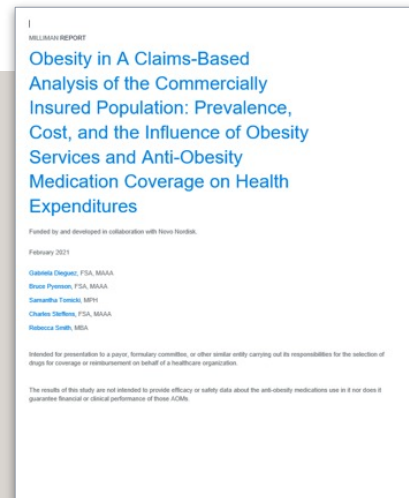# Obesity in a Claims-Based Analysis of the Commercially Insured Population:

Prevalence, Cost, and the Influence of Obesity Services and Anti-Obesity Medication Coverage on Health Expenditures

This white paper was funded by and developed in collaboration with Novo Nordisk.

About Milliman[1]

- Milliman is among the world's largest providers of actuarial and related products and services
- The firm has consulting practices in life insurance and financial services, property and casualty insurance, healthcare, and employee benefits
- Founded in 1947, Milliman is an independent firm with offices in major cities around the globe

Purpose of the Milliman Analysis

Obesity is associated with **>$200 billion[a] in annual medical costs** and comprises **12.9% of total annual private payer spend**[2,3]

This analysis summarized existing literature on the cost impacts of obesity and performed an independent analysis of survey and claims administrative data with 2 goals[1]:

1 Quantify the prevalence of obesity in the commercially insured population

2 Examine the influence of commercial insurance coverage of obesity services on health expenditures

[a]In 2008 US dollars.

Based on the Milliman Analysis Literature Review

Obesity Rates Are on the Rise in the United States[4,a]

3x — Obesity prevalence among adults aged 20 to 74 years has **more than tripled** over the past 60 years, increasing by almost 25% in the past decade[4]

20% — Prevalence of severe obesity **increased 20%** between the 2015 to 2016 and 2017 to 2018 National Health and Nutrition Examination Survey (NHANES) reports[4]

Per the 2017 to 2018 NHANES, **more than two-thirds of US adults aged 20 to 74 years** have overweight or obesity (body mass index [BMI] ≥ 25 kg/m^2)[4]

- Of these, **42.8%** of US adults have obesity (BMI ≥ 30 kg/m^2)[4]
- **9.6%** of adults have severe obesity (BMI ≥ 40 kg/m^2)[4]
- The prevalence of obesity is similar between women and men (42.1% vs 43.5%, respectively); however, **women have a higher prevalence of severe obesity** (12% vs 7.3%, respectively)[4,5]

Based on the Milliman Analysis Literature Review

Rising Obesity Rates Are Driving Significant Comorbidity, Health-Related Quality of Life (HRQOL), and Mortality Burdens[6,7]

Obesity is associated with an increased risk of numerous related illnesses:

- Strongly associated with increased risk of type 2 diabetes mellitus (T2DM); gallbladder disease[6]

- Cancers, including postmenopausal breast, ovarian, colorectal, and kidney[6]

- Cardiovascular disease, including hypertension (HTN), coronary artery disease, congestive heart failure, pulmonary embolism, and stroke[6]

- Asthma; obstructive sleep apnea[6,8]

- Osteoarthritis, rheumatoid arthritis, and chronic back pain[6,9]

- Major depressive disorder[9]

- Higher morbidity and mortality from coronavirus disease-2019 (COVID-19)[10]

BMI ↑
HRQOL[7] ↓

People with a BMI of[9]:

- 40.0 kg/m^2 to 59.9 kg/m^2 had a **2.57-fold increased risk of death** vs those with BMI in normal range (18.5 kg/m^2 to 24.9 kg/m^2)
- >40.0 kg/m^2 were reported to live **6.5 to 13.7 years less** vs those with BMI in normal range

[a]NHANES data are based on a representative sample of the US population.

Based on the Milliman Analysis Literature Review

Obesity Is Associated With Significant Direct Healthcare Costs

Obesity-related illnesses are estimated to account for $209.7 billion[a] in medical costs/year in the United States[9]

Incremental medical costs attributable to obesity=**$1901[b]/person with obesity/year**[11]

Payers' total spend: ~8.5% for Medicare, 11.8% for Medicaid, **12.9% for private**[3]

Each excess kg of weight contributes to **~$140/year in annual healthcare costs**[12]

These excess costs are driven by higher patient interaction with the healthcare system[13]

Compared with people without obesity, those with obesity have higher rates of[13]:

Prescriptions (55%)

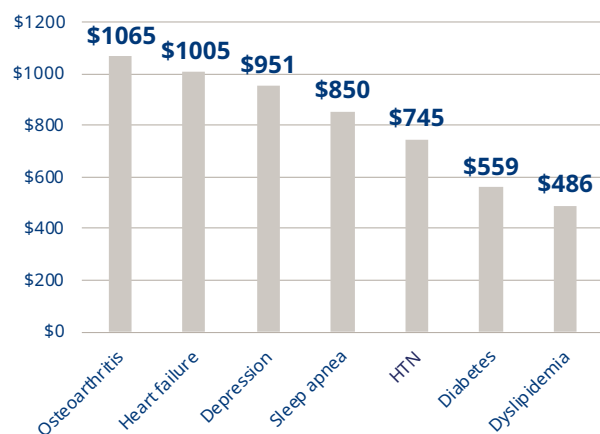Primary care physician contacts (32%)

Hospitalizations (16%)

Based on the Milliman Analysis Literature Review

Geisinger Health System Modeling Study Predicted Consistently Higher Annual Incremental Costs for Obesity-Related Comorbidities[14,c]

- Analysis of Geisinger Health System electronic medical records and claims between January 2004 and May 2013 for **N=153,561 adults** (50% males; 97% white)
- 21 chronic conditions, with **established association with obesity** in the literature, were identified by diagnosis codes and/or lab test results
- Total healthcare costs were measured in each year and association between annual costs and obesity-related comorbidities was assessed by a regression analysis, which jointly considered all the obesity-related comorbidities
- The per-person incremental costs of a single comorbidity, without any of the other obesity-related comorbidities, were calculated

Estimated annual costs of obesity-related comorbidities/person

Comorbidity	Cost
Osteoarthritis	$1065
Heart failure	$1005
Depression	$951
Sleep apnea	$850
HTN	$745
Diabetes	$559
Dyslipidemia	$486

[a] In 2008 US dollars.
[b] In 2014 US dollars.
[c] The incremental costs were calculated as the predicted costs of a comorbidity minus the predicted costs without any comorbidity, where the predicted costs without any comorbidity were estimated to be $1578 per person. All differences were statistically significant at $P<0.05$.

Based on the Milliman Analysis Literature Review

Obesity Has a Measurable Effect on Indirect Costs, as Evidenced by Productivity Losses and Absenteeism[15,16]

Estimated lifetime productivity losses are $18,064 for employees with overweight and $19,390 for employees with obesity[15]

Compared with employees without obesity, employees with obesity missed **27.4% to 44% more workdays/year**[16]

Obesity is reported to account for **6.5% to 12.6% of total absenteeism costs** in the workplace[16]

Combined annual costs of absenteeism + presenteeism due to increased weight were **~$5515** for employees with overweight and **$6402 to $9104** for employees with Class I to Class III obesity[15]

Based on the Milliman Analysis Literature Review

Workers' Compensation Claims Are Increased Among Workers Who Are Overweight or Who Have Obesity[17,18]

Per the Duke Health and Safety Surveillance System

Employees with Class III obesity (BMI ≥40 kg/m²) filed workers compensation claims at a rate of **11.65/100 full-time employees (FTEs) vs 5.8/100 FTEs** for employees without obesity[17]

Per a multiyear study

Employees who had overweight or obesity were **2.81 to 3.19 times**, respectively, more likely to incur a claim expense of at least **$100,000** after a severe injury vs employees without obesity or overweight[18]

Workers' compensation claims for employees with overweight or obesity are also more likely to be high cost

Based on the Milliman Analysis Literature Review

Weight Loss and Weight Maintenance Mitigate the Negative Clinical and Economic Consequences of Obesity

Weight loss

- Weight loss that shifts a person from stable obesity to overweight by midlife has been associated with a **54% reduction** in all-cause mortality risk vs adults with stable obesity[19]

- A sustained 10% reduction in body weight may avert expected disease-years burdened with **HTN, hypercholesterolemia, and T2DM, and expected lifetime incidence of coronary heart disease and strok**e[20]

- This weight loss may decrease the expected lifetime medical care costs of these 5 diseases by **$2200 to $5300**[20]

Weight maintenance

- Patients with T2DM who maintained weight within 5% of baseline[a] experienced a reduction in costs of **~$400 regardless of their level of glycemic control**[21]

- Employees who moved from BMI <30 kg/m^2 to BMI ≥30 kg/m^2 increased their average annual medical costs by ~9.9% more vs **employees who remained at a BMI <30 kg/m^2** [22]

[a]Mean baseline body weight among patients was 217 lb.

Methodology Used to Determine the Obesity Prevalence in the Commercially Insured Population[1]

Analyzed NHANES data to estimate changes in obesity prevalence among commercially insured plans using adjusted data from the **1999 to 2018 NHANES surveys** to reflect the demographics of the commercially insured population

Used age-gender distributions from **Milliman's Commercial Health Cost Guidelines** to adjust NHANES sample weights for each survey respondent for consistency with the age-gender distributions of the commercially insured population for each year included in the study

This allowed for researchers to recalculate the prevalence of obesity and distribution of BMI for the commercially insured population specifically

Methodology Used to Determine the Impact of Coverage of Obesity Treatment in the Commercially Insured Population[1]

Identified **10,866,997 (non-HDHP) commercially insured patients** eligible for study inclusion across **2859 distinct plans**, representing groups of members with similar healthcare benefits

Developed an **obesity engagement index** to capture the extent of a purchaser's coverage and access to obesity-related services

Actuarial value (AV)[a] was used to measure benefit richness for each obesity-related service and AV thresholds were used to divide the study population into 3 approximately equal groups:

Engaged	Plan had to meet a minimum AV threshold for bariatric surgeries or anti-obesity medication (AOM) and at least 1 other of the 4 key services
Not engaged	Plan had to fall below the minimum AV threshold for at least 3 services. This requirement along with the requirement above produced 2 mutually exclusive groups of plans for this study
Indeterminate	All other plans not meeting above criteria

[a]AV=portion of the total claim amount paid by the plan.

Methodology Used to Determine the Impact of Coverage of Obesity Treatment in the Commercially Insured Population (cont'd)

The 2018 IBM MarketScan® Commercial Claims Database (MarketScan) and 2018 Milliman Consolidated Health Cost Guidelines Source Administrative Claims Database were used to assess **commercial plan engagement and obesity-related services**[1,23]

Parameters used to measure obesity management engagement[1]		
Obesity Service	**Minimum AV Threshold**	**Minimum Utilization, if Applicable**
Obesity Primary Care/Specialist	0.80	Not applicable (N/A)
Bariatric Surgery	0.95	0.1 surgeries/1000
Obesity-Related Counseling	0.80	N/A
AOM	0.85	2.0 scripts/1000

What does a higher AV indicate?[1]

The purchaser is **willing to pay** for a greater share of these services, resulting in **lower member out-of-pocket expenses**.

This is expected to encourage members to use **obesity-related services**.

Methodology Used to Define Obesity and Determine Plan Member Inclusion Criteria[1]

Category	Definition
Overweight	BMI ≥25 kg/m^2 to <30 kg/m^2
Obesity Class I	BMI ≥30 kg/m^2 to <35 kg/m^2
Obesity Class II	BMI ≥35 kg/m^2 to <40 kg/m^2
Obesity Class III	BMI ≥40 kg/m^2

Aged ≥18 years as of 1/1/2018

- Continuous enrollment with both medical and pharmacy coverage as an active employee (or dependent) in a non-capitated plan for all 12 months of 2018
- Enrollment in a qualified insured group defined as non-capitated groups who cover ≥500 qualified members
- Enrollment in non–high-deductible health plan (HDHP)

Costs of obesity-related comorbidities and prescription drugs were compared across engaged and non-engaged plans.

Methodology Used to Identify Obesity in the Study Population[1]

The coded obesity rate was calculated by insured group. Due to concerns regarding under-coding of obesity diagnoses, Milliman first performed sensitivity testing on three obesity identification algorithms. In each algorithm, patients were determined to have obesity if:

1   Patients reported 1 or more claims of any type with an obesity International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) diagnosis code in the primary position

2   Patients reported 1 or more claim of any type with an obesity ICD-10-CM diagnosis code in any position

3   Patients reported 2 or more claims on different dates of service with an obesity ICD-10-CM diagnosis code in any position
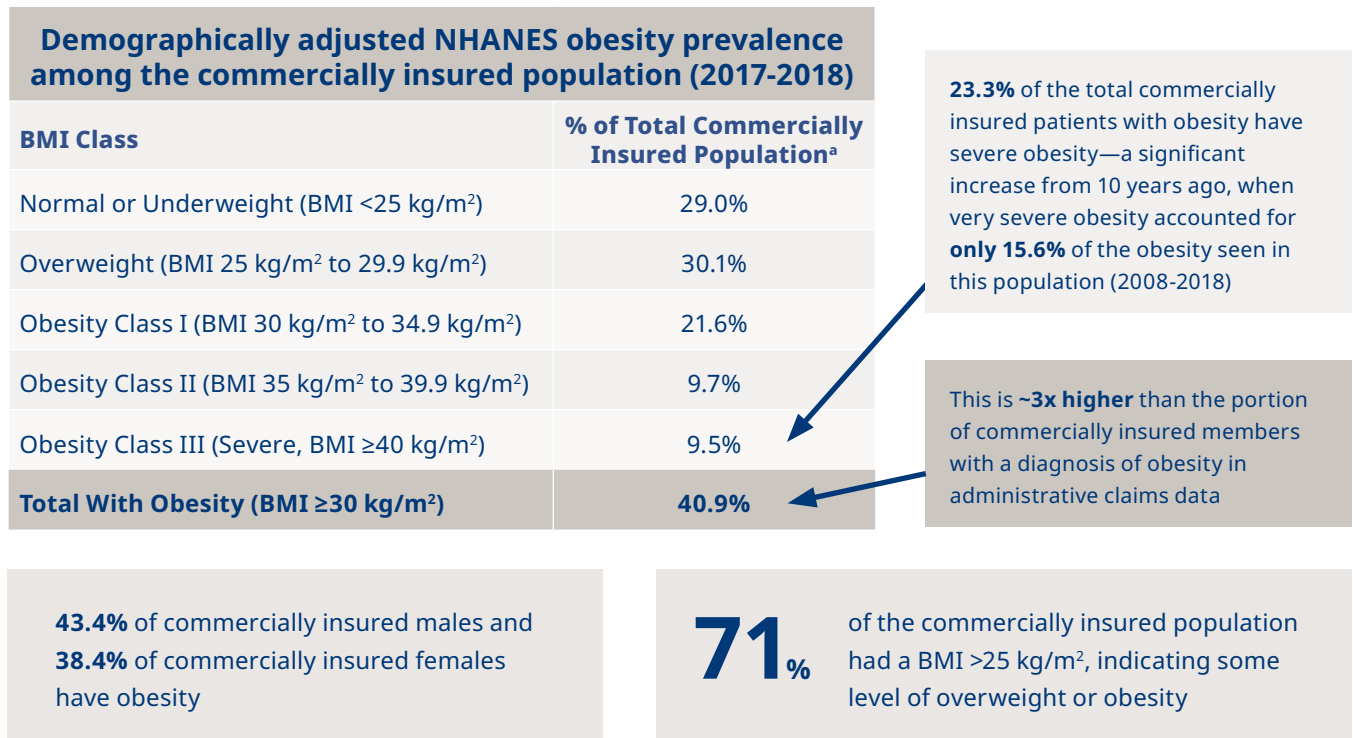
The most inclusive coding definition of obesity was selected to maximize the number of patients identified (algorithm 2 above).

Severe obesity

BMI codes were used to identify members with severe obesity, based on the presence of an ICD-10-CM diagnosis code indicating morbid obesity (E6601, E662), an ICD-10-CM diagnosis code indicating a BMI of 40 kg/m^2 or greater, or an ICD-10-CM diagnosis code indicating a BMI of 35 kg/m^2 or greater who was also identified as having one of the 12 comorbid conditions of interest.

Results

Just Under Half of the Commercially Insured Population Has Obesity[1]

Demographically adjusted NHANES obesity prevalence among the commercially insured population (2017-2018)	
BMI Class	**% of Total Commercially Insured Population[a]**
Normal or Underweight (BMI <25 kg/m^2)	29.0%
Overweight (BMI 25 kg/m^2 to 29.9 kg/m^2)	30.1%
Obesity Class I (BMI 30 kg/m^2 to 34.9 kg/m^2)	21.6%
Obesity Class II (BMI 35 kg/m^2 to 39.9 kg/m^2)	9.7%
Obesity Class III (Severe, BMI ≥40 kg/m^2)	9.5%
Total With Obesity (BMI ≥30 kg/m^2)	**40.9%**

23.3% of the total commercially insured patients with obesity have severe obesity—a significant increase from 10 years ago, when very severe obesity accounted for **only 15.6%** of the obesity seen in this population (2008-2018)

This is **~3x higher** than the portion of commercially insured members with a diagnosis of obesity in administrative claims data

43.4% of commercially insured males and **38.4%** of commercially insured females have obesity

71% of the commercially insured population had a BMI >25 kg/m^2, indicating some level of overweight or obesity

[a]These results are derived from a descriptive analysis and cannot be generalized beyond the non-HDHP commercial plan population.

Costs Associated With Obesity Comorbidities—Heart Failure and Knee Osteoarthritis—Were Statistically Lower for "Engaged Plans" vs "Not Engaged" Plans[1]

Differences in the log-transformed annual allowed comorbidity-related medical cost/member with obesity by comorbidity and insured group engagement ("Not Engaged" population=reference)		
Outcome	**N (Members with comorbidities)**	**Percent Change in Cost for Engaged[a] (95% CI) [P]**
HTN	487,575	-2.9% (-8.6%, 3.1%) [*P*>0.05]
Dyslipidemia	323,877	-5.1% (-12.5%, 2.9%) [*P*>0.05]
T2DM	242,416	-3.8% (-10.6%, 3.5%) [*P*>0.05]
Sleep apnea	175,793	-0.7% (-8.1%, 7.3%) [*P*>0.05]
Prediabetes	21,526	-5.5% (-19.2%, 10.6%) [*P*>0.05]
Asthma	77,446	-0.9% (-11.1%, 10.4%) [*P*>0.05]
Heart failure with preserved ejection fraction (HF-pEF)	**7,546**	**-22.2% (-38.5%, -1.7%) [*P*<0.05]**
Knee osteoarthritis	**46,103**	**-13.7% (-25.1%, -0.6%) [*P*<0.05]**
Polycystic ovarian syndrome	666	13.3% (-18.2%, 56.9%) [*P*>0.05]
Psoriasis	13,176	-6.8% (-21.7%, 11.0%) [*P*>0.05]
Urinary incontinence	3,305	1.2% (-21.6%, 30.8%) [*P*>0.05]
Gastroesophageal reflux disease	119,449	-4.1% (-12.4%, 5.1%) [*P*>0.05]

Annual Per-Patient Prescription Drug Costs Were ~4% Lower in "Engaged" Plans vs "Not Engaged" Plans[1]

Total prescription drug spending for all members with obesity with ≥1 comorbidity adjusted for region, risk score, plan AV, and number of comorbidities		
Outcome	**N (Members with comorbidities)**	**Percent Change in Cost for "Engaged"[b] (95% CI) [P]**
Prescription Total Cost	769,270	-4.0% (-5.0%, -3.1%) [*P*<0.01]

[a]Adjusted for region, risk score, total group count, morbid obesity rate (denominator=obese), AV, obesity rate (denominator=total group count), AOM utilization, counseling utilization, bariatric utilization, obesity utilization (denominator for all utilization measures=total group count). Note: All members continuously enrolled throughout the study period. *P* value calculated using t-test.

[b]Regression analysis adjusted for region, risk score (to control for age, sex, and health status), plan AV (to adjust for the relative richness of benefits for all covered services, not just those obesity-related), and number of comorbidities (out of 12 comorbidities specified in this analysis; stratified into groups of 1, 2, 3, 4+ comorbidities). *P* value calculated using t-test. All members were required to be continuously enrolled throughout the study period. Annual per-patient prescription costs were included because of the difficulty of assigning drugs to a specific condition.

Summary of Results[1]

After adjusting for other factors that may influence costs...

The coding rate for obesity in administrative claims data is much lower than actual rates of obesity	Patients with obesity in "Engaged" plans had statistically significant lower medical costs related to HF-pEF and knee osteoarthritis	Per member prescription drug spending for members with obesity and at least 1 comorbidity was lower in "Engaged" plans vs "Not Engaged" plans

Limitations of This Analysis[1]

Obesity is coded with less frequency in administrative claims data vs NHANES and other sources

- Plan disease burden may be highly understated
- Average costs for members with obesity and comorbidities may be overstated
- Use of *International Classification of Diseases, Tenth Revision, Clinical Modification* (ICD-10-CM) codes might have selected for members with high BMI classes as these codes are used more frequently vs overweight and lower BMI classes

The conclusions from this analysis may not be applicable to other member populations

The claim costs included in the regression analysis may include some care not directly related to the comorbidity and include some care not directly related to obesity

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