panel design in which two calendar years of information are collected from each household through six interviews over two and a half years. The MEPS database consists of a number of files. We linked the Full Year Consolidated File to the Prescribed Medicines File for each year. The Full-Year Consolidated File is at the person-year level and includes information on health care utilization and expenditures, demographic and socioeconomic characteristics, and health insurance status. The Prescribed Medicines File is an event-level file that includes information on specific drug use, the amounts paid for those drugs by patient and insurers, and the length of time that the drug was taken. We convert this event-level data into person-year data and link it to the consolidated MEPS files, which include patient-year level information on the other variables included in this analysis.

We use the Multum Lexicon File, released in Fall 2004, to identify anti-obesity drugs. Specifically, we classify as anti-obesity drugs: 1) any member of the Anorexiants (appetite suppressant) therapeutic class, and 2) orlistat, which is not an anorexiant but inhibits the absorption of fat in the intestines.

We study adults aged 18 and over because no anti-obesity drug was approved for use by adolescents during 1996-2001. The numbers of people in the MEPS database who had a scrip for at least one anti-obesity drug by year are listed in Table 1. The percentage of MEPS adults using anti-obesity drugs rose from 0.81 in 1996 to 0.94 in 1997 but fell thereafter in the wake of the drug withdrawals in September 1997 such that in no year during 1998-2001 is the percentage higher than 0.45, less than half its level in 1997.

We study the following two outcomes: 1) An indicator that equals one if the respondent in that year had a scrip for an anti-obesity drug; and 2) number of scrips filled for anti-obesity drugs conditional on use.⁴

We control for the following variables in our regressions: indicator variables for gender, African-American, Hispanic, other race/ethnicity, married, whether the respondent has health insurance, whether the respondent's health insurance includes prescription drug coverage, age categories, urban residence, year, Census Region categories, income categories, and education categories.

There exist several measures of, or proxies for, the out-of-pocket price of anti-obesity drugs, each with its advantages and drawbacks. MEPS respondents list the amount they paid out of pocket for each drug, but the prices faced by those who did not buy drugs are not observed. We have purchased from Medi-Span the prices of anti-obesity drugs during the period covered by MEPS, but these are national average

wholesale prices and they are collinear with the year fixed effects so their inclusion would prevent us from examining the time effects associated with drug introductions and withdrawals. Figure 1 depicts the nominal average wholesale prices of anti-obesity drugs during the period covered by our data. There is little movement in prices; for the most part, price hikes seem to occur sporadically to adjust for inflation. With such little variation in prices we are unable to estimate the impact of price changes on the use of these drugs and we exclude prices from the set of regressors.

To control for price while avoiding problems of multicollinearity, we use two proxies for the out-of-pocket cost of prescription drugs. The first is an indicator variable for whether the respondent lacked health insurance; uninsurance raises the cost of a physician visit to get a scrip. The second price proxy is an indicator for whether the respondent's health insurance includes prescription drug coverage, which would lower the cost of filling a prescription. These indicators for health insurance coverage are also, strictly speaking, endogenous; one might worry that those who sought to consume large quantities of anti-obesity drugs would most aggressively seek out health insurance and prescription drug coverage. However, this seems unlikely to be an important factor in the decision to seek insurance coverage. Generic anti-obesity drugs are available at prices that are about equal to typical copayments for branded drugs in this class.

The FDA approved anti-obesity drugs for use in patients with a body mass index (BMI) of at least 30 (i.e. the clinically obese) or for patients with a BMI between 27 and 30 if they also have at least one obesity-related comorbidity (Expert Panel on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults, 1998).⁵ There are valid reasons to both include and exclude from the set of regressors the

measure of whether the respondent met FDA criteria for using anti-obesity drugs. On the one hand, it is desirable to control for whether respondents met the medical criteria for using anti-obesity drugs because the prevalence of obesity was rising during the period covered by our data and we do not want that trend to cause omitted variable bias in the coefficients on year indicator variables. On the other hand, obesity status is partly determined by the use of obesity drugs, although the effectiveness of these drugs is typically described as modest and insufficient to reverse obesity.⁶ One potential solution is to find valid instruments for meeting the medical criteria for anti-obesity drug use and estimate a model of instrumental variables, but we have not yet found such instruments.

As an alternative, we estimate models both with and without an indicator for whether the respondent meets the medical criteria for the use of anti-obesity drugs: a BMI of at least 30 (i.e. the clinically obese) or for patients with a BMI between 27 and 30 if they also have at least one of the following conditions: hypertension, cardiovascular disease, hyperlipidemia, or diabetes.⁷ Since using these drugs may reduce obesity, the effect of endogeneity in this context would be to decrease the estimated impact of satisfying the medical criteria on use of the drugs, resulting in conservative estimates of the effect of this factor on the use of anti-obesity drugs.

We calculate BMI using self-reported height and weight from the NHIS for 1996-1999 and self-reported height and weight in the MEPS for 2000. The MEPS for 2001 contains BMI but self-reports of height and weight were withheld to protect respondent confidentiality. Previous research has documented error in self-reports of weight which can cause substantial misclassification of individuals by clinical weight category such as obesity (Nieto-Garcia, 1990). We correct for this reporting error, which has the potential

to bias regression coefficients, using the method of Lee and Sepanski (1995) and Bound, Brown, and Mathiowetz (2002).⁸

The greatest number of observations is lost due to missing values in the variables that measure prescription drug coverage and whether the respondent meets the medical criteria for using anti-obesity drugs. The prescription drug coverage variable is missing for 13,025 (11.0 percent of all) observations, and the medical criteria variable is missing for 23,160 (19.5 percent of all) observations, largely due to missing data on BMI. Overall, 20 percent of MEPS observations are dropped because one or both of these variables are missing. Table 2 lists summary statistics for our sample.

Empirical Results

Empirical results are presented in Table 3. Columns 1 and 2 present odds ratios and z statistics from logit regressions in which the dependent variable is an indicator for whether the person had a scrip for any anti-obesity drug in that year. Columns 3 and 4 present coefficients and t statistics from OLS regressions in which the dependent variable is the natural log of the number of scrips for anti-obesity drugs filled in that year, conditional on filling any. For each dependent variable, we estimate two versions of the same basic model: the first excludes, and the second includes, an indicator for whether the respondent meets the clinical standards for being prescribed an anti-obesity drug. The z and t statistics reflect standard errors that are cluster-corrected to account for correlation in the error term among observations for the same person over time.

H1: Use of anti-obesity drugs is lower among African-Americans and Hispanics.

Without controlling for whether respondents meet the medical criteria, African-Americans are only 52 percent as likely as whites to use anti-obesity drugs (column 1 of Table 3). Obesity is particularly common among African-American women (Flegal et al., 2002), but even when we do not control for obesity, use of anti-obesity drugs is lower among this group. If one controls for whether the respondent meets the medical criteria for using anti-obesity drugs, African-Americans are only 42 percent as likely as whites to use them (column 2 of Table 3).

Conditional on use, African-Americans also tend to fill fewer scrips than whites. Specifically, among those who use anti-obesity drugs, African-Americans fill roughly 25 percent fewer scrips than whites (columns 3-4 of Table 3). Overall, the results strongly support the hypothesis that use of anti-obesity drugs is lower among African-Americans. Lower utilization could be due to the cultural preferences for higher body weight documented in the sociological studies cited earlier, but given the health impact of obesity this gap merits further attention.

There is weaker evidence that Hispanics are less likely to use anti-obesity drugs. When the indicator variable for meeting the medical criteria for use is excluded (column 1 of Table 3), the Hispanic indicator is not statistically significant. When the indicator is included in the regressors (column 2 of Table 3), the Hispanic indicator is significant at the 10 percent level and suggests that Hispanics are only 71 percent as likely as whites to use anti-obesity drugs. This is inconsistent with the finding of Khan et al. (2001), who report that use was one-third *higher* among Hispanics than non-Hispanic whites in the 1998 BRFSS data.⁹ Conditional on use, Hispanics appear to fill just as many scrips for anti-obesity drugs as whites.

H2: Use of anti-obesity drugs is greater among women.

Column 1 of Table 2 indicates that women are 181 percent more likely than men to use anti-obesity drugs. This strongly supports our hypothesis, and is generally consistent with (though smaller in magnitude than) the finding of Khan et al. (2001), who found in the 1998 BRFSS data that use was four times more common among women than men. However, conditional on using any anti-obesity drugs, women fill no more scrips (columns 3-4 of Table 3) than men.

H3: Use of anti-obesity drugs decreases at advanced ages.

The results in Table 3 suggest that the pattern of use by age is relatively constant for 18-29 (the omitted category), 30-49, and 50-64, but that use falls significantly at age 65 and above; in particular, use is only 49 percent as likely for those over age 65 as it is for those between the ages of 18-29 (column 1 of Table 3). However, after one controls for meeting the medical criteria for using anti-obesity drugs (column 2 of Table 3), use is also significantly lower among those 50-64; they are only 67 percent as likely to use anti-obesity drugs as those 18-29. After controlling for medical criteria, those aged 65 and up are only 36 percent as likely to use the drugs as those 18-29.

Conditional on use, the number of scrips filled is relatively constant over age, with the exception that those over age 65 tend to fill about 37 percent fewer scrips than those 18-29 (columns 3-4 of Table 3).

H4: Use of anti-obesity drugs is greater among those with health insurance.

In logit regressions for use (columns 1 and 2 of Table 3) the coefficient on the indicator variable for uninsured is not statistically significant, but that on the indicator for prescription drug coverage is significant at the 5 percent level. Those with drug coverage

are 57.1 percent more likely to use anti-obesity drugs than those who lack it. This is consistent with our hypothesis. However, columns 3 and 4 of Table 3 indicate that, conditional on using any anti-obesity drugs, those who lack health insurance or prescription drug coverage do not fill fewer scrips.

H5: Use of anti-obesity drugs rises with education.

Table 3 indicates that the odds of using any anti-obesity drug are greater for those who have graduated high school than for those who have dropped out, but education does not appear to have a linear impact on the probability of use. Controlling for whether the respondent meets the medical criteria for using anti-obesity drugs (column 2 in Table 3), high school graduates are 79 percent more likely to use anti-obesity drugs than high school dropouts. In comparison, those with some college are 107 percent more likely, college graduates are 103 percent more likely, and those with graduate school are 117 percent more likely to use anti-obesity drugs than high school dropouts.

The number of scrips filled conditional on use does not generally vary with education, with the exception that those who attended graduate school filled 40 percent more scrips than high school dropouts. Overall, the results support the hypothesis that use of anti-obesity drugs rises with education.

H6: Use of anti-obesity drugs rises with income.

There is no detectable pattern of use with income. In Table 3, the coefficients on indicators for income category are generally not significant nor is there a clear pattern in their point estimates. Conditional on use, the number of scrips filled is also uncorrelated with income. We find no support for our income hypothesis.

Other Findings

As mentioned earlier, the indicator for whether the respondent meets the medical criteria for receiving anti-obesity prescription drugs must be considered endogenous. For this reason, we first estimate models without that variable among the regressors, but we also re-estimate models including it as a regressor. Table 3, column 2, indicates that those who meet the medical criteria for using anti-obesity drugs are 333 percent more likely to take anti-obesity drugs as those who do not meet the medical criteria. Conditional on use, however, those who meet the medical criteria fill no more scrips than those who do not meet the medical criteria (column 4 of Table 3).

While the sign on the indicator for meeting the medical criteria for using anti-obesity drugs is in the expected direction, a logical question is: why is anyone who does not meet the medical criteria taking anti-obesity drugs? In our sample, 41 percent of all those taking anti-obesity drugs do not meet the medical criteria; in other words, for every 2.29 individuals taking an anti-obesity drug who satisfy the medical criteria, another individual who does not meet the medical criteria is also taking it. One possible explanation is that when these people were prescribed the drugs they did meet the medical criteria, but the drugs were so effective that the respondents no longer meet the criteria, but they continue to take the drugs to maintain weight loss. This scenario is unlikely for the vast majority of patients, however, given the modest reductions in body weight associated with these drugs. Alternatively, it may be that some of these are false negatives attributable to the fact that we do not account for those with sleep apnea. Another possibility is that people who are not obese but value weight loss are able to convince their physicians to prescribe the drug.

In our sample, only 1.3 percent of those who *do* meet the medical criteria are taking anti-obesity drugs (compared to 0.4 percent of those who do not meet the medical criteria). An intriguing feature of the market for anti-obesity drugs is that the vast majority of those who meet the medical criteria for their use are not taking them, while a substantial percentage of those taking them do not meet the medical criteria for their use.

We also find interesting patterns in the coefficients on the indicator variables for year. Use of anti-obesity drugs was significantly lower from 1998-2001 than it had been from 1996-1997 (Columns 1-2 of Table 3). Relative to 1996, use was only 52 percent as likely in 1998, 50 percent as likely in 1999, 41 percent as likely in 2000, and 46 percent as likely in 2001. Moreover, the number of scrips filled conditional on using an anti-obesity drug was generally lower during 1997-2001 than in 1996 (columns 3-4 of Table 3). The tipping point in use coincides with the withdrawal of fenfluramine and dexfenfluramine from the market in late 1997. This well-publicized event appears to have had a chilling effect on the market, one that not even the introduction of sibutramine in 1998 and orlistat in 1999 could offset.

Conclusion

Despite the importance of pharmacotherapy as a method of treating obesity, there exists little previous research on the correlates of the use of anti-obesity drugs. We offer six hypotheses and test them using nationally representative data for 1996-2001 from the Medical Expenditure Panel Survey.

There are several strong findings. Use of anti-obesity drugs is only half as likely among African-Americans as whites. Use is 181 percent more likely among women than

men. We also find that the probability of using anti-obesity drugs falls significantly with age, especially after age 65.

Prescription drug coverage is strongly correlated with utilization; those with such coverage are 57 percent more likely to use anti-obesity drugs than those who lack such coverage. Use is also correlated with education; those who drop out of high school are significantly less likely to use them. Unexpectedly, we find no correlation of use with income.

We also find that a substantial fraction (41 percent) of those who are taking anti-obesity drugs do not meet the medical criteria for their use; given the measured effectiveness of anti-obesity drugs, this is unlikely to be due to the beneficial effects of being on anti-obesity drugs. Moreover, we find that almost 99 percent of those who satisfy the medical criteria for receiving anti-obesity drugs are not taking them. Intriguingly, the vast majority of those who are approved to take these drugs are not taking them, but a significant number who are not approved to take these drugs *are* taking them.

The well-publicized 1997 withdrawal from the market of the anti-obesity drugs fenfluramine and dexfenfluramine for damaging heart valves appears to have exerted a chilling effect on the market. All else equal, people were only 46 percent as likely to use an anti-obesity drug in 2001 as they were in 1996.

The finding that African-Americans are considerably less likely to use anti-obesity drugs is striking and merits further exploration. It would be useful to know if the lower utilization is due to a lack of access to physicians, a lack of information from physicians, or disinterest because of cultural or philosophical differences about obesity.

Lower utilization is potentially troubling because the prevalence of obesity is particularly high among minority women in the U.S., and these drugs represent one modestly effective way to decrease body weight, although it should be acknowledged that anti-obesity drugs have historically involved adverse side effects and it is not unambiguous that taking anti-obesity drugs always results in a net improvement in health. There is a deep pipeline for anti-obesity drugs, so the wide disparities in their current use may foreshadow even greater disparities in the future as additional anti-obesity drugs are approved by the FDA and enter the market.

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² The risk factors and diseases that justify pharmacotherapy for those with BMI between 27 and 30 are: hypertension, dyslipidemia, coronary heart disease, Type II diabetes, and sleep apnea (Expert Panel on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults, 1998).

³ Randomized clinical trials (RCTs) of a year or more in duration exist only for orlistat and sibutramine. A meta-analysis of these RCTs calculated that average weight loss was 2.7 kg (2.9 percent) higher among obese patients taking orlistat than among those taking placebo, and 4.3 kg (4.6 percent) higher among obese patients taking sibutramine than among those taking the placebo (Padwal et al., 2003).

⁴ Each time a patient fills a prescription, it counts as a scrip. A limitation of the data is that some pharmacies and insurance plans will allow a patient to receive a three-month supply at a time, while others limit the patient to a one-month supply, but all we know is the number of scrips.

⁵ The risk factors and diseases that justify pharmacotherapy for those with BMI between 27 and 30 are: hypertension, dyslipidemia, coronary heart disease, Type II diabetes, and sleep apnea (Expert Panel on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults, 1998).

⁶ Arbeeny (2004), Gura (2003), Farrigan and Pang (2002).

⁷ Sleep apnea is another comorbidity that justifies the use of anti-obesity drugs for those with a BMI between 27 and 30, but in the MEPS sleep apnea is coded within a large category of conditions. Given the

choice between including a wide variety of conditions and risking many false positives, or excluding sleep apnea and risking false negatives, we elected the latter.

⁸ To correct for reporting error in BMI, we use the National Health and Nutrition Examination Survey III (NHANES III) as validation data. NHANES III is ideal for this purpose because it contains both self-reports and measures of actual height and weight. By regressing BMI calculated using actual values of weight and height on BMI calculated using self-reported values of weight and height in NHANES III, “transporting” the coefficients to the MEPS, and multiplying them by the self-reported values, we generate measures of BMI corrected for reporting error. The NHANES III data confirm that substantial misclassification would occur in the absence of the correction; slightly more than 24 percent of those who are truly obese report weights and heights that imply a BMI that is less than obese. (In contrast, only 2.3 percent of the non-obese report weights and heights that imply a BMI that is obese.)

⁹ We experimented with including interactions of the African-American and Hispanic indicators with gender, but these interactions were not statistically significant.

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Table 1: Anti-Obesity Drug Use in MEPS, 1996-2001
of Adults and % of Adults

Anti-Obesity Drug	Adults With Scrips for Anti-Obesity Drug, by Year					
	1996	1997	1998	1999	2000	2001
Sibutramine			15 (.09)	16 (.09)	14 (.08)	24 (.10)
Orlistat				17 (.10)	22 (.12)	23 (.09)
Fenfluramine or Dexfenfluramine	93 (.56)	124 (.50)				
All Others	100 (.61)	173 (.70)	69 (.40)	49 (.28)	37 (.21)	57 (.23)
Any Anti-Obesity Drug	134 (.81)	232 (.94)	78 (.45)	77 (.43)	68 (.38)	99 (.41)

Notes:

- 1) Each cell of the table contains the number of adults with a scrip for that drug in that year, and below it in parentheses the percent of adults with a scrip for that drug in that year.
- 2) Dexfenfluramine was introduced in 1996.
- 3) Sibutramine was introduced in 1998.
- 4) Orlistat was introduced in 1999.
- 5) Fenfluramine and Dexfenfluramine were pulled from the market in September 1997.
- 6) All Others includes Phentermine, Diethylpropion, Phendimetrazine, Benzphetamine, and Mazindol.

Table 2: Summary Statistics, MEPS Sample

Variable	N	Mean	S.D.	Min	Max
Currently Using An Anti-Obesity Drug	78992	0.0066	0.0813	0	1
Number of Scripts Filled for Anti-Obesity Drugs	525	3.8457	4.0762	1	40
Female	78992	0.5292	0.4992	0	1
Hispanic	78992	0.1751	0.3801	0	1
African-American	78992	0.1264	0.3323	0	1
Other Race	78992	0.0318	0.1754	0	1
Married	78992	0.6537	0.4758	0	1
Aged 30-49	78992	0.4390	0.4963	0	1
Aged 50-64	78992	0.2092	0.4067	0	1
Aged 65+	78992	0.1563	0.3631	0	1
Main Respondent	78992	0.6466	0.4780	0	1
Urban	78992	0.7792	0.4148	0	1
Midwest	78992	0.2218	0.4155	0	1
South	78992	0.3667	0.4819	0	1
West	78992	0.2334	0.4230	0	1
High School Graduate	78992	0.3380	0.4730	0	1
Some College	78992	0.2206	0.4147	0	1
College Graduate	78992	0.1346	0.3413	0	1
Graduate School	78992	0.0883	0.2838	0	1
Family Income 25-45k	78992	0.2413	0.4279	0	1
Family Income 45-70k	78992	0.2305	0.4211	0	1
Family Income 70k +	78992	0.2778	0.4479	0	1
Uninsured	78992	0.1144	0.3183	0	1
Has Prescription Drug Coverage	78992	0.6797	0.4666	0	1
Year: 1997	78992	0.1737	0.3788	0	1
Year: 1998	78992	0.1299	0.3362	0	1
Year: 1999	78992	0.0885	0.2840		
Year: 2000	78992	0.2052	0.4039	0	1
Year: 2001	78992	0.2788	0.4484	0	1
Meets Medical Criteria for Use of Anti-Obesity Drugs	78992	0.3019	0.4591	0	1
Obese	78992	0.2517	0.4340	0	1

Table 3: Utilization of Anti-Obesity Drugs
Columns 1 and 2: Logit Odds Ratios and z Statistics
Columns 3 and 4: OLS Coefficients and t Statistics

	(1) Any Use	(2) Any Use	(3) Ln (# Scripts)	(4) Ln (# Scripts)
Female	2.808*** (7.60)	2.905*** (7.76)	0.155 (1.53)	0.160 (1.57)
Hispanic	0.806 (1.14)	0.713* (1.80)	-0.146 (1.12)	-0.153 (1.17)
African American	0.522*** (3.18)	0.418*** (4.28)	-0.236* (1.76)	-0.250* (1.85)
Other Race	0.310** (2.21)	0.361* (1.91)	-0.294 (0.86)	-0.277 (0.81)
Married	0.892 (0.91)	0.895 (0.88)	0.086 (0.96)	0.085 (0.96)
Age 30-49	1.250 (1.24)	1.011 (0.06)	-0.065 (0.59)	-0.070 (0.64)
Age 50-64	0.955 (0.23)	0.670* (1.91)	-0.052 (0.40)	-0.061 (0.46)
Age 65+	0.485** (2.20)	0.360*** (3.14)	-0.365* (1.94)	-0.377** (2.00)
Respondent is the Primary Interviewee	1.673*** (3.68)	1.571*** (3.16)	-0.146 (1.33)	-0.140 (1.27)
Urban	0.865 (0.85)	0.928 (0.44)	-0.025 (0.26)	-0.016 (0.17)
Midwest	1.063 (0.28)	0.999 (0.01)	-0.164 (1.24)	-0.163 (1.23)
South	1.891*** (3.35)	1.810*** (3.15)	-0.259** (2.17)	-0.251** (2.10)
West	1.287 (1.25)	1.317 (1.38)	-0.047 (0.36)	-0.038 (0.29)
High School Graduate	1.723*** (2.85)	1.787*** (3.03)	-0.090 (0.64)	-0.086 (0.61)
Some College	1.921*** (3.45)	2.066*** (3.85)	0.037 (0.25)	0.042 (0.28)
College Graduate	1.720** (2.16)	2.034*** (2.81)	0.160 (0.98)	0.162 (0.98)
Graduate School	1.770** (2.15)	2.170*** (2.94)	0.398** (2.15)	0.402** (2.16)
Family Income 25-45k	1.125 (0.69)	1.158 (0.86)	-0.033 (0.26)	-0.034 (0.27)
Family Income 45-70k	1.150 (0.75)	1.204 (0.99)	-0.052 (0.41)	-0.054 (0.43)
Family Income < 70k	1.088 (0.43)	1.209 (0.95)	-0.096 (0.72)	-0.094 (0.70)
Uninsured	0.733	0.747	-0.012	-0.010

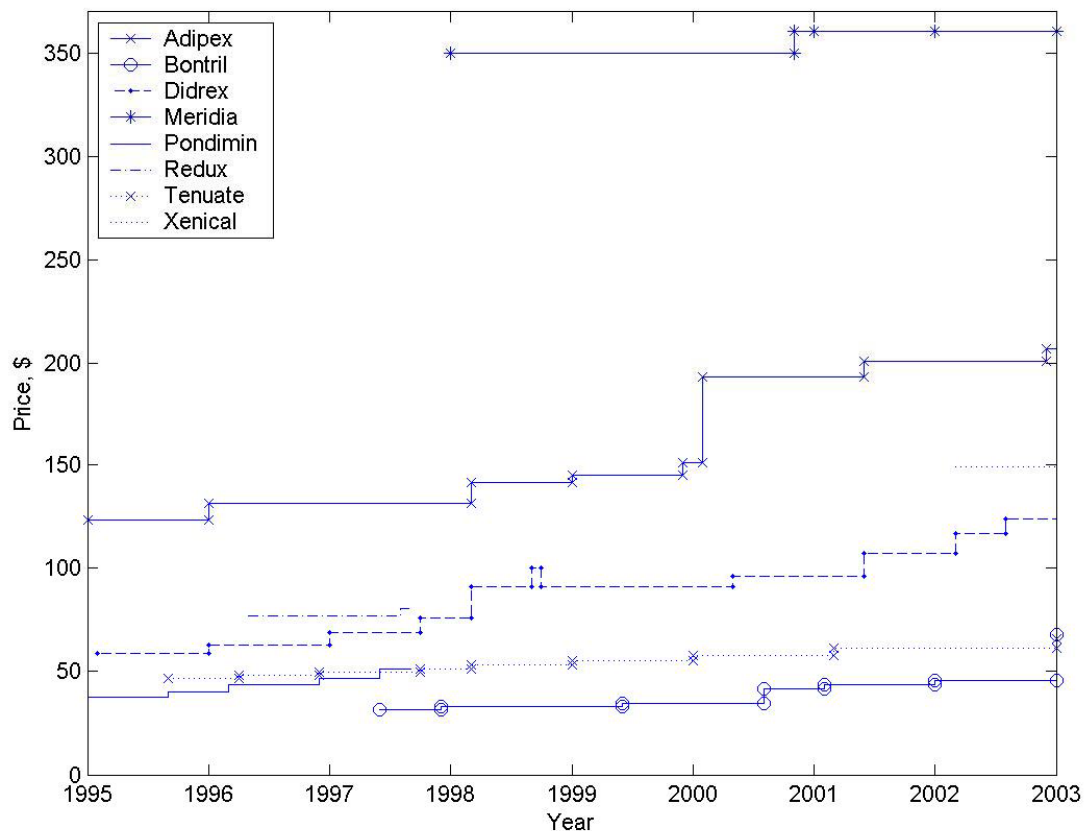
	(0.95)	(0.89)	(0.06)	(0.05)
Has Prescription Drug Coverage	1.571**	1.549**	-0.038	-0.050
	(2.41)	(2.33)	(0.32)	(0.42)
Year: 1997	1.184	1.166	-0.217**	-0.212**
	(1.36)	(1.24)	(2.04)	(2.00)
Year: 1998	0.521***	0.493***	-0.327**	-0.329**
	(3.52)	(3.82)	(2.20)	(2.21)
Year: 1999	0.501***	0.464***	-0.288	-0.289
	(2.94)	(3.24)	(1.62)	(1.63)
Year: 2000	0.405***	0.349***	-0.390***	-0.399***
	(5.02)	(5.75)	(2.83)	(2.89)
Year: 2001	0.461***	0.393***	-0.295**	-0.299**
	(5.07)	(6.08)	(2.39)	(2.42)
Meets Medical Criteria for Using Anti-Obesity Drugs		4.333***		0.082
		(10.72)		(1.03)
Constant			1.430***	1.375***
			(5.71)	(5.38)
Observations	78992	78992	525	525

Notes:

1) Absolute value of t statistics in parentheses

2) The following symbols indicate statistical significance: * significant at 10%; ** significant at 5%; *** significant at 1%

Figure 1: Average Wholesale Prices of Selected Anti-Obesity Drugs, 1995-2003



Notes:

- 1) Nominal prices are shown (i.e. prices are not corrected for inflation) in order to better illustrate the timing of nominal price hikes.
- 2) Data: Medi-Span.
- 3) The generic names of the listed drugs are shown in parentheses: Adipex (Phentermine), Bontril (Phendimetrazine), Didrex (Benzphetamine), Meridia (Sibutramine), Pondimin (Fenfluramine), Redux (Dexfenfluramine), Tenuate (Diethylpropion), and Xenical (Orlistat).
- 4) Pondimin (Fenfluramine) and Redux (Dexfenfluramine) were withdrawn from the market in September 1997.
- 5) The following drugs were introduced to the market during this time: Redux (Dexfenfluramine) in 1996, Meridia (Sibutramine) in 1997, and Xenical (Orlistat) in 1999.
- 6) Prices may not be available in all years because the specific combination of medicinal strength and number of pills to which the prices corresponds was not always available.