Economic Value of Weight Loss in Adults With Obesity

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Introduction

- An estimated 39.8% of adults have obesity in the United States (US), according to 2015–2016 data from the National Health and Nutrition Examination Survey[1]
- Obesity imposes a significant economic burden on US society, incurring $1.72 trillion in both direct and indirect costs annually[2]
- While there have been studies to explore the economic benefits of weight loss (WL),[3,4] the short-term cost savings as a result of WL or sustained WL for a defined period of time (eg, 1 year) have not been well described
- Although the efficacy and economic benefits of surgical weight loss have been demonstrated,[5] the economic impact of nonsurgical WL has not been comprehensively investigated
- Here, we describe the short-term impact of nonsurgical WL and sustained nonsurgical WL on per-patient-per-month (PPPM) healthcare costs in adults who have obesity in the US

Objectives

- Objective 1: To assess the impact of nonsurgical WL on PPPM healthcare costs 1 year after WL compared to no weight change and how it differs by starting obesity class
- Objective 2: To assess the impact of nonsurgical WL that is sustained over an average of 2 years on PPPM healthcare costs compared to no weight change over time, and how it differs by starting obesity class

Methods

Study Design

- A retrospective, longitudinal cohort study used the IBM MarketScan Explorys® Claims Electronic Medical Record (EMR) Data Set from January 1, 2012 through June 30, 2018
- Eligibility criteria
  - » Inclusion criteria
    - – A measurement of body mass index (BMI) ≥ 30 kg/m² on the first instance (index date) of BMI between January 1, 2012 and June 30, 2014
    - – Aged 18–64 years on the index date
    - – Continuous enrollment during the follow-up period
    - – ≥ 1 BMI measurement at 12, 24, and 36 months after the index date (within ± 6 months)
  - » Exclusion criteria
    - – ≥ 1 diagnosis/procedural code for conditions related to unintentional WL or weight gain (WG) at any time during the study period, including:
      - • Acute or chronic pancreatitis, end-stage renal disease, dialysis/renal replacement therapy, feeding difficulty, liver cirrhosis, cancer or malignancy, gestational diabetes, pregnancy, and total pancreatic failure
    - – ≥ 1 diagnosis/procedural code for bariatric surgery at any time during the study period
    - – > 20% WG or WL between consecutive BMI measurements in any year in the study period
    - – Capitated insurance (ie, healthcare providers receive the same amount per month regardless of individual patient healthcare resource utilization) at any time during the study period

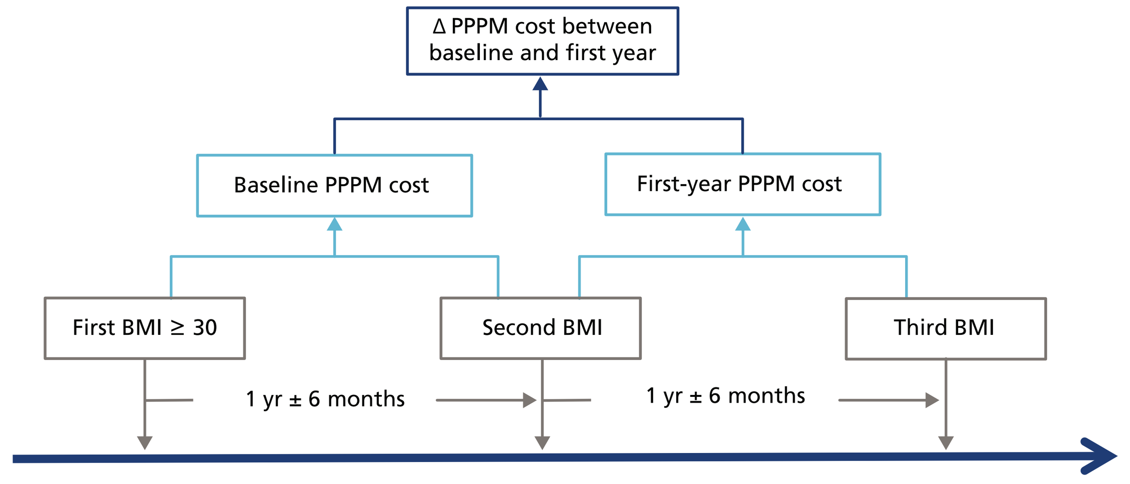
Data Analysis

- The study cohorts were classified based on the difference between index and second BMI measurements (approximately 1 year [± 6 months] after index BMI)
  - » WG: ≥ 3%
  - » No weight change: Within ± 3%
  - » WL: ≥ 3–≤ 5%, > 5–≤ 10%, or > 10–≤ 20%
    - – Sustained WL was defined as WL during the baseline period and < 3% WG from second to third BMI
- PPPM healthcare costs were calculated for baseline, and first and second year of follow-up:

$$\textit{Per-patient-per-month costs} = \frac{\textit{Total healthcare costs}}{\textit{Number of months available}}$$

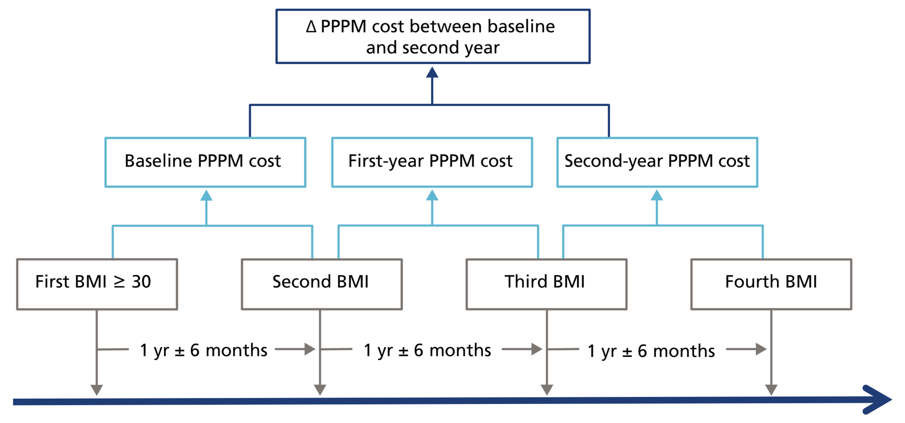
- Generalized linear models were used to examine whether change in PPPM healthcare costs from baseline to the first year of follow-up in the WL cohorts (**Figure 1**) and whether change in PPPM healthcare costs from baseline to the second year of follow-up in sustained-WL cohorts (**Figure 2**) differed significantly from the no-weight-change cohort
  - » Covariates with $P < 0.2$ in univariate analyses were included in the final models: age, sex, modified Elixhauser Comorbidity Index score, dyslipidemia, type 2 diabetes, osteoarthritis (knee, hip), gastroesophageal reflux disease, hypertension, and musculoskeletal pain
- Adjusted PPPM healthcare costs were further stratified by starting obesity class (class 1: BMI 30–< 35, class 2: BMI 35–< 40, class 3: BMI ≥ 40) to assess differential impact by starting obesity class

Figure 1: Objective 1 – Assessment of the Impact of Nonsurgical WL on PPPM Healthcare Costs



BMI, body mass index; PPPM, per-patient-per-month; WL, weight loss.

Figure 2: Objective 2 – Assessment of the Impact of Sustained Nonsurgical WL on PPPM Healthcare Costs



BMI, body mass index; PPPM, per-patient-per-month; WL, weight loss.

Results

Overall Study Population

- Overall, the total sample consisted of 20,488 adults aged 18–64 years with obesity, including:
  - » 11,588 (56.6%) patients with no weight change
  - » 5,072 (24.8%) patients with WG
  - » 1,683 (8.2%) patients with ≥ 3–≤ 5% WL, 1,576 (7.7%) patients with > 5–≤ 10% WL, and 569 (2.8%) patients with > 10–≤ 20% WL
- Results are presented for patients with nonsurgical WL and no weight change, given the focus of this study

Objective 1 – Nonsurgical WL vs No Weight Change

- Baseline characteristics for the total sample and by weight change status are shown in **Table 1**
  - » Study cohorts were similar with respect to mean age and BMI (mean BMI: 35.3; ie, class 2 obesity) at index
  - » The > 10–≤ 20% WL cohort had a higher proportion of women (65.9%) and a higher prevalence of musculoskeletal pain (42.9%) at baseline relative to other cohorts

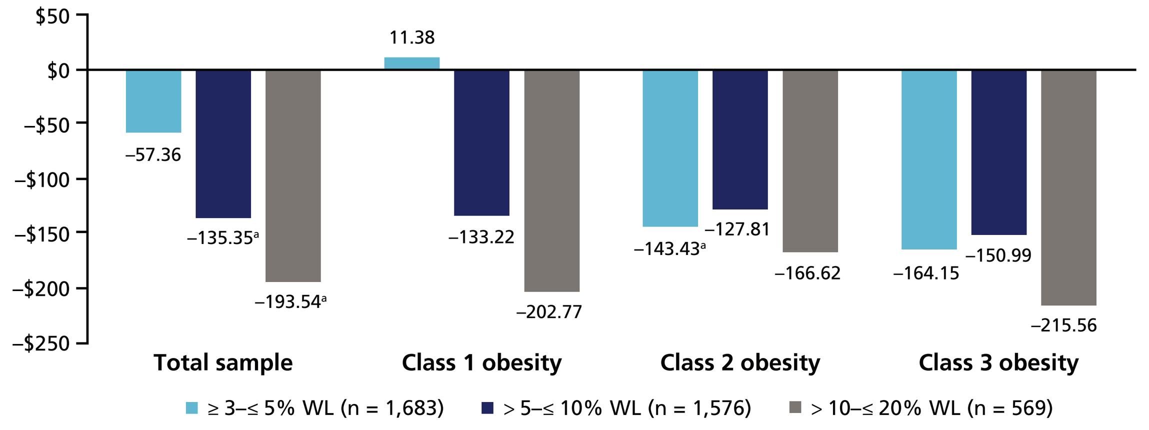
Table 1: Objective 1 – Baseline Characteristics and Comorbidities Included in the Final Model by Weight Change Status

Variable	Total Sample	No Weight Change	≥ 3–≤ 5% WL	> 5–≤ 10% WL	> 10–≤ 20% WL
Sample size, n (%)	20,488 (100)	11,588 (56.6)	1,683 (8.2)	1,576 (7.7)	569 (2.8)
Age, mean (SD)[a]	47.9 (9.9)	48.6 (9.5)	48.7 (9.6)	47.9 (10.4)	46.3 (11.2)
Female, %[a]	53.7	50.7	51.7	55.8	65.9
Index BMI, mean (SD)[a]	35.3 (5.4)	35.3 (5.3)	35.6 (5.6)	35.9 (6.0)	36.5 (6.4)
Elixhauser Comorbidity Index score, mean (SD)[a]	0.9 (1.1)	0.8 (1.1)	0.9 (1.1)	1.0 (1.2)	1.2 (1.5)
Obesity-related comorbidities, n (%)					
Dyslipidemia[a]	8,745 (42.7)	5,078 (43.8)	777 (46.2)	685 (43.5)	225 (39.5)
Type 2 diabetes[a]	3,854 (18.8)	2,139 (18.5)	444 (26.4)	398 (25.3)	107 (18.8)
Osteoarthritis (knee, hip)	880 (4.3)	527 (4.5)	62 (3.7)	65 (4.1)	22 (3.9)
Gastroesophageal reflux disease[a]	2,397 (11.7)	1,294 (11.2)	236 (14.0)	194 (12.3)	78 (13.7)
Hypertension[a]	9,283 (45.3)	5,294 (45.7)	841 (50.0)	701 (44.5)	246 (43.2)
Musculoskeletal pain[a]	7,482 (36.5)	4,112 (35.5)	617 (36.7)	605 (38.4)	244 (42.9)

[a]Differences with $P < 0.05$ based on Chi-square tests.
BMI, body mass index; SD, standard deviation; WL, weight loss.

- The largest adjusted PPPM healthcare cost reductions (total sample: –$193.54) occurred in the > 10–≤ 20% WL cohort (**Figure 3**), regardless of starting obesity class

Figure 3: Objective 1 – Adjusted ΔPPPM Total Healthcare Cost From Baseline to First Year of Follow-up for Nonsurgical WL Compared With No Weight Change



[a]$P < 0.05$
PPPM, per-patient-per-month; WL, weight loss.

Objective 2 – Sustained Nonsurgical WL vs No Weight Change

- Sustained WL was observed in 2,352 (61.4%) of all 3,828 patients with nonsurgical WL
  - » Sustained WL was observed in 1,113 (7.3%) patients with ≥ 3–≤ 5% WL, 964 (6.3%) patients with > 5–≤ 10% WL, and 275 (1.8%) patients with > 10–≤ 20% WL
  - » As in the total sample, the proportion of women (63.3%) and the prevalence of musculoskeletal pain (43.6%) were higher in the > 10–≤ 20% sustained-WL cohort than in other cohorts (**Table 2**)

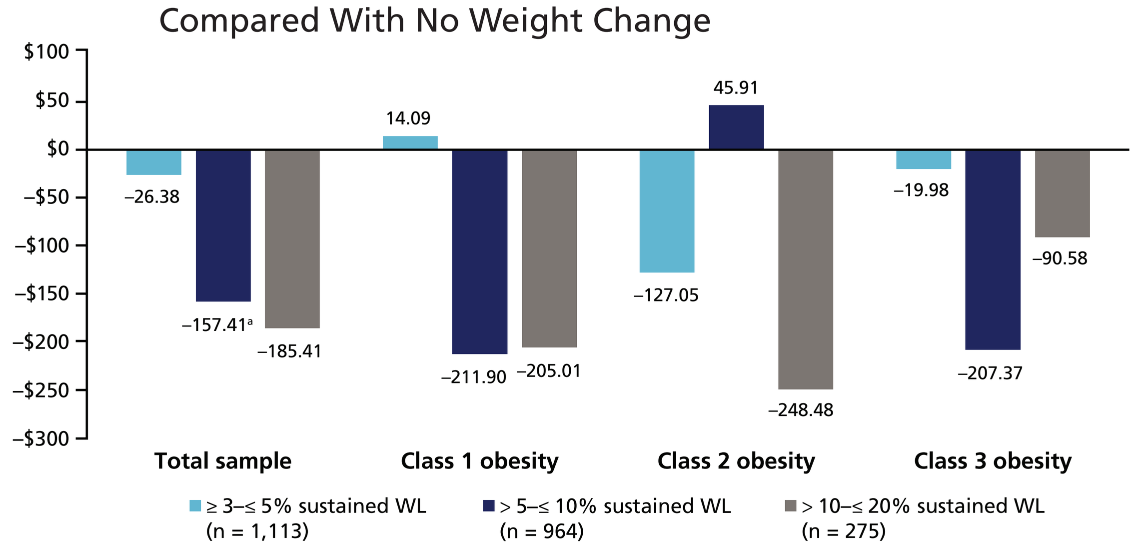
Table 2: Objective 2 – Baseline Characteristics and Comorbidities Included in the Final Model by Weight Change Status

Variable	Total Sample	No Weight Change	≥ 3–≤ 5% Sustained WL	> 5–≤ 10% Sustained WL	> 10–≤ 20% Sustained WL
Sample size, n (%)	15,307 (100)	9,097 (59.4)	1,113 (7.3)	964 (6.3)	275 (1.8)
Age, mean (SD)[a]	48.1 (9.9)	48.6 (9.5)	49.5 (9.2)	49.0 (10.0)	47.6 (11.0)
Female, %[a]	53.10	50.70	49.10	53.90	63.30
Index BMI, mean (SD)	35.3 (5.3)	35.2 (5.2)	35.6 (5.6)	36.1 (6.1)	36.5 (6.3)
Elixhauser comorbidity index score, mean (SD)[a]	0.9 (1.1)	0.8 (1.1)	0.9 (1.1)	1.0 (1.3)	1.4 (1.7)
Obesity-related comorbidities, n (%)					
Dyslipidemia[a]	6,560 (42.9)	3,932 (43.2)	541 (48.6)	444 (46.1)	129 (46.9)
Type 2 diabetes[a]	2,824 (18.4)	1,591 (17.5)	335 (30.1)	285 (29.6)	64 (23.3)
Osteoarthritis (knee, hip)	657 (4.3)	407 (4.5)	45 (4.0)	41 (4.3)	14 (5.1)
Gastroesophageal reflux disease[a]	1,763 (11.5)	998 (11.0)	156 (14.0)	116 (12.0)	39 (14.2)
Hypertension[a]	6,970 (45.5)	4,120 (45.3)	575 (51.7)	454 (47.1)	129 (46.9)
Musculoskeletal pain[a]	5,507 (36.0)	3,174 (34.9)	407 (36.6)	361 (37.4)	120 (43.6)

[a]Differences with $P < 0.05$ based on Chi-square tests.
BMI, body mass index; SD, standard deviation; WL, weight loss.

- The largest adjusted PPPM healthcare cost reduction (total sample: –$185.41) occurred in the > 10–≤ 20% sustained-WL cohort across starting obesity classes (**Figure 4**)
  - » For the ≥ 3–≤ 5% and > 10–≤ 20% sustained-WL cohorts, the largest adjusted PPPM healthcare cost reductions (–$127.05 and –$248.48, respectively) were observed among individuals with starting obesity class 2
  - » For the > 5–≤ 10% sustained-WL cohort, the largest adjusted PPPM healthcare cost reduction (–$211.90) was observed in individuals with starting obesity class 1

Figure 4: Objective 2 – ΔPPPM Total Healthcare Cost From Baseline to Second Year of Follow-up for Sustained Nonsurgical WL Compared With No Weight Change



[a]$P < 0.05$
PPPM, per-patient-per-month; WL, weight loss.

Limitations

- Weight measurement in the EMR provides very few data points to track weight fluctuations
- Patients in poor health may be more likely to receive diagnoses/procedural codes and have more frequent BMI measurements, potentially leading to selection bias in the analyses
- Stratified analyses were based on small patient counts in each group

Conclusions

- Considerable short-term healthcare cost savings were observed with nonsurgical WL compared with no weight change and sustained nonsurgical WL compared with no weight change 1 year after WL in adults with obesity; this was true in all nonsurgical WL and sustained nonsurgical WL cohorts (≥ 3–≤ 5%, > 5–≤ 10%, and > 10–≤ 20%)
- Overall, greater magnitudes of nonsurgical WL and sustained nonsurgical WL were associated with greater cost savings
- Our study demonstrated that there is substantial economic value of nonsurgical WL in adults with obesity. Improved access to WL medications and strategies should be considered by payers and employers

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References: (**1**) Hales at al. Prevalence of obesity among adults and youth: United States, 2015–2016. https://www.cdc.gov/nchs/data/databriefs/db288.pdf. Published October 2017. Accessed October 2019; (**2**) Waters & Graf. America's obesity crisis: the health and economic costs of excess weight. Milken Institute. https://www.milkeninstitute.org/sites/default/files/reports-pdf/Mi-Americas-Obesity-Crisis-WEB.pdf. Published October 2018. Accessed October 2019; (**3**) Oster et al. Lifetime health and economic benefits of weight loss among obese persons. *Am J Public Health*. 1999;89:1536–1542; (**4**) Avenell et al. Systematic review of the long-term effects and economic consequences of treatments for obesity and implications for health improvement. *Health Technol Assess*. 2004;8:iii-iv, 1–182; (**5**) Lopes et al. Is bariatric surgery effective in reducing comorbidities and drug costs? A systematic review and meta-analysis. *Obes Surg*. 2015;25(9):1741–1749.