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Provider Education Network Webinar: ROI Obesity Model for Employees

March 31, 2021

Louisiana's Health Initiative

Speaker

- Courtney L. Walker, Pharm.D., R. Ph
  - Medical Account Director for Texas/Louisiana/New Mexico Region
  - Novo Nordisk, Inc.
  - Specializing in Diabetes and Obesity

MONICA PRADO COTA
Monica's BMI is 35

ROI Obesity Model for Employers: Developing a strategy to address the issue of obesity

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Medical Account Director

Novo Nordisk Inc.

March 31, 2021

Obesity: Impact on Employer

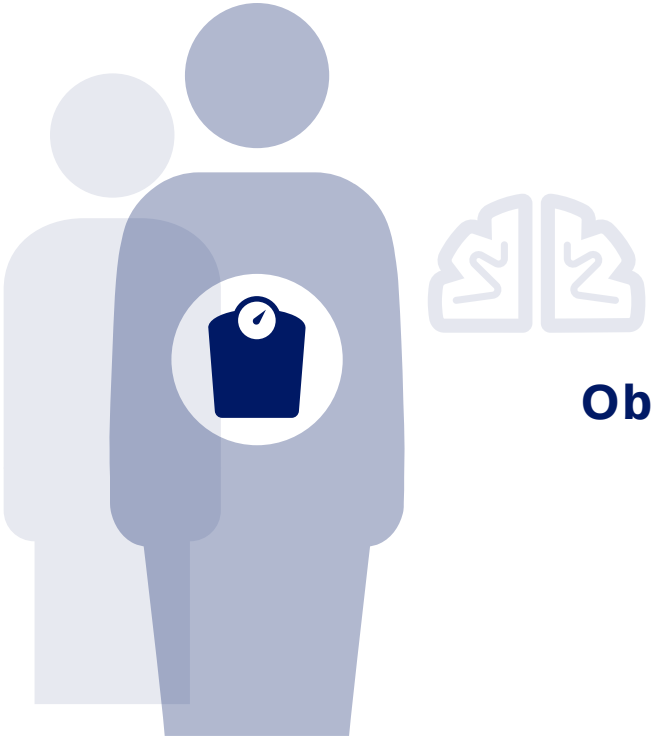
Contents

Objectives

Summary: To evaluate the role Obesity has in disease management with special emphasis on the impact said disease has on the workplace. We will evaluate the truth of how obesity has been traditionally viewed in light of current research showing the impact of new discoveries on the topic. How does clinical management lead to overall improvement?

Objectives:

1. To discuss the disease of obesity and its direct and indirect cost to our system. We will examine the burden of obesity financially and otherwise.
2. We will evaluate the clinical and economic benefits of weight loss. This will include, but not be limited to, clinical intervention with impact and economic benefits to therapy and treatment.
3. What the barriers are to efficient management of obesity and what the implications of weight loss interventions are on overall loss of weight.



Obesity as a Disease

Imagine a disease…

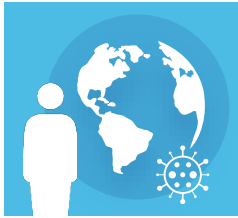
… affecting **>650 million** adults† with a **100% increase** in global prevalence since 1980[1,2]

… for which there is **limited coverage for treatment** and **only 2%** of people eligible to receive pharmacological treatments actually receive them[6,7]

… linked to **2.8 million deaths** annually and the fifth leading cause of global death‡[2,3]

… that students leaving medical school are **not adequately prepared** to manage and **receive limited reimbursement** for providing care[8,9]

… that is **chronic**, **progressive**, associated with **relapse**, and affected by **genes**, **hormones** and **living environment**[4,5]



This is the current state of obesity

†As of 2016
‡Due to having overweight or obesity

References: 1. World Health Organization. Obesity and overweight. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweighthttps://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight. **2.** The European Association for the Study of Obesity. Obesity statistics. https://easo.org/media-portal/statistics/. **3.** World Health Organization. 10 facts on obesity. https://www.who.int/features/factfiles/obesity/en/. **4.** Thaker VV. Genetic and epigenetic causes of obesity. Adolesc Med State Art Rev. 2017;28(2):379-405. **5.** Bray GA et al. Obesity: A chronic relapsing progressive disease process. A position statement of the World Obesity Federation. Obesity Reviews. 2017;18:715-23. **6.** Baum C et al. The challenges and opportunities associated with reimbursement for obesity pharmacotherapy in the USA. Pharmacoeconomics. 2015;33(7):643-653. **7.** Thomas et al. Low adoption of weight loss medications: A comparison of prescribing patterns of antiobesity pharmacotherapies and SGLT2s. Obesity (Silver Spring). 2016 Sep;24(9):1955-61. **8.** Butsch WB et al. Low priority of obesity education leads to lack of medical students' preparedness to effectively treat patients with obesity: results from the U.S. medical school obesity education curriculum benchmark study. BMC Med Educ. 2020;20(1):23. **9.** Kaplan LM et al. Perceptions of barriers to effective obesity care: results from the national ACTION study. Obesity. 2018;26:61-69.

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What we know about obesity: it's not like it used to be[1]

Historical view of obesity[2]

Energy imbalance led by
poor patient choices…

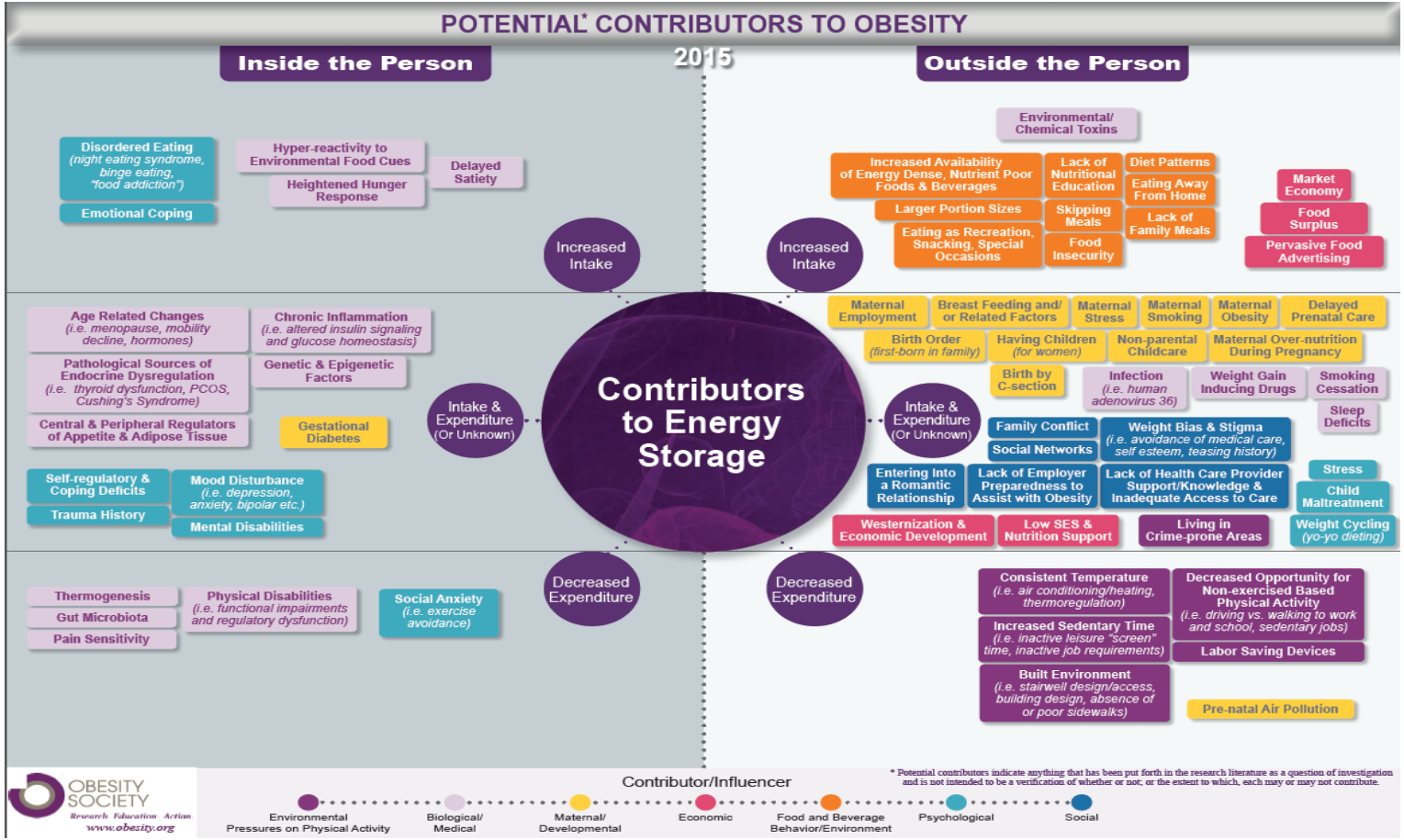
- FOOD
- LIFESTYLE
- PHYSICAL ACTIVITY

Modern view of obesity[2,3]

- **Brain chemistry** and biology determine eating behaviors
- **Not all calories are alike;** the type and nature are crucial
- **Physiological factors** drive weight regain after weight loss through dieting

References: 1. Obesity Action Center. Take the pledge to speak out and challenge perceptions of obesity. Available at: https://www.obesityaction.org/action-center/challenge-perceptions-of-obesity-pledge/. **2.** Schwartz et al. Obesity Pathogenesis: An Endocrine Society Scientific Statement. Endocrine Reviews 2017;38(4):267-296. **3.** Sumithran et al. Long-term persistence of hormonal adaptations to weight loss. N Engl J Med. 2011 Oct 27;365(17):1597-604

Potential Contributors to Obesity



What impact does obesity have on employers?

Healthcare costs are high

Obesity is associated with a **46% increase** in inpatient costs, a **27% increase** in non-inpatient costs, and an **80% increase** in prescription medication costs vs normal weight[1]

Lost productivity costs are concerning

Obesity accounts for **per-employee** additional annual sick leave and short-term disability cost of **$1,002** and **$205** among workers in the US[2]

The future workforce is at risk

Over **one fifth (20.6%)** of 12- to 19-year-olds in the US have obesity[3]

World Health Organization

It is not getting better: the World Health Organization has declared obesity an **epidemic**[4]

References: 1. Finkelstein et al. Annual medical spending attributable to obesity: payer- and service-specific estimates. Health Affairs. 2009. **2.** Kleinman et al. Cohort analysis assessing medical and nonmedical cost associated with obesity in the workplace. J Occup Environ Med. 2014 Feb;56(2):161-70. **3.** Centers for Disease Control. Prevalence of obesity among adults and youth: United States, 2015-2016. NCHS Data Brief 288, October 2017. Available at: https://www.cdc.gov/nchs/data/databriefs/db288.pdf. **4.** World Health Organization. Obesity: preventing and managing the global epidemic. Available at: https://www.who.int/nutrition/publications/obesity/WHO_TRS_894/en/.

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Obesity is not simply a problem of lifestyle, but has its own pathophysiology

Health-related organizations, agencies and professional associations have recognised obesity as a **global health challenge** requiring a "**chronic disease management model**"[1]

World Health Organization

"Obesity is a chronic disease, prevalent in both developed and developing countries, and affecting children as well as adults"[2]

AACE

"… Obesity is a primary disease, and the full force of our medical knowledge should be brought to bear on the prevention and treatment of obesity as a primary disease entity…"[5]

AMA AMERICAN MEDICAL ASSOCIATION

"Recognizing obesity as a disease will help change the way the medical community tackles this complex issue that affects approximately one in three Americans"[3]

OBESITY SOCIETY Founded in 1982

"Obesity is a multi-causal chronic disease recognized across the life-span resulting from long-term positive energy balance with development of excess adiposity that over time leads to structural abnormalities, physiological derangements, and functional impairments"[6]

FDA

"FDA agrees with these comments that obesity is a disease.… Being overweight, i.e., being more than one's ideal weight but less than obese, however, is not a disease"[4]

Abbreviations: FDA, Food and Drug Administration.

References: 1. Jensen et al. 2013 AHA/ACC/TOS guideline for the management of overweight and obesity in adults. J Am Coll Cardiol. 2014;63(25 Pt B):2985-3023; **2**. World Health Organization. Obesity: preventing and managing the global epidemic. World Health Organ Tech Rep Ser. 2000;894:i-xii, 1-253. **3.** American Medical Association. AMA adopts new policies on second day of voting at annual meeting. http://www.ama-assn.org/ama/pub/news/news/2013/2013-06-18-new-ama-policies-annual-meeting.page. **4.** Food and Drug Administration. Federal Register, Part IV. 2000;65(4):1000-1050. **5.** Mechanick JI et al. American Association of Clinical Endocrinologists' position statement on obesity and obesity medicine. Endocr Pract. 2012;18:642–648. **6.** Jastreboff et al. Obesity as a disease: The Obesity Society 2018 position statement. Obesity. 2019;27(1):7-10.

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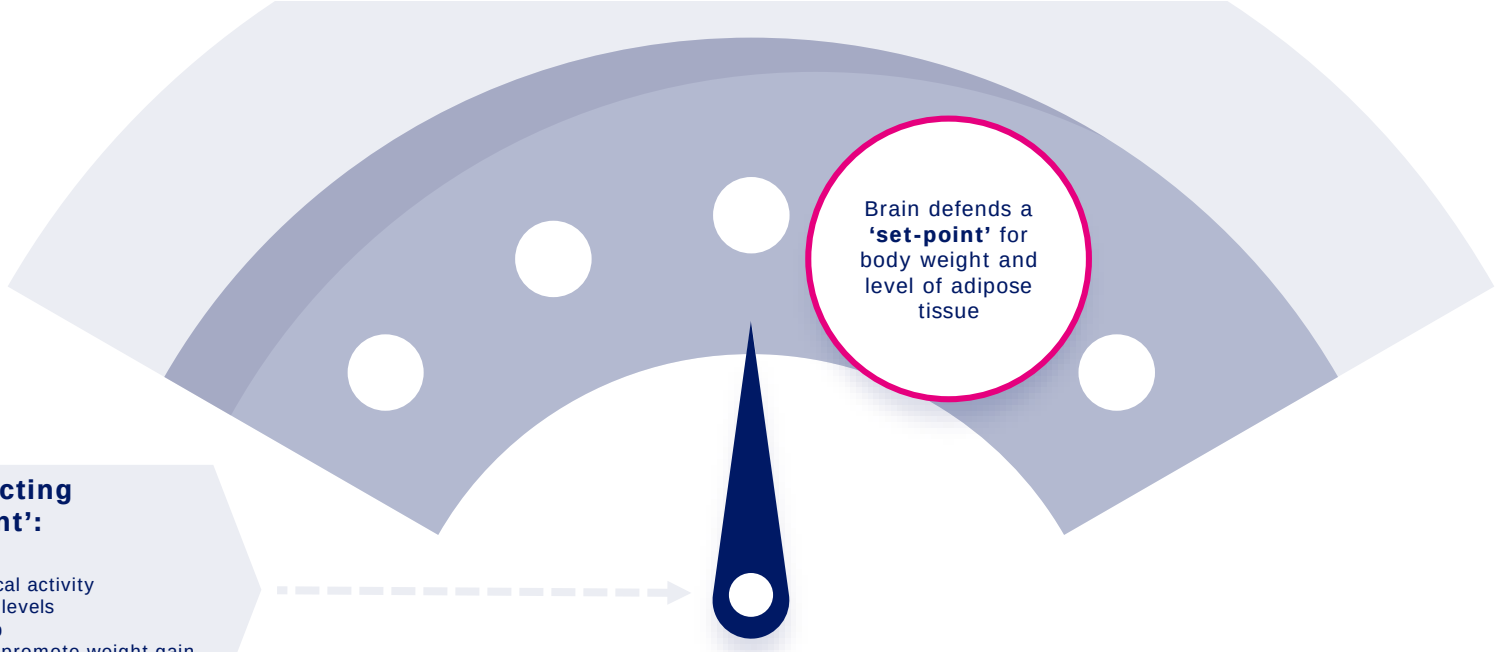
Body weight regulation is influenced by genetics, physiology, and the environment[1-4]



Factors affecting the 'set-point':

- Western diet
- Decreased physical activity
- Increased stress levels
- Inadequate sleep
- Medications that promote weight gain
- Metabolic adaptation to weight loss attempts

Years of exposure to factors increase the set-point

References: 1. Woods et al. Understanding the physiology of obesity: review of recent developments in obesity research. Int J Obes Relat Metab Disord 2002;26(Suppl. 4):S8–S10. **2.** Badman, Flier. The gut and energy imbalance: visceral allies in the obesity wars. Science 2005;307:1909–14. **3.** Campfield, Smith. The pathogenesis of obesity. Best Pract Res Clin Endocrinol Metab 1999;13;13–30. **4.** Farias et al. Set-point theory and obesity. Metab Syndr Relat Disord 2011;9:85–9.

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The role of the brain in regulating appetite[1]

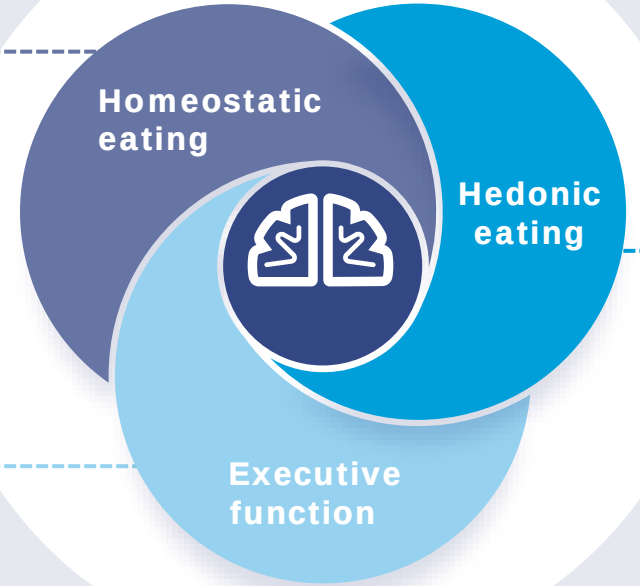
EATING FOR HUNGER

Satiety

- GLP-1
- Peptide YY
- Oxyntomodulin
- Pancreatic polypeptide
- Amylin

Hunger

- Ghrelin



EATING FOR PLEASURE

Dopamine

controls wanting; the motivation to eat

Opioid and cannabinoid

receptors control liking; the pleasure associated with food

DECIDING TO EAT

Behavioral interventions

empower sustainable behaviors in controlling eating

References: 1. Ahima et al. Brain regulation of appetite and satiety. Endocrinol Metab Clin North Am. 2008;37(4):811-823.

The brain defends a ‘set-point’ for body weight and level of adipose tissue, making sustained weight loss difficult[1]

Set-point:
Adaptations that resist weight loss

Changes in

Hormone levels (↓ satiety hormones; ↑ hunger hormones)

Metabolism (↓ energy expenditure)

References: 1. Farias et al. Set-point theory and obesity. Metab Syndr Relat Disord 2011;9:85–9.

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BMI ≥30 kg/m² is increasing in prevalence and severity among adults in the US

Estimated **prevalence of body mass index (BMI) ≥30 kg/m²** among US adults, 1999–2018[1]

Prevalence of **BMI ≥40 kg/m²** is **increasing faster** than the prevalence of obesity as a whole[2]

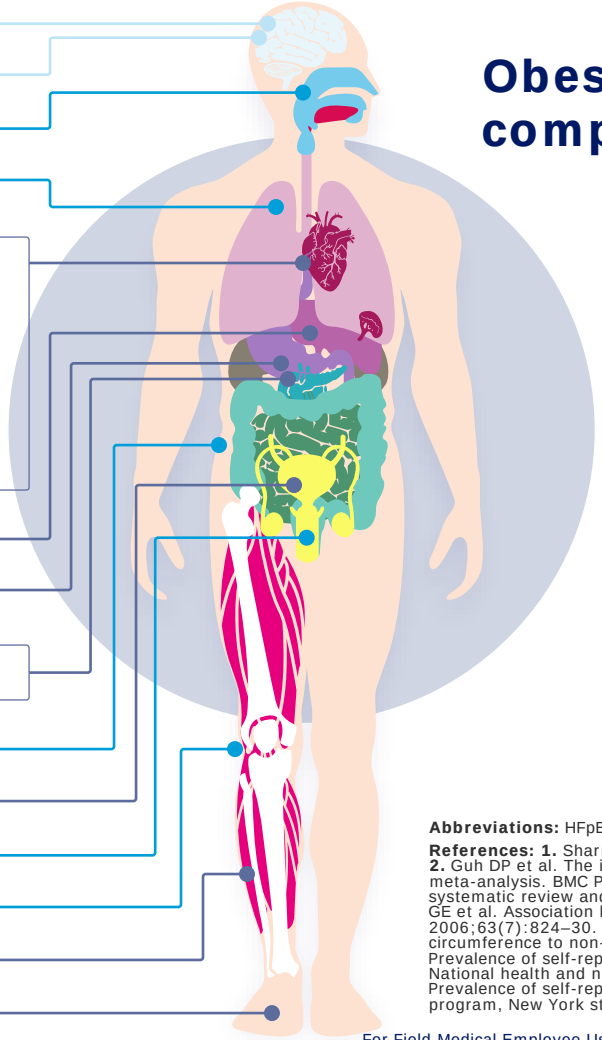
†Significant linear trend.
Estimates were from age-adjusted by the direct method to the 2000 US Census population using the age groups 20–39, 40–59, and ≤60 years.

Abbreviations: BMI, body mass index.

References: 1. Centers for Disease Control. NCHS data brief: Prevalence of Obesity and Severe Obesity Among Adults: United States, 2017–2018. Available at: https://www.cdc.gov/nchs/data/databriefs/db360-h.pdf.

Obesity is associated with multiple complications[1-7]

- Depression
- Anxiety
- Sleep Apnoea
- Asthma
- Cardiovascular diseases
  - Stroke
  - Dyslipidaemia
  - Hypertension
  - Coronary artery disease
  - Pulmonary embolism
  - HFpEF
- Coronary heart failure
- NAFLD
- Gallstones
- Type 2 diabetes
- Prediabetes
- Chronic back pain
- Infertility
- Incontinence
- Knee osteoarthritis
- Thrombosis
- Gout



- Cancers – including:
  - breast
  - colorectal
  - endometrial
  - esophageal
  - kidney
  - ovarian
  - pancreatic
  - prostate
- Physical functioning

- MENTAL
- MECHANICAL
- METABOLIC

Abbreviations: HFpEF, heart failure with preserved ejection fraction; NAFLD, non-alcoholic fatty liver disease.

References: 1. Sharma AM. M, M, M & M: A mnemonic for assessing obesity. Obes Rev 2010;11:808–9. **2.** Guh DP et al. The incidence of co-morbidities related to obesity and overweight: A systematic review and meta-analysis. BMC Public Health 2009;9:88. **3.** Luppino FS et al. Overweight, obesity, and depression: A systematic review and meta-analysis of longitudinal studies. Arch Gen Psychiatry 2010;67(3):220–9. **4.** Simon GE et al. Association between obesity and psychiatric disorders in the US adult population. Arch Gen Psychiatry 2006;63(7):824–30. **5.** Church et al. Association of cardiorespiratory fitness, body mass index, and waist circumference to non-alcoholic fatty liver disease. Gastroenterology 2006;130(7):2023–30. **6.** Li C et al. Prevalence of self-reported clinically diagnosed sleep apnea according to obesity status in men and women: National health and nutrition examination survey, 2005-2006. Prev Med 2010;51(1):18–23. **7.** Hosler AS. Prevalence of self-reported prediabetes among adults participating in a community-based health awareness program, New York state. Prev Chronic Dis 2009;6(2):A48.

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Life expectancy decreases as BMI increases

Increased BMI in the US between 1988 and 2011 has **reduced life expectancy** at age 40 by 0.9 years in 2011, and accounted for **186,000 deaths** in that year[1]

The chance of reaching age 70 is reduced with increasing body mass index (BMI):[2]

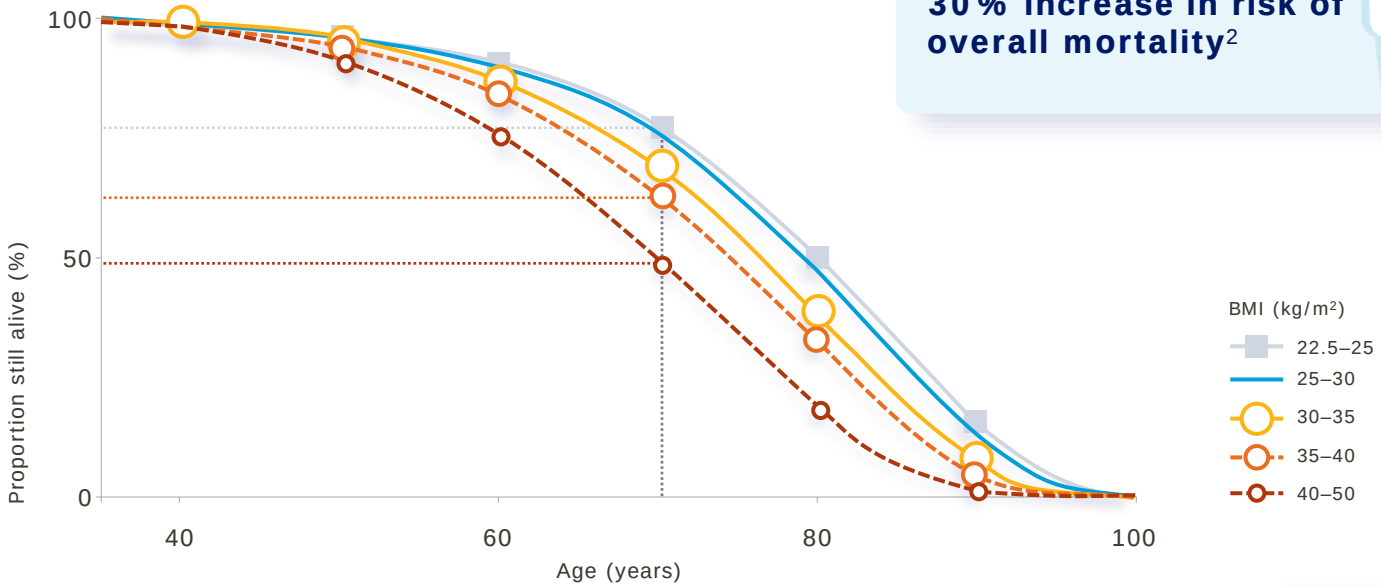
Above a BMI of 25 kg/m², **each 5 kg/m²** increase in BMI is, on average, associated with a **30% increase in risk of overall mortality**[2]

Normal BMI
80%

BMI 35–40 kg/m²
60%

BMI 40–50 kg/m²
50%

Chance of reaching age 70 years

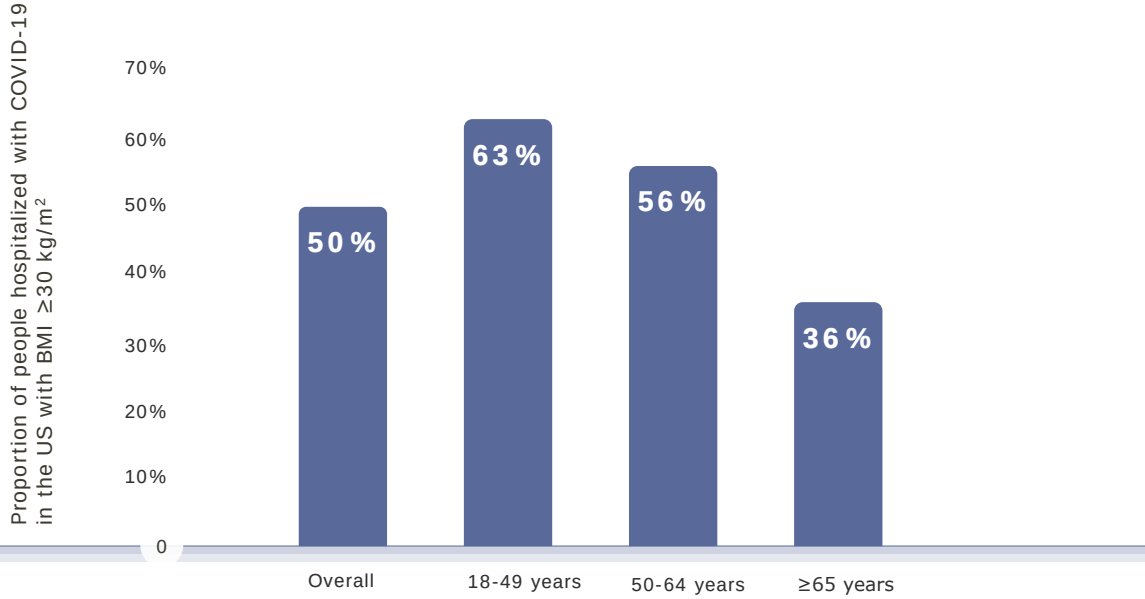


Abbreviations: BMI, body mass index.

References: 1. Preston et al. Proc Natl Acad Sci USA 2018;115(5):957-961. **2.** Prospective Studies Collaboration. Body-mass index and cause-specific mortality in 900,000 adults: collaborative analyses of 57 prospective studies. Lancet. 2009;373:1083–96.

BMI ≥30 kg/m² increases the risk of severe illness from COVID-19[1]

As of August 2020, half of people hospitalized with COVID-19, and 63% of those aged 18–49 years, had BMI ≥30 kg/m² [2]

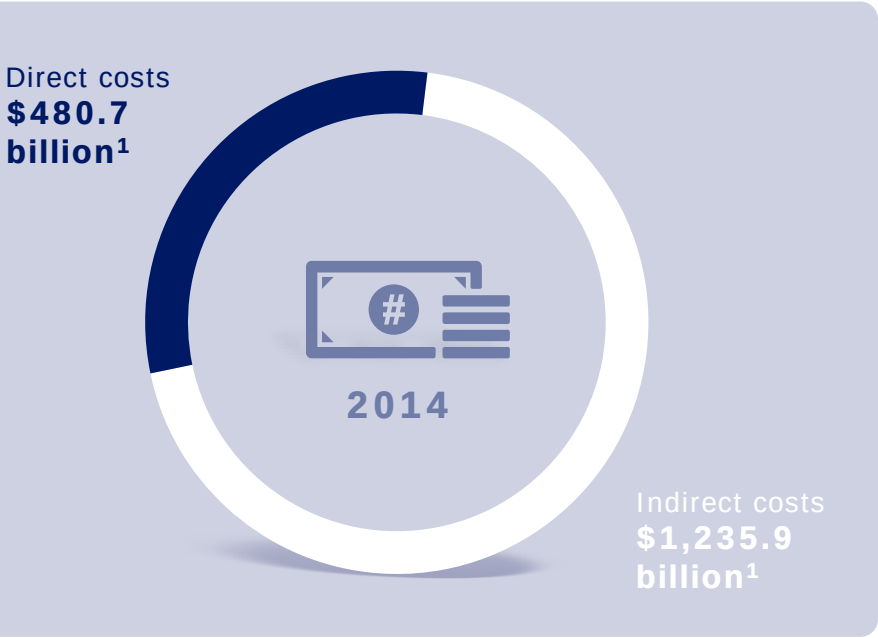


Abbreviations: BMI, body mass index.

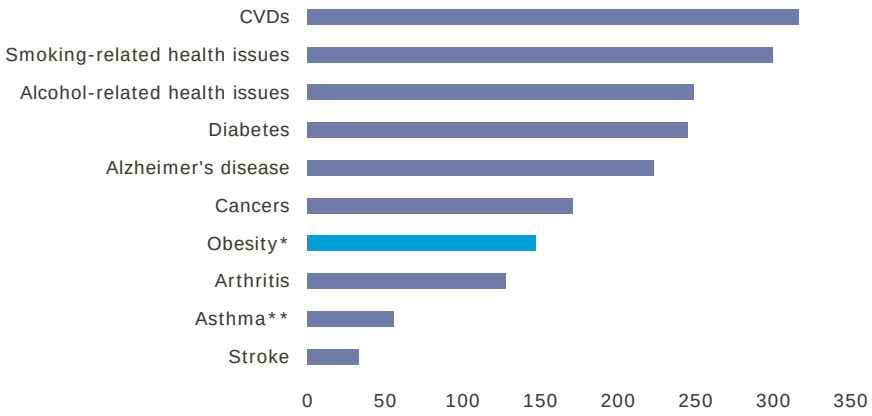
References: 1. Centers for Disease Control and Prevention. Coronavirus Disease 2019 (COVID-19). Available at: https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-ncov%2Fneed-extra-precautions%2Fgroups-at-higher-risk.html. **2.** COVID-NET: Covid-19-associated hospitalization surveillance network, Centres for Disease Control and Prevention. https://gis.cdc.gov/grasp/COVIDNet/COVID19_5.html.

Cost of Obesity

Obesity is associated with an annual economic burden of $1.72 trillion in the US,[1] making it one of the top 10 most expensive chronic diseases for healthcare payers[2]



Centers for Disease Control most expensive diseases for US payers ($ billion)[2]

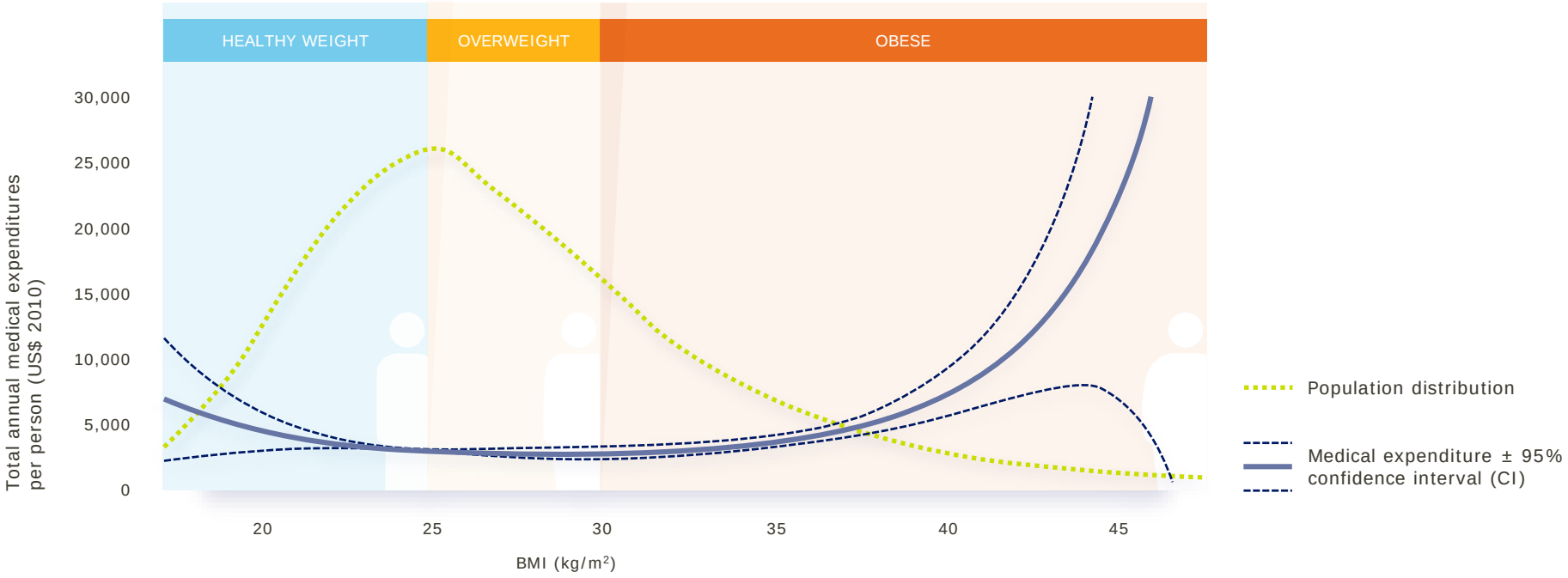


*Direct costs; does not include $117 billion in costs related to physical activity.
**Direct costs only.

References: 1. Waters & Graf. America's obesity crisis: The health and economic costs of excess weight. 2018. Available at: https://milkeninstitute.org/sites/default/files/reports-pdf/Mi-Americas-Obesity-Crisis-WEB.pdf. **2.** Beaton. Top 10 most expensive chronic diseases for healthcare payers. 2017. Available at: https://healthpayerintelligence.com/news/top-10-most-expensive-chronic-diseases-for-healthcare-payers.

Costs rise exponentially with BMI >35 kg/m²

Predicted relationship between body mass index (BMI) and annual direct medical costs[1]



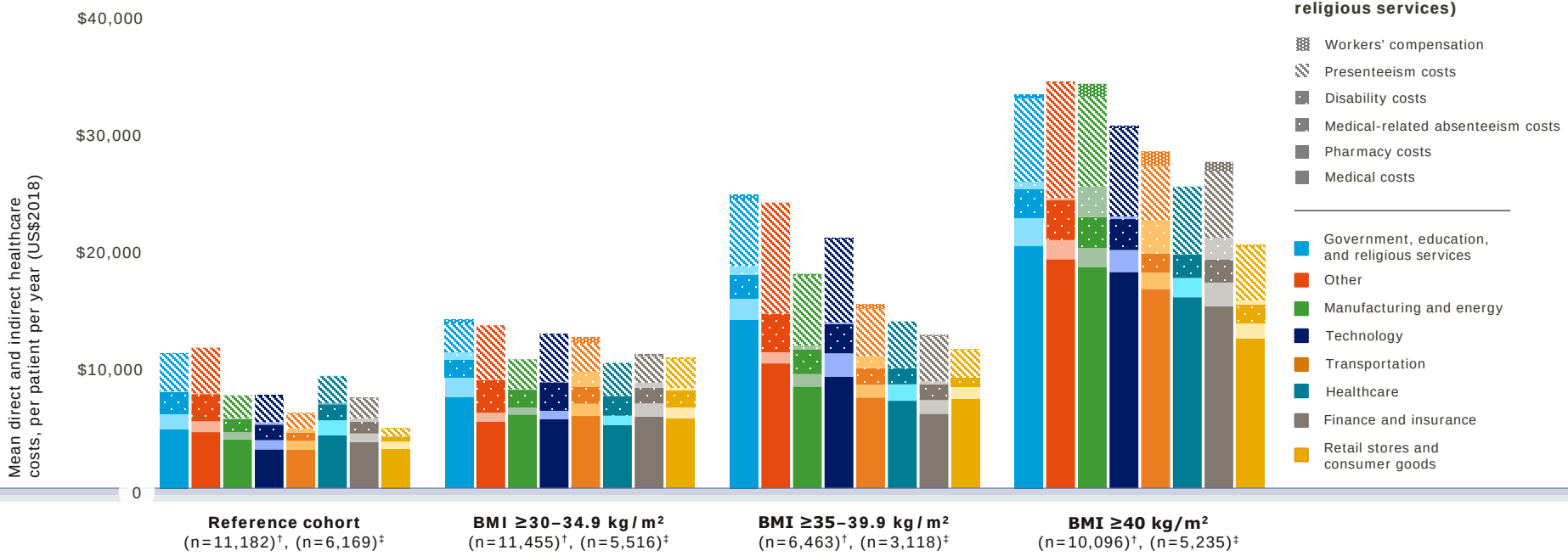
US data from the Medical Expenditure Panel Survey (MEPS).

Abbreviations: BMI, body mass index; CI, confidence interval; MEPS, Medical Expenditure Panel Survey.

References: 1. Cawley et al. Savings in medical expenditures associated with reductions in body mass index among US adults with obesity, by diabetes status. Pharmacoeconomics. 2015;33(7):707-22.

Increasing BMI increases direct and indirect healthcare costs across multiple industries in the US[1]

Among employees with body mass index (BMI) ≥30 kg/m², the highest total costs were observed in the government, education, and religious services, food and entertainment services (other), and technology industries[1]



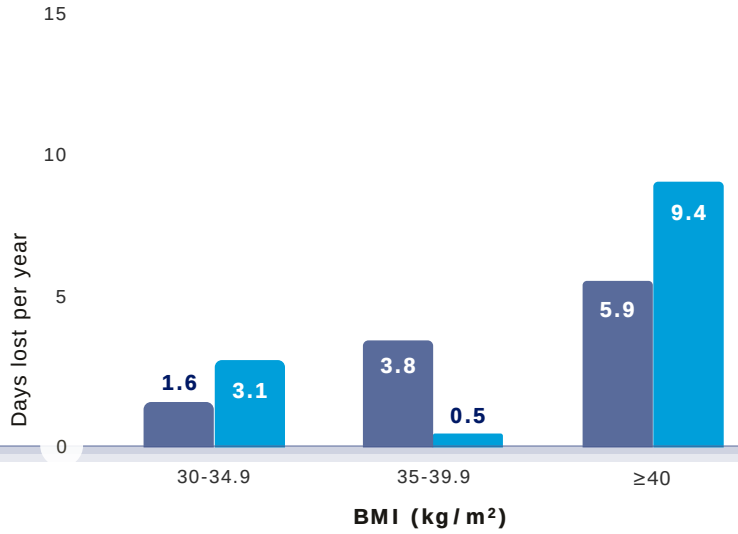
†Sample size for direct costs, representing employees of the 8 industries studied. ‡Sample size for indirect costs, representing the number of employees with work loss coverage.

Abbreviations: BMI, body mass index.

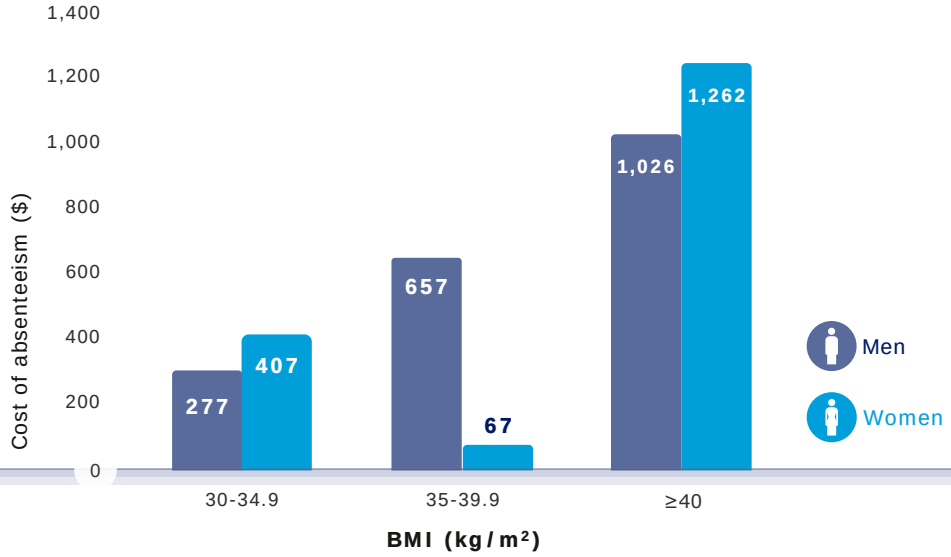
References: 1. Ramasamy et al. Direct and indirect cost of obesity among the privately insure in the United States: a focus on the impact by type of industry. J Occup Environ Med. 2019; [Epub ahead of print].

BMI ≥30 kg/m² and related complications adversely affect work productivity, resulting in substantial costs to employers

Days lost per year to absenteeism per patient with body mass index (BMI) ≥30 kg/m² in the US[1]



Annual cost of absenteeism per patient with BMI ≥30 kg/m² in the US[1]

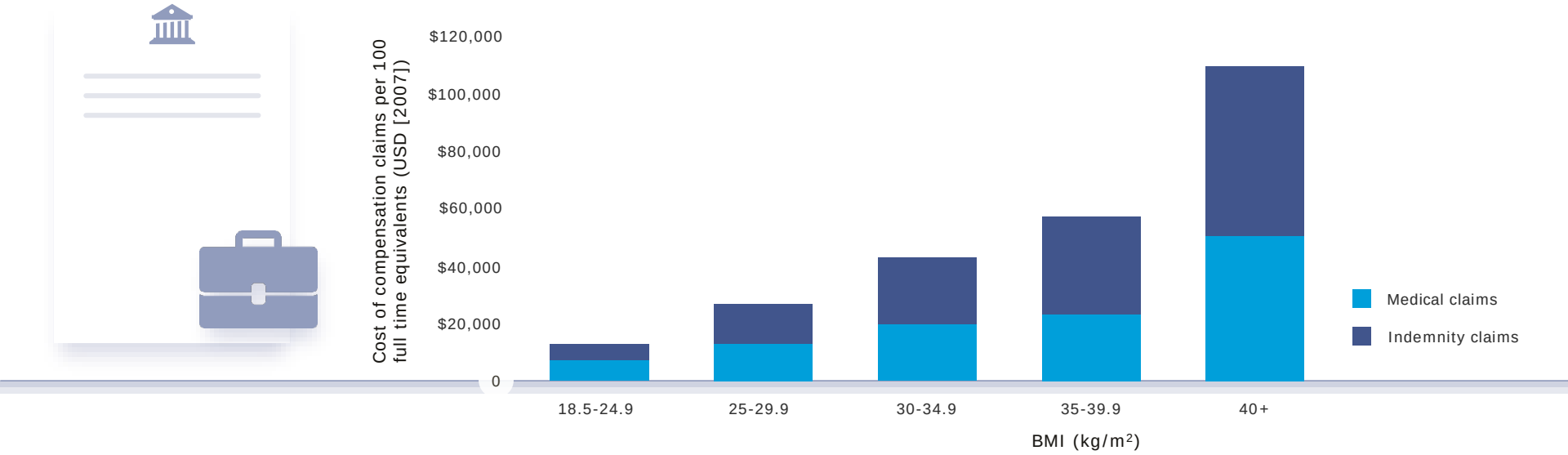


Abbreviations: BMI, body mass index.

References: 1. Finkelstein et al. The costs of obesity in the workplace. J Occup Environ Med. 2010;52(10):971-6.

The cost of workers' compensation claims increases substantially with increasing BMI

In a US study of healthcare and university employees, the cost of workers' compensation claims providing medical care and income replacement (indemnity) increase with increasing body mass index (BMI):[1]

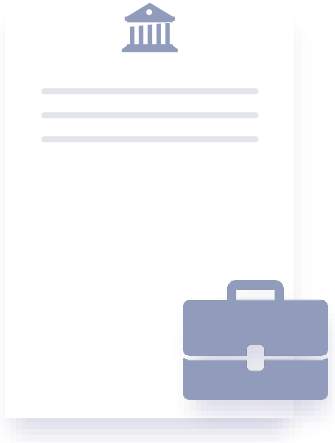


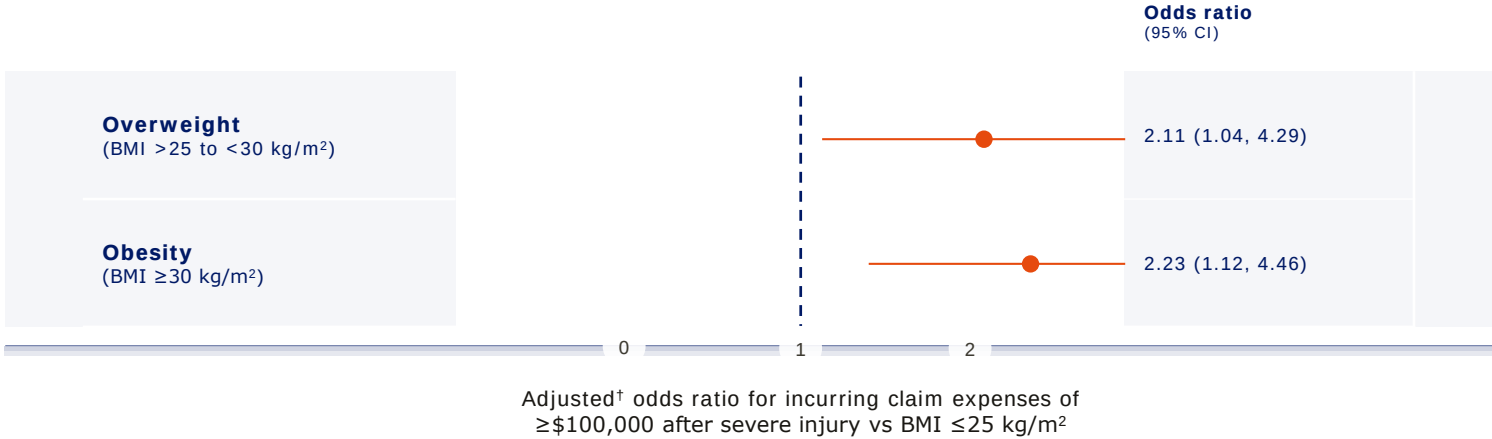
Abbreviations: BMI, body mass index; USD, United States dollars.

References: 1. Ostbye et al. Obesity and workers' compensation. Arch Intern Med 2007;167(8):766–773.

People with BMI >25 kg/m² are significantly more likely to claim ≥$100,000 in work compensation after severe injury than those with BMI ≤25 kg/m²

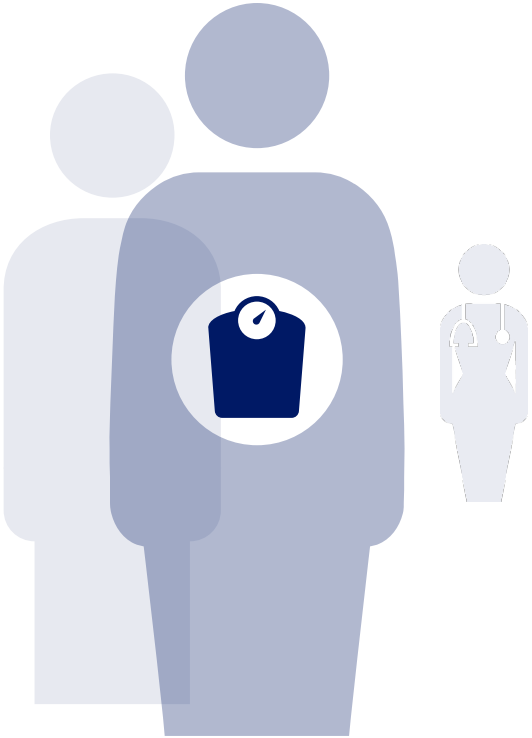
In a pilot study including 2,301 injured workers in the US, the odds of incurring a workers' compensation claim of ≥$100,000 after a severe injury were significantly greater for those with BMIs >25 kg/m² to ≤30 kg/m² and ≥30 kg/m² vs those with BMI ≤25 kg/m² [1]





†Adjusted for gender, age, marital status, attorney involvement, and spinal procedures.
Abbreviations: BMI, body mass index; CI, confidence interval.

References: 1. Tao et al. Is obesity associated with adverse workers' compensation claims outcomes. JOEM 2016;58(9):880–884.



Clinical and Economic Benefits of Weight Loss

Weight loss has a positive impact on complications and greater weight loss results in greater health benefits

Weight loss required for therapeutic benefit (%)*

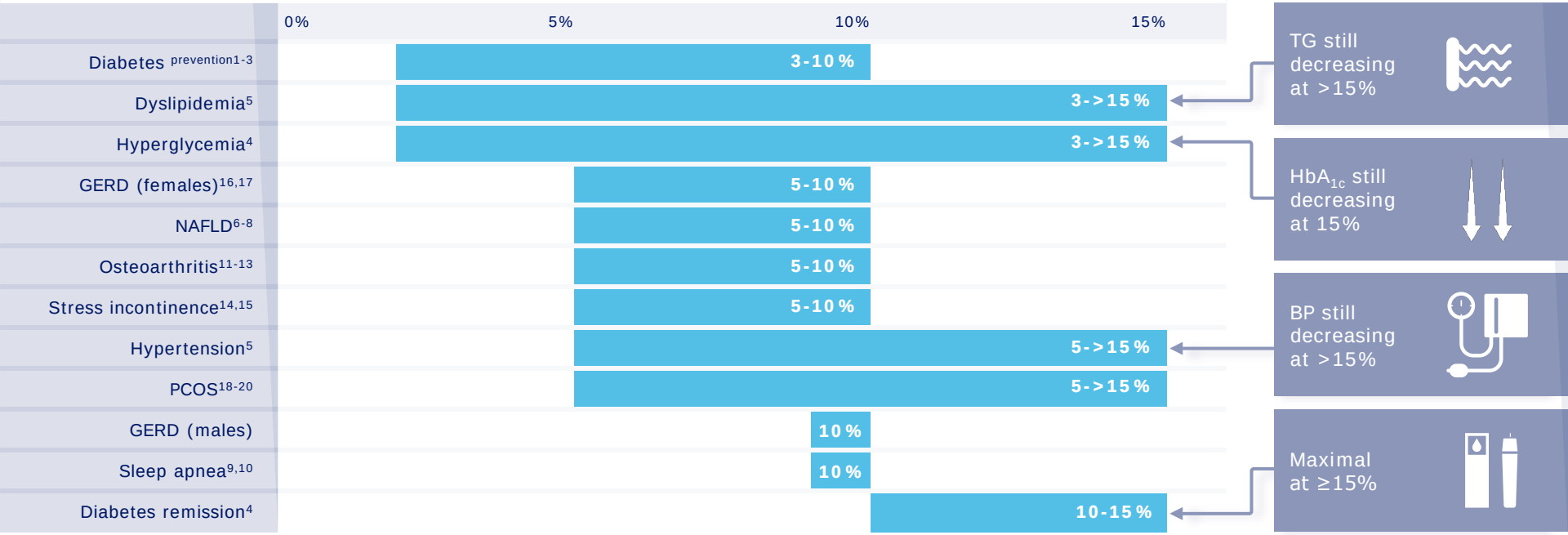


*Figure displays weight loss ranges examined in the studies (impact of >10% weight on NAFLD, and sleep apnea symptoms was not reported).

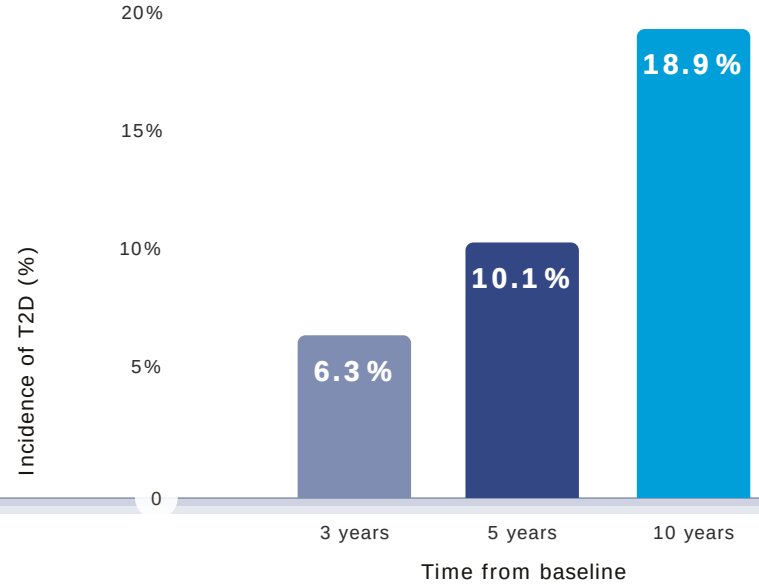
Abbreviations: BP, blood pressure; GERD, gastroesophageal reflux disease; NAFLD, non-alcoholic fatty liver disease; PCOS, polycystic ovary syndrome; TG, triglycerides.

References: SEE NOTES PANE

Sustained weight loss reduces the risk of developing type 2 diabetes

In a retrospective evaluation of adults in primary care with BMI >27 kg/m^2 (N=49,327), those who achieved and maintained ≥5% weight loss over 2 years (N=6,437)† were less likely to develop T2D than those who did not lose weight[1]

Incidence of T2D in the overall population of US adults with BMI >27 kg/m^2 (N=49,327)[1]



33%

LOWER RISK OF INCIDENT T2D among weight loss maintainers vs overweight/obesity maintainers†‡

28%

LOWER RISK OF INCIDENT T2D for each additional 5% of weight loss maintained§

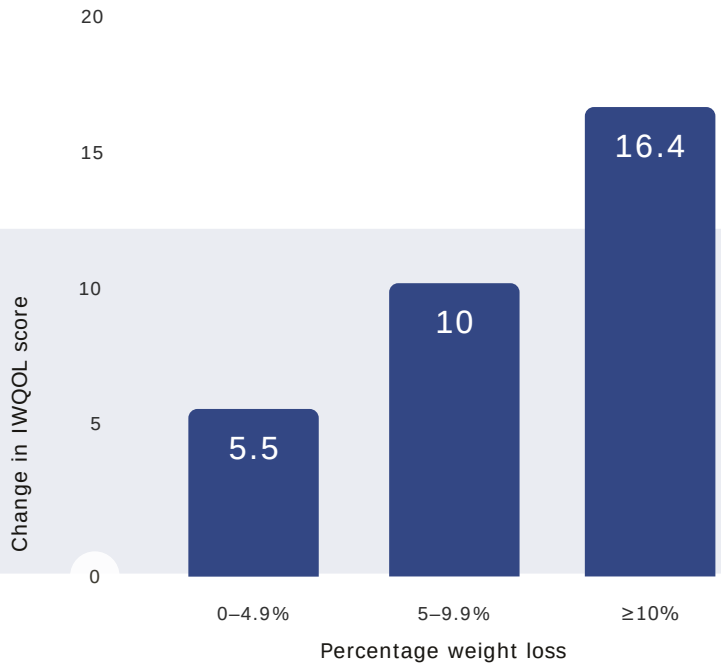
†Weight loss maintainers achieved ≥5% weight loss in Year 1 and maintained ≥80% of weight loss in Year 2. ‡Based on an adjusted HR of 0.67 $[0.61, 0.73]_{95\%\ CI}$ ($p<0.0001$). §Based on an adjusted HR of 0.72 $[0.64, 0.81]_{95\%\ CI}$ ($p<0.0001$).

Abbreviations: BMI, body mass index; CI, confidence interval; HR, hazard ratio; T2D, type 2 diabetes.

References: 1. Wood et al. Impact of sustained weight loss on incident type 2 diabetes. J Patient Cent Res Rev. 2020 Apr 6;7(1):64–137.

Weight loss is associated with improvements in health-related quality of life[1]

Weight loss over one year is associated with **improved HRQoL**, with **greater weight loss resulting in greater improvement** as demonstrated by increases in the IWQOL score, the weight-related measure of HRQoL



Mean baseline IWQOL score	**74.2**	**74.1**	**71.4**

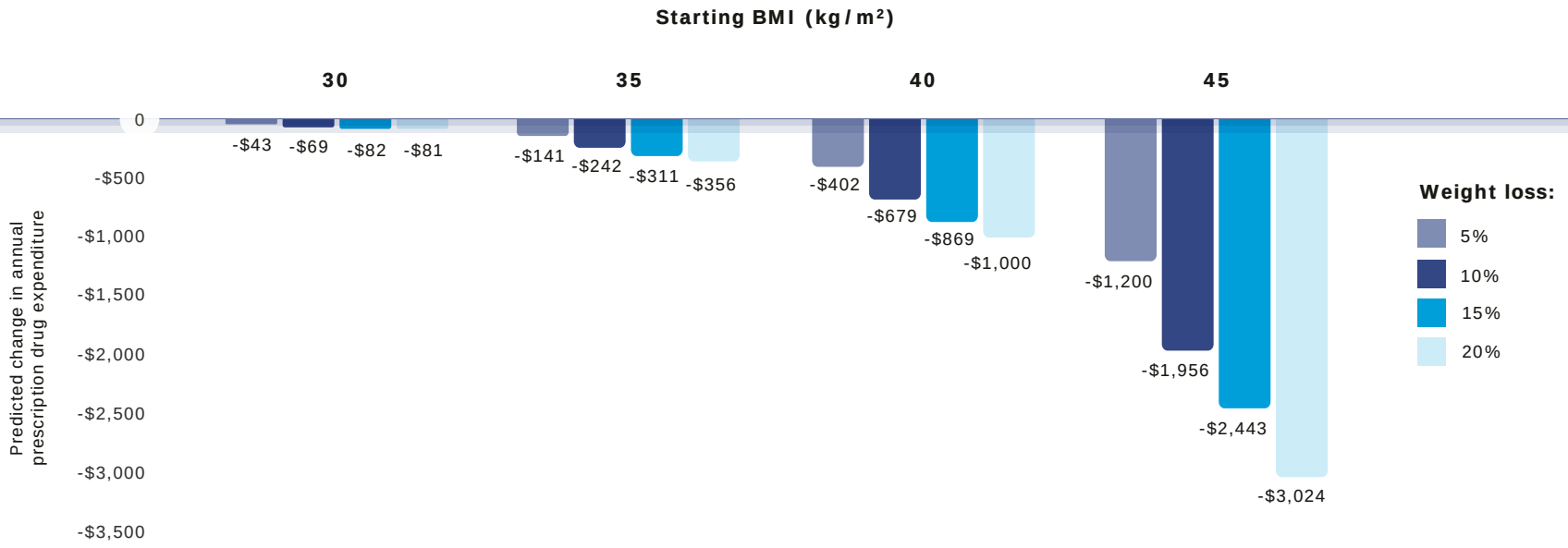
Data are change in HRQoL (IWQOL) scores based on weight change at 1 year collected from 926 individuals with obesity. The IWQOL is a validated, self reported measure of weight-related QoL that provides a total score of 0 to 100 (100 represents the best QoL) with five domains (Physical Function, Self-Esteem, Sexual Life, Public Distress, and Work).

Abbreviations: HRQoL, health-related quality of life; IWQoL-Lite, Impact of Weight on Quality of Life-Lite.

References: 1. Kolotkin RL et al. One-year health-related quality of life outcomes in weight loss trial participants: Comparison of three measures. Health Qual Life Outcomes. 2009;7:53.

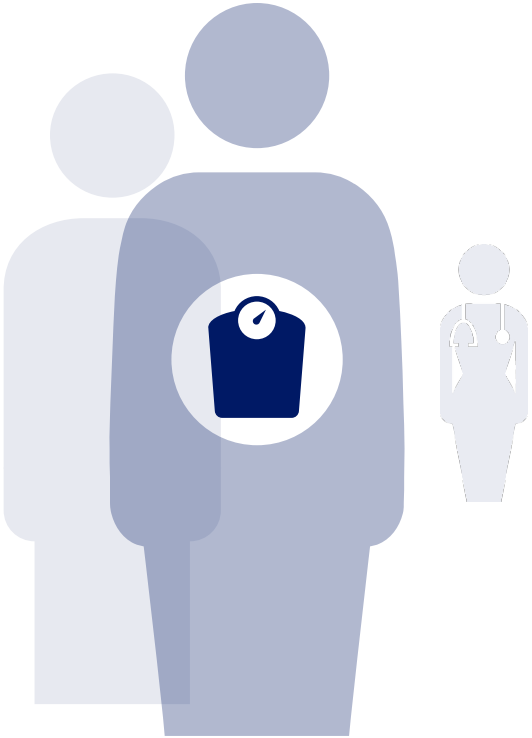
Weight loss is associated with reduced drug expenditure

Weight loss is associated with reductions on prescription drug expenditure, with greater increases observed among people with higher starting body mass index (BMI):[1]



Abbreviations: BMI, body mass index.

References: 1. Cawley et al. Savings in medical expenditures associated with reductions in body mass index among US adults with obesity, by diabetes status. Pharmacoeconomics. 2015;33(7):707-22.



Weight Loss Interventions and Barriers to Weight Loss

AACE guidelines recommend ongoing evaluation and increasing treatment intensity in line with disease stage[1]

Normal Weight

(No obesity)

BMI 18.5–24.9 kg/m^2

- Healthy meal plan
- Physical activity
- Health education

Goal: Maintain healthy weight

Stage 0

No complications

Overweight
BMI 25–29.9 kg/m^2
Obesity BMI ≥30 kg/m^2

- Lifestyle/behavioral therapy
- Consider pharmacotherapy if lifestyle alone not effective

Goal: Prevent progressive weight gain or promote weight loss

Stage 1

One or more mild to moderate complications may be treated effectively with moderate weight loss

BMI ≥25 kg/m^2

- Lifestyle/behavioral therapy
- Consider pharmacotherapy (BMI ≥27 kg/m^2)

Stage 2

≥1 Severe complication or requires more aggressive weight loss for effective treatment

BMI ≥25 kg/m^2

- Lifestyle/behavioral therapy
- Add pharmacotherapy (BMI ≥27 kg/m^2)
- Consider bariatric surgery (BMI ≥35 kg/m^2)

Goal: Achieve weight loss sufficient to ameliorate the complications and prevent further deterioration

Abbreviations: BMI, body mass index.

References: 1. American Association of Clinical Endocrinologists. Treatment algorithm for the medical care of patients with obesity. https://www.aace.com/files/guidelines/ObesityAlgorithm.pdf.

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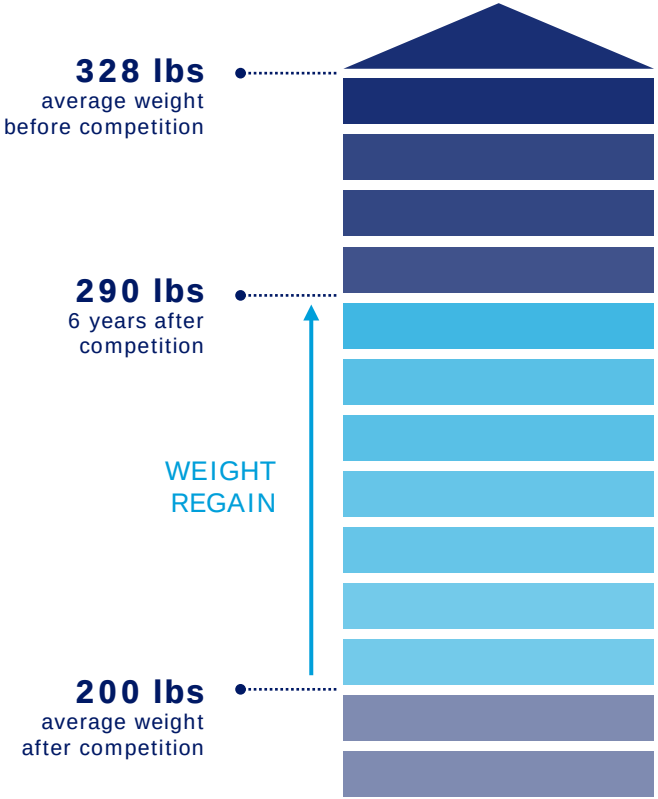
Lifestyle interventions alone are not always effective in achieving sustained weight loss

6 years after
The Biggest Loser
competition in the US,
most contestants experienced
weight regain[1]



References: 1. Fothergill et al. Persistent metabolic adaptation 6 years after the Biggest Loser competition. Obesity (Silver Spring). 2016;24(8):1612-1619.

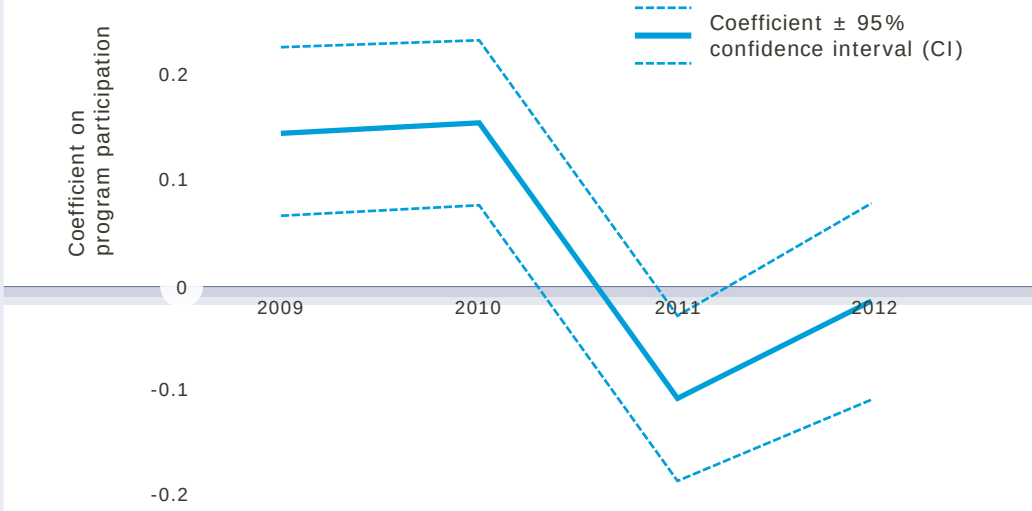
Lifestyle interventions alone do not result in direct, measurable improvements in clinical outcomes or health care expenditure

In an assessment of the impact of a workplace wellness program offered by a large US employer, with 75–80% participation:[1]

No direct link was observed between **participation and improved health** outcomes

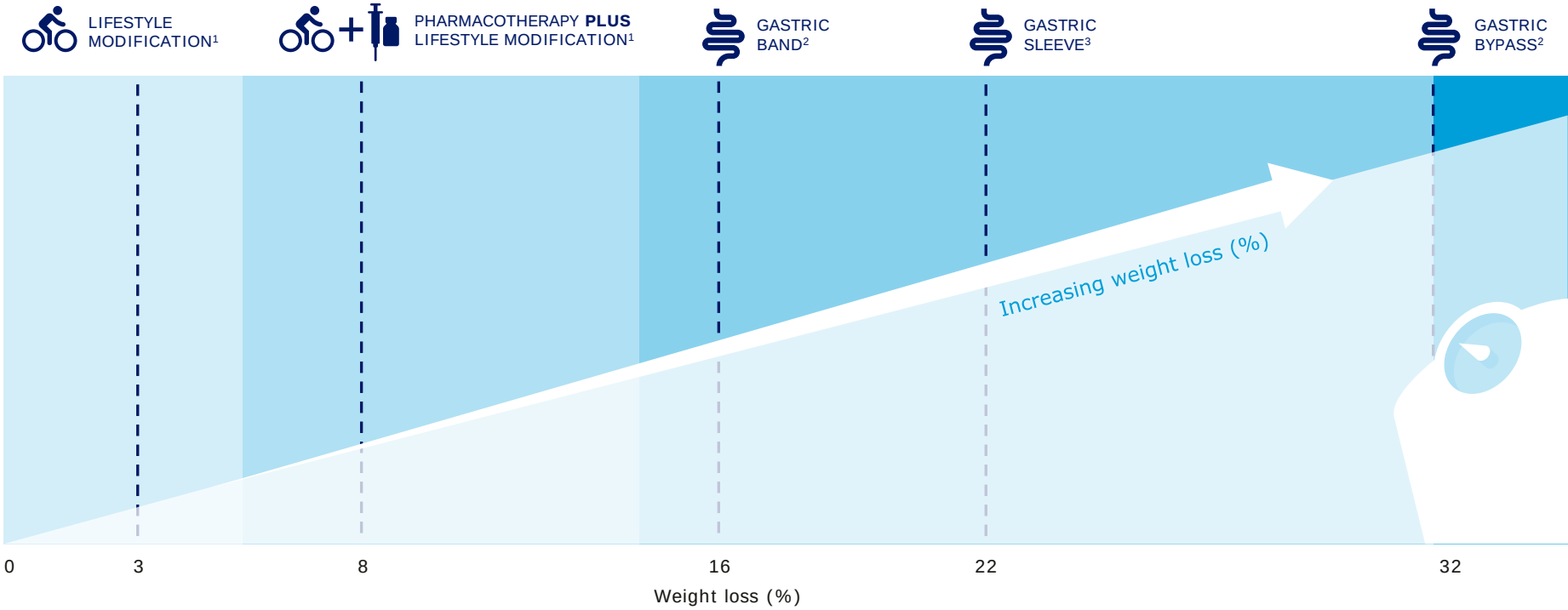
After an **initial increase in cost** (possibly as a result of preventative medicine uptake), **healthcare expenditure was reduced, but later increased**

Relationship between participations in a workplace wellness program and health care expenditure over 4 years[1]



References: 1. Einav et al. The impact of financial incentives on health and health care: Evidence from a large wellness program Health Economics 2019;28:261-279.

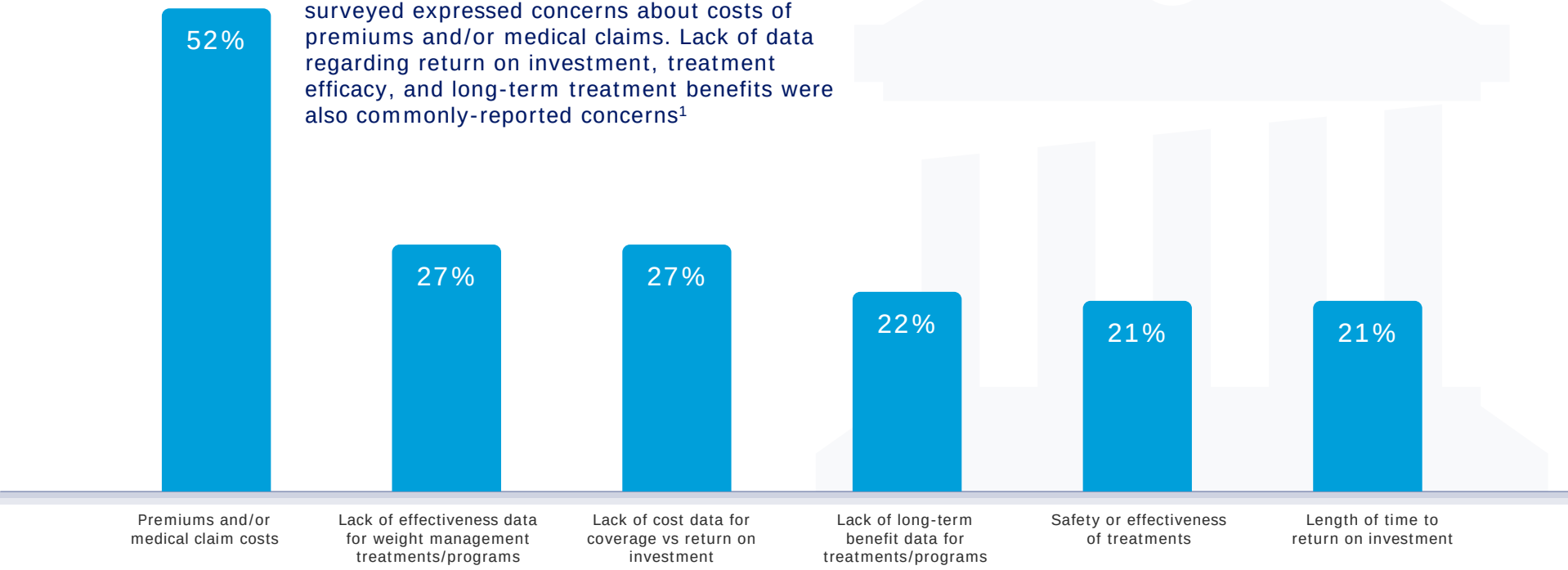
Pharmacotherapy can help to bridge the gap between lifestyle modification and more intensive surgical options



References: 1. Jensen et al. 2013 AHA/ACC/TOS guideline for the management of overweight and obesity in adults. J Am Coll Cardiol. 2014;63(25 Pt B):2985-3023. **2.** Courcoulas et al. Weight change and health outcomes at three years after bariatric surgery among patients with severe obesity. JAMA. 2013;310(22):2416-25. **3.** Berry et al. Sleeve gastrectomy outcomes in patients with BMI between 30 and 35-3 years of follow-up. Obes Surg. 2018;28: 649-655.

Employer concerns about offering insurance coverage for obesity management may be a barrier to access to weight loss interventions

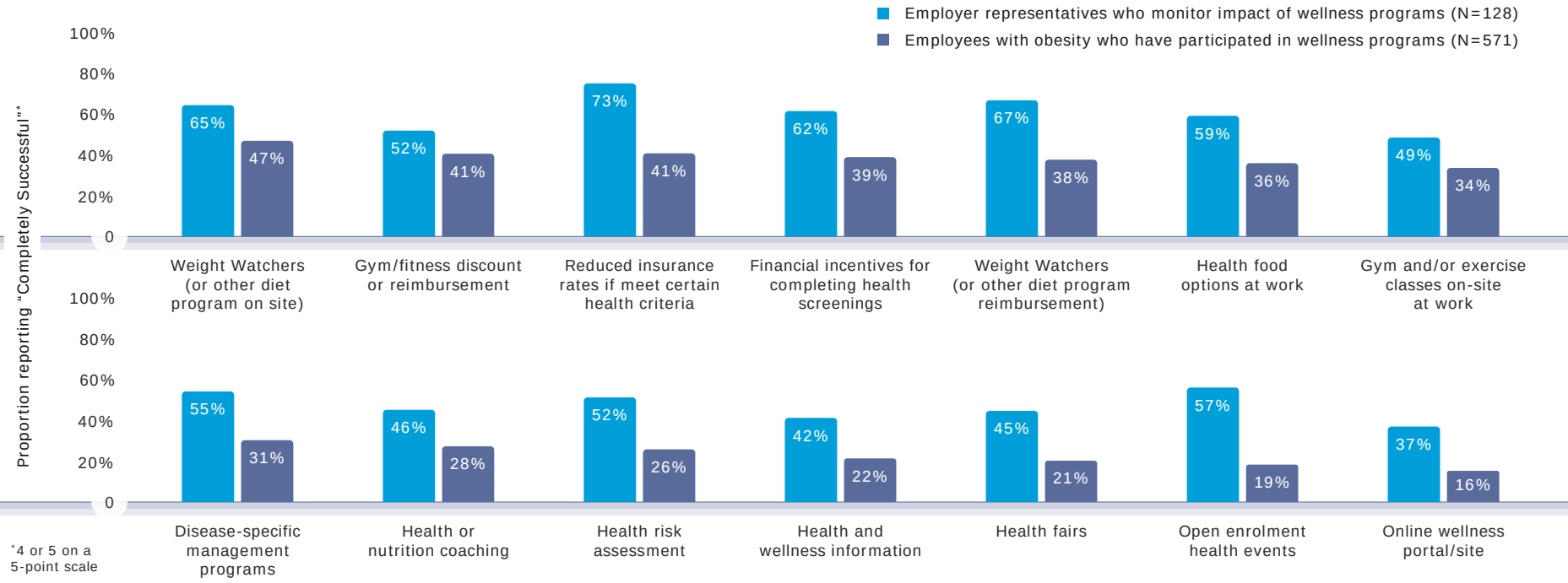
In the ACTION Study, over half of 153 employers surveyed expressed concerns about costs of premiums and/or medical claims. Lack of data regarding return on investment, treatment efficacy, and long-term treatment benefits were also commonly-reported concerns[1]



References: 1. Kaplan et al. Perceptions of barriers to effective obesity care: results from the national ACTION study. Obesity. 2018;26:61-69.

Less than half of employees with obesity who had participated in wellness programs considered any program completely successful

In the ACTION Study, employer representative monitoring wellness programs were more likely to consider them completely successful than employees with obesity who had participated in these programs[1]



*4 or 5 on a 5-point scale

References: **1**. Jinnett et al. Insights into the role of employers supporting obesity management in people with obesity: results of the national ACTION study. Population Health Management. 2019;22(4):308-314.

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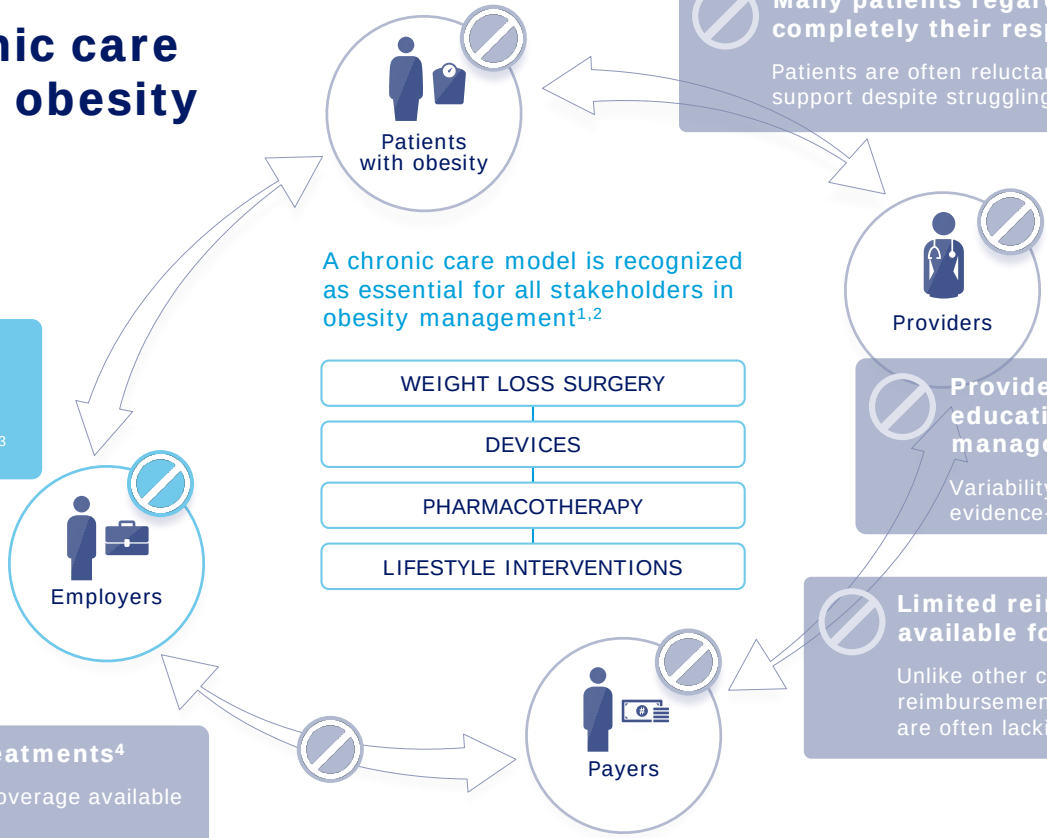
Barriers to a chronic care model for treating obesity



Many patients regard weight loss as completely their responsibility[5]

Patients are often reluctant to seek professional support despite struggling with weight loss[5]

Providers may have limited education on obesity management[6,7]

Variability in application of evidence-based practice

Limited reimbursement is available for obesity care[2,7]

Unlike other chronic diseases, reimbursement strategies for obesity are often lacking[2]

Poor coverage of obesity treatments[4]

Limited or fragmented treatment coverage available for obesity-related care[2,4]

Employer strategies prioritize wellness programs[3]

Self-directed wellness programs lack systematic, multi-disciplinary support[3]

A chronic care model is recognized as essential for all stakeholders in obesity management[1,2]

- WEIGHT LOSS SURGERY
- DEVICES
- PHARMACOTHERAPY
- LIFESTYLE INTERVENTIONS

References: 1. Dietz and Gallagher. A proposed standard of obesity care for all providers and payers. Obesity. 2018;27:1059-1062. **2.** Baum et al. The challenges and opportunities associated with reimbursement for obesity pharmacotherapy in the USA. PharmacoEconomics. 2015;33:643-632. **3.** Jinnett et al. Insights into the role of employers supporting obesity management in people with obesity: results of the national ACTION study. Population Health Management. 2019;22(4):308-314. **4.** Wilson et al. Obesity coverage gap: consumers perceive low coverage for obesity treatments even when workplace wellness programs target BMI. 2017:25;370-377. **5.** Kaplan et al. Perceptions of barriers to effective obesity care: results from the national ACTION study. Obesity. 2018;26:61-69. **6.** Forman-Hoffman et al. Barriers to obesity management: a pilot study of primary care clinicians. BMC Family Practice. 2006:7(35). **7.** Bornhoeft. Perceptions, attitudes, and behaviors of primary care providers towards obesity management: a qualitative study. Journal of Community Health Nursing. 2018:3;85-101.

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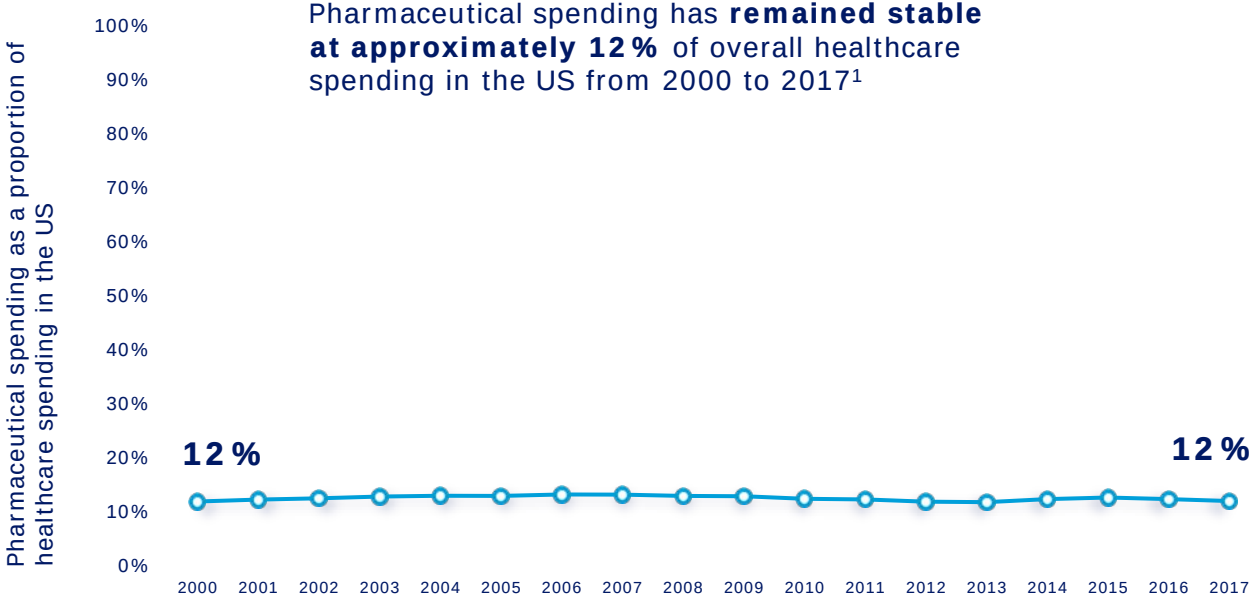
Pharmaceutical spending makes up only 12% of healthcare spending and has the potential to reduce overall expenditure

Pharmaceutical spending has **remained stable at approximately 12%** of overall healthcare spending in the US from 2000 to 2017[1]



The US Congressional Budget Office estimates that a **1% increase in the number of prescriptions filled** by Medicare beneficiaries would cause Medicare **spending on medical services to fall by approximately 0.2%**[2]

References: 1. OECD. Pharmaceutical spending. Available at: https://data.oecd.org/healthres/pharmaceutical-spending.htm. **2.** US Congressional Budget Office. Offsetting Effects of Prescription Drug Us on Medicare's Spending for Medical Services. 2012. Available at: https://www.cbo.gov/sites/default/files/112th-congress-2011-2012/reports/MedicalOffsets_One-col.pdf.

Questions

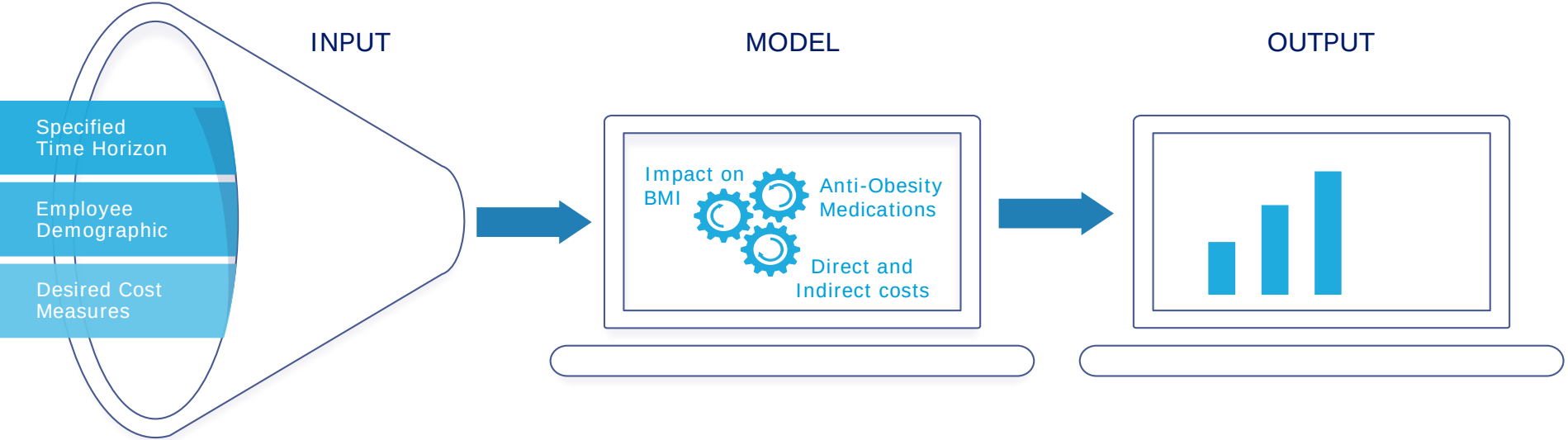
What do you see as the **largest barrier** to obesity management?

How successful is your current **wellness or obesity program**?

Do you feel that your current **wellness or obesity management program** is sufficient?

Under what conditions can anti-obesity medications (AOMs) be considered an "Investment"?

Understanding the methodology of the US Employer Cost Offset Model



Your population-level employee demographics
OR
Pre-specified national level data

Transparent model based on:

- AOM Efficacy in published clinical trials
- Direct/Indirect costs based on national published data

Cost offsets as measured by:

- Cost of intervention vs direct/indirect medical cost
- ROI versus no intervention or ILT

Abbreviations: AOM, anti-obesity medication; BMI, body mass index; ILT, intensive lifestyle therapy; ROI, return on investment.

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Return on investment would be observed over 10 years among several sub-populations of patients with obesity

	vs no intervention			vs intensive lifestyle therapies		
	OBESITY CLASSES			OBESITY CLASSES		
	I, II and II	II and III	III	I, II and II	II and III	III
People with obesity						
ANY CARDIOMETABOLIC DISEASE						
Cardiovascular diseases			✓		✓	✓
with cerebrovascular diseases			✓		✓	✓
with diabetes			✓		✓	✓
with dyslipidemia		✓	✓		✓	✓
with hypertension		✓	✓	✓	✓	✓
Cerebrovascular diseases			✓	✓	✓	✓
Diabetes						
Dyslipidemia			✓		✓	✓
Hypertension						
OSTEOARTHRITIS						
with cardiovascular diseases		✓	✓	✓	✓	✓
with diabetes						✓

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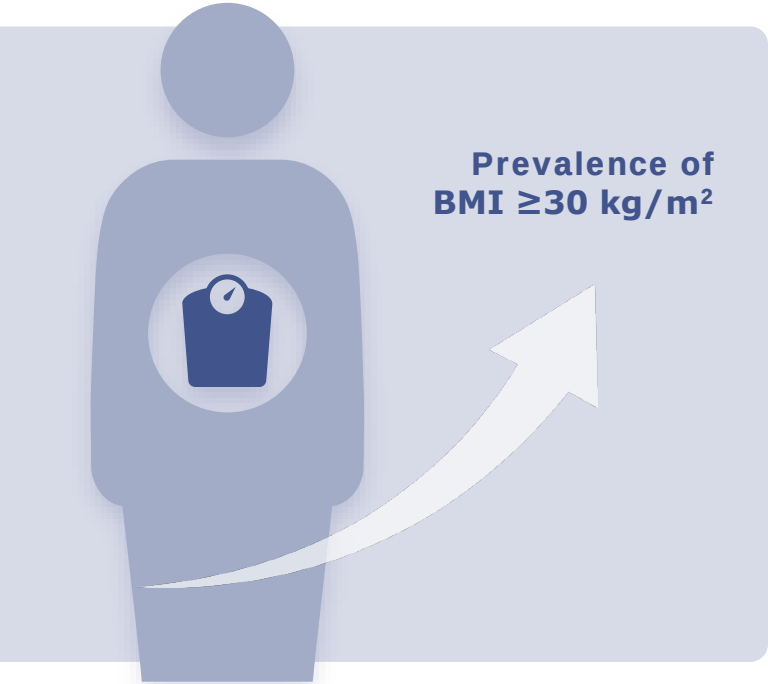
Appendix: Back-up slides

Multiple factors contribute to increased prevalence of BMI ≥30 kg/m^2



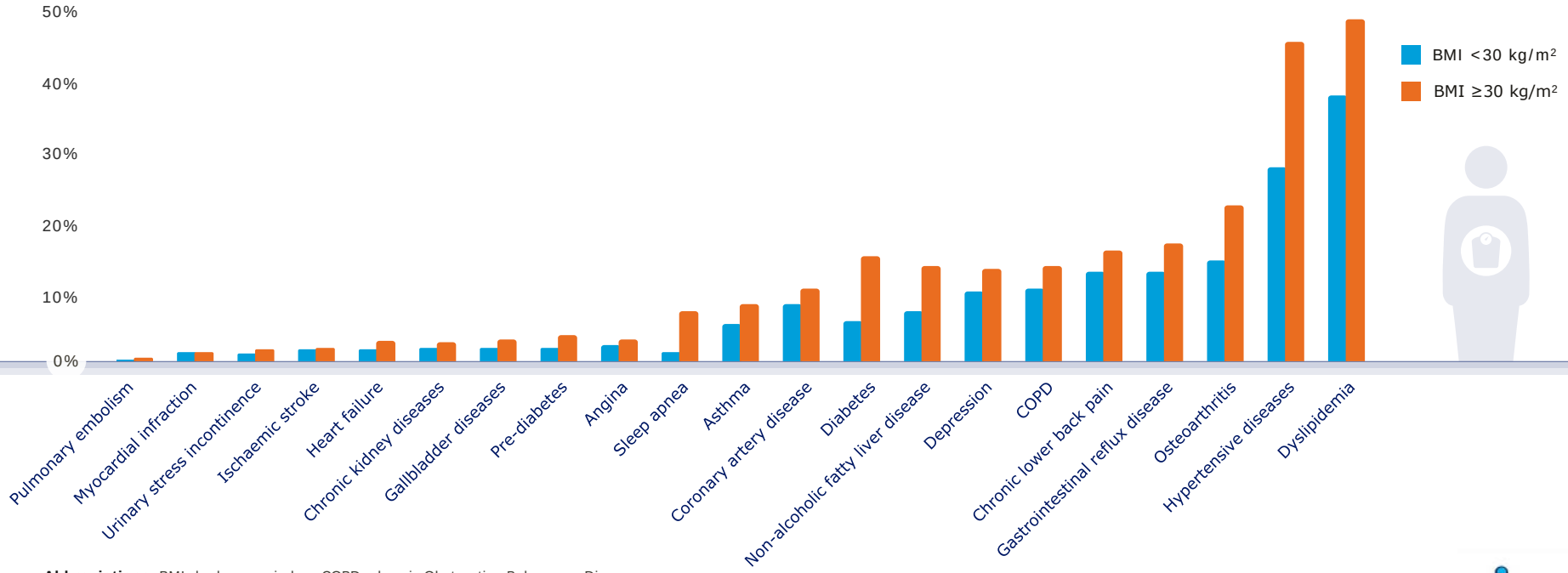
- Older parental age at birth
- Demographic/ethnicity status
- BMI association with increased reproductive fitness
- Endocrine disruptors
- Decreased smoking
- Less sleep
- Reduced physical activity
- Increased time in climate-controlled areas
- Medicines (prednisone, insulin, antidepressants)
- Food marketing prices

Abbreviations: BMI, body mass index.

References: 1. Keith et al. Putative contributors to the secular increase in obesity: Exploring the roads less traveled. Int J Obes 2006;30:1585–94.

BMI ≥30 kg/m² is associated with increased risk of multiple comorbidities

An analysis of US electronic medical records (n=56,895, 59.7% with body mass index [BMI] ≥30 kg/m²) demonstrates increased prevalence of several comorbidities among people with BMI ≥30 kg/m² vs those with BMI <30kg/m² [1]



Abbreviations: BMI, body mass index; COPD, chronic Obstructive Pulmonary Disease.

References: 1. Li et al. Prevalence and healthcare costs of obesity-related comorbidities: evidence from an electronic medical records system in the United States. J Med Econ. 2015;18(12):1020-1028.

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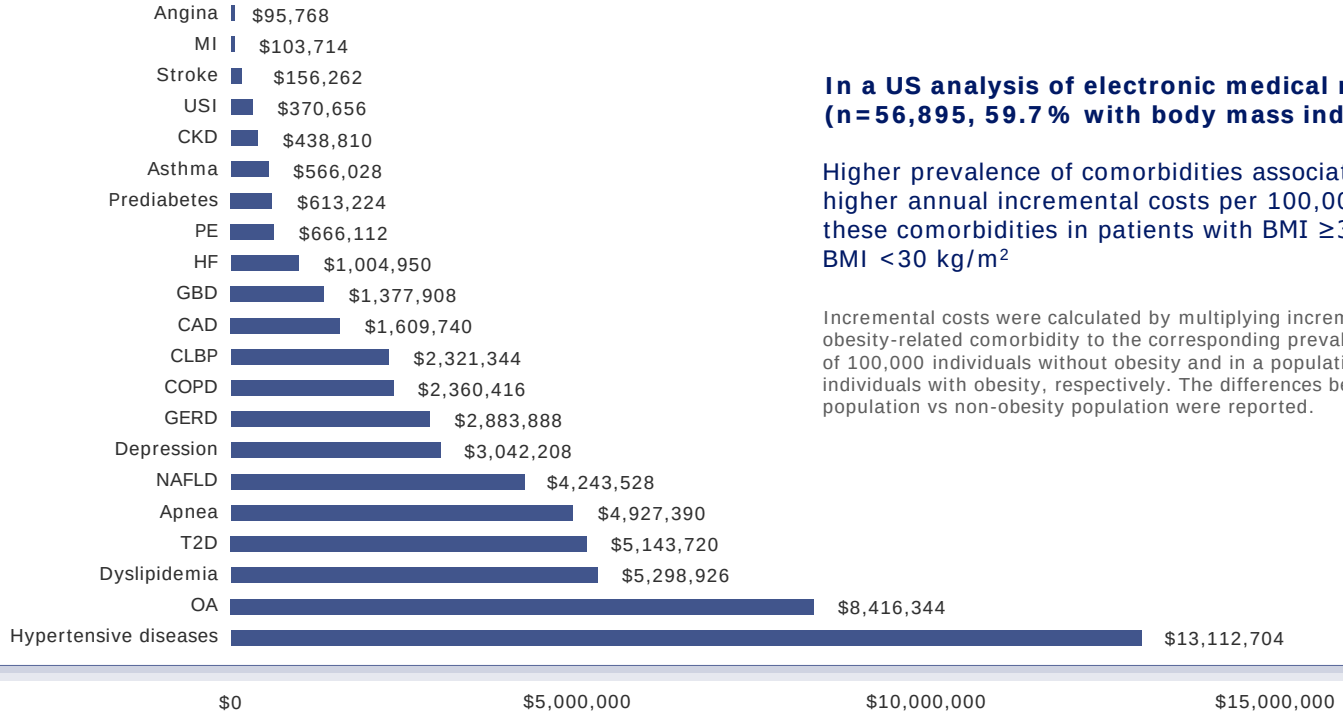
Incremental costs of comorbidities are substantially increased in people with BMI ≥30 kg/m² vs those with BMI <30 kg/m² in the US



In a US analysis of electronic medical records (n=56,895, 59.7% with body mass index [BMI] ≥30 kg/m²):[1]

Higher prevalence of comorbidities associated with obesity led to a higher annual incremental costs per 100,000 individuals of each of these comorbidities in patients with BMI ≥30 kg/m² vs those with BMI <30 kg/m²

Incremental costs were calculated by multiplying incremental for each obesity-related comorbidity to the corresponding prevalence in a population of 100,000 individuals without obesity and in a population of 100,000 individuals with obesity, respectively. The differences between the obesity population vs non-obesity population were reported.

Abbreviations: BMI, body mass index.; CAD, coronary artery disease; CKD, chronic kidney disease; CLBP, chronic lower back pain; COPD, chronic obstructive pulmonary disease; GBD, gallbladder diseases; GERD, gastroesophageal reflux disease; HF, heart failure; MI, myocardial infarction; NAFLD, non-alcoholic fatty liver disease; OA, osteoarthritis; PE, pulmonary embolism; T2D, type 2 diabetes; USI, urinary stress incontinence.

References: 1. Li et al. Prevalence and healthcare costs of obesity-related comorbidities: evidence from an electronic medical records system in the United States. J Med Econ. 2015;18(12):1020-1028.

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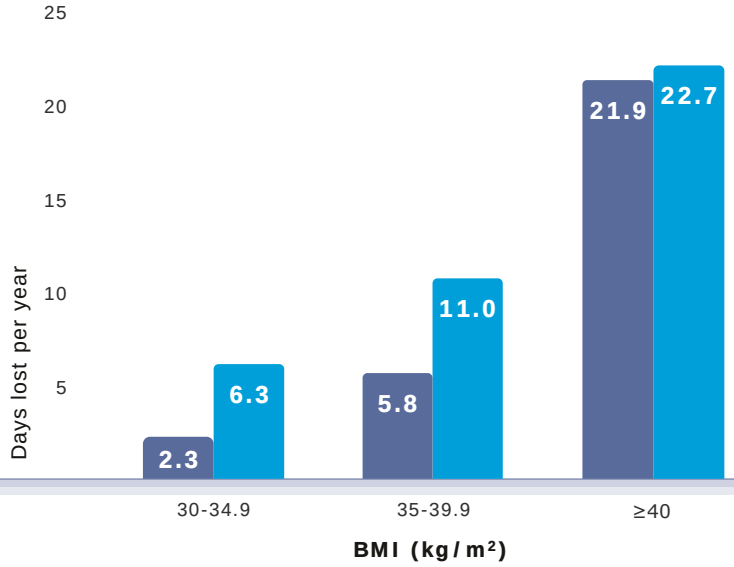
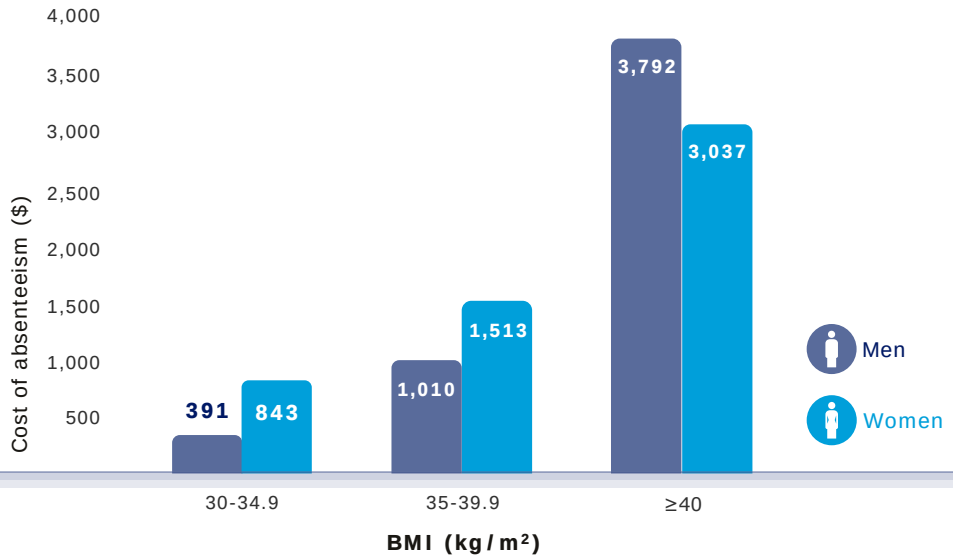
BMI ≥30 kg/m² is associated with increased presenteeism

Days lost per year to presenteeism per patient with body mass index (BMI) ≥30 kg/m² in the US[1]



Annual cost of presenteeism per patient with BMI ≥30 kg/m² in the US[1]

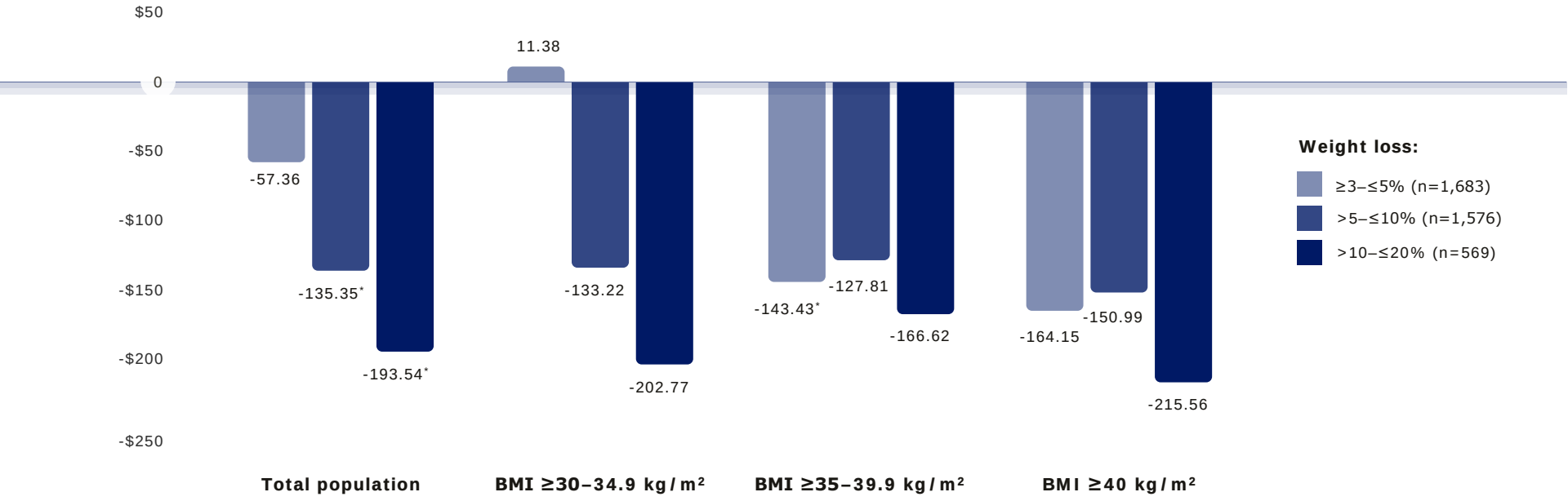


Abbreviations: BMI, body mass index.

References: 1. Finkelstein et al. The costs of obesity in the workplace. J Occup Environ Med. 2010;52(10):971-6.

Weight loss substantially reduces per-patient-per-month healthcare costs

In a real-world analysis of US claims data, large reductions in per-patient-per-month (PPPM) healthcare costs at 1 year were observed with weight loss, resulting in large cost savings that increase with increasing weight loss:[1]



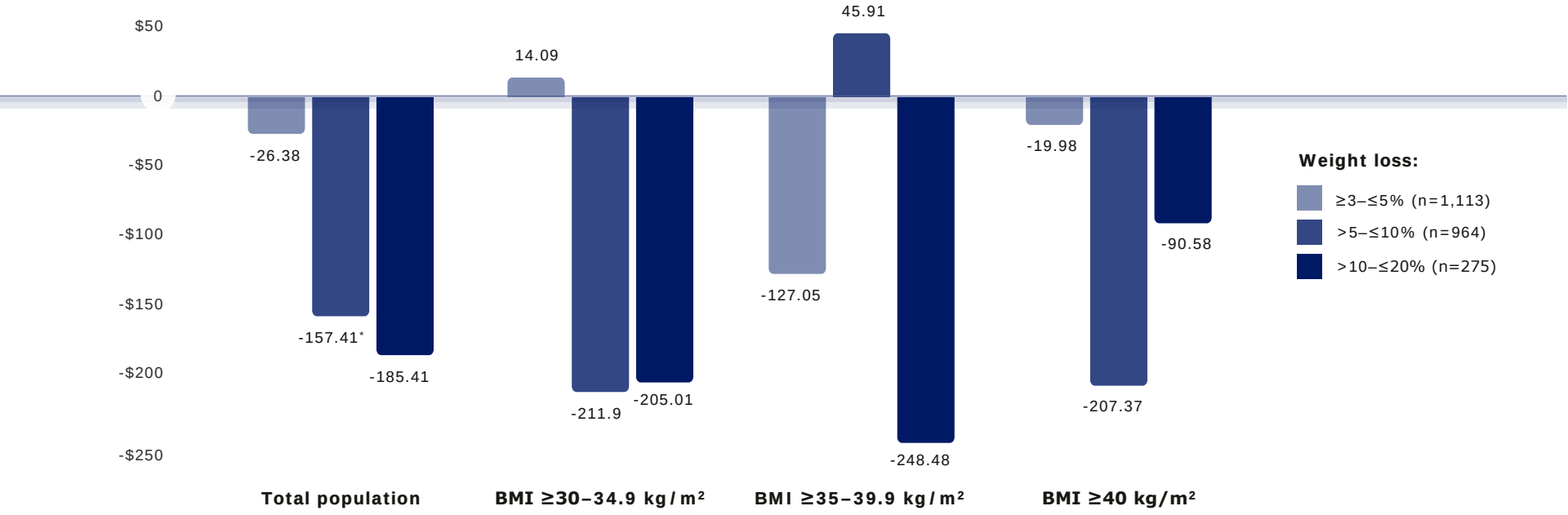
*p<0.05

Abbreviations: BMI, body mass index; PPPM, per-patient-per-month.

References: 1. Ding et al. Economic value of weight loss in adults with obesity. Presented at ObesityWeek 2019, Las Vegas, NV, November 3–7.

Cost savings are achieved among people with sustained weight loss over 2 years

In a real-world analysis of US claims data, reductions in per-patient-per-month (PPPM) healthcare costs resulted in large cost savings among people with obesity with sustained weight loss over 2 years, with the greatest cost savings observed among those with >10–≤20% weight loss:[1]



*p<0.05

Abbreviations: BMI, body mass index; PPPM, per-patient-per-month.

References: 1. Ding et al. Economic value of weight loss in adults with obesity. Presented at ObesityWeek 2019, Las Vegas, NV, November 3–7.

Several factors will determine the potential cost burden of interventions for BMI reduction on employers

EMPLOYER FACTOR		POTENTIAL COST BURDEN OF OBESITY TREATMENT: HIGH	POTENTIAL COST BURDEN OF OBESITY TREATMENT: LOW
Medical plan	**Self-insured**	✓	
	National health insurance provider		✓
Employee obesity burden	**High**	✓	
	Low		✓
Staff turnover	**High**		✓
	Low	✓	
Proportion of staff performing manual work	**High**		✓
	Low	✓	
Provision of an outcomes-driven wellness program	**Yes**		✓
	No	✓	

References: 1. Novo Nordisk. Cost offset model of AOMs for employers. Data on file.

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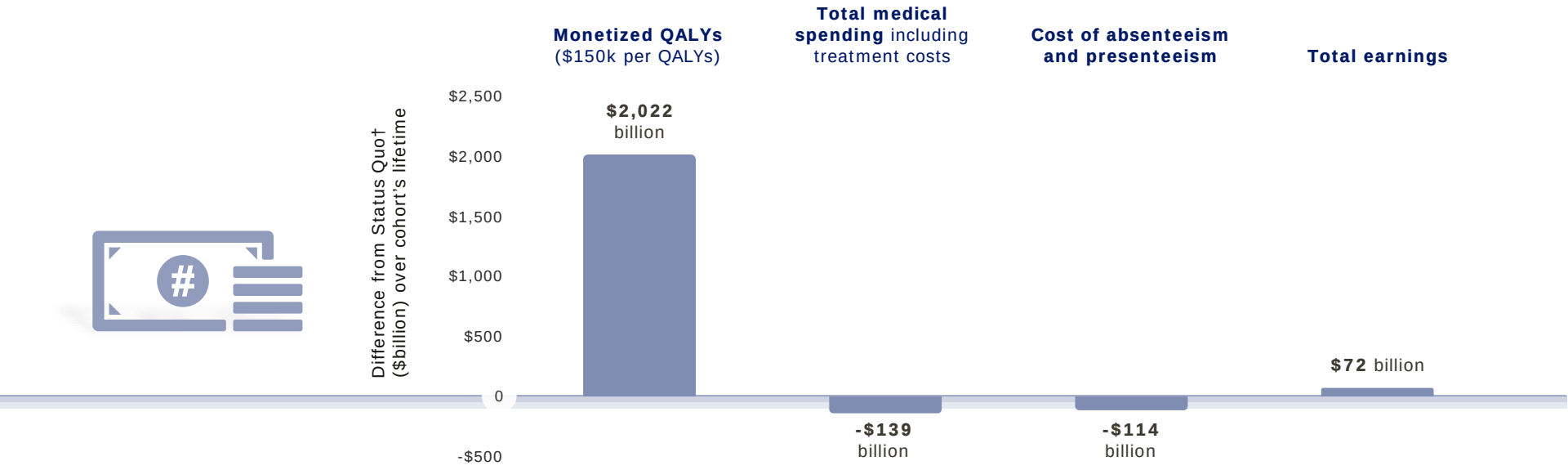
When used appropriately, the cost of anti-obesity medication is more than offset by savings associated with weight loss

Assuming 15% uptake among the 217 million eligible Americans, currently available **anti-obesity medications may generate $1.2 trillion** in societal value through increased monetized quality-adjusted life years (QALYs), reductions in medical costs, reductions in absenteeism and presenteeism costs, and increased total earnings[1]



†Status quo represents current rates of diet and exercise and AOM use.

Abbreviations: QALY, quality-adjusted life year.

References: 1. Kabiri et al. The societal value of broader access to anti-obesity medicines. Obesity 2019.

Appendix: Full results of cost offset model of AOMs for employers

Return on investment for all scenarios: AOMs vs no intervention

Obesity Class	Population of Interest	Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Obesity classes I, II and III	People with obesity	3,061	$0.20	$0.22	$0.23	$0.24	$0.25	$0.26	$0.26	$0.27	$0.27	$0.28
Obesity classes I, II and III	Cardiovascular diseases	230	$0.44	$0.48	$0.50	$0.51	$0.53	$0.54	$0.55	$0.56	$0.57	$0.58
Obesity classes I, II and III	Cerebrovascular diseases	32	$0.69	$0.74	$0.78	$0.80	$0.82	$0.83	$0.85	$0.86	$0.87	$0.87
Obesity classes I, II and III	Dyslipidemia	440	$0.34	$0.37	$0.39	$0.40	$0.42	$0.43	$0.44	$0.45	$0.47	$0.48
Obesity classes I, II and III	Hypertension	833	$0.26	$0.28	$0.29	$0.30	$0.31	$0.32	$0.32	$0.33	$0.34	$0.34
Obesity classes I, II and III	Osteoarthritis	416	$0.35	$0.37	$0.39	$0.40	$0.40	$0.41	$0.42	$0.42	$0.43	$0.43
Obesity classes I, II and III	Diabetes	218	$0.18	$0.20	$0.21	$0.22	$0.23	$0.24	$0.25	$0.26	$0.26	$0.27
Obesity classes I, II and III	Cardiovascular diseases (with cerebrovascular diseases	251	$0.44	$0.48	$0.50	$0.52	$0.53	$0.54	$0.55	$0.56	$0.57	$0.58
Obesity classes I, II and III	Any cardiometabolic disease*	1,142	$0.24	$0.26	$0.27	$0.28	$0.29	$0.29	$0.30	$0.31	$0.31	$0.32
Obesity classes I, II and III	Cardiovascular diseases (with dyslipidemia)	76	$0.41	$0.45	$0.48	$0.50	$0.51	$0.53	$0.56	$0.58	$0.60	$0.63
Obesity classes I, II and III	Cardiovascular diseases (with hypertension)	117	$0.54	$0.59	$0.62	$0.64	$0.66	$0.68	$0.70	$0.72	$0.74	$0.76
Obesity classes I, II and III	Cardiovascular diseases (with diabetes)	34	$0.38	$0.41	$0.44	$0.45	$0.47	$0.48	$0.49	$0.51	$0.52	$0.53
Obesity classes I, II and III	Osteoarthritis (with cardiovascular diseases)	53	$0.50	$0.55	$0.58	$0.60	$0.62	$0.64	$0.66	$0.68	$0.71	$0.74
Obesity classes I, II and III	Osteoarthritis (with diabetes)	43	$0.36	$0.40	$0.41	$0.42	$0.43	$0.44	$0.44	$0.45	$0.45	$0.45
Obesity classes II and III	People with obesity	1,261	$0.26	$0.29	$0.30	$0.32	$0.33	$0.33	$0.34	$0.35	$0.36	$0.37
Obesity classes II and III	Cardiovascular diseases	93	$0.65	$0.70	$0.73	$0.75	$0.77	$0.79	$0.80	$0.82	$0.83	$0.84
Obesity classes II and III	Cerebrovascular diseases	13	$0.59	$0.68	$0.73	$0.79	$0.83	$0.87	$0.90	$0.93	$0.95	$0.96
Obesity classes II and III	Dyslipidemia	175	$0.51	$0.56	$0.59	$0.61	$0.63	$0.66	$0.68	$0.70	$0.72	$0.74
Obesity classes II and III	Hypertension	335	$0.34	$0.37	$0.38	$0.39	$0.40	$0.41	$0.42	$0.43	$0.44	$0.45
Obesity classes II and III	Osteoarthritis	168	$0.35	$0.37	$0.39	$0.39	$0.40	$0.41	$0.41	$0.42	$0.42	$0.43
Obesity classes II and III	Diabetes	87	$0.34	$0.38	$0.40	$0.42	$0.43	$0.45	$0.46	$0.48	$0.50	$0.51
Obesity classes II and III	Cardiovascular diseases (with cerebrovascular diseases	101	$0.64	$0.70	$0.73	$0.75	$0.77	$0.78	$0.80	$0.81	$0.83	$0.84
Obesity classes II and III	Any cardiometabolic disease*	460	$0.32	$0.35	$0.36	$0.37	$0.38	$0.39	$0.40	$0.41	$0.42	$0.42
Obesity classes II and III	Cardiovascular diseases (with dyslipidemia)	30	$0.70	$0.77	$0.82	$0.85	$0.88	$0.92	$0.96	$1.00	$1.04	$1.08
Obesity classes II and III	Cardiovascular diseases (with hypertension)	46	$0.90	$0.99	$1.05	$1.09	$1.12	$1.16	$1.19	$1.23	$1.26	$1.30
Obesity classes II and III	Cardiovascular diseases (with diabetes)	13	$0.58	$0.64	$0.68	$0.71	$0.73	$0.76	$0.79	$0.81	$0.84	$0.87
Obesity classes II and III	Osteoarthritis (with cardiovascular diseases)	21	$0.62	$0.70	$0.75	$0.78	$0.81	$0.85	$0.89	$0.94	$0.99	$1.04
Obesity classes II and III	Osteoarthritis (with diabetes)	17	$0.48	$0.52	$0.54	$0.55	$0.56	$0.56	$0.57	$0.58	$0.58	$0.59
Obesity class III	People with obesity	501	$0.33	$0.37	$0.38	$0.40	$0.41	$0.42	$0.43	$0.44	$0.45	$0.46
Obesity class III	Cardiovascular diseases	36	$1.02	$1.11	$1.15	$1.19	$1.21	$1.23	$1.25	$1.27	$1.29	$1.30
Obesity class III	Cerebrovascular diseases	5	$1.73	$1.98	$2.16	$2.31	$2.46	$2.58	$2.68	$2.77	$2.86	$2.93
Obesity class III	Dyslipidemia	65	$0.78	$0.87	$0.92	$0.96	$1.00	$1.03	$1.07	$1.11	$1.15	$1.19
Obesity class III	Hypertension	127	$0.43	$0.47	$0.49	$0.51	$0.52	$0.53	$0.54	$0.55	$0.56	$0.57
Obesity class III	Osteoarthritis	65	$0.32	$0.34	$0.35	$0.36	$0.37	$0.37	$0.38	$0.38	$0.39	$0.39
Obesity class III	Diabetes	33	$0.55	$0.62	$0.66	$0.69	$0.72	$0.75	$0.78	$0.81	$0.84	$0.88
Obesity class III	Cardiovascular diseases (with cerebrovascular diseases	39	$1.01	$1.10	$1.15	$1.18	$1.20	$1.23	$1.25	$1.27	$1.28	$1.30
Obesity class III	Any cardiometabolic disease*	175	$0.42	$0.46	$0.48	$0.49	$0.51	$0.52	$0.53	$0.54	$0.55	$0.55
Obesity class III	Cardiovascular diseases (with dyslipidemia)	11	$1.22	$1.36	$1.45	$1.52	$1.57	$1.64	$1.71	$1.79	$1.87	$1.95
Obesity class III	Cardiovascular diseases (with hypertension)	17	$1.51	$1.67	$1.76	$1.83	$1.90	$1.96	$2.02	$2.09	$2.16	$2.22
Obesity class III	Cardiovascular diseases (with diabetes)	5	$0.93	$1.06	$1.14	$1.20	$1.26	$1.32	$1.38	$1.44	$1.51	$1.57
Obesity class III	Osteoarthritis (with cardiovascular diseases)	8	$1.04	$1.19	$1.30	$1.39	$1.45	$1.54	$1.63	$1.73	$1.84	$1.95
Obesity class III	Osteoarthritis (with diabetes)	6	$0.59	$0.65	$0.67	$0.69	$0.70	$0.71	$0.72	$0.74	$0.75	$0.76

*Consists of cardiovascular diseases, cerebrovascular diseases, dyslipidemia, hypertension, OR diabetes

Abbreviations: AOM, anti-obesity medication; ROI, return on investment.

References: 1. Novo Nordisk. Cost offset model of AOMs for employers. Data on file.

Return on investment (%) at population level for all scenarios: AOMs vs no intervention

Obesity Class	Population of Interest	Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Obesity classes I, II and III	People with obesity	3,061	-80%	-78%	-77%	-76%	-75%	-74%	-74%	-73%	-73%	-72%
Obesity classes I, II and III	Cardiovascular diseases	230	-56%	-52%	-50%	-49%	-47%	-46%	-45%	-44%	-43%	-42%
Obesity classes I, II and III	Cerebrovascular diseases	32	-31%	-26%	-22%	-20%	-18%	-17%	-15%	-14%	-13%	-13%
Obesity classes I, II and III	Dyslipidemia	440	-66%	-63%	-61%	-60%	-58%	-57%	-56%	-55%	-53%	-52%
Obesity classes I, II and III	Hypertension	833	-74%	-72%	-71%	-70%	-69%	-68%	-68%	-67%	-66%	-66%
Obesity classes I, II and III	Osteoarthritis	416	-65%	-63%	-61%	-60%	-60%	-59%	-58%	-58%	-57%	-57%
Obesity classes I, II and III	Diabetes	218	-82%	-80%	-79%	-78%	-77%	-76%	-75%	-74%	-74%	-73%
Obesity classes I, II and III	Cardiovascular diseases (with cerebrovascular diseases	251	-56%	-52%	-50%	-48%	-47%	-46%	-45%	-44%	-43%	-42%
Obesity classes I, II and III	Any cardiometabolic disease*	1,142	-76%	-74%	-73%	-72%	-71%	-71%	-70%	-69%	-69%	-68%
Obesity classes I, II and III	Cardiovascular diseases (with dyslipidemia)	76	-59%	-55%	-52%	-50%	-49%	-47%	-44%	-42%	-40%	-37%
Obesity classes I, II and III	Cardiovascular diseases (with hypertension)	117	-46%	-41%	-38%	-36%	-34%	-32%	-30%	-28%	-26%	-24%
Obesity classes I, II and III	Cardiovascular diseases (with diabetes)	34	-62%	-59%	-56%	-55%	-53%	-52%	-51%	-49%	-48%	-47%
Obesity classes I, II and III	Osteoarthritis (with cardiovascular diseases)	53	-50%	-45%	-42%	-40%	-38%	-36%	-34%	-32%	-29%	-26%
Obesity classes I, II and III	Osteoarthritis (with diabetes)	43	-64%	-60%	-59%	-58%	-57%	-56%	-56%	-55%	-55%	-55%
Obesity classes II and III	People with obesity	1,261	-74%	-71%	-70%	-68%	-67%	-67%	-66%	-65%	-64%	-63%
Obesity classes II and III	Cardiovascular diseases	93	-35%	-30%	-27%	-25%	-23%	-21%	-20%	-18%	-17%	-16%
Obesity classes II and III	Cerebrovascular diseases	13	-41%	-32%	-27%	-21%	-17%	-13%	-10%	-7%	-5%	-4%
Obesity classes II and III	Dyslipidemia	175	-49%	-44%	-41%	-39%	-37%	-34%	-32%	-30%	-28%	-26%
Obesity classes II and III	Hypertension	335	-66%	-63%	-62%	-61%	-60%	-59%	-58%	-57%	-56%	-55%
Obesity classes II and III	Osteoarthritis	168	-65%	-63%	-61%	-61%	-60%	-59%	-59%	-58%	-58%	-57%
Obesity classes II and III	Diabetes	87	-66%	-62%	-60%	-58%	-57%	-55%	-54%	-52%	-50%	-49%
Obesity classes II and III	Cardiovascular diseases (with cerebrovascular diseases	101	-36%	-30%	-27%	-25%	-23%	-22%	-20%	-19%	-17%	-16%
Obesity classes II and III	Any cardiometabolic disease*	460	-68%	-65%	-64%	-63%	-62%	-61%	-60%	-59%	-58%	-58%
Obesity classes II and III	Cardiovascular diseases (with dyslipidemia)	30	-30%	-23%	-18%	-15%	-12%	-8%	-4%	0%	4%	8%
Obesity classes II and III	Cardiovascular diseases (with hypertension)	46	-10%	-1%	5%	9%	12%	16%	19%	23%	26%	30%
Obesity classes II and III	Cardiovascular diseases (with diabetes)	13	-42%	-36%	-32%	-29%	-27%	-24%	-21%	-19%	-16%	-13%
Obesity classes II and III	Osteoarthritis (with cardiovascular diseases)	21	-38%	-30%	-25%	-22%	-19%	-15%	-11%	-6%	-1%	4%
Obesity classes II and III	Osteoarthritis (with diabetes)	17	-52%	-48%	-46%	-45%	-44%	-44%	-43%	-42%	-42%	-41%
Obesity class III	People with obesity	501	-67%	-63%	-62%	-60%	-59%	-58%	-57%	-56%	-55%	-54%
Obesity class III	Cardiovascular diseases	36	2%	11%	15%	19%	21%	23%	25%	27%	29%	30%
Obesity class III	Cerebrovascular diseases	5	73%	98%	116%	131%	146%	158%	168%	177%	186%	193%
Obesity class III	Dyslipidemia	65	-22%	-13%	-8%	-4%	0%	3%	7%	11%	15%	19%
Obesity class III	Hypertension	127	-57%	-53%	-51%	-49%	-48%	-47%	-46%	-45%	-44%	-43%
Obesity class III	Osteoarthritis	65	-68%	-66%	-65%	-64%	-63%	-63%	-62%	-62%	-61%	-61%
Obesity class III	Diabetes	33	-45%	-38%	-34%	-31%	-28%	-25%	-22%	-19%	-16%	-12%
Obesity class III	Cardiovascular diseases (with cerebrovascular diseases	39	1%	10%	15%	18%	20%	23%	25%	27%	28%	30%
Obesity class III	Any cardiometabolic disease*	175	-58%	-54%	-52%	-51%	-49%	-48%	-47%	-46%	-45%	-45%
Obesity class III	Cardiovascular diseases (with dyslipidemia)	11	22%	36%	45%	52%	57%	64%	71%	79%	87%	95%
Obesity class III	Cardiovascular diseases (with hypertension)	17	51%	67%	76%	83%	90%	96%	102%	109%	116%	122%
Obesity class III	Cardiovascular diseases (with diabetes)	5	-7%	6%	14%	20%	26%	32%	38%	44%	51%	57%
Obesity class III	Osteoarthritis (with cardiovascular diseases)	8	4%	19%	30%	39%	45%	54%	63%	73%	84%	95%
Obesity class III	Osteoarthritis (with diabetes)	6	-41%	-35%	-33%	-31%	-30%	-29%	-28%	-26%	-25%	-24%

*Consists of cardiovascular diseases, cerebrovascular diseases, dyslipidemia, hypertension, OR diabetes

Abbreviations: AOM, anti-obesity medication; ROI, return on investment.

References: 1. Novo Nordisk. Cost offset model of AOMs for employers. Data on file.

Return on investment for all scenarios: AOMs vs intensive lifestyle interventions

Obesity Class	Population of Interest	Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Obesity classes I, II and III	People with obesity	3,061	$0.22	$0.24	$0.29	$0.33	$0.35	$0.37	$0.38	$0.39	$0.40	$0.41
Obesity classes I, II and III	Cardiovascular diseases	230	$0.47	$0.51	$0.62	$0.69	$0.73	$0.76	$0.78	$0.81	$0.83	$0.84
Obesity classes I, II and III	Cerebrovascular diseases	32	$0.79	$0.84	$1.00	$1.09	$1.16	$1.20	$1.23	$1.26	$1.27	$1.29
Obesity classes I, II and III	Dyslipidemia	440	$0.36	$0.39	$0.48	$0.53	$0.57	$0.60	$0.63	$0.65	$0.68	$0.70
Obesity classes I, II and III	Hypertension	833	$0.28	$0.30	$0.37	$0.41	$0.43	$0.45	$0.47	$0.48	$0.49	$0.51
Obesity classes I, II and III	Osteoarthritis	416	$0.39	$0.42	$0.50	$0.55	$0.58	$0.60	$0.61	$0.62	$0.64	$0.64
Obesity classes I, II and III	Diabetes	218	$0.18	$0.20	$0.25	$0.29	$0.31	$0.33	$0.34	$0.36	$0.37	$0.38
Obesity classes I, II and III	Cardiovascular diseases (with cerebrovascular diseases	251	$0.47	$0.51	$0.63	$0.69	$0.73	$0.76	$0.79	$0.81	$0.83	$0.85
Obesity classes I, II and III	Any cardiometabolic disease*	1,142	$0.26	$0.28	$0.34	$0.38	$0.40	$0.42	$0.43	$0.45	$0.46	$0.47
Obesity classes I, II and III	Cardiovascular diseases (with dyslipidemia)	76	$0.42	$0.46	$0.58	$0.64	$0.69	$0.74	$0.78	$0.82	$0.86	$0.90
Obesity classes I, II and III	Cardiovascular diseases (with hypertension)	117	$0.55	$0.60	$0.75	$0.84	$0.90	$0.94	$0.99	$1.02	$1.06	$1.09
Obesity classes I, II and III	Cardiovascular diseases (with diabetes)	34	$0.38	$0.41	$0.52	$0.58	$0.62	$0.66	$0.69	$0.71	$0.74	$0.76
Obesity classes I, II and III	Osteoarthritis (with cardiovascular diseases)	53	$0.54	$0.58	$0.72	$0.79	$0.84	$0.89	$0.94	$0.98	$1.03	$1.07
Obesity classes I, II and III	Osteoarthritis (with diabetes)	43	$0.40	$0.43	$0.51	$0.56	$0.59	$0.61	$0.63	$0.64	$0.64	$0.65
Obesity classes II and III	People with obesity	1,261	$0.29	$0.31	$0.39	$0.43	$0.46	$0.48	$0.50	$0.51	$0.53	$0.54
Obesity classes II and III	Cardiovascular diseases	93	$0.68	$0.74	$0.91	$1.00	$1.06	$1.10	$1.14	$1.17	$1.19	$1.21
Obesity classes II and III	Cerebrovascular diseases	13	$0.57	$0.63	$0.83	$0.97	$1.08	$1.16	$1.23	$1.27	$1.31	$1.34
Obesity classes II and III	Dyslipidemia	175	$0.53	$0.58	$0.72	$0.81	$0.87	$0.92	$0.96	$1.00	$1.04	$1.07
Obesity classes II and III	Hypertension	335	$0.37	$0.40	$0.48	$0.53	$0.56	$0.59	$0.61	$0.62	$0.64	$0.65
Obesity classes II and III	Osteoarthritis	168	$0.40	$0.42	$0.51	$0.55	$0.58	$0.59	$0.61	$0.62	$0.63	$0.64
Obesity classes II and III	Diabetes	87	$0.35	$0.38	$0.48	$0.54	$0.58	$0.62	$0.65	$0.68	$0.71	$0.73
Obesity classes II and III	Cardiovascular diseases (with cerebrovascular diseases	101	$0.68	$0.74	$0.91	$1.00	$1.06	$1.10	$1.13	$1.16	$1.19	$1.21
Obesity classes II and III	Any cardiometabolic disease*	460	$0.34	$0.37	$0.46	$0.50	$0.53	$0.56	$0.58	$0.59	$0.61	$0.62
Obesity classes II and III	Cardiovascular diseases (with dyslipidemia)	30	$0.71	$0.77	$0.98	$1.10	$1.18	$1.26	$1.33	$1.41	$1.48	$1.55
Obesity classes II and III	Cardiovascular diseases (with hypertension)	46	$0.92	$1.00	$1.26	$1.40	$1.51	$1.59	$1.67	$1.73	$1.80	$1.86
Obesity classes II and III	Cardiovascular diseases (with diabetes)	13	$0.58	$0.64	$0.81	$0.91	$0.98	$1.04	$1.10	$1.15	$1.19	$1.24
Obesity classes II and III	Osteoarthritis (with cardiovascular diseases)	21	$0.62	$0.68	$0.88	$1.00	$1.08	$1.17	$1.25	$1.33	$1.41	$1.49
Obesity classes II and III	Osteoarthritis (with diabetes)	17	$0.53	$0.57	$0.68	$0.74	$0.77	$0.80	$0.82	$0.83	$0.84	$0.85
Obesity class III	People with obesity	501	$0.36	$0.39	$0.49	$0.54	$0.58	$0.60	$0.63	$0.65	$0.66	$0.68
Obesity class III	Cardiovascular diseases	36	$1.04	$1.15	$1.41	$1.55	$1.64	$1.70	$1.75	$1.79	$1.82	$1.85
Obesity class III	Cerebrovascular diseases	5	$1.49	$1.68	$2.32	$2.74	$3.09	$3.35	$3.55	$3.72	$3.87	$3.99
Obesity class III	Dyslipidemia	65	$0.80	$0.88	$1.11	$1.25	$1.35	$1.43	$1.51	$1.58	$1.64	$1.71
Obesity class III	Hypertension	127	$0.47	$0.51	$0.62	$0.68	$0.72	$0.75	$0.78	$0.80	$0.81	$0.83
Obesity class III	Osteoarthritis	65	$0.37	$0.39	$0.46	$0.50	$0.53	$0.55	$0.56	$0.57	$0.58	$0.59
Obesity class III	Diabetes	33	$0.56	$0.61	$0.78	$0.89	$0.96	$1.03	$1.09	$1.14	$1.20	$1.25
Obesity class III	Cardiovascular diseases (with cerebrovascular diseases	39	$1.04	$1.14	$1.41	$1.55	$1.63	$1.70	$1.75	$1.78	$1.81	$1.84
Obesity class III	Any cardiometabolic disease*	175	$0.45	$0.49	$0.60	$0.66	$0.70	$0.73	$0.75	$0.77	$0.79	$0.81
Obesity class III	Cardiovascular diseases (with dyslipidemia)	11	$1.21	$1.33	$1.70	$1.92	$2.07	$2.22	$2.36	$2.50	$2.64	$2.78
Obesity class III	Cardiovascular diseases (with hypertension)	17	$1.50	$1.64	$2.08	$2.34	$2.52	$2.68	$2.81	$2.94	$3.05	$3.16
Obesity class III	Cardiovascular diseases (with diabetes)	5	$0.86	$0.95	$1.27	$1.47	$1.62	$1.75	$1.87	$1.99	$2.10	$2.21
Obesity class III	Osteoarthritis (with cardiovascular diseases)	8	$0.94	$1.06	$1.44	$1.68	$1.86	$2.04	$2.22	$2.40	$2.58	$2.75
Obesity class III	Osteoarthritis (with diabetes)	6	$0.63	$0.68	$0.82	$0.90	$0.95	$0.99	$1.02	$1.04	$1.07	$1.09

*Consists of cardiovascular diseases, cerebrovascular diseases, dyslipidemia, hypertension, OR diabetes

Abbreviations: AOM, anti-obesity medication; ROI, return on investment.

References: 1. Novo Nordisk. Cost offset model of AOMs for employers. Data on file.

Return on investment (%) at population level for all scenarios: AOMs vs intensive lifestyle interventions

Obesity Class	Population of Interest	Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Obesity classes I, II and III	People with obesity	3,061	-78%	-76%	-71%	-67%	-65%	-63%	-62%	-61%	-60%	-59%
Obesity classes I, II and III	Cardiovascular diseases	230	-53%	-49%	-38%	-31%	-27%	-24%	-22%	-19%	-17%	-16%
Obesity classes I, II and III	Cerebrovascular diseases	32	-21%	-16%	0%	9%	16%	20%	23%	26%	27%	29%
Obesity classes I, II and III	Dyslipidemia	440	-64%	-61%	-52%	-47%	-43%	-40%	-37%	-35%	-32%	-30%
Obesity classes I, II and III	Hypertension	833	-72%	-70%	-63%	-59%	-57%	-55%	-53%	-52%	-51%	-49%
Obesity classes I, II and III	Osteoarthritis	416	-61%	-58%	-50%	-45%	-42%	-40%	-39%	-38%	-36%	-36%
Obesity classes I, II and III	Diabetes	218	-82%	-80%	-75%	-71%	-69%	-67%	-66%	-64%	-63%	-62%
Obesity classes I, II and III	Cardiovascular diseases (with cerebrovascular diseases	251	-53%	-49%	-37%	-31%	-27%	-24%	-21%	-19%	-17%	-15%
Obesity classes I, II and III	Any cardiometabolic disease*	1,142	-74%	-72%	-66%	-62%	-60%	-58%	-57%	-55%	-54%	-53%
Obesity classes I, II and III	Cardiovascular diseases (with dyslipidemia)	76	-58%	-54%	-42%	-36%	-31%	-26%	-22%	-18%	-14%	-10%
Obesity classes I, II and III	Cardiovascular diseases (with hypertension)	117	-45%	-40%	-25%	-16%	-10%	-6%	-1%	2%	6%	9%
Obesity classes I, II and III	Cardiovascular diseases (with diabetes)	34	-62%	-59%	-48%	-42%	-38%	-34%	-31%	-29%	-26%	-24%
Obesity classes I, II and III	Osteoarthritis (with cardiovascular diseases)	53	-46%	-42%	-28%	-21%	-16%	-11%	-6%	-2%	3%	7%
Obesity classes I, II and III	Osteoarthritis (with diabetes)	43	-60%	-57%	-49%	-44%	-41%	-39%	-37%	-36%	-36%	-35%
Obesity classes II and III	People with obesity	1,261	-71%	-69%	-61%	-57%	-54%	-52%	-50%	-49%	-47%	-46%
Obesity classes II and III	Cardiovascular diseases	93	-32%	-26%	-9%	0%	6%	10%	14%	17%	19%	21%
Obesity classes II and III	Cerebrovascular diseases	13	-43%	-37%	-17%	-3%	8%	16%	23%	27%	31%	34%
Obesity classes II and III	Dyslipidemia	175	-47%	-42%	-28%	-19%	-13%	-8%	-4%	0%	4%	7%
Obesity classes II and III	Hypertension	335	-63%	-60%	-52%	-47%	-44%	-41%	-39%	-38%	-36%	-35%
Obesity classes II and III	Osteoarthritis	168	-60%	-58%	-49%	-45%	-42%	-41%	-39%	-38%	-37%	-36%
Obesity classes II and III	Diabetes	87	-65%	-62%	-52%	-46%	-42%	-38%	-35%	-32%	-29%	-27%
Obesity classes II and III	Cardiovascular diseases (with cerebrovascular diseases	101	-32%	-26%	-9%	0%	6%	10%	13%	16%	19%	21%
Obesity classes II and III	Any cardiometabolic disease*	460	-66%	-63%	-54%	-50%	-47%	-44%	-42%	-41%	-39%	-38%
Obesity classes II and III	Cardiovascular diseases (with dyslipidemia)	30	-29%	-23%	-2%	10%	18%	26%	33%	41%	48%	55%
Obesity classes II and III	Cardiovascular diseases (with hypertension)	46	-8%	0%	26%	40%	51%	59%	67%	73%	80%	86%
Obesity classes II and III	Cardiovascular diseases (with diabetes)	13	-42%	-36%	-19%	-9%	-2%	4%	10%	15%	19%	24%
Obesity classes II and III	Osteoarthritis (with cardiovascular diseases)	21	-38%	-32%	-12%	0%	8%	17%	25%	33%	41%	49%
Obesity classes II and III	Osteoarthritis (with diabetes)	17	-47%	-43%	-32%	-26%	-23%	-20%	-18%	-17%	-16%	-15%
Obesity class III	People with obesity	501	-64%	-61%	-51%	-46%	-42%	-40%	-37%	-35%	-34%	-32%
Obesity class III	Cardiovascular diseases	36	4%	15%	41%	55%	64%	70%	75%	79%	82%	85%
Obesity class III	Cerebrovascular diseases	5	49%	68%	132%	174%	209%	235%	255%	272%	287%	299%
Obesity class III	Dyslipidemia	65	-20%	-12%	11%	25%	35%	43%	51%	58%	64%	71%
Obesity class III	Hypertension	127	-53%	-49%	-38%	-32%	-28%	-25%	-22%	-20%	-19%	-17%
Obesity class III	Osteoarthritis	65	-63%	-61%	-54%	-50%	-47%	-45%	-44%	-43%	-42%	-41%
Obesity class III	Diabetes	33	-44%	-39%	-22%	-11%	-4%	3%	9%	14%	20%	25%
Obesity class III	Cardiovascular diseases (with cerebrovascular diseases	39	4%	14%	41%	55%	63%	70%	75%	78%	81%	84%
Obesity class III	Any cardiometabolic disease*	175	-55%	-51%	-40%	-34%	-30%	-27%	-25%	-23%	-21%	-19%
Obesity class III	Cardiovascular diseases (with dyslipidemia)	11	21%	33%	70%	92%	107%	122%	136%	150%	164%	178%
Obesity class III	Cardiovascular diseases (with hypertension)	17	50%	64%	108%	134%	152%	168%	181%	194%	205%	216%
Obesity class III	Cardiovascular diseases (with diabetes)	5	-14%	-5%	27%	47%	62%	75%	87%	99%	110%	121%
Obesity class III	Osteoarthritis (with cardiovascular diseases)	8	-6%	6%	44%	68%	86%	104%	122%	140%	158%	175%
Obesity class III	Osteoarthritis (with diabetes)	6	-37%	-32%	-18%	-10%	-5%	-1%	2%	4%	7%	9%

*Consists of cardiovascular diseases, cerebrovascular diseases, dyslipidemia, hypertension, OR diabetes

Abbreviations: AOM, anti-obesity medication; ROI, return on investment.

References: 1. Novo Nordisk. Cost offset model of AOMs for employers. Data on file.

Appendix: Economic value of weight loss in adults with obesity

Background

An estimated 39.8% of adults have obesity in the US, according to 2015–2016 data from the National Health and Nutrition Examination Survey. Obesity imposes a significant economic burden on US society, incurring $1.72 trillion in both direct and indirect costs annually

While there have been studies to explore the economic benefits of weight loss (WL), the **short-term cost savings** as a result of WL or sustained WL for a defined period of time (e.g., 1 year) have not been well described

Although the efficacy and economic benefits of surgical weight loss have been demonstrated, the economic impact of **nonsurgical WL** has not been comprehensively investigated

References: 1. Ding et al. Economic value of weight loss in adults with obesity. Presented at ObesityWeek 2019, Las Vegas, NV, November 3–7.

Objectives

- Assess the impact of **nonsurgical weight loss** on per-patient-per month healthcare cost compared to no weight change, and how it differs by starting obesity class
- Assess the impact of **sustained nonsurgical weight loss** on per-patient-per month healthcare cost compared to no weight change, and how it differs by starting obesity class

References: 1. Ding et al. Economic value of weight loss in adults with obesity. Presented at ObesityWeek 2019, Las Vegas, NV, November 3–7.

Method

Data source

Truven MarketScan – Explorys Linked Claims - EMR Database (Jan 1, 2012 - Jun 30, 2018)

Study cohorts

Weight loss (WL) and sustained WL*: >3% to ≤5%, >5% to ≤10%, and >10% to ≤20% weight loss

No weight change: within ±3% weight change

Study outcomes

Per-patient-per-month (PPPM) total healthcare cost including inpatient, outpatient, emergency room, and pharmacy costs, calculated as:

$$\text{PPPM cost} = \frac{total\ healthcare\ cost}{number\ of\ months\ available}$$

Note: sustained WL was defined as WL between 1st and 2nd BMI measurements and <3% weight gain between 2nd and 3rd BMI measurements.

References: 1. Ding et al. Economic value of weight loss in adults with obesity. Presented at ObesityWeek 2019, Las Vegas, NV, November 3–7.

Method:

Objective #1: Impact of nonsurgical weight loss on PPPM healthcare cost

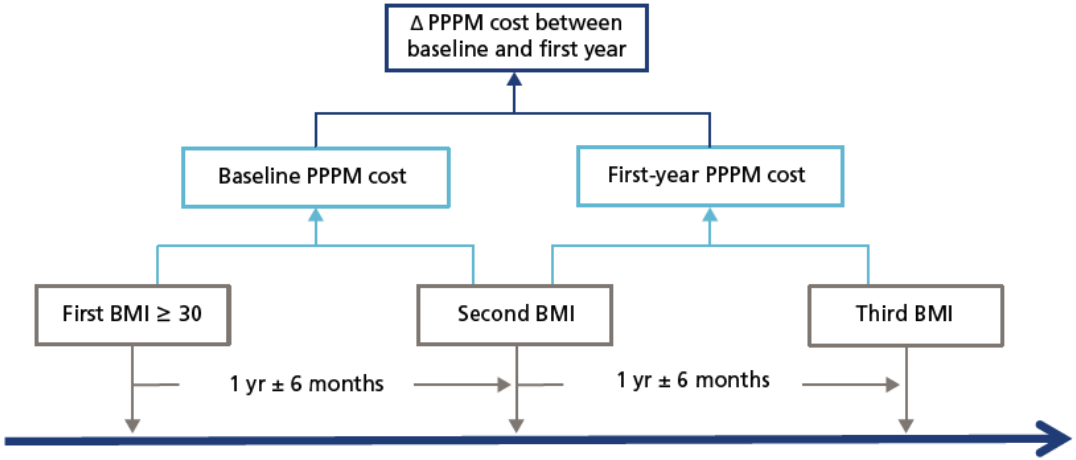
Comparison cohorts

- WL vs. No weight change

Outcomes

- PPPM healthcare costs in baseline and 1st year of follow-up
- ΔPPPM healthcare cost difference between baseline and 1st year of follow-up

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.

References: 1. Ding et al. Economic value of weight loss in adults with obesity. Presented at ObesityWeek 2019, Las Vegas, NV, November 3–7.

Method:

Objective #2: Impact of sustained nonsurgical weight loss on PPPM healthcare cost

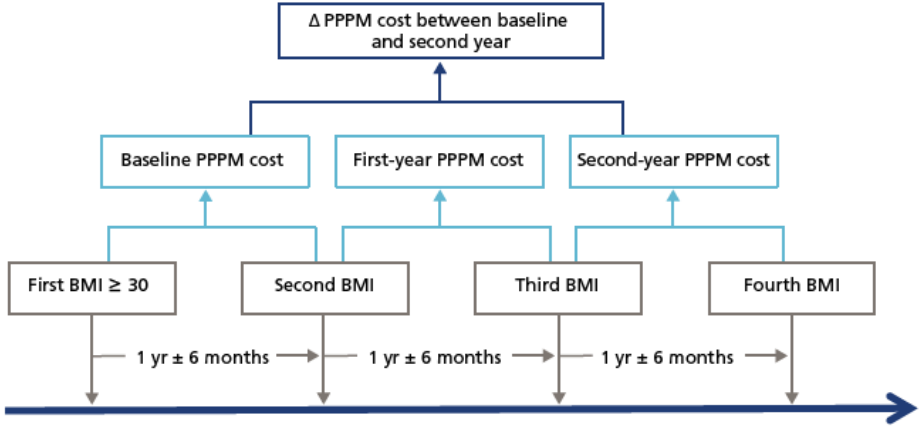
Comparison cohorts

- Sustained WL vs. No weight change

Outcomes

- PPPM healthcare costs in baseline and 1st and 2nd years of follow-up
- ΔPPPM healthcare cost difference between baseline and 2nd year of follow-up

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.

References: 1. Ding et al. Economic value of weight loss in adults with obesity. Presented at ObesityWeek 2019, Las Vegas, NV, November 3–7.

Baseline characteristics

Objectives #1 and #2

- Similar mean age and BMI on index date across all study cohorts
- Higher proportions of females and higher prevalence of musculoskeletal pain in 10-20% WL and sustained WL group

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.

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.

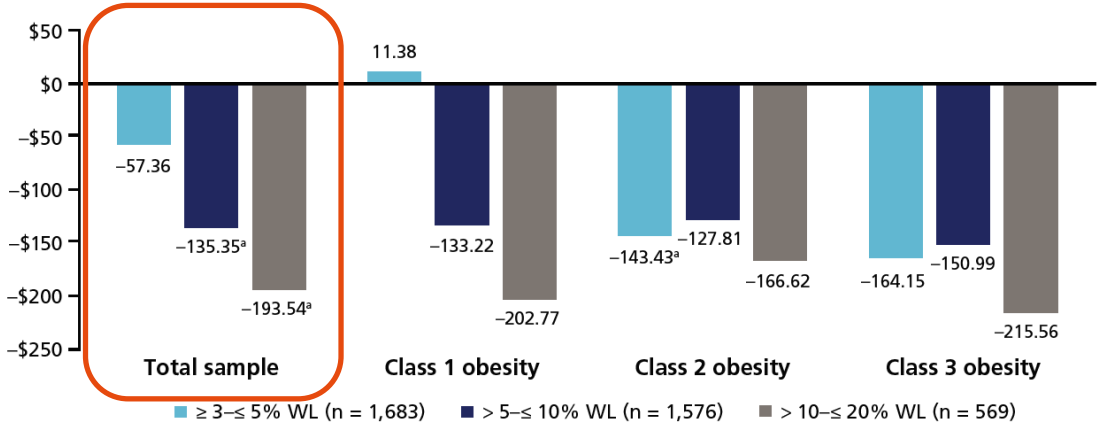
References: 1. Ding et al. Economic value of weight loss in adults with obesity. Presented at ObesityWeek 2019, Las Vegas, NV, November 3–7.

Adjusted PPPM healthcare costs reduced for nonsurgical WL compared to no weight change

Largest adjusted PPPM cost reduction occurred in 10-20% WL regardless of starting class of obesity

In all WL groups, largest adjusted PPPM cost reduction was observed for people with starting obesity class III

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.

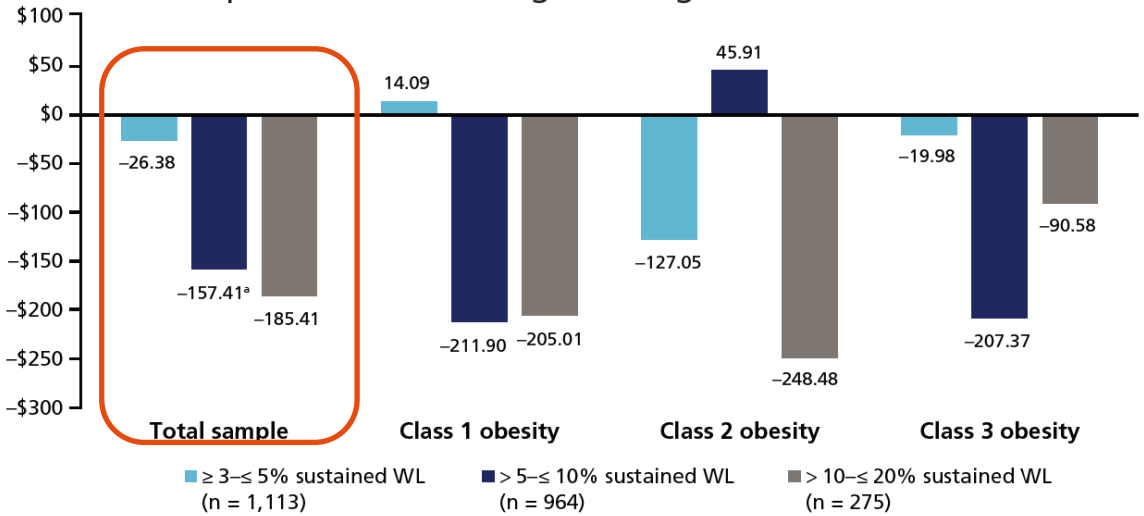
References: 1. Ding et al. Economic value of weight loss in adults with obesity. Presented at ObesityWeek 2019, Las Vegas, NV, November 3–7.

Adjusted PPPM healthcare costs reduced for sustained nonsurgical WL compared to no weight change

Largest cost reduction occurred in 10-20% sustained WL in total sample

- For 3-5% and 10-20% sustained WL, largest cost reduction occurred in people with starting obesity class II
- For 5-10% sustained WL, largest cost reduction occurred in people with starting obesity class I

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.

References: 1. Ding et al. Economic value of weight loss in adults with obesity. Presented at ObesityWeek 2019, Las Vegas, NV, November 3–7.

Conclusions

Our sample consists of **20,488 adults aged 18-64 years with obesity**

- Overall, greater magnitudes of nonsurgical weight loss and sustained nonsurgical weight loss were associated with greater cost savings

- Our study demonstrated that there is substantial economic value of nonsurgical weight loss in adults with obesity. Improved access to weight loss medications and strategies should be considered by payers and employers

References: 1. Ding et al. Economic value of weight loss in adults with obesity. Presented at ObesityWeek 2019, Las Vegas, NV, November 3–7.

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

References: 1. Ding et al. Economic value of weight loss in adults with obesity. Presented at ObesityWeek 2019, Las Vegas, NV, November 3–7.

QUESTIONS?

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Thank You for Joining Us!

Louisiana’s Health Initiative