Obesity Treatment:

A Cost-Effective, Evidence-Based, Multidisciplinary, Weight-Management Program

Heartland Weight Loss

White Paper

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SUMMARY:

Over the last several decades, an epidemic of “lifestyle diseases” has developed in the United States. Unhealthy lifestyles, such as inactivity, poor nutrition, tobacco use and frequent alcohol consumption, are driving up the prevalence of chronic diseases such as diabetes, heart disease and a multitude of other health conditions. These chronic conditions have become a major economic burden, as they lead to increased health care costs, decreased quality of life, as well as premature death and disability. In 2014, the direct and indirect costs of obesity and obesity-related comorbidities totaled $1.42 trillion, equivalent to 8.2 percent of the U.S. gross domestic product.

Obesity is recognized as a leading cause of preventable death in the U.S., second only to smoking. In spite of the magnitude of this disease burden and the existence of a wide variety of popular weight loss remedies, rates of overweight and obesity in the US population continue to increase each year.

Misconceptions about obesity abound in today’s world. Obesity is not simply the result of energy imbalance or lack of willpower. Obesity is influenced by a complex interaction of genetic, environmental and behavioral factors. Because of the multitude of factors contributing to obesity, a multidisciplinary team is required to adequately address all aspects of the disease process.

Because abundant evidence strongly indicates that lifestyle measures, such as improved nutrition, increased physical activity, and behavioral modification should form the foundation of obesity treatment, a multidisciplinary approach that individualizes obesity treatment offers the best chance of long-term effectiveness. An individualized, multidisciplinary, collaborative, evidence-based treatment program provides the most flexible and effective strategy in combating the disease of obesity. A successful obesity treatment program should enable individuals to draw on the resources of knowledge of specialists in medicine, nutrition, exercise, and behavior modification.

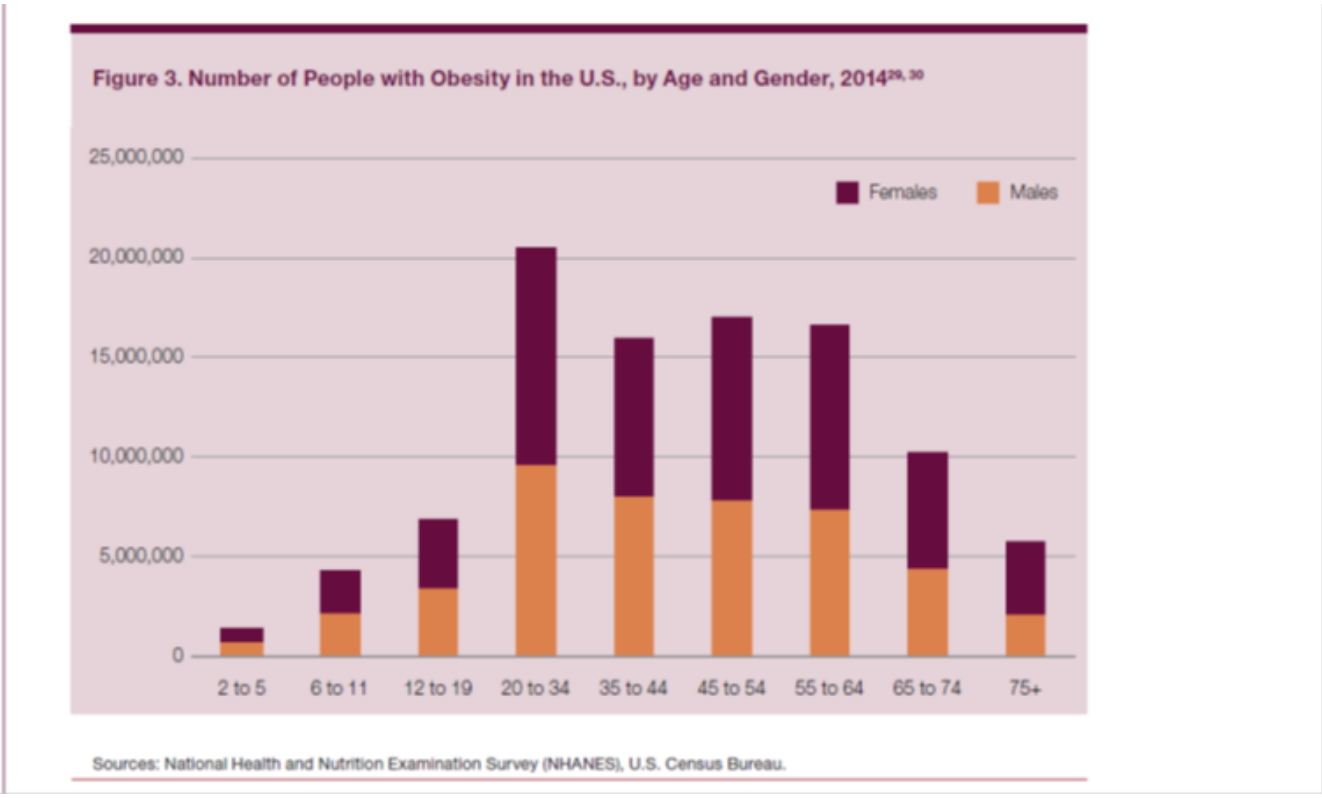
DEFINITIONS:

The terms “overweight” and “obesity” refer to body weight that is greater than what is considered healthy for a certain height. The international standard for measuring obesity is the body mass index (BMI), adopted by the World Health Organization (WHO), other international organizations, and the U.S. government. BMI is calculated as a person’s weight, measured in kilograms, divided by the square of his or her height, measured in meters. A BMI of 18.5-24.9 is considered normal, a BMI of 25-29.9 is considered overweight, and a BMI ≥30 is considered obese. Obesity is then subcategorized into obesity grade I (BMI 30-34.9), obesity grade II (BMI 35-39.9) and obesity grade III (sometimes referred to as severe, morbid, or extreme obesity), which refers to a BMI ≥ 40. [1] In some circumstances (those individuals with a great deal of muscle mass or those with very little), the BMI can be misleading. Another way to determine whether or not a person is obese is by measuring waist circumference. Women with a waist circumference greater than 35” and men with a waist circumference greater than 40” are considered obese. Percent body fat is also an excellent way at determining obesity. Women with a body fat percentage greater than 32% and men with a body fat percentage >25% are considered obese.

[1] Occasionally, researchers use the terminology class I, class II, and class III obesity. These categories are fully interchangeable with grade I, grade II, and grade III obesity. Wording has not been changed in order to preserve the language of individual study findings.

EPIDEMIOLOGY:

Obesity affects more than 300 million people globally. In 2015, the CDC released a report stating that the prevalence of obesity was 36.5% among US adults. That equates to over 98.7 million U.S. residents suffering from obesity and another 89.9 million defined as overweight. To put it another way, a total of 60.7% of the population age 2 and above is defined as either overweight or obese (Waters, 2017). The highest prevalence of obesity is currently 40.2% among middle-aged adults (aged 40–59). The prevalence among older adults (aged 60 and over) is 37.0%. The prevalence among younger adults (aged 20-39) is 32.3%. Obesity rates in the U.S. have increased steadily for the past several decades, climbing from 13.4% of adults in 1962 to the current 36.4%. (Waters, 2017) While recent analysis of the National Health and Nutrition Examination Survey (NHANES) data suggests that the trend in obesity prevalence may be slowing or leveling, other projections suggest that more than two thirds of U.S. residents will be obese by 2020 (Van Nuys, 2014).



In addition to the increase in the prevalence of obesity, there is also a worsening of the severity of the disease. In 2009-2010, it was estimated that 6.4% of the U.S. adult population was severely obese (BMI ≥ 40). It is expected that the prevalence of severe obesity will nearly double over the next two decades. This shift in the population weight distribution towards the more extreme ends of obesity is concerning, given the increased risk for cardiovascular disease and all-cause mortality that is associated with this magnitude of excess body weight (Unick, 2013).

OBESITY-RELATED COMORBIDITIES:

Obesity is among the most costly chronic conditions. The rapid increase in the prevalence of obesity has had severe consequences for public health. A disease in its own right, obesity is also a driver of many other chronic diseases, most notably type II diabetes and cardiovascular disease, but also:

High blood pressure (hypertension)
Arthritis
Gallstones / Gallbladder surgery
Asthma
Stroke
Certain cancers (breast, endometrial, colon, thyroid, esophageal)
Pregnancy complications and birth defects
Dementia
Depression
Surgical complications
Incontinence
Decreased immune function
Gastroesophageal reflux disease (GERD)
Poor wound healing
Obstructive sleep apnea
Joint problems requiring orthopedic surgery
Premature death

Obesity is arguably the most important risk factor for overall chronic disease burden and increased health care spending, with the possible exception of tobacco use. Obesity is also associated with a reduced average life expectancy.

Metabolic syndrome:

Epidemiologists have long known that obesity can be viewed as an exposure or risk factor for metabolic changes that cause adverse health conditions. It increases insulin resistance, blood pressure, LDL cholesterol, and triglycerides. Further, obesity lowers HDL cholesterol and places the body in a proinflammatory state. Extreme fat retention in the body is detrimental because fat cells networked together act effectively as an endocrine organ. The number of metabolic pathways that are affected by obesity suggests a high degree of interrelationships among the associated diseases. Together, these multiple related pathways are referred to as metabolic syndrome (Waters, 2017).

Type II Diabetes, Prediabetes and Cardiovascular Disease:

Diabetes has become one of the most prevalent and expensive diseases confronting the nation. These changes are closely linked with rising obesity levels. Although occasionally lean individuals develop type II diabetes, weight gain and obesity typically trigger its onset in genetically predisposed individuals. Type II diabetes is a chronic, progressive disease characterized by the body's inability to regulate glucose levels in the bloodstream by either resisting the effects of insulin or not producing enough. As a result, glucose builds up in the blood, overflows into the urine, and passes out of the body – never fulfilling its role as the body's source of fuel. In adults, type II diabetes accounts for approximately 90-95% of all cases of diabetes (CDC, 2014, NIDDK, 2014). As of 2014, 29.1 million people (or 9.3% of the U.S. population) had diabetes (CDC, 2014, NIDDK, 2014). 61% of

people with diabetes are currently in the workforce (ages 20-64). A recent report by The Milken Institute estimated that the direct costs of diabetes attributable to obesity and overweight in the United States increased from less than $1 billion in 1962 to $11.7 billion in 1994 and $111.9 billion in 2014 (Waters, 2017).

Prediabetes is a condition in which individuals have high blood glucose or hemoglobin A1C levels but these values are not high enough to be classified as diabetes. In 2009-2012, based upon laboratory data, it was estimated that 37% of U.S. adults aged 20 years or older had prediabetes (CDC, 2014, NIDDK, 2014). Applying this percentage to the entire U.S. population yields an estimated 86 million Americans age 20 and older with prediabetes. Without intervention (weight loss and moderate physical activity), approximately 11% of people with prediabetes will develop type II diabetes within 5 years and almost all will develop it within 10 years (CDC, 2014, NIDDK, 2014).

The more body fat a person has, the more likely they are to develop prediabetes and type II diabetes. NHANES data from 2010 examined 10,568 adults and found that 18.5% of obese participants had diabetes compared to 8.2% of those overweight and 5.4% of normal-weight participants. The associated relative risk for obese people to develop type II diabetes is 3.43, meaning that obese individuals are 3.43 times more vulnerable to contracting diabetes than a person of normal weight. The relative risk of type 2 diabetes related to being overweight is 1.52 (Waters, 2017)

As part of the disease process, type II diabetes doubles to triples the risk for cardiovascular disease. Hyperglycemia (elevated blood sugar) affects the structure of blood vessels, making them prone to atherosclerosis (Mayer, 2016). On average, a 1-point increase in an individual's BMI leads to a 10-percent increase in the risk of coronary heart disease (Waters, 2017). A 20-year follow-up analysis of the Nurses' Health Study cohort found that overweight women have a 1.43 relative risk of developing CHD compared to women of normal weight; the relative risk for obese women was 2.44 (Waters, 2017). A larger meta-analysis of 31 studies—encompassing 389,239 individuals and 20,652 coronary heart disease events—found an relative risk of developing cardiovascular disease of 1.33 for those overweight and 1.69 for obese people after adjusting for age, gender, and smoking status (Waters, 2017). Cardiovascular death rate is 1.7 times higher in diabetics, hospitalization for heart attack is 1.8 times higher, and hospitalization for stroke is 1.5 times higher among adults with type II diabetes aged 20 years or older. The risk of death is 50% higher for adults with diabetes. (NIDDK, 2014).

2009-2012 data demonstrated that of adults aged 18 or older with diagnosed diabetes, 71% have hypertension or use medications to lower their blood pressure. 65% have hyperlipidemia or use cholesterol-lowering medication (CDC, 2014). The relative risk for dyslipidemia in overweight and obese individuals is 1.56 and 1.74, respectively. Among cardiovascular disease causally tied to obesity, hypertension has the strongest association, with women being affected more severely than men. A systematic review and meta-analysis published in 2009 found the relative risks for overweight and obese females to develop hypertension to be 1.65 and 2.42 respectively. For men, the relative risks were 1.28 for overweight men and 1.84 for obese men (Waters, 2017).

In addition to its association with cardiovascular disease, diabetes is also the main cause of kidney failure

requiring dialysis. End stage renal disease (ESRD) is the last stage of kidney disease and parallels type 2 diabetes in its association with obesity. The Framingham Heart Study identified the relationship between BMI and increased risk for end stage renal disease, finding a relative risk of 1.23 per increase of 1 standard deviation in BMI. This relationship has been reconfirmed in more recent research, with a meta-analysis showing that overweight individuals have a relative risk of developing end-stage renal disease of 1.87, and those who are obese have an relative risk of 3.57 (Waters, 2017).

Diabetes is the leading cause of limb amputation and new-onset blindness in American adults. Patients with poor control of their disease have much higher rates of complications than those with good control.

Unfortunately, glycemic control is maintained in only 40% of diabetic patients. Patients with intensive medication regimens and polypharmacy (especially those requiring insulin) often face multiple side effects, which decreases adherence and, thus, disease management (Mayer, 2016) In 2012, approximately 2.9 million people with diabetes (or 14%) were treating their disease with insulin. 3.1 million (14.7%) were treating their disease with both insulin and oral medication, and 56.9 million (11.9%) were treating their disease with oral medication only. 3 million (14.4%) were not treating their disease with any type of medication.

There are now more than 30 clinical studies linking bariatric surgery to type II diabetes resolution. In an analysis of more than 600 studies involving over 135,000 patients, 78% of patients with type II diabetes had complete resolution of their disease after surgery, and 87% had improved blood glucose levels (Mayer, 2016) Clearly, studies have shown that dramatic weight loss (in these cases, caused by surgical weight loss) results in resolution of diabetes for most patients. These results are typically persistent for the rest of a person's life, as long as a healthy body weight is maintained. This argues that the weight loss (not the surgery itself) is primarily responsible for the resolution of diabetes. Patients who have a milder form of type II diabetes (controlled with diet) for less than five years, and who achieve greater weight loss after surgery are more likely to also achieve complete resolution of diabetes. Furthermore, weight-loss following gastric bypass in obese non-diabetic patients decreases their likelihood of developing diabetes by 60 percent over four years. A key finding of all studies is that the less time one suffers from diabetes, the more likely he or she will have complete remission of diabetes following surgery (Mayer, 2016)

Because of this data, both the International Diabetes Federation and the American Diabetes Association have recently mentioned bariatric surgery as a possible treatment for severely obese patients with type II diabetes, especially those who have a shorter duration of diabetes with cardiovascular risk factors and those who struggle with both weight and glycemic control. However, bariatric surgery is not a magical cure-all. Many people have significant weight regain following their initial loss. Furthermore, bariatric surgery comes with a significant amount of risk. Gastric bypass surgery (Roux-en-Y) has a 30-day mortality rate of 0.5% and a 1-year mortality rate of 1%. Sleeve gastrectomy rates are only slightly better. The risk of postoperative complications and reoperation rates are high with all types of bariatric surgery. Behavioral adjustments and changes are still needed postoperatively. Adherence to lifestyle change is vital to sustain weight loss, prevent dietary deficiencies and reduce the risk of complications and/or diabetes recurrence.

Cancer:

Multiple studies have found a strong association between obesity and cancers of the breast, colon, endometrium, gallbladder, liver, pancreas, and ovaries. There is a linear relationship between breast, ovarian and endometrial cancer risk and BMI. Obesity has a double impact on women's risk for breast cancer, increasing the prevalence by 30 percent to 50 percent. A summary review published in 2004 calculated a relative risk of developing breast cancer at 1.3 for overweight women and 1.5 for obese women. In addition, among women who have breast cancer, those who are overweight or obese have shorter survival times and worse prognoses. Obese women have a high relative risk of ovarian cancer compared to women of normal weight— the relative risk of developing ovarian cancer is 1.53 for overweight women and 3.22 for obese women. For endometrial cancer, the statistics are worse; the relative risk is 2.0 for overweight women and 3.5 for those who are obese. Relative risks for gallbladder cancer for men and women alike are 1.5 for overweight individuals and 2.0 for those who are obese. High BMI levels also pose a risk for gallbladder disease, with relative risks of 1.44 for overweight women and 2.32 for obese women. The corresponding numbers for men are 1.09 and 1.43. Obesity is a risk factor for liver cancer; the relative risk for those who are obese is estimated to be between 1.5 and 4.0 (Waters, 2017).

Asthma:

Obesity can lead to inflammation of the airways in the lungs, increasing the risk of asthma and potentially the severity of asthma cases. A meta-analysis published in 2009 found that the relative risk is 1.25 for overweight women and 1.78 for obese women. The corresponding numbers for men are 1.20 and 1.43 (Waters, 2017).

Chronic Back Pain:

Individuals who have obesity also have a 2.81 relative risk of chronic back pain, compared to those of normal weight. Overweight people have a relative risk of 1.59. Osteoarthritis is linked to overweight and obesity as well, with relative risks of 1.80 and 1.96 for women who are overweight and obese, respectively. The corresponding relative risks for men are 2.76 and 4.20 (Waters, 2017).

Dementia / Stroke:

In the past decade, several studies have demonstrated a strong causal relationship between obesity and Alzheimer's and vascular dementia. A meta-analysis of 15 prospective studies published in 2011, found that the relative risk of Alzheimer's disease or vascular dementia was 1.35 and 2.04 for overweight and obese individuals, respectively. Obesity is also a significant risk factor for stroke; a systematic review covering more than 2 million participants in prospective studies found that the relative risk of stroke associated with being overweight is 1.22, with a corresponding RR for obese individuals of 1.64 (Waters, 2017).

Despite the prevalence of the disease, very few obese individuals want to remain obese. Reviews of the literature have consistently demonstrated that obesity is linked with decreased physical and psychosocial aspects of quality of life. As the degree of obesity increases, so does the level of impairment in health-related quality of

life, with the greatest impairment observed in physical domains. (14) Most Americans (63%) have seriously attempted to lose weight at some point in their lives, and 29% report currently trying to lose weight Gudzune, 2015). Despite this, NHANES data shows that Americans gain an average of approximately 1-2 pounds per year from early adulthood through middle age. Overweight adults typically gain 2.2 – 3.3 pounds per year (or 1-1.5kg / year), thereby gradually worsening the underlying problem (Van Dorsten, 2008).

DIRECT AND INDIRECT MEDICAL COSTS ATTRIBUTABLE TO OBESITY:

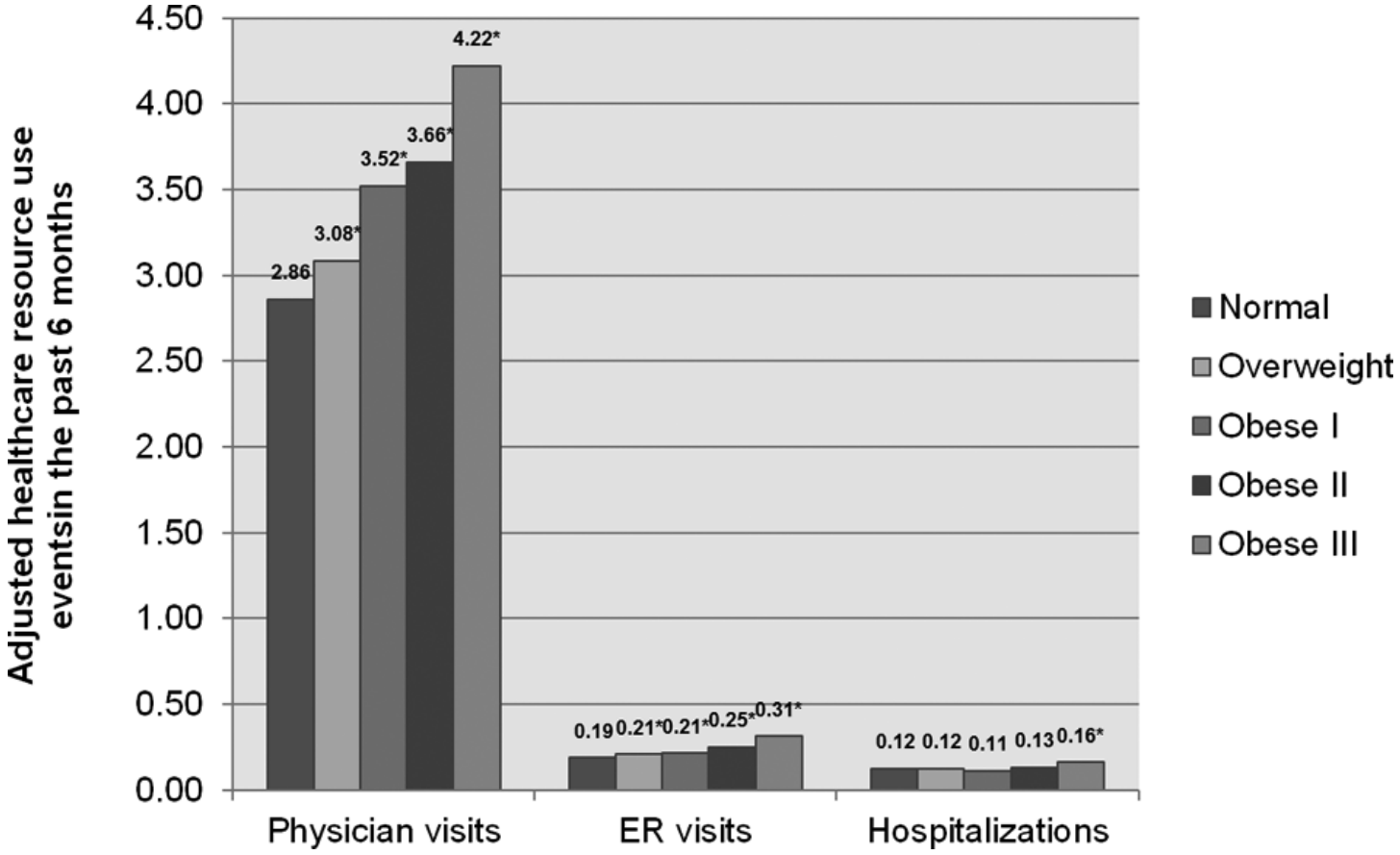
There is an undeniable link between rising rates of obesity and rising medical spending. In a new report by the Milken Institute, researchers found that in 2014, the direct costs in the US for medical treatment for health conditions causally related to overweight and obesity totaled $427.8 billion. Among those conditions, type II diabetes had the highest treatment costs at $111.9 billion, accounting for 26.1 percent of total direct medical costs for the diseases caused by excess weight. Alzheimer's disease and vascular dementia were next, with $56.0 billion in direct treatment costs. Gallbladder disease was third with $43.9 billion, followed by osteoarthritis at $42.1 billion. In total, the direct medical expenses associated with treating diseases caused by obesity accounted for 14.3 percent of U.S. health-care spending in 2014 (Waters, 2017).

Although pharmaceutical, medical and surgical interventions to treat obesity are available; these treatments remain rare and account for only a minute portion of the medical costs of obesity. The costs attributable to obesity are almost entirely a result of costs generated from treating the diseases that obesity promotes. This is dramatically increased since 1998, at which time the medical costs of obesity and obesity-related illness were estimated by Finkelstein et al to be approximately $78.5 billion (Finkelstein, 2009).

Estimations of the burden of obesity vary from one study to the next depending upon criteria used to quantify the costs, but every one of the studies shows a significant increase in direct medical costs for individuals that are obese. Converting healthcare resource use to direct costs, costs range from $12,234 per year for a normal weight individual to $17,689 per year for someone with grade III obesity (DiBonaventura, 2015). Among patients with type II diabetes, the cost differential between annual medical expenditures for normal weight individuals ($24,573) and grade III obese individuals ($29,451) is less pronounced but still statistically significant – and notably higher than patients without type II diabetes (DiBonaventura, 2015). Patients with prediabetes also incur a substantially higher cost with normal weight individuals incurring an average yearly cost of $17,087 and grade III obese individuals incurring an average yearly cost of $22,914 (DiBonaventura, 2015). Although not all of these costs are attributable to obesity, the great majority of them are. If not for obesity, these costs would be substantially lower, as would costs for other conditions caused by, or worsened by, excess weight.

In a 2011 review, Scoggins et al found that medical expenditures are greater for obese employees than for normal weight employees (Scoggins, 2011). Data relying on MEPS (Medical Expenditure Panel Surveys) shows that across all payers, it was estimated that obesity increased costs by 37%. Also using MEPS data, multiple researchers have found that individuals with BMI>30 have covered yearly medical expenditures that are significantly higher than those with BMI<30 (Cawley, 2015 and Finkelstein, 2009). For 2006, the per capita percentage increase in annual costs attributable to obesity was estimated to be 36% for Medicare, 47% for Medicaid and 58% for private payers (Finkelstein 2009). This comes from a 90% increase in the cost of inpatient services, a 37.9% increase in cost for non-inpatient services and 81.8% increase in cost for prescription drugs for private insurers. In percentage terms, these increases represent 82% higher prescription drug cost and 90% higher inpatient services compared with people of normal weight. An estimated 12.9% of private payer spending

was attributable to obesity in 2006 (Finkelstein, 2009). DiBonaventura et al showed that increasing BMI is associated with an increasing number of physician visits and ER visits.



(Image courtesy of DiBonaventura, 2015)

The presence of type II diabetes, which is strongly correlated with excess weight, dramatically increases an individual's direct medical costs in every analysis performed. In 2012, the estimated annual cost of treating people with diabetes was $245 billion. Of this, $176 billion was direct medical costs, which is 2.3 times higher than for people without diabetes. The largest components of medical expenditures are:

- Hospital inpatient care (43%)
- Prescription medications to treat complications of diabetes (18%)
- Anti-diabetic medications and diabetes supplies (12%)
- Physician office visits (9%)
- Nursing / residential facility stays (8%)

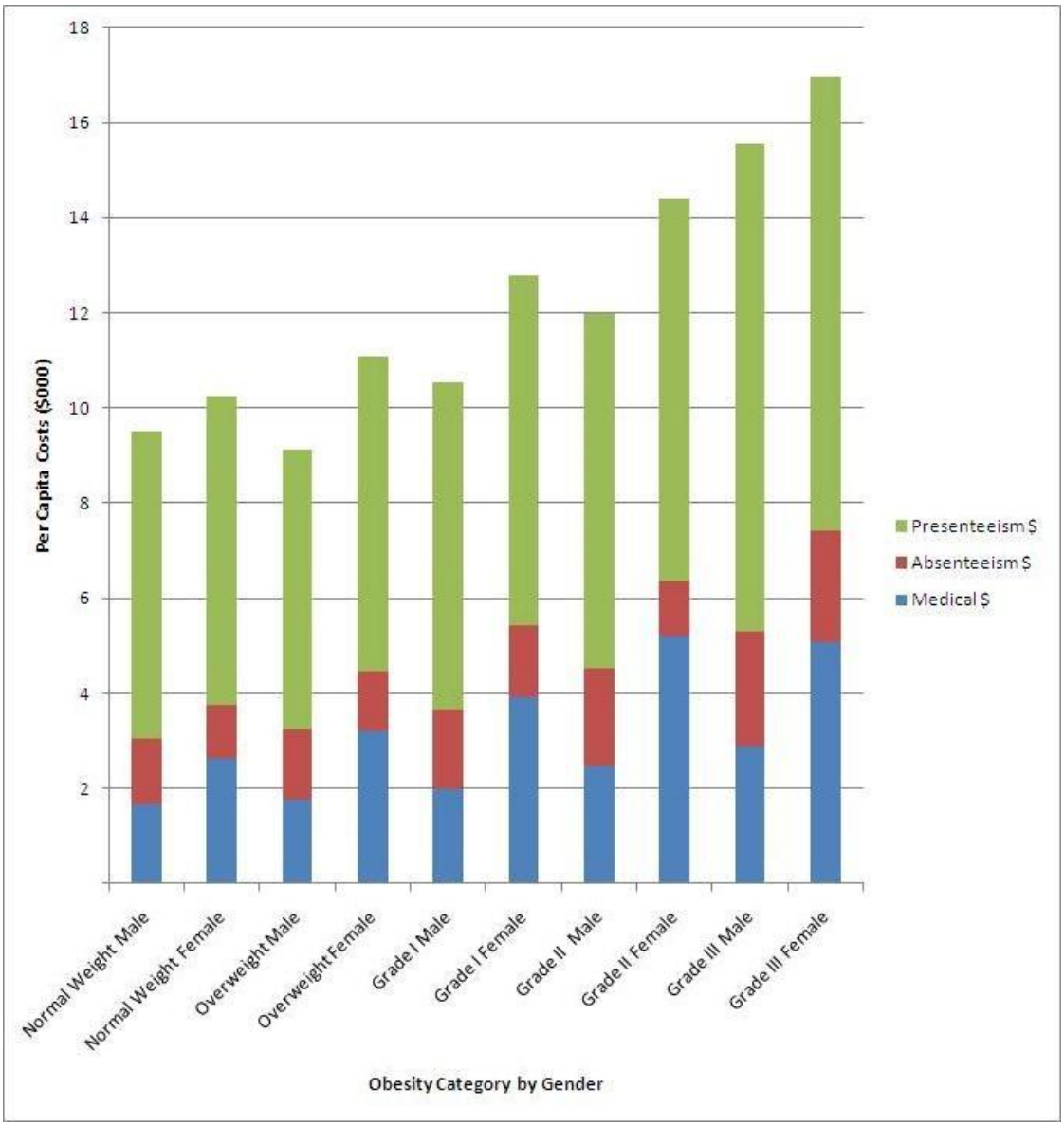
In addition to direct medical costs, approximately $69 billion of the $245 billion spent each year treating diabetes is indirect costs (disability, work loss, premature death). People with diabetes have increased absenteeism ($5 billion in costs), reduced productivity while at work ($20.8 billion) for the employed population, inability to work

as a result of a disease-related disability ($21.6 billion) and lost productive capacity due to early mortality ($18.5 billion) (CDC, 2014).

While direct medical expenditures are the most manifest costs of illnesses caused by obesity, they are by no means the only costs. Obesity-related illnesses take their tolls in lost productivity. Higher rates of emotional exhaustion, psychological complaints and lower quality of life are correlated with obesity (Kleinman, 2014). Measurable indirect costs include absenteeism, presenteeism, short- and long-term disability claims, worker's compensation claims, life insurance premiums, and premature death. Levels of work productivity loss rises as BMI increases with the most pronounced effects in overall work impairment observed among class III obese employees (DiBonaventura, 2015). According the recent report by The Milken Institute, total indirect costs related to lost work time or lower productivity caused by diseases attributable to excess weight amounted to $988.8 billion in 2014. Because it is too difficult to quantify, this data does not include the time costs for informal caregivers—which for some conditions, such as Alzheimer's disease, can be considerable. Nor does the estimate include the full costs of the effects of chronic disease on employee performance and output. For this reason, all estimates of indirect costs should be considered conservative.

Using 2006-2008 data from MEPS, Finkelstein et al determined that across the three categories (medical expenditures, absenteeism and presenteeism), average per capita costs ranged from $9507 for normal weight men to $15,561 for grade III obese men. In all three categories, the increased costs attributable to obesity ranged from -$322 for overweight men to $6087 for grade III obese men. Annual missed workdays ranged from 0.5 more days for overweight men to 5.9 more days for grade III obese men. Presenteeism was also significantly greater for obese men and ranged from 2.3 days for grade I obesity to 21.9 days for grade III obese men. Among obese men, the value of presenteeism ranged from $391 for grade I obesity to $3792 for grade III obesity, with the latter equating to more than 1 month per year of lost work time while at work for grade III obese men (Finkelstein, 2010).

For women, the estimated average per capita costs (medical expenditures, absenteeism and presenteeism) ranged from $10,241 for normal weight to $16,969 for grade III obese women. Medical expenditures were significantly higher for overweight and obese women than for normal weight women, with obese grade II women having additional expenditures of $2532 and obese grade III $2395. Not surprisingly, absenteeism was found to be greater among those women with increasing levels of excess weight. Days and dollars lost to presenteeism for female employees were significantly higher with each successive weight category; the incremental number of days lost approximately doubled for each obesity grade (6.3 to 11 to 22.7 days respectively). Across the three categories, the combined costs of medical expenditures and lost productivity due to absenteeism and presenteeism attributable to obesity ranged from $797 for overweight women to $6694 for obese grade III women (Finkelstein, 2010).



Multiple studies have found that obese employees are between 25% and 100% more likely to be absent from work compared with normal-weight employees. In addition, obese employees have higher costs in the areas of disability, workers compensation, sick leave and other health related absences (Kleinman, 2014). Employees suffering from obesity having significantly more self-reported presenteeism, work impairment or limitations as well as increased difficulty getting along with coworkers (Kleinman, 2014).

Studies that have evaluated the impact of health risks on workplace productivity, including absenteeism and presenteeism, have shown that employees with other risk factors in addition to obesity have a higher magnitude of productivity losses. Although biometric risks such as high blood glucose and excess weight are significant predictors of higher absenteeism costs, other risk factors associated with obesity (such as depression and stress) have been shown to predict greater absenteeism and presenteeism (Kowlessar, 2011).

Certain comorbidities are particularly influential in the relationship between BMI and employer costs. Those with a comorbid condition demonstrate a significantly steeper relationship between BMI and the probability of a short-term disability claim. An employee with BMI of 35 plus either diabetes, hypertension, or hyperlipidemia has a higher risk of short-term disability (6.7%) and higher average claims ($2319) than does someone with a BMI 5 points higher but with none of these comorbidities (5.0% risk of STD, average claims $2215). Milken estimated that the indirect productivity costs of diabetes alone attributable to obesity and overweight totaled $207.6 billion in 2014 (Waters, 2017).

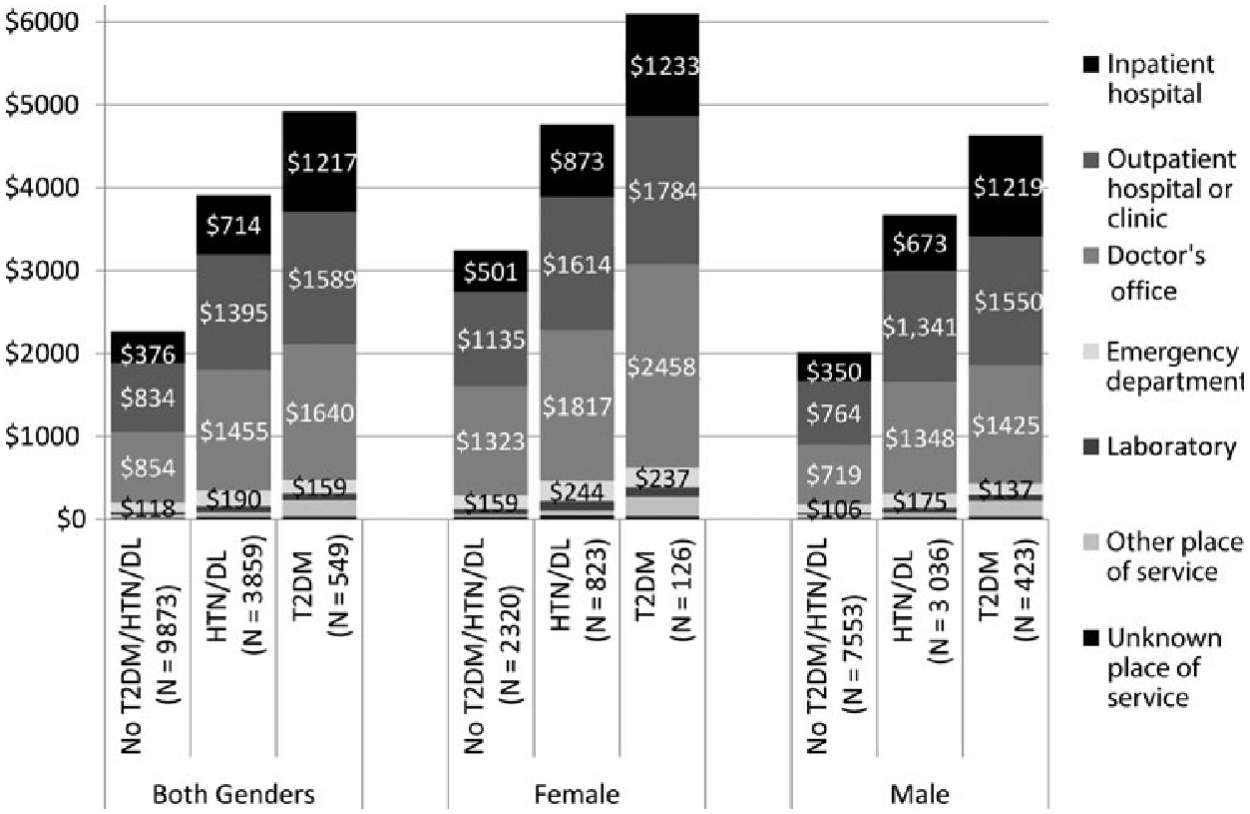
Total costs and days absent for women based upon BMI were:

BMI	Medical Costs	Days Absent
< 27	$5302	5.58
27-30	$5946	6.91
> 30	$7932	8.66

For men, costs and days absent based upon BMI were calculated at:

BMI	Medical Costs	Days Absent
< 27	$3648	3.58
27-30	$4248	4.61
> 30	$4471	6.95

In this particular study population, the BMI >30 cohort had particularly high inpatient costs relative to the other cohorts. Those patients with type II diabetes mellitus generally had the highest costs and most absence days (Kleinman, 2014).



Using comorbidities, Kleinman et al looked at the relationship between obesity and other coexisting chronic diseases. They compared obese employees with type II diabetes (T2DM), hypertension and/or hyperlipidemia (HTN/DL) with a comparison group that did not suffer from these lifestyle diseases. Not surprisingly, their data showed that the subcohort with type II diabetes had significantly higher inpatient, outpatient, laboratory and other medical costs than the HTN/DL subcohort and that both groups incurred higher costs than the comparison group that did not suffer from one or more of these chronic diseases (Kleinman, 2014).

The disproportionately high per capita and total cost of grade II and grade III obesity is particularly concerning, given that this BMI range is the fastest growing subset of the obese population. Individuals with a BMI >35 represent 37% of the obese population, yet they are responsible for 61% of the costs resulting from excess weight (Finkelstein, 2010).

On the flip side, among workers with health insurance, obese employees earn significantly lower wages than their nonobese counterparts (Van Nuys, 2014). Annual salary is significantly lower when BMI is highest, averaging $87,604, $83,178, and $65,843 in the BMI <27, 27-30, and >30 cohorts. This may offset some the increased medical costs to the employers (Kleinman, 2014). Interestingly, baseline BMI is also inversely related to job satisfaction, with employees with the highest BMI reporting the least satisfaction with their jobs (Barham, 2011).

BARRIERS TO SUCCESSFUL OBESITY TREATMENT:

Expert panels sponsored by both the World Health Organization and the National Institutes of Health have recommended that obese adults as well as those that are overweight and have comorbid conditions, lose 10% of their initial weight (Wadden, 2012). Despite the absoluteness of this statement, neither organization provides much in the way of guidance as to how to achieve this momentous task. Underlying most recommendations for weight loss is an assumption that people suffering from obesity simply need to "eat less and move more" and that failure to follow such simple instructions is a result of poor self-discipline or laziness.

The belief that obesity is purely a behavioral issue remains widespread, despite a plethora of published evidence indicating otherwise. Successful treatment of obesity requires an approach that combines environmental and behavioral modification as well as understanding of the chronic metabolic aspects of the disease.

Commonly available commercial weight loss programs are far from satisfactory – primarily because they focus only on calories and simple behavioral modification. Physician advice to lose weight combined with common diet and exercise information is also insufficient to produce clinically significant sustained weight loss. These interventions typically fail because they don't take into account the biological adaptations that occur when patients with obesity lose weight, which predisposes them to weight regain. These biological adaptations provide a strong rationale for using medications, surgery, and/or intense medical intervention to treat obesity, particularly severe obesity. In humans, many other cues such as reward and emotional factors play a role in food intake aside from hunger, and multiple pathways are responsible for reward-associated feeding behavior. Increased hunger and decreased satiety after weight loss are associated with significant changes in various appetite-related hormones. These changes appear to persist for at least a year after weight reduction and may remain altered indefinitely in a manner that promotes increased energy intake and ultimately weight regain Apovian, 2015).

Although the perception persists that there are no effective long-term treatments for obesity, decades of research has provided convincing evidence that obese individuals can lose and maintain significant weight. and in doing so, significantly reduce their risk for comorbidities of obesity. The definition of successful weight loss is loss of 5-10% of baseline body weight for at least a year has been recommended by the 2013 AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults as well as the NIH and CDC (Montesi, 2016). Furthermore, this is the efficacy benchmark used by the FDA in evaluating weight loss medications.

Although a 10% weight loss may not return an obese individual to a non-obese state, the health impact of a 10% weight loss is well documented. From a clinical point of view, 5-10% weight loss significantly reduces the risk of developing type II diabetes in susceptible people, and eliminates many of the other risks associated with obesity. Moreover, this modest amount improves psychological functioning, in particular mood, body image and binge eating (Montesi, 2016). Based upon current population data, the Obesity Treatment Foundation estimates that a reduction in the average BMI by 2020 by 5% would result in:

- 3.5 million cases of hypertension avoided
- 0.3 million cases of cancer avoided
- 2.9 million cases of heart disease and stroke avoided
- 3.6 million cases of diabetes avoided
- 1.9 million cases of arthritis avoided

Branded weight loss programs are broadly available to the general public and represent a multibillion dollar industry. In 2014, Americans spent approximately $2.5 billion on commercial or proprietary weight loss services with Weight Watchers (45%), NutriSystem (14%) and Jenny Craig (13%) dominating the market share (Goetzel, 2014). A 2005 systematic review of commercial and proprietary weight loss programs' efficacy concluded that only Weight Watchers had demonstrated efficacy in achieving modest weight loss based on results from 3 randomized controlled trials. A more recent review by Gudzune et al also came to the conclusion that Weight Watchers' participants consistently lose more weight than control/education participants, which they typically sustain beyond 12 months. However, they were unable to determine whether Weight Watchers was superior to behavioral counseling. Nutrisystem demonstrated better short-term weight loss than control groups and those receiving behavioral counseling; however, they have never provided long-term trial results (Gudzune, 2015). Internal validity of studies evaluating commercial weight loss programs is typically weak due to high or attrition and inadequate handling of missing data. In many trials, study staff assisted in program retention and trials often covered the cost of these programs for participants. Therefore, the study results are likely better than can be expected in a "real world" setting.

To illustrate the paucity of statistically significant, unbiased data regarding commercial weight loss programs, consider this; Johnston et al looked at randomized controlled trials that reported weight loss or BMI reduction at 3 months follow-up or longer. Of the 889 that proved potentially relevant, only 59 articles proved eligible. These studies comprised 7286 individuals with a median BMI of 33.7. The median duration of the diet intervention was 24 weeks (range 16-52 weeks). Treatments had an average of 8kg (17.6 lbs) weight loss at 6 months and 6-7kg (13.2-15.4 lbs) at 12 months. However, analyses were based on the original intended randomized design, not by adherence to the actual diet. Details on patients' actual adherence were not accounted for, making true statistics somewhat vague and nonspecific. Using different methods to analyze data, the American Heart Association, the American College of Cardiology, and the Obesity Society came to similar conclusions. Based upon their reviews, they issued joint guidelines concluding that popular diets are roughly equally effective and that evidence is inadequate to recommend any particular diet (Johnston, 2014). To make matters worse, data from commercial programs only addresses short-term weight loss with no statistics about long-term weight loss and weight-loss maintenance.

Because of the lack of long-term data regarding the efficacy of commercial weight loss programs, it shouldn't come as a surprise that healthcare organizations rarely consider them covered services for obesity treatment. In

2007, after extensive study, CMS determined that they needed to focus on long-term weight loss because short-term weight loss is not a cure for obesity. Wisely, they determined that population-level changes in obesity (and presumably its concomitant health problems) will only occur if losses are maintained. They acknowledged that direct indicators of health, such as blood pressure, cholesterol levels, disease incidence, and even mortality, are important outcomes of obesity treatments and should be considered when determining effectiveness of an obesity treatment program. CMS stated that they believed that low follow-up rates biased the results of diet studies, making the programs appear to be more effective than they were, and because of their findings, determined that they would not reimburse commercial weight loss programs as part of their coverage (Mann, 2007).

Weight cycling (the repeated loss and regain of weight) is commonly observed in commercial dieters and there is evidence from large-scale observational studies that weight cycling is linked to increased all-cause mortality and to increased mortality from cardiovascular disease. In addition, weight cycling is associated with increased risk of acute myocardial infarction, stroke and type II diabetes, increased HDL, increased systolic and diastolic blood pressure and even suppressed immune function (Mann, 2007).

SUCCESSFUL OBESITY TREATMENT PROGRAMS:

In contrast to commercial weight-loss programs that are poorly studied, most of what the scientific community knows about the treatment of obesity comes from well-designed, randomized controlled trials conducted at academic medical centers. Despite having numerous studies, meta-analyses report high levels of heterogeneity among individual studies, which makes it difficult to compare effectiveness of various programs. (Kubendran, 2017). Furthermore, it is difficult to translate these study findings to the general population since throughout most of these programs, experienced therapists treat highly motivated patients, and the cost of treatment is not a factor. It is typically unrealistic to apply the programs and results to non-academic populations (Wadden, 2004).

However, due to the rigorous scrutiny required by academic programs, we can learn a lot from the data generated by these programs. Currently, intensive lifestyle interventions yield an average weight loss of up to 10% at 1 year. These academic-based lifestyle modification programs [2]include 3 primary components: diet, exercise and behavior therapy. They typically include a weight loss phase, consisting of 16-24 weekly sessions over the course of 6 months, followed by a weight maintenance phase, which typically lasts at least 1 year with monthly or more frequent contacts in person or by telephone. Lifestyle modification programs are traditionally delivered by trained health professionals such as dieticians, or subjects having masters' degree training in exercise physiology, behavioral psychology or health education. Lifestyle modification programs are typically provided to groups of 10-20 participants at a time.

Data from large-scale lifestyle programs has demonstrated that weight loss typically reaches its peak within 6 months of the start of treatment and in the absence of a weight maintenance program; the trend begins to reverse thereafter. Therefore, traditional lifestyle modification programs typically require a greater focus on long-term maintenance (Montesi, 2016). A recent systematic review on the outcome of weight loss lifestyle modification programs found that at 1 year, approximately thirty percent of participants had a weight loss ≥ 10% of their starting weight, twenty-five percent lost between 5% - 9.9% of their starting weight and forty percent lost ≤ 4.9% of their starting weight. Weight regain typically slows after the first year, but by 5 years, approximately 50% of patients are likely to have returned to their baseline weight (on a positive note, 50% have not). However, the incidence of type II diabetes in these participants is still significantly lower than in controls, showing that modest weight loss, even when followed by slow regain, can be beneficial to long-term health. Furthermore, patients in these programs have typically avoided many years of weight gain that would have occurred in the absence of treatment, making the net loss even more significant (Wadden, 2012).

A fundamental role in attending lifestyle programs is played by personal motivation for change. Motivation is no longer thought of as a static trait, but is actually a psychological dynamic state that can fluctuate over time in relation to many interpersonal and intrapersonal factors. Motivation is thus considered an interpersonal

[2] "lifestyle Intervention programs" and "behavioral weight control program" are essentially the same and the two terms are used interchangeably depending upon the reference.

accessible factor that can be modified during a change process. In a lifestyle intervention, assessing and working on the factors affecting motivation to change seem to be fundamental in order to facilitate behavioral change. Subjects need at least 3-6 months to start to change and a longer time (1 year and more) to stabilize this new acquisition (Livia, 2016).

The Milken Institute performed a meta-analysis of weight-loss interventions and came to a conclusion that multi-component behavioral weight-loss programs are effective and that certain behavioral or psychological techniques significantly improve weight loss (Kubendran, 2017). Among the factors they deemed important for success are:

- Having weight as a primary outcome
- Having a clearly defined goal
- Using an attention control.
- Measuring treatment fidelity
- Using a behavioral component as part of a multi-component trial
- Using a trans-theoretical model (instead of social cognitive theory)
- Using behavior-change techniques that compare participant behaviors with those of others

There are several well-studied lifestyle intervention programs that can be modified to apply to non-academic populations. In the U.S., the **Diabetes Prevention Program (DPP)** provides the most long-term, comprehensive, successful treatment for obesity and is considered by most the gold standard by which to measure other programs designed to achieve weight-loss and weight-loss maintenance. CMS has acknowledged that the DPP has the most promising results, with three-year lifestyle participants losing an average of 4 kg (8.8 lbs) in contrast to placebo participants, which gain an average of 0.5 kg (1.1 lbs). Approximately half the lifestyle group reached a 7% weight loss goal and ¾ met the 150 minute weekly physical activity goal by the end of 16 sessions; 37% and 67% of the cohort remained at weight and activity goals, respectively after 3.2 years. Although the DPP has demonstrated statistically significant weight loss sustained over three years, what is more important is that, during this time, the lifestyle group reduced their incidence of type II diabetes by 58% compared with the placebo group (Mann, 2007). The 10-year follow up of the DPP showed that the cumulative incidence of diabetes among adults at high risk remained lower in the lifestyle group. This outcome occurred even if the original lifestyle group partly regained weight – which underlies that the effect of lifestyle modification programs may produce significant health benefits even if the weight lost is partly regained (Montesi, 2016). The Diabetes Prevention Program (DPP) has helped clinicians understand that even a modest weight loss substantially reduces the risk of new-onset type II diabetes and that even with some weight regain, the reduced number of “pound years” of exposure to excess weight has a beneficial impact on health. The Centers for Disease Control (CDC) National Diabetes Prevention Program (NDPP) and others have focused on training a competent workforce to implement DPP-adapted interventions with fidelity and build infrastructure to sustain group based diabetes prevention programs (Vendetti, 2014). These DPP programs are commonly delivered at medical and community sites and are currently limited, as they are labor-intensive and expensive to administer. (3) Modifications have been

made to the DPP to decrease costs and improve access. Telephonic and web-based approaches are increasingly being utilized as a cost-effective means. However, Vendetti et al noted that face-to-face interaction has consistently been shown to be most effective for weight loss and maintenance (Vendetti, 2014).

The **Look AHEAD** (Action for Health in Diabetes) trial studied the long-term health consequences of intentional weight loss in overweight and obese individuals with type II diabetes. The Look AHEAD trial enrolled 5,145 overweight and obese adults with type II diabetes and randomly assigned half to an intensive lifestyle intervention (ILI) and half to diabetes support and education (DSE). The intervention group (ILI) showed an average weight loss of 8.5%, which was significantly greater than the 0.6% seen with the DSE group. More importantly, by year 8, the ILI group had maintained an average weight loss of 4.7% compared to 2.1% of the DSE group. Nearly 25% of the ILI participants were able to maintain a loss of ≥ 10% of initial weight at year 4. Fully 46% maintained a loss of ≥ 5%, an amount widely agreed to produce clinically significant improvements in cardiovascular disease risk factors. Furthermore, the ILI group demonstrated significantly greater improvements in health parameters than the DSE group, including improved hemoglobin A1C levels, fitness, systolic blood pressure, HDL cholesterol levels, as well as other markers of cardiovascular health (Melchart, 2015, Wadden, 2012).

Weight loss in the Look AHEAD trial is among the largest reported at this length of follow-up for individuals in a randomized controlled trial who were treated by lifestyle intervention. Just like the Diabetes Prevention Program, the Look AHEAD trial was also an intense, multidisciplinary lifestyle intervention. During the first year, Intensive Lifestyle Intervention (ILI) participants were provided a comprehensive intervention designed to induce an average loss of ≥ 7% of initial weight. The intervention was adapted from the DPP and was delivered to groups of 10-20 persons by experienced lifestyle counselors. During the first 6 months, participants were provided group sessions for the first 3 weeks of each month. The fourth week, they had an individual meeting with their interventionist. During months 7-12, participants continued to have monthly individual meeting with their interventionist but the number of group sessions was reduced from three to two per month. Interventionists included registered dieticians, psychologists, and exercise specialists, all of whom delivered group treatment following detailed protocols. This study used intensive meal replacements and structured meal plans and participants' activity goal was ≥ 175 min/week of moderately vigorous physical activity to be achieved by month 6, with a further increase for participants that met this goal. The activity program relied on unsupervised (at home) exercise which, for most participants, consisted of brisk walking. Throughout the first year, participants were instructed to record daily their food and calorie intake, as well as their physical activity. During years 2-4, the focus of treatment shifted to maintaining the weight losses and high levels of physical activity achieved during the first year. Each month, participants had an individual, on-site meeting with their interventionist, with a second individual contact by telephone or email about 2 weeks later. At each monthly on-site visit, participants completed (with their interventionist) a goal sheet. They also indicated their desired weight change for the month and selected other behavioral targets as appropriate. Approximately 2 weeks after each on-site

meeting, participants were scheduled to have a 10-15 minute phone call or email exchange with their interventionist to review successes (or barriers) in meeting the goals selected that month. In addition to the individual contacts, several forms of group intervention were offered during years 2-4. All sites provided a monthly group session at which participants weighed in, reviewed any diet and activity records they had completed, and then listened to a presentation on a new topic on lifestyle modification. Interventionists were trained to tailor the behavioral intervention to the participants' cultural differences. They used elements of problem solving, motivational interviewing, self-regulation theory and relapse prevention.

During each of the first 4 years of the Look AHEAD trial, participants in DSE (placebo group) were invited to attend three one-hour group meetings that discussed diet, physical activity, and social support. Participants who desired more help in losing weight were told to speak with their own primary care providers, who were permitted to recommend whatever treatments they thought were appropriate. It is important to note that participants in the DSE (placebo) group received substantially more intervention than patients not enrolled in a structured program, so program results would be even more impressive if they could be compared to patients without any intervention at all.

In the Look AHEAD trial, Unick et al demonstrated that weight loss in as early as the first few weeks of an intervention is predictive of longer-term weight loss success. Findings from their analysis showed that weight losses in the first two months of treatment are strongly correlated with weight loss following the first year of an intensive lifestyle intervention. Interestingly, the amount of weight lost during the second month of the program was a stronger predictor of long-term term success than month 1. In addition to initial weight loss, weight loss in the first year of treatment was strongly related to weight change at year 4. Very few individuals who lost less than 3% at months 1 and 2 went on to achieve clinically significant weight loss at year 1 (Unick, 2014).

Retrospective analysis of the Look AHEAD participants demonstrated that those patients that were able to maintain 10% weight loss had significantly more treatment contacts during years 2-4 than did participants who maintained a loss of only 0-4.9% or who gained above their baseline weight. At year 4, successful maintainers in the Look AHEAD trial appeared to have taken greater advantage of the treatment sessions provided in addition to displaying improved eating and activity behaviors. Data from other studies has shown that group sessions delivered twice a month for 1 year after the weight loss phase, keeping patients in active treatment, helps patients maintain weight loss. An extended care model of treatment provides patients with the support and motivation needed to continue to practice weight control behaviors.

Bischoff et al studied a large group of patients in Germany that underwent a defined multidisciplinary non-surgical weight loss program. In addition to an intense 6-month program, the program also included additional weight loss maintenance training for 6 months. This maintenance phase focused primarily on weight regain prevention and improvement of long-term success rates. The program was based upon four modules (psychology, medicine, dietetics and exercise), imparted by a team of trained qualified health professionals such as psychologists, medical doctors, dieticians / nutritionists and physical therapists. During the program, closed

groups of 8-15 people met weekly for about 3.5 hours per session. Although data from the study demonstrated statistically significant weight loss, it suffered from a high attrition rate similar to commercial weight loss programs. Of the 8296 recruited participants, 3446 (42%) terminated the program before 52 weeks. Of those, 1818 (22% of all participants) dropped out within the first 26 weeks. The high dropout rate was likely due to a very low calorie diet that was not considered sustainable. However, of the participants that stayed on the program, 82.1% of the completers successfully reduced their initial body weight by 10% or more. The reduction in waist circumference was also highly significant. In a subgroup of 301 of the subjects, data on body weight beyond the intervention period of 1 year could be obtained and analyzed for up to 3 years. The baseline parameters of these patients matched the overall study population during the 1-year intervention program, suggesting that this data could be reasonably well extrapolated to the remainder of the participants. The data showed that even 3 years after the start of intervention, the extent of weight loss remained statistically significant, despite a relative weight gain of 15.1% 2 years after program termination. The mean weight loss after 3 years was 5.9 kg (13 lbs); a relative weight loss of 4.2% of initial body weight (Bischoff, 2011).

A program at Harvard called "**Why WAIT**" helped 450 people with type 2 diabetes to lose an average of 24 pounds and to keep most of it off three years later. Participants improved their disease profile enough that 70% were able to reduce their medicine, and 21% of those taking insulin were able to stop. Annual total health care savings were calculated at $1,619 per patient, with $996 saved on diabetes-only care. "Why WAIT" takes a comprehensive approach, providing nutritional counseling, an exercise program, and counseling to help patients modify behavior. Why WAIT also adjusts medicines to emphasize drugs that either don't encourage weight gain or that promote weight loss (Hamdy, 2008).

All of these programs provide statistically significant data demonstrating that an effective long-term weight reduction and maintenance program is possible. A common theme throughout is that success relies on an integrated, multidisciplinary approach that combines changes in nutrition, increased physical activity, and individual behavior modification. Success also heavily depends upon an intensive, long-term weight management program.

Few studies have examined the long-term effects of behavioral weight loss programs in severely obese cohorts. Using data from the Look AHEAD trial, it is clear that severely obese participants tended to be younger and a large proportion are female. Overall, they have lower physical activity and fitness (Unick, 2013). The Louisiana Obese Subjects Study (LOSS) was a 2-year, randomized clinical trial that assessed whether primary care physicians could effectively implement a lifestyle weight loss program in the severely obese population. Individuals who completed this intensive program achieved a 13.1% weight loss at 1 year and regained approximately ¼ of lost weight by year 2, despite continued monthly group meetings and the use of prescription weight loss medications. Unick et al set out to examine the effects of an intensive lifestyle intervention on body weight and cardiovascular disease risk factors in severely obese individuals over a 4-year period. Moreover, the severely obese were compared to the less obese on each of these parameters. Although weight regain occurred between year 1 and

4 in each BMI group, on average, severely obese lifestyle participants regained 40.7% of the weight lost at year 1 whereas the magnitude of regain was 56.5%, 46.7%, and 47.5% for overweight, class I, and class II obese participants respectively. In addition, 47% of severely obese participants who lost ≥ 10% of their initial body weight at year 1 maintained this magnitude of weight loss at year 4. This was similar to class I (40%) and class II obese (41%) participants and significantly greater than those who were overweight (38%) (Unick, 2013).

Multiple analyses have concluded that an extended care approach, with monthly or more frequent contacts, in person or via telephone or internet, improves successful weight loss. It also reduces the risk of weight regain during the maintenance phase. The 2013 obesity treatment guidelines published by the American Heart Association / American College of Cardiology / The Obesity Society sets a standard of at least 14 visits over a period of 6 months, using individual or group counseling. Patients typically must use a combination of programming (group classes, one-on-one office or telephone visits with providers, and online programs) to meet high-intensity standards. These are all to be offered without copays. Kaiser Permanente has a high-intensity lifestyle intervention that meets these standards. An additional Kaiser goal is that all physicians with a specialty weight management practice are certified by the American Board of Obesity Medicine (Kaiser, 2015).

However, as mentioned earlier, intensive lifestyle interventions that extend for a year or more are time-consuming and expensive to administer. In order to make programs more cost-effective, multiple attempts have been made to create technology-based interventions using the Internet, mobile phones, computer programs, telemedicine, and/or SMS messaging in various functions and frequencies. Unfortunately, these types of programs have had limited efficacy, with 7 of 15 studies showing no significant changes in body weight. The **STOP Regain** trial compared a face-to-face weight loss intervention with an Internet-based intervention, both emphasizing daily self-weighing and self-regulation. This trial demonstrated that a face-to-face program improved weight loss maintenance over a period of 18 months when compared to an internet-based program (Wing, 2006)

In a recent report released by the Milken Institute, researchers concluded that a technology-based intervention combined with an in-person intervention results in larger weight reductions compared with in-person interventions alone (-1.0 kg to -1.48 kg).(29) Other recent research has demonstrated that integrating additional treatment components (such as interactive multimedia lessons, small financial incentives, and automated tailored feedback based on participants' goal progress) demonstrates promise for improving the efficacy of behavioral weight management programs (Ross, 2016). Current evidence does not strongly support the potential for technology to completely replace in-person lifestyle interventions. However, technology yields significant improvements in weight loss when used in addition to typical lifestyle interventions. Though the magnitude of weight loss is relatively small in the studies reviewed, improvements associated with access to technology-based modalities may still be cost-effective if the patient population has easy access to the technology platform (Kubendran, 2017

Increasingly it is recognized that social factors play a role in the development of health problems and their resolution. For example, the incidence of obesity has been shown to occur in clusters, with the development of obesity in one person increasing the odds that obesity will develop in their close friends. These social processes have been harnessed as a means to improve outcomes in several approaches to behavioral weight loss. For example, Wing and colleagues recruited participants with several of their friends and/or family members and treated these participants as a team, with group activities utilized to stress intra-group cohesion and inter-group competition. This social intervention improved overall weight loss outcomes. Moreover, there was a clustering in the weight loss outcomes among the team members; weight losses of one member of the team were found to be strongly related to that of the other members, such social contagion appears to extend even outside the program; the untreated spouses of patients in a behavioral weight loss program have been shown to achieve weight losses similar to the patients actually participating in the program. Typically, behavioral weight loss tested in research studies are conducted in a group format. Weight losses achieved in group programs appear to surpass those seen with individual contact. Studies of group performance suggest that characteristics such as the size of the group and the similarity of group members to each other might influence treatment outcomes. Using the Look AHEAD data, analyzing those people in the ILI arm, Wing et al determined that weight losses did not cluster among members of a treatment group, and although the 209 groups varies in weight losses, with a mean of 8.64% loss, neither size nor baseline homogeneity of members affected the outcome. These findings suggest that weight loss programs that seek to use social influence processes to improve outcome will need to provide more focused strategies, such as developing within-group activities or between-group competitions, to accomplish this goal or alternatively, use existing relationships such as between friends or family members. The composition of the group has little effect on the outcome, nor does the size of the group (Wing, 2014).

MAINTENANCE OF WEIGHT LOSS:

Although initially successful, short-term treatment of obesity is associated with a very high risk of failure and weight regain. There is a general perception that almost no one succeeds in long-term maintenance of weight loss. In the absence of follow-up care, obese individuals typically regain 1/3 of their lost weight in the year following treatment with return to baseline weight frequently observed in 5 years (Van Dorsten, 2008). However, research has also shown that approximately 20% of individuals are successful at intentional long-term weight loss (again, defined as losing at least 10% of initial body weight and maintaining the loss for at least a year) (Wing, 2005). It has also been demonstrated that weight loss maintenance gets easier over time; after individuals have successfully maintained their weight loss for 2-5 years, the chance of long-term success greatly increases (Wing, 2005).

Participation in lifestyle based, weight-maintenance sessions following acute weight loss is the most reliable method of facilitating long-term weight control. Continued patient-provider contact is associated with improved maintenance of lost weight. In one study, it was shown that Individuals who attend group maintenance sessions every 2 weeks during the first year after weight reduction maintain an average of 13 kg of an initial 13.2 kg weight loss, whereas study participants assigned to a control group regained an average of 5.1 kg by the end of the year (Wadden, 2011). In a separate study, Wing et al showed that monthly patient-provider contact, whether in person or via the Internet, similarly improved the maintenance of a previous loss of 19.3kg (Wing, 2014). Van Dorsten concluded that long-term contact with treatment providers has widely been identified as an important factor in facilitating weight maintenance (Van Dorsten, 2008). Maintenance sessions seem to provide many patients with the support and motivation they need to continue to practice weight control behaviors. Inadequate treatment clearly contributes to weight regain; short-term treatment is no match for what is a chronic disorder for most individuals. Obesity cannot be cured by 6 months of therapy, any more than type 2 diabetes or hypertension can be cured by such a brief intervention.

Although some people are very successful with intense lifestyle intervention programs, for many others, sustained weight loss is difficult to achieve. Ingestive behaviors and weight loss maintenance are often hindered by a complex interaction of environmental, biological, behavioral and cognitive factors, which are only partly known. They variably interact in individual patients in an extent that is difficult to forecast. Remarkably little is known about factors responsible for weight regain, despite the frequency with which this problem is observed. Contributors are likely to include compensatory metabolic responses to weight loss that include reductions in resting energy expenditure and alterations in hormones such as leptin and ghrelin. These pressures interact and, ultimately, their collective input dictates a “steady-state weight”. A significant change in any of these inputs has the potential to upset the existing balance, induce a change in weight, and evoke responses affecting a new steady-state weight. These adaptive responses to both energy restriction and weight loss are thought to be in place in order to protect humans against the adverse effects of starvation but they also create the biological pressure to return the body to its original weight (MacLean, 2015). In order to counteract these biological

responses to weight loss, multiple therapeutic interventions must be applied for an extended period of time, if not indefinitely.

Strategies for weight loss maintenance differ from strategies for initial weight loss. Psychosocial variables are important in predicting success of weight loss maintenance, an enterprise dependent on human motivation. Wing et al found that several psychological variables were related to weight regain during maintenance including increases in depressive symptoms, dietary hunger, and disinhibition. (Wing, 2014). Vieira and colleagues compared health-related quality of life, psychological well-being and self-regulation of eating among women who had previously lost weight. Results revealed that successful weight loss maintainers had higher physical health-related quality of life, lower eating disinhibition and perceived hunger; and higher exercise enjoyment and perceived competence. Delahanty et al found that long-term weight maintenance of 7% weight loss was positively associated with older age, fewer previous weight loss attempts, increased exercise self-efficacy, decreased selection of high-fat foods, increased dietary restraint, and lower baseline activity levels (Brantley, 2014). Older adults whose primary motivation for weight loss is improving health are more compliant in continuous care (Montesi, 2016).

Several psychosocial factors have been associated with successful weight loss maintenance in long term observational and randomized studies. A few pertain to the behavioral area, a few to the cognitive component and a few to personality traits and patient-therapist interaction. Behavioral fatigue plays a big part in weight regain for many people. Patients eventually tire of attending treatment sessions and drop out. Reasons for attrition are not fully understood but are likely to be associated with several factors. The first is that patients perceive the cost of adherence gradually exceeds the perceived benefits. Initially, the positive consequences of weight loss (e.g., sense of accomplishment; better fit of clothes) outweigh the cognitive and physical effort needed to lose weight. Later, when the goal is to maintain lost weight, the positive feedback is less compared to the effort required to keep adhering to the same regimen. Thus, the benefits no longer seem to justify the costs (MacLean, 2015).

Individuals who set out to lose weight often have unrealistic expectations. Most patients who receive lifestyle modification or pharmacotherapy cannot lose more than 15 - 20% of their initial weight, even if treated continuously for more than 2 years. However, most people set a weight loss goal of more than 25% of their initial weight, despite efforts to convince them otherwise. Expected weight loss plateaus are frustrating to patients, many of whom remain obese after 1 year of treatment despite substantial weight loss.

Another factor associated with attrition from therapy is complaints that treatment is monotonous and sometimes demoralizing. Patients often feel that they do not acquire new information or skills after the first 6-12 months of therapy. In addition, weight maintenance sessions give greater attention to individuals that suffer lapses and regain weight than to people that are successful (Wadden, 2004).

Finally, In addition to individual treatment to achieve successful maintenance of weight loss, ultimately, we must

tackle what can be referred to as a “toxic environment” that explicitly encourages the consumption of super-sized servings of high-fat, high-sugar foods, while explicitly discouraging physical activity as a result of sedentary work and leisure habits. Most people are confronted daily by an environment that explicitly encourages them to consume large quantities of foods high in fat and sugar. For many, weight regain appears to be a nearly inevitable response to this environment. Changing this environment is going to take widespread changes both at the individual level as well as the community level.

The **National Weight Control Registry (NWCR)** was established in 1993 to identify successful weight loss maintainers and describe strategies used to achieve and maintain weight loss. Eligibility criteria for the NWCR includes ≥ 30 lbs weight loss maintained for ≥1 year. The NWCR continues to accrue individuals and currently has over 10,000 members. Analysis of the 3284 individuals who enrolled between 1993-2000 (available for 10 year follow-up) and using a 10% weight loss as the criterion of success, 88% were estimated to be still successful at year 5 and 87% at year 10. Not surprisingly, data from the NWCR clearly demonstrates that those individuals with larger initial weight losses maintained larger weight losses throughout the entire follow-up period. The study also provides important data on the trajectory of weight change. Regain was shows to be fastest in the early years of follow-up with decreasing rates over each of the first 5 years, followed by relatively stable maintenance over the subsequent 5 years. This is consistent with previous research from NWCR suggesting that weight-loss maintenance becomes less effortful over time (Thomas, 2014).

Over the past 15 years, researchers have identified common behaviors and strategies used by these successful NWCR individuals. These include: consuming a healthy diet, engaging in high levels of physical activity (about an hour per day), consistent self-monitoring of body weight (at least several times per week), eating breakfast regularly, and maintaining a consistent eating pattern across weekdays and weekends. With the exception of high dietary restraint and low levels of disinhibition, participants in the NWCR do not show higher levels psychological symptoms (depression, emotional distress, binge eating and self-induced vomiting) than observed in the general population. Continued adherence to each of these behaviors seems to improve long-term outcomes in these participants (Thomas, 2014). Interestingly, successful NWCR individuals have a high rate of medical triggers that they report to have sparked their motivation to lose weight (a physician promoting weight loss for medical reasons and/or having a family member with a heart attack) (Monesi, 2016).

Ogden et al has attempted to identify unique clusters of individuals within the NWCR that have distinct experiences, strategies and attitudes with respect to weight loss and weight loss maintenance. Cluster 1 is identified as the “typical” NWCR participant and encompasses 50.5% of the participants. These members can be described as weight-stable, healthy, exercise-conscious individuals. On average, these individuals have been maintaining a weight loss of at least 30 lbs below lifetime maximum weight (averaging 62.4 lbs below) for an average of 5.8 years. At entry into this registry, this group had a BMI average of 23.4, reduced from a maximum lifetime BMI of 33.5. All participants in this cluster report previous unsuccessful weight loss attempts. The majority (56.1%) report losing weight on their own without the help of any specific program or contact with a

health care professional. 94.5% report having modified their physical activity to accomplish their successful weight loss. Following an exercise routine is rated extremely important by this cluster for maintaining weight loss. In addition to exercise, the most commonly reported strategies for maintaining or losing weight during the year before registry entry include keeping many healthy foods in the house (96.6%), and weighing on a regular basis (85.5%). These individuals are the most satisfied with their current weight and report low levels of depression and stress (Ogden, 2012).

Cluster 2 is identified as the "struggling" NWCR participants and consists of 26.9% of participants. These individuals struggle the most with their weight, are more likely to weight cycle, require more effort to lose and maintain weight, and have poorer overall health compared to other NWCR members. This group has the highest maximum lifetime BMI (44.7) as well as the highest BMI (28.6) at entry into the registry. This cluster is also trying to maintain the greatest weight loss, an average of 100.5 lbs. below maximum weight. The members of this cluster are much more likely to have been overweight during childhood and adolescence compared to other clusters. This is the youngest cluster with an average age of 45.7 years and contains the highest proportion of females (83.1%). Despite being the youngest cluster, this cluster was the least healthy of the four clusters before successful weight loss. The members of this cluster are least likely to report losing weight on their own (38%) and they utilize all professional resources more than the other clusters, such as commercial weight loss programs (30.6%), physicians (21.8%), and self-help groups (19.4%). This group is also most likely to report using prescription weight loss medications and diet pills, surgical procedures, diet programs from books or magazines and hypnosis for their successful weight loss. They are also the most likely to report using physical activity to achieve weight loss (although their estimated amount of physical activity is lower than those in cluster 1). Compared to other clusters, this cluster is least satisfied with their weight loss, is most depressed, and least able to cope with stress (Ogden, 2012).

Cluster 3 participants are those with "immediate and long-term success" and comprise approximately 12.7% of NWCR participants. The distinguishing characteristic of the third cluster is that 94.8% of them had no previous weight loss attempts before their successful attempt. At entry into the registry, this group had an average BMI of 25.3 but also had the lowest maximum lifetime BMI of 32. This is the most weight-stable group (79%) and members of this cluster are least likely to have been overweight as children or adolescents. This group has the highest proportion of males (41.6%) and an average age of 51 years. The individuals belonging to this cluster have the highest education (60.2% have a college degree) and are most likely to be married (68.6%). This group can be classified as the healthiest group and is by far the most likely to report losing weight on their own. This group is less likely to report using other tools (consultation with a psychologist, counselor, join commercial weight loss programs, use self-help groups, prescription weight-loss medications) or strategies during loss or maintenance – except for self-weighing regularly, which is used by 85%. Similar to cluster 1, the members of this cluster are satisfied with their current weight and have low levels of depression and stress (Ogden, 2012).

Cluster 4 participants are the "less physically active" individuals and compromises 9.9% of participants. This

group is the oldest group with a mean age of 53.3 years and with a lower proportion of females (71.7%). The average BMI at registry entry was 26.1 and participants have a maximum lifetime BMI of 37.3. Except for cluster 2, this group is the least healthy. This group is more likely to utilize self-help groups, and more likely to consult with physicians, psychologists or counselors. Only 45.8% report modifying physical activity for weight loss and the importance of currently following an exercise routine was rated extremely low by this cluster of individuals. This group reports eating fewer meals per day than the other clusters, but consumes a higher proportion of calories from fat and lower proportion of calories from carbohydrates (Ogden, 2012).

The diversity among NWCR participants as well as the variability among non-participants demonstrates that weight loss maintenance is not a “one size fits all” strategy.

THE IMPORTANCE OF A MULTIDISCIPLINARY TEAM:

A consensus on the best approach to treat obesity is lacking. Lifestyle modifications are considered the basis of treatment for all overweight and obese individuals. Lifestyle modifications include three main components; diet, physical activity and behavioral therapy. Many excellent studies have shown that a comprehensive lifestyle modification program can induce and sustain successful weight loss (Artandi, 2012). However, there is a large treatment gap between obese and overweight patients needing treatment for their condition and available therapeutic options and medical professionals comfortable with treating obesity. To address this treatment gap, several major medical centers have established weight management centers. Most patients do not have access to these programs and participation is typically limited.

The recent evolution of lifestyle modification programs has focused on developing multidisciplinary lifestyle modification teams that are able to exist in a community setting; combining dietary and physical activity recommendations with specific cognitive behavior strategies to improve patients' adherence to a long-term weight management plan. A multidisciplinary approach combines the skills of several experts to aid the patient in the treatment of obesity. Multidisciplinary care aimed at small steps and practical approaches to lifestyle change can be an effective means of treatment for many patients who find it difficult to lose weight. Each member of the team - physicians, dieticians, exercise specialists, behavioral therapists, and nurses - brings a unique set of skills to bear on patient needs (Blackburn, 2008).

Obesity Medicine Physician:

Montesi et al aggregated data and highlighted the benefits of a lifestyle modification-based approach for the management of obesity, featuring an obesity medicine physician as a pivotal member of the team – whose primary role is in engaging patients, team coordination and supervision, managing the complications associated with obesity and making decisions about drug treatment or bariatric surgery (Montesi, 2016). The physician is often seen as the best source of health information for a patient and advice from such a healthcare provider can significantly increase patient motivation. The US Preventative Services Task Force recommended in 2003 that clinicians should screen all adult patients for obesity and offer intensive counseling and behavioral interventions to promote sustained weight loss for obese adults (USPSTF, 2003).

However, too often during routine medical visits, the subjects of weight, nutrition, and physical activity are overlooked by the physician or brought up only as an afterthought, which can negatively affect the level of perceived importance the patient assigns to these topics (Blackburn, 2008). Many physician are unaware of how to approach the subject of weight or they fear offending their patients through direct discussion about the topic. Furthermore, most physicians have very little training in weight management techniques and are often inadequately informed regarding appropriate therapeutic options for obesity; therefore, the advice most often given is to "eat less and move more" - advice that is rarely helpful and can often be detrimental to weight loss. It

may be unrealistic to expect primary care physicians to provide effective weight management for all of their patients who require it, unless greater resources are provided in their practices (Artandi, 2012).

Obesity Medicine is defined as the field of medicine dedicated to the comprehensive care of patients with obesity. Obesity Medicine physicians are physicians with advanced training and certification by the American Board of Obesity Medicine (ABOM). The American Board of Obesity Medicine was created by the Obesity Medicine Association and The Obesity Society in 2011 and has nearly 1,600 Diplomates in the U.S. and Canada as of 2016. The growth of this group is faster than any other sub-specialty in medicine. Board-certification distinguishes a physician as having achieved a higher level of understanding in obesity care by completing specialized education. After completing the rigorous education requirements, physicians must then prepare for and pass the National Certification Examination for ABOM. By definition, an ABOM physician is a clinician with expertise in the subspecialty of obesity medicine. This requires competency in and a thorough understanding of the treatment of obesity as well as the genetic, biological, environmental, social, and behavioral factors that contribute to obesity. An ABOM physician employs evidence-based therapeutic interventions for patients affected by excess weight and recognize the need for a comprehensive approach that considers the multiple factors that contribute to obesity; including lifestyle, medical, pharmacological and surgical treatment options. The field of Obesity Medicine looks beyond BMI to better assess and treat patients and their needs.

The field of Obesity Medicine is relatively new in terms of physician specialization, but it is growing rapidly as physicians recognize the need for and seek out advanced training in the field. In fact, prior to 2012, it was considered fraud by most payers to bill for services rendered primarily to treat obesity. Since then, ABOM members have advocated for and achieved recognition of obesity as a disease, and payers are starting to provide coverage for obesity medicine services. We are making great strides and progress in our field of obesity medicine, not just in the science but in the insurance world as well. Today, Obesity Medicine physicians are typically found in two areas of medicine. Many are practicing in academic institutions where they combine clinical practice with medical research. Because this type of practice is funded by grant money, reimbursement by third-party payors is typically not sought. In the past several years, a growing number of ABOM diplomates have begun practicing Obesity Medicine outside of academia. Community-based Obesity Medicine clinics have expanded access to treatment to a larger, more diverse population and have the potential to have a large impact on the health of local communities. However, insurance reimbursement for specialized obesity treatment remains scarce, so most of these clinics are operating as cash businesses, which inevitably limits access for those individuals without the disposable income to pay for it. As we transition health care from a fee-for-service model to a value-based care model, the role of Obesity Medicine physicians will inevitably change and these clinics will likely exist under the umbrella of larger Accountable Care Organizations. In fact, Kaiser has multiple clinics devoted to obesity medicine and has a goal that all physicians with a specialty weight management practice within their organization become certified by the American Board of Obesity Medicine.

Obesity Medicine physicians practicing independently and those supervising multidisciplinary lifestyle modification teams are tasked with managing the medical and psychosocial complications associated with obesity as well as referring the patients to other physicians and health professionals according to specific comorbidities. Obesity medicine physicians are responsible for monitoring the effects of treatment, both on lifestyle and on weight outcomes, and potentially adding adjunctive treatment with obesity drugs, residential rehabilitative treatment and any recommendations for bariatric surgery.

Prior to formation of the American Board of Obesity Medicine (ABOM) and recognition of Obesity Medicine as a medical specialty, treatment of obesity was traditionally performed by primary care physicians and was rarely founded upon evidence-based medicine. Medications were occasionally used to treat obesity, but since few of the medications had any long-term data about effectiveness or risk, they were used sporadically and/or used as a primary treatment for obesity rather than adjunctive to dietary counseling and lifestyle modification. Inevitably, most of these medications failed to achieve substantial weight loss and their use declined. Several were removed from the market due to unfavorable risk/benefit ratios. During that time obesity was attributed to a lack of willpower or personal responsibility. Taking medications to treat something that was essentially viewed as poor self-control was stigmatized. Weight-loss medications essentially fell out of favor for many years.

However, with the organization of a large number of physicians practicing evidence-based medicine for the treatment of obesity, combined with a plethora of new data regarding the biochemical pathways that contribute to obesity, interest in weight-loss medications has been renewed. In fact, weight-loss medications are recommended as an adjunct to lifestyle modification in patients unable to lose sufficient weight (approximately 10% of initial body weight) with diet and exercise alone. In fact, it is the position of the Obesity Medicine Association (OMA) that pharmacotherapy may be used for patients affected by obesity, but only in a comprehensive obesity management program that includes a thorough medical evaluation and support for lifestyle change (Vetter, 2010) The addition of weight-loss medications to lifestyle modification has been shown to increase weight loss over a year. In a 2005 study conducted by Wadden et al, subjects who received combined therapy lost a mean of 12.1 ± 9.8 kg, whereas those receiving lifestyle modification alone lost significantly less weight (6.7 ± 7.9 kg). Furthermore, nearly twice as many subjects in the combined-therapy group as in the monotherapy group lost 10% or more of their initial weight (Wadden, 2005).

In their position paper, the Obesity Medicine Association states that since obesity is a chronic disease with a high risk of relapse when treatment is discontinued, treatments that are offered must be appropriate for chronic use. This applies for support visits, nutritional interventions, behavioral programs, exercise programs, medical care, anti-obesity medications, and even surgery. However, they also specify that pharmacotherapy for the treatment of obesity should be prescribed only by licensed health care professionals qualified by training and experience to treat obesity (Obesity Medicine Association, 2015).

A few data are also available on the long-term weight loss maintenance with pharmacotherapy. To improve long-term maintenance, Montes et al suggest that in addition to permanent lifestyle changes, long-term drug

treatment should be considered for those patients who have been unsuccessful with diet and exercise alone. Montesi et al suggested that adding weight loss drugs to the lifestyle modification programs not only improves long-term weight loss, but also reduces the incidence of diabetes in the future (Montesi, 2016).

In February 2015, the Endocrine Society released clinical practice guidelines for the pharmacological management of obesity. The Endocrine Society voiced agreement with the opinions of prominent medical societies that current scientific evidence supports the view of obesity as a disease. They acknowledged that weight loss produces many benefits including risk factor improvement, prevention of disease, and improvements in feeling and function. They stated that greater weight loss produces greater benefits, but modest (5-10%) weight loss, such that produced by lifestyle modifications and medications, has been shown to produce significant improvements in many conditions. The Endocrine Society outlined many steps that clinicians should take in the clinical encounter with the patient that is overweight or obese. These include:

- Annual and symptom-based screening for major chronic conditions associated with obesity in all adult patients with a BMI >30
- Timely adherence to national cancer screening guidelines with the understanding that individuals who are obese are at increased risk for many malignancies
- Identification of contributing factors to obesity
- Identification and appropriate screening for secondary causes of obesity
- Adherence to AHA/ACC/OTS guidelines for the management of overweight and obesity in adults
- Identification of medications that may contribute to weight gain
- Formulation of a treatment plan based on diet, exercise and behavior modification.

The Endocrine Society position statement was that drugs may amplify adherence to behavior change and may improve physical functioning such that increased physical activity is easier on those that cannot exercise initially. Patients who have a history of being unable to successfully lose and maintain weight and who meet label indications are considered candidates for weight loss medications. They make a powerful statement that “if permanent weight loss could be achieved exclusively with behavioral reductions in food intake and increases in energy expenditure, medications for obesity would not be needed. Weight loss is difficult for most patients and the patients’ desire to restrict food and energy intake is counteracted by adaptive biological responses to weight loss. The fall in energy expenditure (out of proportion to reduction in body mass) and increase in appetite that are observed after weight loss are associated with changes in a range of hormones. Some of them represent adaptive responses to weight loss and result in altered physiology that promotes weight regain (Apovian, 2015).

Although the use of anti-obesity medications is helpful in achieving and sustaining clinically-significant weight loss, pharmacotherapy does not form the basis of successful obesity treatment. Regular follow-up by physicians and other members of the multidisciplinary care team has been demonstrated to be strongly associated with patient compliance and long-term success. The more accountable patients are to weight loss programs, the

better the outcomes that are expected. The AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults reviewed randomized clinical trials on weight loss interventions and determined that the best weight loss outcomes occur with frequent face-to-face visits (16 per year on average) (Apovian, 2015). Studies have consistently shows that continued contact is important for maintaining weight loss (Teixeira, 2015). Maintenance of weight after the initial 6 months is crucial to long-term success and benefits. After weight stabilization following the first 6 months of treatment and after a careful evaluation, a physician may recommend that some individuals attempt additional weight loss to achieve desired health goals, but this is a complex decision requiring a close evaluation of the patient as a whole.

The importance of active physician involvement in the patients' efforts to initiate and maintain a healthy body weight and healthy lifestyle practices cannot be overemphasized. However, engaged patients should also be managed by trained lifestyle counselors (dietitians, psychologists, physical activity supervisors) to implement both the weight loss phase and the long-term maintenance phase of the lifestyle modification. This multidisciplinary approach based on lifestyle modification has the potential to address several obstacles to reach the optimum long-term management of obesity (Montesi, 2016).

Registered Dietitian:

In a multidisciplinary approach to obesity treatment, the primary role of the registered dietitian (RD) is to guide the patient toward simple, effective strategies to improve their diet quality and decrease overall energy intake. Confusion about food and diet is widespread and education about healthy eating is imperative to ensure success during weight loss and maintenance of weight loss. Fortunately, physicians that are board-certified in obesity medicine have extensive training in the field of nutrition as it relates to weight loss and type II diabetes. An obesity medicine physician can often oversee or administer nutrition education for most patients, utilizing referrals to registered dietitians for patients that have more complex issues.

Physical Therapist:

To maintain weight loss, individuals must adhere to behaviors that counteract physiological adaptations favoring weight regain. Physical activity has a modest impact during the weight loss period, but becomes essential once patients transition to maintenance of weight loss. Both volitional and regimented exercise attenuate weight regain after weight loss and counter the biological factors that promote weight regain by reducing intake and elevating expenditure (MacLean, 2015). Unfortunately, the level of daily energy expenditure necessary to prevent weight regain is high compared with the modern-day lifestyle. Data from case studies, correlational investigations, and randomized trials all have concluded that high levels of physical activity facilitate long-term weight control. In one study, participants in a high-activity group maintained weight loss significantly better than those in a low-activity group at both the 12- and 18-month assessments. Obese individuals that exercised 200 or more minutes per week achieved significantly greater weight loss at 18 months than persons who exercised less than 150 minutes per week (Wadden, 2004). In fact, according the National Weight Control Registry (NWCR),

90% of its participants use regular physical activity as a strategy to maintain their weight loss (Ogden, 2012, Thomas, 2014).

There are two ways that patients can increase their energy expenditure – programmed or lifestyle activity. Programmed activity (walking, hiking, biking, etc.) is typically planned and completed in a discrete period of time at a relatively high-intensity level. Lifestyle activity, by contrast, involves increasing energy expenditure while completing everyday tasks. There is a trend (especially among children) for lifestyle activity to be associated with less weight regain than was programed exercise at one year after treatment, which suggests that lifestyle activity should be practiced by all patients that struggle with excess weight, especially for patients that report they hate to exercise (Venditti, 2014).

In addition to its role in maintaining weight loss, physical activity is critical for improving cardiovascular disease risk factors in individuals with obesity (Vetter, 2010). Multiple studies have shown that cardiorespiratory fitness attenuates the increased mortality associated with obesity. An effective obesity treatment plan must include a physical activity component. Within this treatment plan, in addition to increased daily lifestyle activities, should be aerobic activity and strength (resistance) training. On the basis of extensive clinical experience and research, for the majority of overweight and obese adults, walking is recommended as the safest, most convenient, and most effective aerobic activity. When osteoarthritis or other joint conditions are a consideration, swimming, water aerobics, or cycling offer comparable low-impact choices. However, when dealing with obese patients who are at high risk of injury, a provider trained in physical fitness and injury prevention must consider the safety and accessibility of the activity. Physical therapists are highly qualified to provide instruction in physical activity with a focus on safety and injury prevention.

Unfortunately, the majority of obese patients do not perceive physical activity as a relevant component of healthy behavior (Montesi, 2016). Furthermore, many of those most in need of physical activity perceive it as daunting (Blackburn, 2008). Many obese individuals are not comfortable with group physical activity and are self-conscious about exercising in a public gym. Fortunately, less structured exercise plans seem to facilitate long-term adherence and weight control. Perri et al randomized obese participants to receive either 12 months of behavioral weight control that included on-site supervised exercise or a comparable program of home-based activity. During the first 6 months, the two groups exercised approximately the same number of minutes per week and lost comparable amounts of weight. At 15 months, however, those that exercised at home engaged in more minutes of activity and lost significantly more weight than persons who exercised on-site (Perri, 2002). At-home exercise potentially removes common barriers to physical activity, such as travel time, cost, the need for child care, or embarrassment about weight or shape. Physical therapists are able to teach patients how to exercise at home and provide instruction in aerobic activity as well as strength training.

Psychologist:

Failure to maintain diet and exercise modifications may occur when a patient is not mentally prepared for long-term interventions. Many people participating in a weight loss program are nervous and afraid, which can promote resistance to change. Behavior therapy provides the mental preparation and structure that can help patients manage obstacles and identify and achieve their goals (Blackburn, 2008). Behavior therapy refers to a set of principles and techniques for modifying diet and exercise. It teaches patients how to achieve their eating and exercise goals by methods such as keeping records of their physical activity and food intake or modifying cues that elicit unwanted eating (e.g., the sight of food on the counter).

However, educational instruction alone is not sufficient to induce clinically significant weight loss (Wadden, 2004). Regularly scheduled treatment visits and homework assignments are two critical components of lifestyle modification. In a traditional behavior therapy model, patients receive treatment sessions weekly for an initial 16-26 weeks. Interventionists often introduce a new topic at each session, but the majority of time is devoted to discussing methods to help participants adhere to their eating and activity regimens (Wadden, 2004).

Complex behaviors involved in successful weight loss and maintenance of long-term weight loss are in part influenced by conscious cognitive processes. Nevertheless, cognitive factors have largely been neglected in traditional weight-loss lifestyle modification interventions, which are based mainly on the principles of behaviorism. Cognitive behavioral therapy (CBT) for obesity is founded upon the premise that that the manner in which a person thinks about themselves or a given event impacts how they will emotionally and behaviorally respond to the event. When an expectation of failure exists, many individuals will not engage in goal-directed behaviors and in turn interpret this “inevitable” lack of success as evidence of personal incompetence. Cognitive approaches to weight loss focus on identifying behavioral and thought patterns that affect eating and have the potential to be useful in weight-loss treatment by identifying and modifying thoughts or self-perceptions associated with maladaptive diet and exercise patterns, prior relapses, or prior treatment failures (Van Dorsten, 2008). CBT incorporates skills of self-monitoring, stimulus control and cognitive restructuring. Self-monitoring helps participants become aware of any patterns to their intake. Stimulus control techniques help patients manage cues or triggers associated with eating. Cognitive restructuring teaches participants how to identify and challenge problem thinking patterns (Vetter, 2010). Shaw et al reported collective results for two studies testing psychologic interventions for weight treatment and concluded that CBT, when added to diet and exercise interventions, produced superior weight losses (7.3kg) than diet and exercise treatment alone (2.4kg). (Shaw, 2005). Multiple studies have shown similar results.

The QUOVADIS study (and observational study on 1944 treatment-seeking obese patients in 25 medical centers in Italy) investigated several cognitive factors involved in long-term weight loss. The study confirmed that some cognitive factors are directly associated with the amount of weight lost (increased dietary restraint and reduced disinhibition) while others are associated with long-term weight loss maintenance (satisfaction with results achieved, confidence in being able to lose weight without professional help) (Dalle Grave, 2009).

In addition to addressing crucial cognitive behavioral issues such as motivation, self-efficacy and self-monitoring, it is increasingly being recognized that patients that suffer from obesity often struggle with food addictions and binge eating disorder (BED) (Gearhardt, 2011). Binge eating disorder is a severe, life-threatening and treatable eating disorder characterized by recurrent episodes of eating large quantities of food (often very quickly and to the point of discomfort); a feeling of a loss of control during the binge; experiencing shame, distress or guilt afterwards; and not regularly using unhealthy compensatory measures (e.g., purging) to counter the binge eating. Binge eating disorder is the most common eating disorder in the United States. About 3.5 percent of adult women and 2 percent of adult men have binge eating disorder (NIDDK / NIH, 2017). Cognitive Behavioral Therapy is the best-established treatment for binge eating disorder and to be effective, should only be administered by someone with advanced training in the field of CBT.

For most people, effective weight loss and maintenance of weight loss requires significant shifts in thinking, reasoning and motivation. Repeatedly addressing these issues throughout the process is crucial to success, as is individualized treatment for those patients with more complex issues.

Nurse:

In any clinical care setting, the nurse is an important figure in the patient's experience. In a multidisciplinary weight loss team, this role becomes even more critical. As one of the initial contacts, the nurse sets the stage for first impressions. Negative attitudes or stigma toward overweight or obesity can make patients uncomfortable and hinder treatment. By the same token, nurses are in a unique position to enhance patient comfort and encourage ongoing involvement with weight loss efforts. In a multidisciplinary team, the nurse is the key patient contact and nexus for communication between team members. He or she is in a unique position to educate patients, make them feel comfortable and accepted, and gain access to the kind of information that will help direct optimal treatment strategies (Blackburn, 2008).

Health coaches are often used to supplement treatment; between treatment visits, coaches provide ongoing support, accountability, and information to promote behavior change. Health coaching occurs in person, via the internet or over the phone. In a randomized controlled study, Leahey and Wing studied the efficacy of three types of health coaches (peer, professional, and mentor) and determined that there were differences in weight losses produced by the three coach conditions. Participants with a professional coach lost the most weight (9.6±8.1 percent) compared with the other two groups (9.1±5.0 percent for peer coaches and 5.7±5.6 percent for mentor coaches) (Leahey, 2013). In a multidisciplinary weight loss team, the nurse is ideally situated to function as a life coach for most patients, however, engaging a licensed physical therapist and a licensed psychologist as assistant life coaches provides patients with continuity and a high level of engagement.

CONCLUSION:

There is no doubt that obesity and obesity-related complications take a huge toll on population health and well-being. Without a strong and sustained reduction in obesity prevalence, the disease of obesity will continue to impose major costs on the health system. Although health reform is necessary to address health inequities and rein in rising health spending, real savings are likely to be achieved through reforms that reduce the prevalence of obesity and related risk factors (Finkelstein, 2009). There is no magic bullet or no single tactic to address the obesity epidemic. Multiple factors are responsible for its rise; consequently, effective treatment will require a comprehensive assessment aimed at developing a multidimensional and individualized treatment which is best managed by a multidisciplinary team. Employers, medical providers, insurers, biopharmaceutical firms, the food and beverage industry, governments, and communities need to begin to work together—and the individuals affected by excess weight need the most current, evidence-based treatment to manage their disease (Waters, 2017). By its nature, obesity is not a permanent affliction, and therein lies an opportunity to improve public health and economic conditions. On an individual scale, weight loss even as small reductions is associated with multiple health benefits, and on a population scale, these incremental changes could result in significant economic improvements.

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