Research Report

A Heavy Burden: The Individual Costs of Being Overweight and Obese in the United States

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EXECUTIVE SUMMARY

More than 60% of the United States population is overweight or obese, and if the current trajectory continues, 50% of the population will be obese by 2030. There is no question that being obese or overweight, is more costly than being of normal weight. Using existing literature, we have detailed the costs incurred due to overweight and obesity that affect working-age adults at the individual level.

In this report, we have provided estimates of annual, incremental costs of overweight and obesity from the individual perspective. However, in addition to the individual, employers, and to some extent, the government, bear some of the costs. Among the items discussed in this review, overweight or obese individuals bear the full burden for some costs, such as the value of lost life, lost wages, gasoline costs, and, when applicable, life insurance. Employers and employees share the burden for many other costs, including direct medical costs, short-term disability, disability pension insurance, absenteeism, and productivity losses. Employers directly pick up the costs for many of these expenditures. However, employees indirectly share part of this burden through lower wages. In addition, through publicly funded programs such as Medicare and Medicaid, the government pays a significant portion of direct medical costs for their beneficiaries.

What is the cost of being obese in America?

The overall, tangible, annual costs of being obese are $4,879 for an obese woman and $2,646 for an obese man. The overall annual costs of being overweight are $524 and $432 for women and men, respectively. For both genders, the incremental costs of obesity are much higher than the incremental costs of being overweight.

Adding the value of lost life to these annual costs produces even more dramatic results. Average annualized costs, including value of lost life, are $8,365 for obese women and $6,518 for obese men.

We only have a partial approximation of the cost of obesity for individuals.

The picture we have created is only a partial look at the individual costs related to obesity. Existing literature provides information on health- and work-related costs, but with the exception of fuel costs, there is no published academic research that gives us insight into consumer-related costs, such as clothing, air travel, automobile size or furniture. Anecdotal evidence suggests these costs could be significant.

How obese you are matters.

Where it was possible to break down the costs by degrees of obesity, it is clear the incremental costs of morbid obesity are much higher than those of moderate obesity. Total incremental costs for obese women are more than nine times higher than those for overweight women. For obese men, the incremental costs are six times higher than for overweight men.

The cost drivers are different for the overweight and the obese.

For those who are overweight, the main cost drivers are direct medical costs – 66% for women and 80% for men. Conversely, while direct medical cost is the primary driver of costs for obese men, only one-third of the overall costs for obese women are medical costs.

Obese women are disproportionately affected by job-related costs.

The overall, annual, incremental costs are significantly higher for obese women than for obese men. The difference is mostly the result of lost wages for obese women.

Introduction & Background: Over the past decade, payers and policy makers have become increasingly aware of the adverse health effects and increased health expenditures related to the escalating prevalence of both adult and childhood obesity (Flegal et al., 2010; Must et al., 1999; Finkelstein et al., 2009). Today, two out of three Americans are obese or overweight (Flegal et al., 2010). If the current trajectory continues, one in two adults will be obese by 2030 (Wang et al., 2008). The obesity epidemic has been accompanied by an increase in the prevalence of co-morbidities, including type II diabetes, hypertension, cardiovascular disease, hypercholesterolemia, asthma, sleep apnea, musculoskeletal diseases, stomach ulcer, gallbladder diseases, chronic liver disease and certain types of cancer (Malnick and Knobler, 2006; NHLBI, 1998). In addition, studies have shown that obesity reduces life expectancy (Fontaine et al., 2003) and increases disability (Sturm et al., 2004).

Obese individuals incur costs over and beyond those borne by non-obese individuals. There is no question that obesity has affected the demand for and supply of health care, resulting in significant increases in direct medical spending (Finkelstein et al., 2009). However, to fully understand the costs associated with obesity, it is important to capture not only direct medical costs, but also other types of costs associated with being overweight or obese, including lost wages, higher work-related costs, and higher costs associated with the purchase of personal goods.

This paper provides a systematic review of the peer-reviewed literature of various types of costs of obesity that affect overweight or obese working-age adults (Table 1). In addition, we combine results from these studies to calculate estimates for the overall cost of obesity at the individual level.

Table 1: Types of obesity-related costs and their definitions included in this report

Economic costs	**Definition**
Total direct medical costs	Both out-of-pocket and insurance-covered expenditures related to physician services, office-based care, outpatient and inpatient hospital care, emergency room (ER) care, dental care and pharmaceuticals
Absenteeism	Absence from work measured by the annual number of days of sick leave
Presenteeism	Time lost at work due to lowered productivity
Short-term disability	Salary-continuation benefit for employees off work measured by time away from work due to illness (between six days and six months)
Disability pension insurance	Pension benefits paid to employees due to their inability to work because of excess weight-related health problems
Premature mortality	Value of years of life lost measured by the dollar value of a quality-adjusted life year (QALY)
Workers' compensation	Type of labor, hourly wage measured by medical care and indemnity costs received annually
Personal costs	Clothing, daily needs, gasoline, etc.

Methods: A systematic literature search was performed using Medline, PubMed, EconLit, and Embase databases. Searches were limited to U.S.-based studies published in English before June

2010. The high obesity prevalence and health care spending in the U.S. in comparison to other high-income countries warrant this concentration and allows for the standardization of results among the studies included in this literature review. Search terms included obesity, overweight, body mass index, cost, expenditures, absenteeism, sick leave, sickness absence, wages, labor, employment, disability insurance, presenteeism, productivity, premature mortality, years of life lost, clothing, personal expenditures, gas and food costs. Referenced materials in relevant papers were also reviewed to identify additional relevant studies.

A first selection of papers was made through a title and abstract review. Criteria for inclusion of articles included peer-reviewed published articles and studies that were not limited to one particular disease. To assess the body of existing literature, no restrictions were placed on the definition of obesity, study subpopulation, or methods. As a result, 94 studies were identified, which we have divided into eight expenditure categories: 42 studies of direct costs, 12 studies of premature mortality, 17 studies of absenteeism, 13 studies of presenteeism, 13 studies of disability, 13 studies of wages, one study of gasoline consumption, and one study of life insurance (Table 1). From these papers, we discuss studies representative of the U.S. adult population, unless otherwise noted. Nationally representative estimates were available for studies that cover direct medical costs, premature mortality, lost wages, disability pension insurance, absenteeism, early retirement, gasoline use, and life insurance costs. No nationally representative studies were available to study the effects of obesity on short-term disability days or presenteeism. A short summary of these studies is available in the appendix. For each cost category, we report the available evidence for standard body mass index (BMI) cohorts. While some cost categories, such as direct medical costs and absenteeism costs, were already estimated in the reviewed studies, where possible, we calculated costs for the remaining categories using data reported from nationally representative studies.

***Obesity Definition*:** Current literature uses a wide variety of measures of obesity, including Body Mass Index (BMI), weight, body fat, and waist circumference. In this paper, we refer to standard weight cohorts that are most frequently used in the literature; normal weight (BMI 18.5 - <25), overweight (BMI 25 - <30), moderately obese (BMI 30 - <35), severely obese (BMI 35 - <40), and morbidly obese (BMI >40). In this paper, the term “obese” refers to those with a BMI higher than 30. Most, but not all, studies report these BMI groups. When studies use other BMI classifications or other weight denominations, it is noted in the text.

***Estimation of Costs*:** We report total incremental costs for each type of expenditure. Incremental costs are the additional costs borne by obese and overweight individuals and their employers relative to normal-weight individuals. Many obesity-related costs stem from the comorbidities associated with obesity; however, these expenditures are considered attributable to obesity. For some expenditure categories, such as direct medical costs and absenteeism, papers in the existing literature have already provided estimates of costs in the format adopted in this paper and are thus directly reported in this review. For the other expenditure categories (premature mortality, lost wages, disability, wages, gasoline consumption, and life insurance), we use existing research on the relationship between obesity and each of these expenditure categories to calculate incremental costs borne by the individual and by employers, if applicable. The papers we include

in the section on direct medical costs estimated costs at both the individual and societal levels. For all other costs, we report estimated costs at the individual level.

For job-related expenditure categories (lost wages, absenteeism, presenteeism, and disability), we estimate the costs for overweight and obese full-time employees (FTEs), because existing studies included in this review focused on the relationship between obesity and labor input for FTEs. Because the majority (79%) of the workforce is employed full-time, we believe the estimated labor-related costs are representative for the majority of employed individuals (authors' calculations using 2007 MEPS). In this review, we adjusted all reported costs to 2009 dollars, unless mentioned otherwise. Direct medical costs were adjusted using the Department of Labor, Bureau of Labor Statistics medical Consumer Price Index (CPI) (U.S. BLS, 2010a). All other costs were adjusted using the Department of Labor annual CPI (U.S. BLS, 2010a).

In the following sections, we discuss the relationship between BMI and the costs of obesity for each type of expenditure separately. In each section, we briefly describe our methodology for calculating costs. Further, detailed information on the estimation methods is available in the methodological appendix. In the final section, we present an estimate of the overall costs of obesity and discuss who bears these costs, followed by a brief conclusion.

RESULTS:

Direct Medical Costs

BMI and Societal Direct Medical Costs

Ten studies estimate obesity-related direct medical costs[1] at the national level. Of these studies, six report societal-level costs (Allison et al., 1999; Arterburn et al., 2005; Colditz, 1999; Finkelstein et al., 2009; Wang et al., 2008; Wolf and Colditz, 1996), and four reported individual-level costs (Arterburn et al., 2005; Finkelstein et al., 2009; Thompson et al., 1999; Thorpe et al., 2004).

Table 2: Summary of research on obesity-related direct medical costs at the societal level ($2009 billion)

Author	Wolf and Colditz*	Finkelstein et al. (2009)	Arterburn et al.	Wang et al.	Finkelstein et al. (2009)	Wang et al.	Wang et al.
Year	1980-1993	1997-98	2000	2000	2006	2010	2020
Overweight	$22.5	NA	$24.8	$27.4 - 29.7	NA	$45.5 - 48.1	$74.1 - 78.6
Obese	$42.1	$76.5	$55.9	$76.6 - 87.7	$151.7	$150.8 - 168.9	$283.7 - 318.9

* Prevalence-based study. The estimates of prevalence-based approaches largely depend on the number of adverse health effects included in the study. Wolf and Colditz (1980 – 1993) included non-insulin-dependent diabetes mellitus (NIDDM), coronary heart disease (CHD), hypertension, and gallstones. Colditz (1999), not included in this table, included a much larger range of diseases: NIDDM, cardiac heart disease, hypertension, gallbladder disease, osteo-arthritis, and breast-, colon-, and endometrium cancer and a larger BMI range. Therefore, his estimate of $119 billion in 1988–1994 is relatively large.

[1] Total direct medical costs include costs related to office-based care, outpatient hospital care and inpatient hospital care, ER care, dental care, and pharmaceuticals.

**Costs estimated at the societal level.

Source: Allison et al. (1999), Arterburn et al. (2005), Colditz (1999), Finkelstein et al. (2009), Wang et al. (2008), Wolf and Colditz (1996)

Table 2 displays the annual obesity-related direct medical costs at the societal level. Two findings become directly apparent. First, direct medical costs due to overweight and obesity are sizeable. For example, the most recent study from Finkelstein et al. (2009) estimates that incremental obesity-related direct medical costs total $152 billion annually in the U.S. ($2009 dollars), which corresponds to 9.1% of National Health Expenditure Account spending. Second, direct medical costs due to overweight and obesity have increased over time. For example, Finkelstein et al. (2009) estimate that in 2006, annual direct medical costs of obesity were $151.7 billion ($2009 dollars), double the amount of obesity-related spending in 1997-1998 (Finkelstein et al., 2003). Finkelstein et al. (2009) conclude that the main factor driving the trend in obesity-related direct medical expenditures was the increased prevalence of obesity rather than the increased costs of obesity-related care.

Projected estimates predict that future costs will continue to rise. Of the studies included in this review, Wang et al. (2008) forecast future costs of obesity using obesity prevalence from the National Health and Nutrition Examination Survey (NHANES) I, II, III, and 2003-2004, and cost estimates from both Thorpe et al. (2004) and Finkelstein (2003). Wang's results suggest that direct costs attributable to obesity could double from 2010 to 2020 (Table 2) and account for 15.8% - 17.6% of national health care expenditures in 2030 (Wang et al., 2008). These estimates predate the recently enacted Patient Protection and Affordable Care Act (PPACA) and the Health Care and Education Reconciliation Act (in this paper collectively referred to as PPACA). PPACA mandates preventive and wellness services be included in an essential health benefits package and requires health insurance plans to cover evidence-based or preventive services rated 'A' or 'B' by the United States Preventive Services Task Force (USPSTF). Due to the likelihood of an overall increase in health care services, health care costs, including obesity-related direct medical costs, may increase.

Individual Medical Costs

Studies estimating health care expenditures by weight cohort show health care expenditures increase exponentially with weight, which means morbidly obese people spend much more on health care than overweight or moderately obese individuals. For example, Arterburn et al. (2005) estimates the health care costs for an overweight person are $346 higher per year than the health care costs for a normal-weight person (Table 3). In contrast, the health care costs for a morbidly obese person are $2,845 higher per year than the health care costs for a normal-weight person (Table 3). The incremental costs for morbidly obese persons are eight times the incremental costs of overweight individuals.

Table 3: Individual annual incremental medical costs attributable to obesity by weight cohort ($2009)

Overweight	$346
Moderately obese	$807
Severely obese	$1,566
Morbidly obese	$2,845

Source: Arterburn et al. (2005)

Table 4: Individual annual medical costs and share of overall medical costs attributable to obesity in 2006 by expenditure type

	Incremental costs in 2006 ($2009)	Share of costs attributable to obesity (%)	% increase attributable to obesity from 1998 – 2006
Inpatient	$433	10.3	45.5
Non-inpatient*	$458	5.9	26.9
Prescription drug	$586	15.2	80.4
Total	$1,474	9.1	

*Non-inpatient care includes outpatient, office-based, dental, and home health care, emergency room, vision, and other (excluding prescription drug expenditures).
Source: Finkelstein (2009)

Prescription drug expenditures are affected most by obesity and obesity-related conditions. The share of costs attributable to obesity varies from 5.9% for non-inpatient care (excluding prescription drug expenditures) to 15.2% of prescription drug costs. Over time, health care and drug use by obese patients have changed. Between 1998 and 2006, 80% of the increase in prescription drug expenditures was obesity-related, compared to only 27% of the increase in non-inpatient expenditures (Table 4).

BMI and Premature Mortality

The majority of studies on premature mortality, including four studies representative of the entire adult population, find a U-shaped association between BMI and premature mortality, indicating both underweight and obese cohorts have a higher mortality rate than the normal-weight cohort (Calle et al, 1999; Fontaine et al., 2003; Stewart et al., 2009; Tucker et al., 2006). For instance, an overweight 40-year-old white man is expected to live 0.2 year less compared to a normal-weight 40-year-old white man, and a 40-year-old white man who is severely obese is expected to live 6years less than a normal-weight white man (Table 5).

Conversely, several studies have shown that elderly individuals who are obese have longer life expectancies than elderly individuals of normal weight, suggesting obesity has a protective effect (Al Snih et al., 2007; Lakdawalla et al., 2005; Reuser et al., 2009; Tucker et al., 2006). However, Yang and Hall (2008) show this finding is due to selectivity, whereby obese people who survive to later ages were less likely to be adversely affected by excess weight earlier in life.

Costs of Premature Mortality

We calculated the value of years of life lost, which converts reduced life expectancy of overweight and obese individuals into a dollar value. Years of life lost (YoLL) is calculated by subtracting life expectancy of overweight and obese individuals from the life expectancy of normal-weight individuals. The only study that provides YoLL estimates is by Fontaine et al. (2003) and is therefore used for these calculations. Using established estimates of quality-adjusted life year (QALY) and abridged life tables, we converted YoLL to life-cycle and annualized values of YoLL. QALYs are widely used in cost-effectiveness research and are

intended to adjust for differences in health status. In this review, we assume each YoLL equals one QALY, and therefore, we assume people are in perfect health. No consensus exists on what value of QALY should be used. For our estimates, we used $50,000 per QALY, a number commonly used in comparative effectiveness research. Note, however, that this number has not been adjusted for inflation since 1982. More recently, researchers estimated the value of life to range between $109,000 and $297,000 in 2003 dollars (Braithwaite et al., 2008; Hirth et al., 2000). The results are presented in Table 5.

The effect of obesity on life expectancy is greater for men than for women at all weight cohorts. Men experience a larger reduction in life expectancy than women. For example, life expectancy for a morbidly obese white male is reduced by 5.2 years, while life expectancy for a morbidly obese white female is reduced by 4.3 years (Table 5).

Table 5: Years of life lost (YoLL), life-cycle value and annualized value of YoLL due to disability

	YoLL (years)		Life-cycle value of YoLL ($2009)		Annualized value of YoLL ($2009)	
	White male	White female	White male	White female	White male	White female
Overweight	0.0	0.0	$0	$0	$0	$0
Moderately obese	1.4	0.8	$70,000	$40,000	$2,357	$1,299
Severely obese	2.8	2.4	$140,000	$120,000	$4,947	$4,110
Morbidly obese	5.2	4.3	$258,333	$216,667	$9,961	$7,946

Note: Results are presented for the average age of adult men and women (respectively 46 and 53) with a BMI of 24 as the reference group. Annualized value of years of life lost is estimated using CDC abridged life tables from the 1990 U.S. vital statistics (U.S. DHHS, 1993). In this report, we do not focus on ethnic disparities. Results for African-American men and women are available in the appendix.

Source: Authors' calculations using Fontaine et al. (2003)

Table 5 shows the average number of YoLL increases with weight. For example, an overweight white male has the same life expectancy as a white male with normal weight. In contrast, a morbidly obese white male is expected to live 5.2 fewer years than a normal-weight white male. The loss of 5.2 years is valued at $258,333. An average adult man (age 46) is expected to have 31.1 remaining years of life (CDC, 1994). Annualized, the value of early mortality for a morbidly obese white male is $9,961.

Box 1: Two studies suggest some obese women are less likely to be employed, but African-American obese men and women are more likely to be employed.

Two nationally representative studies examined the relationship between obesity and employment status (Han et al., 2009; Tunceli et al., 2006). Tunceli et al. (2006) concluded women, ages 18 – 45 years, who were obese in 1986, were less likely to be employed in 1999, but the disparity among men was not significant. Han et al. (2009) estimated the effects of obesity on employment probability by gender and ethnic groups and concluded the effects vary between groups. While Hispanic and white obese women are less likely to be employed than their normal-weight counterparts, they find no such relationship for Hispanic and white men. However, obese African-American men and women are more likely to be employed than normal-weight African-American men and women. These studies suggest some obese people are less likely to be employed. However, their results also suggest that more in-depth research on the relationship is warranted.

Source: Han et al. (2009), Tunceli et al. (2006)

Obesity and Wages

Eleven studies on wages assess the relationship between obesity and wages using longitudinal, nationally representative datasets such as the National Longitudinal Survey of Youth and Panel Study of Income Dynamics (Averett and Korenman, 1996; Baum and Ford, 2004; Bhattacharya and Bundorf, 2009; Cawley, 2000b, 2004; Gregory and Ruhm, 2009; Han et al., 2009; Kim and Leigh, 2010; Mitra, 2001; Mocan and Tekin, 2009; Wada and Tekin, 2007). These studies used

different proxies to capture obesity: seven papers used BMI, three papers used continuous weight, and one paper used body fat.

The studies suggest body weight and wages for female employees are negatively related, ranging between 1.5% and 15% (Averett and Korenman, 1996; Baum and Ford, 2004; Bhattacharya and Bundorf, 2009; Cawley, 2000b, 2004; Gregory and Ruhm, 2009; Han et al., 2009; Kim and Leigh, 2010; Mitra, 2001; Mocan and Tekin, 2009; Wada and Tekin, 2007). Thus, female employees who are obese earn relatively lower wages compared to female employees who are not obese. In contrast, results for the relationship between body weight and wages for male employees are mixed, but likely insignificant. Five studies report insignificant differences when comparing obese to normal-weight employees, two studies report a negative relationship between body weight and wages, and one study reveals a positive effect between excess body weight and wages. While there is reliable evidence supporting a relationship between obesity and wages by gender, we do not yet know why the relationship is clear for women, but not for men.

Lost Wages

Using reported wages from Averett and Korenman (1996) and Baum and Ford (2004), we estimate annual wages for normal-weight and obese FTEs. Lost wages are calculated by taking the difference between annual wages for normal weight and obese FTEs. The annual wage loss for male FTEs is $75, but as discussed in the previous section, this estimate is likely not statistically different from zero. For female FTEs, the annual wage loss is $1,855, a 6% reduction in annual salary for a woman with a median annual wage of $32,450 in 2009.

Obesity and Costs of Productivity

Productivity in the office is often measured through self-reported limitations at work or limitations in the amount of work that an employee can perform. Only one study on productivity uses nationally representative datasets (Ricci and Chee, 2005). The authors find that obese people are less likely to be productive at work than normal-weight people. Ricci and Chee (2005) explain that this reduced productivity is due to differences in health status between obese and normal-weight workers.

Three papers estimate the costs of reduced productivity. Using nationally representative data, Ricci and Chee (2005) estimate that on an annual basis, incremental costs associated with reduced productivity are $358 per obese worker. Other estimates for specific populations suggest there is some variation between the costs. Using health plan member data, Goetzel et al. (2010) estimates the costs per obese worker to be $54, while Gates et al. (2008) estimates the costs to be $575, using data from manufacturing firms.

Obesity and Absenteeism

Five studies on absenteeism, defined as annual missed work days due to illness or injury, used nationally representative datasets (Cawley, 2007; Finkelstein et al., 2005; Lightwood et al., 2009; Ricci and Chee, 2005; Wolf and Colditz, 1996). All studies conclude that obese employees are more likely to be absent from work as a result of illness or injury than normal-weight employees.

Table 6: Incremental costs of absenteeism ($2009)

	Males	Females
Overweight	$0	$106
Moderately obese	$0	$343
Severely obese	$730	$1,063
Morbidly obese	$495	$914

Source: Finkelstein et al. (2005)

Finkelstein et al. (2005) is the only study to directly estimate obesity costs associated with absenteeism (Table 6). In comparison to normal-weight men, severely and morbidly obese men miss two additional days of work per year. In comparison to normal-weight women, overweight, moderately obese, severely obese, and morbidly obese women miss between an additional one and five working days annually.

BMI and Disability

Four studies (Burkhauser and Cawley, 2006; Cawley, 2000a; Renna and Thakur, 2010; Thompson et al., 1998) used nationally representative datasets. Research has concentrated on the short-term effects of disability, short-term absence from work (between 6 days and 6 months), and limitations in the amount of work a person can perform for pay. Few studies have analyzed the effects of weight on long-term disability, such as receiving Social Security disability insurance and provision of disability pension insurance payments (Renna and Thakur, 2010).

Overweight and obese workers are more likely to suffer from disability than normal-weight workers, regardless of the measure of disability used. Arena et al. (2006) conclude that an overweight employee had a 26% increase in risk of a short-term disability event in comparison to a normal-weight employee. In comparison to a normal-weight employee, an obese employee had a 76% increase in risk of a short-term disability event. Although this research is not based on a nationally representative sample of workers, this finding is consistent across studies with samples from multistate financial institutions, firefighters, and petrochemical industry workers. Male workers comprise the majority of the workforce for firefighters and the petrochemical industry, 100% and 82%, respectively (Soteriades et al., 2008; Tsai et al., 1997; 2005; 2008). However, of two multistate financial institutions 74% and 63% of the employees were female (Arena et al., 2006; Burton et al., 1998, 1999).

Overweight and obese people face more work-related limitations and higher incidences of long-term disability. Burkhauser and Cawley (2006) find that each additional unit of BMI increases the probability of reporting work limitations by 1%. According to the authors, overweight individuals have a BMI that is, on average, five points higher than normal-weight individuals and will thus face a 5% increase in the probability of work limitations. The authors do not report average probability of reporting work limitations. Assuming 25% of the workforce reports work limitations, a 5% increase would raise the probability of reporting work limitations to 26.3%. Renna and Thakur (2010) find severely and morbidly obese men and women have a 1.6 percentage point higher incidence of long-term disability than normal weight individuals.

Costs of Short-term Disability and Disability Pension Insurance

We estimate disability costs associated with short-term disability and disability pension insurance for FTEs. Of the studies reviewed, two studies (Arena et al., 2006; Thompson et al., 1998) were suitable for calculating annual expenditures. We did not have enough information to estimate the costs associated with work limitations and long-term disability. Costs of short-term disability were calculated using the median wage of male and female FTEs (U.S. BLS, 2010b). In comparison to a normal-weight employee, the annual costs of short-term disability are $55 higher for an average overweight employee and $349 higher for an average obese employee (Table 7).

Table 7: Obesity-related annual incremental disability costs for full-time employees ($2009)

Dependent variable	Annual incremental costs of disability due to obesity by weight category	Based on
Number of days (between 6 days and 6 months) lost due to illness as a result of overweight or obesity for which employers paid disability claims	Total costs (males and females): Overweight: $55 Obese: $349 Total costs by gender: Overweight males: $61 Overweight females: $48 Obese males: $389 Obese females: $307	Arena et al. (2006)
Disability pension insurance premiums	Total costs (males and females): Overweight: no significant difference Obese: $69	Thompson et al. (1998)

Source: Authors' calculations using unadjusted estimates from Arena et al. (2006) and Thompson et al. (1998). 2009 median wage data was derived from the Bureau of Labor Statistics (2010)

Using the National Health Interview Survey, Thompson et al. (1998) conclude that obesity-attributable expenditures on disability insurance amounted to $800 million in 1994, or $1.2 billion in 2009 dollars. Using the number of employees in 1995 (U.S. DL, 2010) and the percentage of obese people in the U.S. (BRFSS, 1995), we calculate disability pension insurance costs per FTE. The annual incremental costs for obese FTEs are $69 (Table 7). However, the authors find no significant difference in disability pension insurance costs between overweight and normal-weight individuals, so we do not report an incremental cost for overweight.

Box 2: Severely and morbidly obese employees retire earlier than normal-weight employees

Renna and Thakur (2010) estimate individuals who are severely or morbidly obese are more likely to retire earlier than normal-weight individuals. Compared to normal-weight women, women who are severely or morbidly obese are 2.5 percentage points more likely to retire early. Men who are severely or morbidly obese are 1.5 percentage points more likely to retire early compared to men of normal weight. Individuals who retire early incur a loss of income. This loss will equal their wage minus the early retirement benefits the individuals receive. We do not estimate the losses incurred by individuals due to the wide variation in early retirement benefits.

Source: Renna and Thakur (2010)

Personal Costs: Gasoline Use

In addition to medical costs and lost wages, it is likely that obese individuals bear the burden of higher costs related to other personal expenditures. Jacobson and McLay (2006) assess the relationship between weight and fuel use and conclude that nearly 1 billion additional gallons of fuel are consumed annually because of average-passenger weight increases since 1960. Annually, they estimate that for every additional pound of weight for all car passengers, an additional 39.2 million gallons of fuel are consumed.

In order to calculate the number of gallons consumed by overweight and obese individuals, we first estimate the weight for the average of each BMI group. Table 8 presents the incremental costs by weight cohort. We calculate these estimates by using the midpoints of the BMI cohorts and the average heights for men and women in the U.S. For example, for two women of average height (63.8 inches), the difference in weight between a normal-weight female (BMI 21.75) and an overweight female (BMI 27.5) is 33 pounds. Using the estimates of Jacobson and McLay (2006) in combination with 2003 U.S. Department of Transportation data (U.S. DT, 2006), we calculate the increased consumption of gas for an individual in each weight group (Table 8). For instance, in a year, an overweight woman consumes an additional three gallons of gas and spends $8 more than a normal-weight woman. Although incremental gasoline costs are small for overweight men and women, the annual incremental costs are larger for morbidly obese passengers, who spend $30 and $36 for females and males, respectively (Table 8).

Table 8: Average additional weight (lbs) and consequential increases in annual gas costs

	Weight gain (lbs)		**Incremental gas cost ($2009)**	
	Female	Male	Female	Male
Overweight (27.5 BMI)	33.3	39.4	$8	$10
Moderately obese (32.5 BMI)	62.2	73.6	$16	$19
Severely obese (37.5 BMI)	91.2	107.9	$23	$27
Morbidly obese (42.5 BMI)	120.1	142.2	$30	$36

Note: Weight gain and cost estimates are calculated for an average-height male and female, 69.4 and 63.8 inches, respectively (NHANES 2002-2006). In 2009, gas prices in the U.S. averaged $2.35 per gallon (U.S. EIA, 2010).

Source: authors' calculations using Jacobson and McLay (2005) and U.S. DT (2006)

Personal costs: Life insurance

Thompson et al. (1998) estimate that people in 1995 spent an additional $2.6 billion on life insurance as a result of being overweight or obese. We calculated individual life insurance costs using the number of employees in 1995 (U.S. DL, 2010) and the prevalence of overweight and obesity (BRFSS, 1995). In comparison to normal-weight individuals, an overweight and obese individual will incur an additional $14 and $111, respectively, in life insurance costs annually.

Overall Costs

Table 9 summarizes the incremental costs for overweight and obese persons by expenditure type. Two overall cost estimates are reported: overall estimates including job-related costs, and overall estimates excluding job-related costs. We find that the overall costs of being obese are $4,879 for an obese woman and $2,646 for an obese man.

Table 9: Summary of per-person annual incremental obesity-related costs, by gender ($2009)

	Costs for women	Share*	Costs for men	Share*	Bearer
*Direct medical***					
Overweight	$346	66%	$346	80%	
Obese	$1,474	30%	$1,474	56%	Individual, Employer, Government
Wage					
Overweight	NA		NA		
Obese	$1,855	38%	$0	0%	Individual
Short-term disability					
Overweight	$48	9%	$61	14%	
Obese	$307	6%	$389	15%	Individual, Employer
*Disability pension insurance***					Individual, Employer
Overweight	$0	0%	$0	0%	
Obese	$69	1%	$69	3%	
Sick leave (absenteeism)					
Overweight	$106	20%	$0	0%	
Obese	$674	14%	$212	8%	Individual, Employer
*Productivity (presenteeism)***					
Overweight	NA		NA		
Obese	$358	7%	$358	14%	Individual, Employer
Gasoline for cars					
Overweight	$8	2%	$10	2%	
Obese	$21	0%	$23	1%	Individual
*Life insurance***					
Overweight	$15	3%	$15	4%	
Obese	$121	2%	$121	5%	Individual, Employer
Total (including work)					
Overweight	**$524**	**100%**	**$432**	**100%**	
Obese	**$4,879**	**100%**	**$2,646**	**100%**	Individual, Employer, Government
*Value of lost life due to premature mortality****					
Overweight	$0		$0		
Obese	$3,486		$3,872		Individual
Total (including value of lost life)					
Overweight	**$524**		**$432**		
Obese	**$8,365**		**$6,518**		Individual, Employer, Government

* Share of total, including work-related costs

** Source does not provide estimates by gender

*** For whites only

Note: for premature mortality, sick leave, and gasoline, we used the moderately obese, severely obese, and morbidly obese prevalence rates reported by Flegal et al. (2009) as weights to calculate costs for the obese category.

Source: Authors' calculations

Key Findings and Discussion

In this study, we provide estimates of various obesity-related costs, stratified wherever possible by gender. This paper presents four important findings, highlighted in Table 9.

First, the overall, tangible, annual costs of being obese are $4,879 for an obese woman and $2,646 for an obese man. The overall annual costs of being overweight are $524 and $432 for women and men, respectively. For both genders, the incremental costs of obesity are much higher than the incremental costs of being overweight. For obese women, the total incremental costs are more than nine times higher than those for overweight women. For obese men, the total incremental costs are six times higher than for overweight men. These differences are found in all expenditure classes.

Adding the value of lost life, which is a less tangible cost than, for example, direct medical costs and wages, produces even more dramatic results. Costs including value of lost life are $8,365 for obese women and $6,518 for obese men. As a result, total incremental costs for obese individuals are 15 times higher than the total costs for overweight individuals, irrespective of their gender and employment status.

Second, the literature review reveals there is a lack of research on costs that are neither medical nor job-related. With the exception of the paper by Jacobson and McLay (2006) on fuel costs, there is virtually no peer-reviewed analysis of consumer-related costs at the individual level. Anecdotal evidence of the obese paying higher costs for goods and services, such as clothing and airline travel (Bellafonte, 2010; Higgins, 2010), are reported somewhat regularly in the popular press, but to our knowledge, there has been no systematic research published on these types of costs. Nor did we find any attempt to place a value on socio-demographic variables such as marital status or education level.

Third, where we were able to break down the costs by class of obesity, we found the incremental costs of morbid obesity are much higher than the incremental costs of moderate obesity. We observed this trend in direct medical costs, premature mortality, absenteeism, and fuel consumption. For example, the direct medical costs for morbid obese individuals are 3.5 times higher than the direct medical costs for moderately obese individuals. As a result, Allison (1999) estimates one-fifth of total incremental costs of obesity at the societal level are due to morbidly obese patients, although the morbidly obese comprise only 5.7% of the population (Flegal et al., 2010).

Fourth, the main driver of costs differs for the overweight and obese. Direct medical costs are the most important cost driver for overweight people overall. Overall annual incremental costs for overweight female and male adults are $524 and $432, respectively, of which 66% and 80% are direct medical costs (Table 9). For obese people, gender differences emerge. Direct medical costs remain the main cost driver for obese men, while non-medical costs are the most important cost driver for obese women. Roughly half of the overall costs of obese men are explained by direct medical costs. In contrast, two-thirds of total costs for obesity among females are attributable to non-medical costs, although direct medical costs are high in absolute numbers.

Fifth, there are significant differences in job-related costs by gender.[2] Overall annual incremental costs are higher for obese women than for obese men ($4,879 for an obese woman compared to $2,646 for an obese man). This disparity is attributable mostly to lost wages and absenteeism. These factors account for 38% and 14%, respectively, of overall costs to an obese female employee (Table 9).

Sharing the Costs

In this report, we have provided estimates of annual incremental costs of overweight and obesity from the perspective of the individual. However, in addition to the individual, employers, and to some extent, government, bear some of the costs. Of the items discussed in this review, overweight or obese individuals bear the full burden for some costs, such as value of lost life, lost wages, gasoline costs, and, when applicable, life insurance. Employers and employees share the burden for many other costs, including direct medical costs, short-term disability, disability pension insurance, absenteeism, and productivity losses. Employers directly pick up the costs for many of these expenditures. However, employees indirectly share part of this burden through lower wages, for example[3]. In addition, the government, through publicly funded programs such as Medicare and Medicaid, pays a significant portion of direct medical costs for their beneficiaries.

Two out of three adults is now considered overweight or obese, and the number of obese individuals will grow to almost 50% in the next 20 years. Our workforce reflects the general population; it is clear that a significant portion of the labor pool is comprised of overweight and obese individuals. With such a large percentage of the population falling into these categories, the workplace will become an increasingly important part of the solution. However, programs designed to promote workforce wellness are also likely to affect the costs of being overweight or obese. One example is a provision in PPACA in which employers may give rewards, such as premium discounts, to employees for satisfying a target related to a health status factor, including BMI. The amount of the reward can be up to 30% of the employee share of the cost of health insurance coverage. There is an ongoing debate regarding the effects of such initiatives.

Study Limitations

Our study faces several limitations. First, for two cost categories (short-term disability days and presenteeism), nationally representative data were not available; therefore, we must rely on subpopulations. Second, our study uses estimates reported in other, recently published research that was not adjusted to represent the growth in obesity prevalence observed in recent years. Third, for indirect costs, most peer-reviewed studies focus on employment-related costs. We were unable to calculate the costs of long-term disability, early retirement, work limitations, and probability of employment. There is virtually no analysis of other consumer-related costs other than anecdotal evidence. This lack of information about several categories of costs, such as travel costs, other personal costs, and long-term loss of earnings result in an underestimation of indirect costs. Fourth, accurately estimating the causal relationships between wages and weight cohorts is

[2] In 2007, the majority of American men and women (age 18 – 65) were employed: 73.5% of obese women and 86.5% of obese men had a part-time or full-time job (MEPS, 2007).
[3] This discussion is related to the arguments for the identification problem discussed in the wage section.

problematic, as the direction of the relationship has not been conclusively determined. Several theories have been put forward arguing that obesity results in lower wages. At the same time, lower wages may also cause obesity. Fifth, these are annual, incremental cost estimates. They are not adjusted for changes over the life cycle and therefore should not be summarized over a lifetime.

Areas for Future Research

This review has identified several gaps in the current knowledge on the effects of excess weight on costs. For example, some studies show racial and ethnic disparities in direct medical costs (Finkelstein et al., 2008), premature mortality (Fontaine et al., 2003), and lost wages (Cawley, 2004; Gregory and Ruhm, 2009; Han et al., 2009). These studies suggest the incremental costs of obesity may be lower for obese African-American men and women than for obese white men and women. (For a discussion on racial and ethnic disparities in premature mortality, please see the Appendix.) To our knowledge, no studies have attempted to explain why these disparities exist, whether the adverse health effects of obesity are less severe for African-Americans, or whether these disparities are due to other lifestyle or environmental factors. Given that obesity prevalence among African-American and Hispanic populations is higher than obesity prevalence among the white population, this would be an important area for future research.

In addition, there is a need for more research to improve understanding of the gender differences in obesity-related costs. Gender differences may be more pronounced than indicated in this paper, particularly because obesity-related medical costs may differ by gender. Assessing lifetime costs attributable to overweight and obesity by gender and race, Finkelstein (2005) finds that for all BMI groups, women have higher medical expenditures than men. However, no studies have fully explored or explained this finding.

CONCLUSION:

It is clear from this review that across a number of expenditure categories, obese individuals incur higher costs than normal-weight or overweight individuals. As individuals move up in the degree of obesity, costs grow exponentially. Obese women are more affected than obese men, particularly regarding work-related expenses. Further study is warranted to explain racial and ethnic disparities related to obesity-related costs.

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