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Estimated Reduction in Health Care Spending Associated with Weight Loss among Adults

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Abstract

Importance: Recent data from federal surveys show that over 70 percent of adults are either overweight or obese. This percent continues to rise. Overweight and obesity are associated with a large number of expensive chronic conditions such as type 2 diabetes, heart disease, hypertension, hyperlipidemia among several others. The rising prevalence of chronic disease is a key driver of rising health care spending among employers and the Medicare program.

Objective: To estimate the level in health care spending among overweight and obese privately insured and Medicare adults associated with higher and lower body mass index.

Design, Setting and Participants: This cross-sectional study included all privately insurance and Medicare adults with a body mass index of 27 and higher. We use data from the Medical Expenditure Panel Survey-Household Component to tabulate total annual health care spending. Using an instrumental variable regression model with predict total spending at various levels of body mass index.

Main Outcomes and Measures: The primary measures is total annual health care spending controlling for patient demographics, income, education and body mass index.

Results: Among those with employer-sponsored insurance, adults with a baseline BMI of 30 are predicted to spend nearly 10 percent less compared to those with a BMI 5 percent lower and nearly 40 percent less compared to those with a BMI 25 percent lower. . The results are even more pronounced for those with higher baseline BMI. For adults with a baseline BMI of 45, adults with a 5 percent lower BMI was associated with an 11 percent reduction in spending while an adults with a 25 percent reduction in weight was associated with over a 44 percent reduction in spending.

The results were similar for Medicare adults. Those adults with a baseline BMI of 30 were predicted to spend over 6 percent less with a 5 percent reduction in weight and 28 percent less with a 25 percent reduction in weight. Those with a baseline BMI of 45 were predicted to spend over 7 percent less on health care and a 25 percent reduction was associated with a 32 percent reduction in spending.

INTRODUCTION

The share of U.S. adults considered to have obesity (BMI ≥ 30) has increased sharply, rising from 30.5 percent in 2000 to an estimated 42 percent in 2020. With the additional 30.7 percent of adults considered overweight [1]. 72.7% of adults would need to lose weight to achieve recommended BMI. Excess weight increases the likelihood of developing several chronic diseases including type 2 diabetes, hypertension, heart diseases, hyperlipidemia, osteoarthritis, and pulmonary diseases as well as increasing the risks of developing several types of cancer. The rising prevalence of chronic disease over time, fueled in part by rising rates of overweight and obesity, is a major driver of the level and growth in health care spending. Recent estimates show that obesity was associated with over $260 billion in annual health care spending in 2016 alone [2]. With the anticipated growth in health spending, this total would rise to more than $385 billion in health spending in 2024 [3].

While most of the health care costs associated with obesity are paid by employer-based health insurance, nearly a quarter of the costs are borne by Medicare and Medicaid with consumers paying approximately 8 percent of the remaining spending out of pocket [4].

Interventions to reduce the level and growth in obesity are major public health and economic opportunities with far-ranging benefits. Obesity has a major economic impact on employers as obesity in the workforce is associated with greater workplace accident rates and employer and worker spending on health care. Research on employer-related obesity costs found that workers with obesity had almost twice as many workers' compensation claims, seven times higher medical claims costs, and 11 times greater indemnity claim costs compared to coworkers with normal weight [5]. Compared with other employees, workers with obesity required nearly three times more workers' compensation days, 2.92 versus 8.59 days [6]. Having a BMI over 35 increases

the lifetime risk of developing type 2 diabetes to 70% or more [7], and every 5-point increase in BMI raises the risk of heart failure by nearly a third [8]. Moreover, excess weight gain accounts for 65-78% of the risks for developing hypertension [9].These data provide a compelling rationale for all payers, both public and private, to invest in interventions to encourage the achievement and maintenance of healthy weight levels to reduce costs associated with obesity and related chronic conditions.

There are several evidence-based approaches to reduce the level and growth in obesity and overweight. Lifestyle intervention programs such as the Diabetes Prevention Program have been shown to be cost-effective (since it is now a Medicare covered benefit), by producing a 5-7 percent reduction in weight [10]. Bariatric surgery is another evidence-based option. Bariatric surgeries are expensive, involve inherent patient risks, and often require revisional surgeries and failure to achieve and maintain weight loss. Payers, including Medicare, limit bariatric surgery to patients with a body mass index (BMI) of 35 and above plus one obesity-related comorbid condition or a BMI ≥ 40 [11]. However, there is a substantial published literature examining the impact of bariatric surgery on health care spending. One recent meta-analysis found across the studies that weight loss resulting from bariatric surgery results in net health care savings [12,13]. Finally, recent innovations in pharmacotherapy such as GLP-1 agonist medications provide a third option. These novel medications have been shown to produce substantial reductions in weight among people living with excess weight or obesity. At week 68, the mean difference among placebo and the GLP-1 tested groups was a 12.4 percent reduction in weight [14]. However, nearly a quarter of the adults using a GLP-1 agonist achieved more than a 20 percent reduction in weight. The magnitude of these results is impressive. While the costs of each of these interventions are well known, the reductions in health care spending for adults achieved through weight loss are less well documented.

While there have been a couple of studies have estimated the reductions in spending associated with various levels of weight loss, they have generally been limited to privately insured patients with a comorbid condition like diabetes or limited to adults with private insurance. This paper expands on this limited work in two areas. First, it updates the reductions in health care spending associated with weight loss to 2023 dollars. Second, it expands the literature to include reductions in health care spending in the Medicare program. We examine changes in health care spending overall for those with one or more chronic conditions including for 8 key chronic conditions related to obesity: hyperlipidemia, hypertension, mental disorders, pulmonary disease, arthritis, back problems, heart disease and asthma. The analysis presents changes in annual spending associated with 5,10,15,20 and 25 percent reductions in baseline BMI.

DATA SOURCES AND METHODS

We use data from the 2001 to 2016, 2018, and 2020 Medical Expenditure Panel Survey Household Component (MEPS-HC) consolidated and medical condition data files [13]. For Medicare we used 2001-2016 and 2018 and for ESI 2001-2016, 2018 and 2020. We found some anomalies in the COVID era data for Medicare in 2020. The MEPS-HC is a nationally representative sample of the civilian noninstitutionalized population. It collects self-reported medical condition information, insurance coverage, health care use over two calendar years, and detailed demographics (age, gender, race/ethnicity, education among others). In 2020, due to COVID-19, the MEPS-HC primarily moved from in-person surveys to telephone interviews. The transition did not appear to significantly impact reported BMI among those with private insurance but the trends among Medicare patients appeared to be affected.

Medical conditions in the MEPS-HC files are coded using Clinical Classifications Software (CCS) codes for years 2001 to 2015 and Clinical Classifications Software Refined (CCSR) codes for years after 2015. We selected respondents with one or more of the following 10 clinical conditions: diabetes (*CCS 49, 50; CCSR END002 - END006*), hyperlipidemia (*CCS 53; CCSR END010*), hypertension (*CCS 98, 99; CCSR CIR007 CIR008*), mental health (*CCS 650 - 663;*

CCSR MBD001 - MBD014, MBD017 - MBD034), pulmonary disease (*CCS 127,129 - 134;*

CCSR RSP006 - RSP008, RSP010 - RSP014, RSP016), arthritis (*CCS 201 - 204; CCSR MUS001*

- MUS007), back problems (*CCS 205; CCSR MUS011, MUS038*), heart disease (*CCS 96, 97, 100 - 108; CCSR CIR001 - CIR006, CIR010 - CIR012, CIR014 - CIR018*), cerebrovascular disease (*CCS 109 - 113; CCSR NVS012, CIR020 - CIR025*) and asthma (*CCS 128; CCSR RSP009*). The analysis was limited to adults aged 24 to 64 with BMI ≥ 25 and 12 months of employer-sponsored insurance with a child in household aged 11 to 20 and adults aged greater than or equal to 24 with BMI ≥ 25 and 12 months of Medicare with a child in the household aged 11 to 45. We excluded pregnant women and adults with BMI greater than 80 from the analysis.

We also excluded those missing weight data and other covariates in our regression model.

Finally, we excluded those adults with outlier expenditures above $506,000 (nominal) total expenditures resulting in a sample size of We estimate separate models for total health expenditures for those with employer-sponsored insurance and Medicare.

The analysis was completed using STATA version 17. The survey estimation commands were used to adjust for the complex survey design of the MEPS-HC. All dollars were inflated to 2023 using the Personal Consumption Health Care Expenditures Index [15].

There are several approaches one could adopt to evaluate the relationship between weight and health care spending. These include microsimulation models such as the Future Adult Model (FAM) and longitudinal analyses such as the work around the diabetes prevention program [16,17]. Our analysis relies on cross-

sectional data on health care spending and BMI. Each approach has concluded that health care spending is higher with increased in BMI. Following earlier published work on this, we treated the BMI for each adult as an endogenous variable [18]. Our analysis used a two-stage residual inclusion instrumental variable (IV) model. Critical to reliable estimation is that the instrument used is strongly correlated with the variable of interest, here BMI. We followed the approach used by Cawley et al., that used the BMI of each adult's oldest child. Instruments need to be highly predictive of the endogenous variable and not correlated with the error term in the second stage regression. For those with employer-sponsored insurance we used the BMI of the oldest child between ages 11 and 20 as the instrument. For the Medicare population we use the BMI of the oldest child through age 45. We use the relationships mapping available in the MEPS-HC to link parents and children. The weight of a biologic child has been shown to be a strong predictor of the parent's weight since up to 75 percent of the variation in weight across individuals is genetic. Earlier work completed by Cawley has shown the child's BMI is a strong predictor of the parents BMI (the F-statistics in the first stage of the regressions were substantially higher than the recommended F=10 threshold for minimum statistical power). In our model, the first stage using the child's BMI had F- statistics ranging from 23 to over 300 in the employer model and 24 to over 110 for the Medicare model. For each of the conditions and total spending the first stage of each model had F-statistics that far exceeded the minimum standard showing significant power. We show these first stage results in the supplement. Second requirement for an instrument is validity; that the child's BMI is not correlated with adults predicted medical spending after controlling for predicted BMI and other control variables. There is a considerable literature however that finds no measurable impacts of common experiences within the household and are largely irrelevant in determining individual differences in weight.

Generalized linear models (GLM) with gamma distribution and log link function were estimated using total spending among those with at least one condition reported. The models control for BMI, race, gender, age groups, education, region of the country, marital status, household composition, self or proxy reported information, gender and age in months of oldest child whose BMI is used as instrument, and year. To get changes in health care spending, we estimate predicted spending, then reduce weight by 5,10,15, 20 and 25 percent to get predicted spending at the lower BMI levels. We report the difference in baseline spending to the reduced BMI spending and report the difference between them. Marginal effects of models are reported in appendices.

Summary baseline statistics for the variables used in the analysis are presented in Table 1. For adults with BMI ≥ 25 and employer-sponsored insurance (Table 1) mean total health care spending was $6,912 and the average BMI was 31.5. Approximately 60% of the sample was between the ages of 45 and 64. Almost three-quarters of those with employer-sponsored insurance were non-Hispanic White adults.

Among Medicare adults with BMI ≥ 25 average health care spending was $15,510 and mean BMI was 32.5. About 61% of the Medicare adults were non-Hispanic White.

Table 1: Baseline Population Characteristics of Adults with Employer-Sponsored Insurance and Medicare, BMI ≥ 25

Characteristic	Medicare (N = 3,774) Mean Std. dev	Employer-Sponsored Insurance (N = 13,443) Mean Std. dev
Total Spending	$15,510 ($31,456)	$6,912 ($14,703)
Body Mass Index	32.5 (6.4)	31.5 (5.6)
Age	63.1 (11.1)	46.3 (6.9)
Oldest Child BMI	28.0 (7.6)	23.3 (5.3)
Oldest Child Female	41.6% (49.3%)	47.8% (50.0%)
Oldest Child Age (months)	363.6 (124.4)	195.1 (32.8)
Female Male	50.4% (50.0%) 49.6% (50%)	47.6% (49.9%) 52.4% (49.9%)
Race		
Non-Hispanic White	61.3% (48.7%)	73.0% (44.4%)
Non-Hispanic Black	17.4% (37.9%)	11.1% (31.4%)
Non-Hispanic Other	7.3% (26.0%)	4.9% (21.6%)
Hispanic	14.0% (34.7%)	11.0% (31.3%)
Age Category		
24-34	0.7% (8.4%)	4.2% (19.8%)
35-44	7.8% (26.9%)	36.9% (48.3%)
45-54	15.4% (36.1%)	47.2% (49.9%)
55-64	14.9% (35.6%)	11.7% (32.1%)
65+	61.2% (48.7%)	0.0% (0.0%)
Education		
Less than High School	25.8% (43.8%)	6.0% (23.8%)
High School Graduate	35.3% (43.0%)	29.0% (45.4%)
Some College	23.9% (42.7%)	28.6% (45.2%)
College Graduate	15.0% (35.7%)	36.3% (48.1%)
Region		
Northeast	21.7% (41.2%)	19.2% (39.4%)
Midwest	19.7% (39.8%)	25.2% (43.4%)
South	39.4% (48.9%)	36.5% (48.1%)
West	19.2% (39.4%)	19.1% (39.3%)
Married	62.5% (48.4%)	86.7% (33.9%)
Self-reported information	61.8% (48.6%)	55.9% (49.6%)
# in household 0 – 5 years old	0.09 (0.35)	0.11 (0.36)
# in household 6 – 17 years old	0.51 (0.89)	1.34 (0.99)
# in household 18 – 64 years old	1.90 (0.98)	2.49 (0.85)
# in household 65+ years old	0.90 (0.79)	0.03 (0.17)

Appendix 1 and 2 presents the regression results of the employer-sponsored insurance and Medicare adults. We report the results from the second stage. The F-statistics for the first stage of the model (not reported) in both regressions far exceeded 10, a threshold for statistical significance of our instrument, the BMI of the adult's oldest child. The residual term (ivbmianydx) of the first stage regression is included as a covariate.

RESULTS AND DISCUSSION EMPLOYER-SPONSORED INSURED RESULTS

The association of BMI and health care spending among adults with employer-sponsored insurance was significant (p<.01) and

large. Each point increase in BMI over 30 is associated with a $454 increase in annual health care spending. There were also large differences in annual spending by race and ethnicity (**Appendix 1**). Relative to non-Hispanic Whites, non-Hispanic Black adults spend $1,262 less and Hispanic adults $1,896 less per year.

Table 2 reports the predicted dollar reduction in spending associated with a 5 to 25 percent reduction in weight for baseline BMIs from 30 to 45. The table reports total spending among all patients with at least one of the listed chronic condition. Table 2 also reports annual and predicted reduction in spending for individuals by each of the 9 chronic conditions. Overall, adults achieving a 5 percent weight loss are predicted to spend $952, over 11 percent less on health care. The dollar and percent reductions in spending increase sharply for each 5-percentage point reduction in weight. Adults with a 25 percent reduction are predicted to achieve spending reductions over 4 times higher than those with a 5 percent reduction. At a 25 percent reduction in weight, reduction in predicted spending is $3,810, over 44 percent lower than their baseline spending.

The results are similar for annual spending among patients with any one of the 9 chronic diseases, but differed greatly among the individual conditions. Projected savings were greatest across all percentages of weight loss for people living with obesity and type 2 diabetes. A 15 percent reduction in weight resulted in predicted spending reductions that ranged from approximately a 10.5 percent reduction in spending among those with hyperlipidemia to more than 54 percent among adults with diabetes.

By the nature of the GLM model, the association of BMI and annual health care spending is nonlinear and varies by baseline BMI and percent reduction in weight. These results are reported in **Appendix 3**. Higher baseline BMI levels were associated with higher health care spending such that, the inverse: lower weight reduced health care spending held across all BMI and weight loss percentages. The potential for savings escalates according to baseline BMI such that the same percent reduction in weight generated greater savings at higher BMI baseline levels. For instance, a 5 percent reduction in weight for an adult with baseline BMI of 30 was associated with a 9.5 percent reduction in spending. The same 5 percent reduction in weight for an adult with a baseline BMI of 45 was associated with nearly a 14 percent reduction annual health care costs.

The percent reduction in annual spending was most substantial among those with the highest BMI and largest percent weight loss. Adults with a 25 percent reduction in weight had predicted reductions in spending of nearly 40 percent with baseline BMI of 30 to over 50 percent for those with a BMI 42 and higher. Among this group, annual projected spending dropped by $2,484 to over $3,810 per year compared to baseline level of spending without the weight loss.

MEDICARE RESULTS

We used the same two-stage least squares approach for Medicare adults as well. The results are presented in **Appendix 2**. Each 1 point increase in BMI among Medicare adults was associated with a $655 increase in total health care spending. Table 3 presents the reduction in annual health care spending associated with a 5 to 25 percent reduction in weight for BMIs 30 - 45. Adults with Medicare who lose 5 percent of their weight were predicted to reduce spending by 7.4 percent. The reduction in spending nearly doubles for 10 percent reduction in weight. For a 25 percent reduction in weight the reduction in spending doubles again (relative to the 10 percent reduction), cutting spending by $5,560, nearly 32 percent lower compared to spending at the baseline weight.

Appendix 4 presents the reduction in health care spending as BMI increases from 30 to 45. Overall, the average reduction in health care spending assuming a 25 percent reduction in BMI was $5,561, a 32 percent reduction. Among Medicare beneficiaries with a 15 percent reduction in BMI, predicted spending decreased by more than $3,590, a 20 percent reduction in spending from baseline.

As displayed in **Appendix 4**, the dollar and percent reductions in health spending for a given percent reduction in BMI were far greater for higher levels of baseline BMI. Following the same pattern reported for those with employer-sponsored insurance, for a given percent reduction in weight increases in baseline BMI resulted in larger dollar and percent reductions in health care spending. For example, among Medicare adults with a baseline

Table 2: Reduction in Annual Total Health Care Spending per condition, Adults (24-64), BMI 30- 45, and Employer-Sponsored Health Insurance, 2023

		Percentage BMI Reduction				
	Predicted Baseline Expenditures	5%	10%	15%	20%	25%
One or more conditions	$8,628	$952	$1,797	$2,549	$3,216	$ 3,810
Diabetes	14,273	3,275	5,791	7,726	9,214	10,361
Hyperlipidemia	8,403	305	599	882	1,155	1,418
Hypertension	8,349	707	1,353	1,944	2,485	2,979
Mental Health	11,461	1,381	2,594	3,659	4,594	5,416
Pulmonary Disease	7,744	268	527	777	1,018	1,251
Arthritis	12,794	1,707	3,183	4,460	5,565	6,522
Back Problems	12,301	1,902	3,507	4,862	6,006	6,972
Heart and/or Cerebrovascular Disease	14,497	1,176	2,256	3,247	4,157	4,992
Pulmonary and/or Asthma	8,006	295	580	853	1,117	1,371

Table 3: Reduction in Annual Total Health Care Spending per condition, Adults (24+), BMI 30- 45, and Medicare, 2023

	Percentage BMI Reduction					
	Predicted Baseline Expenditures	**5%**	**10%**	**15%**	**20%**	**25%**
One or more conditions	$17,534	$1,291	$2,486	$3,591	$4,615	$5,562
Diabetes	20,248	1,060	2,064	3,014	3,914	4,767
Hyperlipidemia	16,695	852	1,661	2,427	3,154	3,843
Hypertension	18,321	1,448	2,779	4,004	5,131	6,168
Mental Health	21,028	766	1,504	2,215	2,899	3,558
Pulmonary Disease	20,693	1,038	2,023	2,959	3,846	4,689
Arthritis	18,659	862	1,683	2,466	3,212	3,923
Back Problems	19,026	624	1,227	1,811	2,374	2,920
Heart and/or Cerebrovascular Disease	22,520	-347	-699	-1,056	-1,419	-1,788
Pulmonary and/or Asthma	20,178	920	1,798	2,635	3,434	4,196

BMI of 30, a 15 percent reduction in weight was associated with a $2,450, or 17 percent reduction in spending. For the same adult, a 25 percent reduction in weight was associated with a $3,884 or 28 percent reduction in health care spending. At the extreme, an adult with a baseline BMI of 45 achieving a 15 percent reduction in weight was associated with a $7,022, a 25 percent reduction in spending. For the same adult, a 25 percent reduction in spending was associated with a $10,692 nearly a 40 percent reduction in spending. The results are similar for annual spending among Medicare beneficiaries with baseline BMI of 30 or more and having any one of the 9 chronic diseases, though the magnitude of savings varied by conditions. Projected savings were greatest across all percentages of weight loss for individuals living with obesity and type 2 diabetes. A 15 percent reduction in weight resulted in predicted spending reductions that ranged from a 10.5 percent reduction in spending among those with hyperlipidemia to more than 54 percent among adults with diabetes.

DISCUSSION

The results show the substantial reduction in predicted health care spending associated with weight loss. This study has updated previous work and expanded it to include the impact of weight loss on Medicare adults. Among those with employer-sponsored insurance, adults with a baseline BMI of 30 are predicted to spend nearly 10 percent less on health care with a 5 percent reduction in weight to nearly 40 percent less with a 25 percent reduction in weight. The results are even more pronounced for those with higher baseline BMI. For adults with a baseline BMI of 45, a 5 percent reduction in weight was associated with an 11 percent reduction in spending while a 25 percent reduction in weight was associated with over a 44 percent reduction in spending.

The results were similar for Medicare adults. Those adults with a baseline BMI of 30 were predicted to spend over 6 percent less with a 5 percent reduction in weight and 28 percent less with a 25 percent reduction in weight. Those with a baseline BMI of 45 were predicted to spend over 7 percent less on health care and a 25 percent reduction was associated with a 32 percent reduction in spending.

The approaches for generating weight loss in these ranges are currently available. Randomized trials of the use of GLP-1 agonists have found that over a third of participating adults with overweight or obesity using the product loss 20 percent or more of their body weight. On average adults lost nearly 13 percent of body weight. These results should be of special interest to employers, health plans and Medicare given the substantial projected reduction in health care spending associated with the weight loss among people with obesity. Medicare does not currently reimburse for FDA-approved weight loss medications, a potential missed opportunity. Many employers also deny coverage outright or significantly limit coverage of the drugs. This analysis of the significant projected reduction in health care spending associated with weight loss should provide important new information for changes in policy toward reimbursement for evidence-based weight loss treatments.

LIMITATIONS

The analysis highlights the reduction in health care spending associated with lower levels of BMI. The results are based on a cross-sectional and not longitudinal analysis that models estimated changes in health care spending associated with a 5 to 25 percent reduction in BMI. Unlike some earlier analyses of the diabetes prevention program and bariatric surgery, the analysis does not track patients over time pre and post intervention.

CONCLUSIONS

The projected annual savings from weight loss among the four in ten U.S. adults living with obesity is significant for both Medicare and employer-based insurance. Projected savings start at modest levels of weight loss and accelerate by multiples as weight loss percentage increases. Projected savings are consistent for employers and Medicare and are highest for people with higher baseline BMI levels. The common presence of comorbid chronic conditions associated with excess weight are also predictive of projected savings from weight reduction across BMI levels of 30 or more with type 2 diabetes showing the highest level of savings. These savings do not, however, reflect the significant potential of promoting weight loss as a means to preventing the development of common chronic conditions associated with excess weight and obesity. Those conditions, including diabetes, heart disease, stroke, hypertension, and many cancers, are primary drivers of health care spending, preventable

disability, economic losses, and premature death. Accordingly, significantly greater overall benefits could be realized by Medicare, private insurers, individuals, and society at large from promoting weight loss and healthy weight maintenance among people living with excess weight or obesity. Achieving weight loss and the projected savings is facilitated by improving access to evidence-based programs and treatments demonstrated to promote and maintain weight loss. Improving access to new weight loss medications along with existing evidence-based behavior change and weight loss interventions should help reduce health care spending associated with obesity in America.

AUTHOR CONTRIBUTIONS

Dr. Thorpe outlined the study design and wrote the paper manuscript and takes full responsibility for all results. Mr. Joski conducted the statistical analysis.

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Roles of the Funder/Sponsor

The funding organization had no role in the design and conduct of the study.

DATA SHARING STATEMENT

All data are available online from the Medicare Expenditure Panel Survey-Household Component.

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