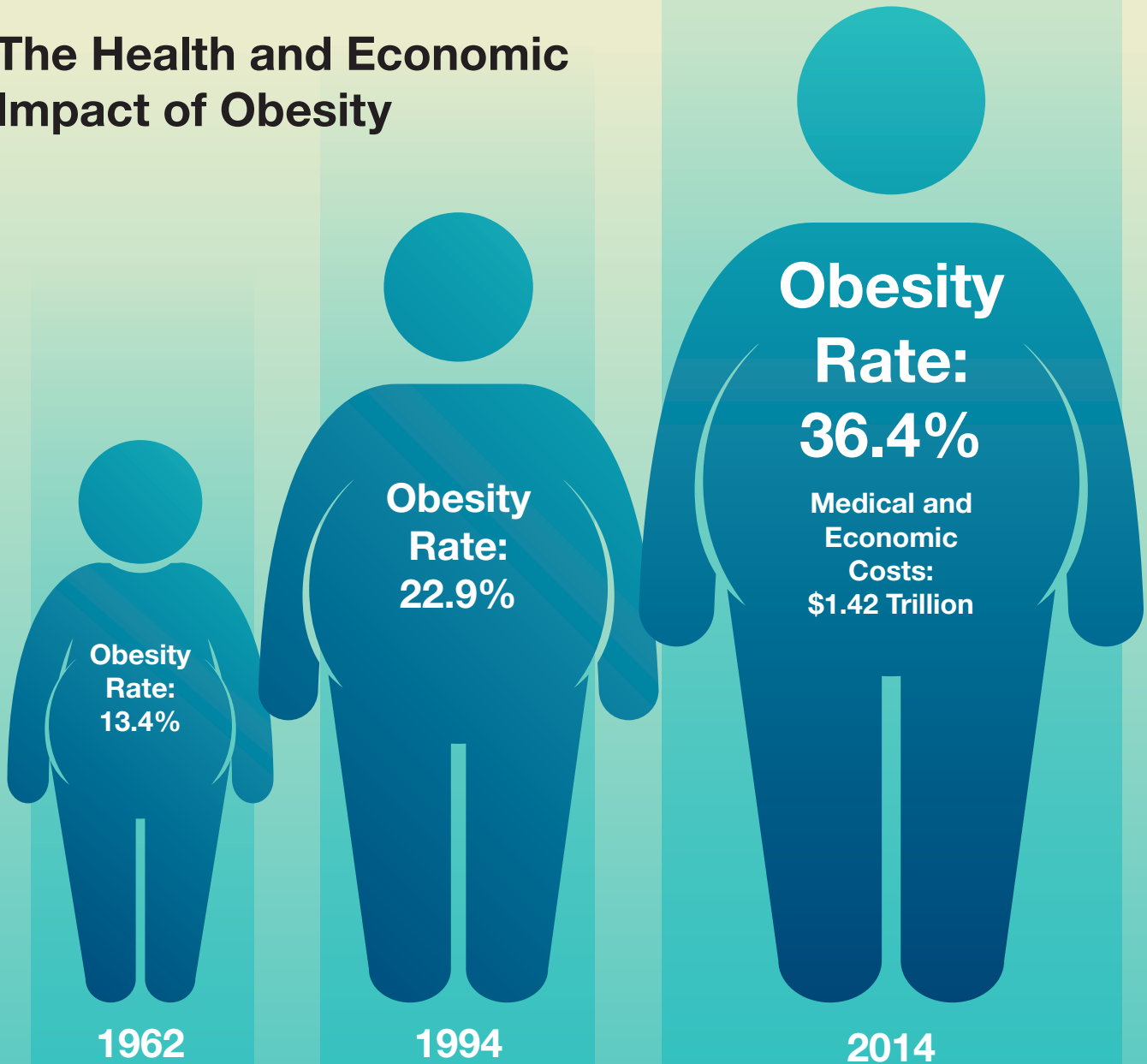


# Weighing Down America

The Health and Economic Impact of Obesity



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**The Health and Economic  
Impact of Obesity**

Hugh Waters and Ross DeVol



**MILKEN INSTITUTE**  
LYNDA AND STEWART RESNICK CENTER FOR PUBLIC HEALTH

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## **ACKNOWLEDGMENTS**

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# Executive Summary

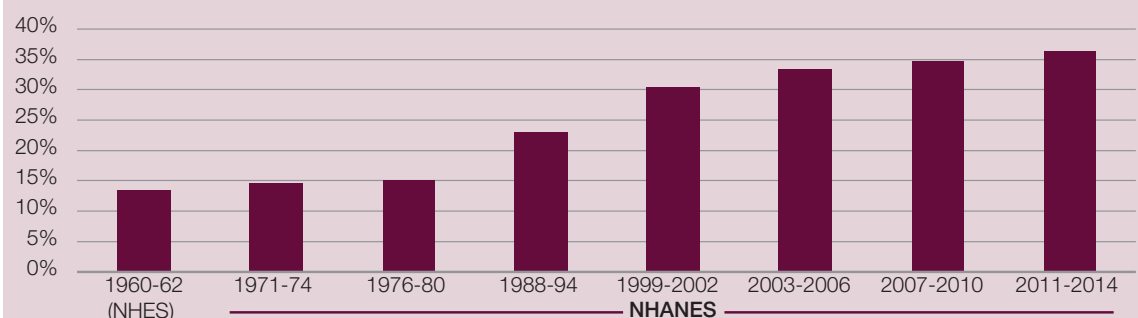
## The Prevalence of Obesity

The increasing number of people who are obese and overweight impose a very significant toll on the U.S. economy—and this impact will increase in the near future. Obesity causes a wide range of chronic diseases, leading to extensive direct health-care costs as well as indirect costs in terms of lost work time, lower productivity, and premature death. The chronic diseases caused by obesity impose considerable intergenerational costs, including reduced educational attainment and poorer health for those afflicted and their children, potentially creating a downward economic spiral. If the obesity epidemic is not stopped and reversed, the first generation of Americans born after the baby boomers (Generation X) could be the first to see its life expectancy decline, undoing many of the benefits that improving health status bestowed on our economy in the 20th century.

In 2014, 98.7 million U.S. residents had obesity, and another 89.9 million were overweight. In all, 188.6 million people—or 60.7 percent of the population ages 2 and above—either had obesity or were overweight. Obesity rates in the U.S. have increased steadily. Among adults, the prevalence of obesity has climbed from 13.4 percent in 1960-62 to 36.4 percent in 2014 (see page 2, Figure 1).

Obesity has been rising in all the member countries of the Organization for Economic Cooperation and Development (OECD) over the past two decades.<sup>1</sup> In this area, unfortunately, the United States has been the leader for quite some time. By 1991 the U.S. already had the highest obesity rate among member countries at 23.3 percent. Obesity has also been spreading geographically within the nation. As recently as 1990, fewer than 15 percent of Americans were obese in every state. Southern states were the first to cross the 15 percent threshold. By 2014, no state had an obesity prevalence below 20 percent. The human suffering, medical costs, and economic impacts of diseases caused by obesity now affect all geographic regions of the United States.

Figure 1. Adult Obesity Rates, 1962-2014 <sup>2</sup>



Sources: National Health Examination Survey (NHES), National Health and Nutrition Examination Survey (NHANES).

## Health Conditions Caused by Obesity

The human body has evolved metabolically to save excess energy as fat. In modern times, this adaptation has led to a range of negative effects. Obesity increases blood pressure, low-density lipoprotein (LDL) cholesterol, and triglycerides. Further, it lowers high-density lipoprotein (HDL) cholesterol, which removes LDL cholesterol, and places the body in a pro-inflammatory state. Extreme fat retention in the body is detrimental because fat cells networked together effectively act as an endocrine organ, releasing resistin, a hormone that increases the liver's production of LDL while degrading LDL reuptake—increasing the probability of developing insulin resistance and type 2 diabetes. The pancreas tries to compensate for the insulin resistance by producing even more insulin, which increases the risk of a variety of cancers. Obesity also decreases sensitivity to leptin, resulting in an inability to detect satiation—interrupting the signals that normally make a person feel “full” and thus stop eating.

The latest scientific and medical research has expanded the number of known non-communicable diseases caused by obesity. In the past decade, significant evidence has emerged concerning the degree of obesity's linkage with Alzheimer's and vascular dementia.<sup>3</sup> Maternal obesity has also been linked to the development of autism spectrum disorder (ASD) in children.<sup>4</sup> However, we have not included ASD in this study out of caution to only include definitive epidemiologic evidence of a causal association. Nor have we included mental disorders such as depression among conditions causally linked to obesity because disagreement about the direction of causation persists. We discuss depression in Section 8.

## Direct and Indirect Costs/Economic Impact

**In the United States in 2014, the direct costs of medical treatment for health conditions causally related to obesity and overweight totaled \$427.8 billion.** Among those conditions, type 2 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 obesity and being overweight. In 1962, the nation spent just \$1 billion in 2014 dollars on treatments for diabetes, with 700,000 cases



attributable to obesity and overweight. In 2014, there were 16.8 million cases of diabetes caused by obesity and overweight. 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.**<sup>5</sup>

The indirect costs related to obesity and overweight include the combination of absenteeism, or lost workdays, and presenteeism (productivity loss or underperformance at work) due to disease—measured in lost employee output. **These indirect costs amounted to \$988.8 billion in 2014. Together, the direct and indirect costs of these conditions were \$1.42 trillion (see Table 1 below and see Figure 2, page 4), equivalent to 8.2 percent of U.S. gross domestic product in 2014. In addition, more than 320,000 deaths were attributable to obesity and overweight.**

**Table 1. Diseases, Deaths, and Costs Attributable to Obesity and Overweight, 2014**

Condition	Total Attributable Cases	Deaths	Costs (in \$ Millions)		
			Direct	Indirect	Total
Alzheimer's and Vascular Dementia	1,802,605	31,815	\$55,998	\$25,912	\$81,910
Asthma	9,973,875	803	\$17,269	\$27,707	\$44,976
Breast Cancer	658,604	8,844	\$3,890	\$37,845	\$41,735
Chronic Back Pain	15,830,754	-----	\$31,184	\$183,879	\$215,063
Colorectal Cancer	336,676	14,785	\$4,338	\$3,995	\$8,333
Congestive Heart Failure	7,538,628	18,158	\$30,641	\$11,867	\$42,509
Coronary Heart Disease	2,690,484	93,941	\$10,936	\$16,965	\$27,901
Diabetes Type 2	16,761,756	43,235	\$111,886	\$207,596	\$319,482
Dyslipidemia	26,901,236	†	\$19,975	†	\$19,975
End Stage Renal Disease	2,992,115	31,292	\$20,467	††	\$20,467
Endometrial Cancer	418,359	6,555	\$1,878	\$1,637	\$3,515
Esophageal Adenocarcinoma	15,718	6,306	\$622	\$61	\$684
Gallbladder Cancer	3,070	1,363	\$15	\$12	\$27
Gallbladder Disease	5,633,739	928	\$43,949	\$22,041	\$65,990
Gastric Cardia Adenocarcinoma	28,874	3,941	\$1,143	\$113	\$1,256
Hypertension	26,651,189	11,519	\$21,090	\$324,586	\$345,676
Liver Cancer	7,110	3,291	\$35	\$28	\$63
Osteoarthritis	21,593,765	317	\$42,061	\$109,336	\$151,397
Ovarian Cancer	25,514	1,846	\$723	\$100	\$823
Pancreatic Cancer	13,738	11,455	\$107	\$650	\$757
Prostate Cancer	167,508	33	\$900	\$6,358	\$7,259
Renal Cancer	98,047	3,544	\$1,480	\$384	\$1,864
Stroke	1,287,999	26,300	\$7,197	\$7,716	\$14,914
<b>Totals</b>	<b>141,431,364</b>	<b>320,271</b>	<b>\$427,787</b>	<b>\$988,789</b>	<b>\$1,416,576</b>

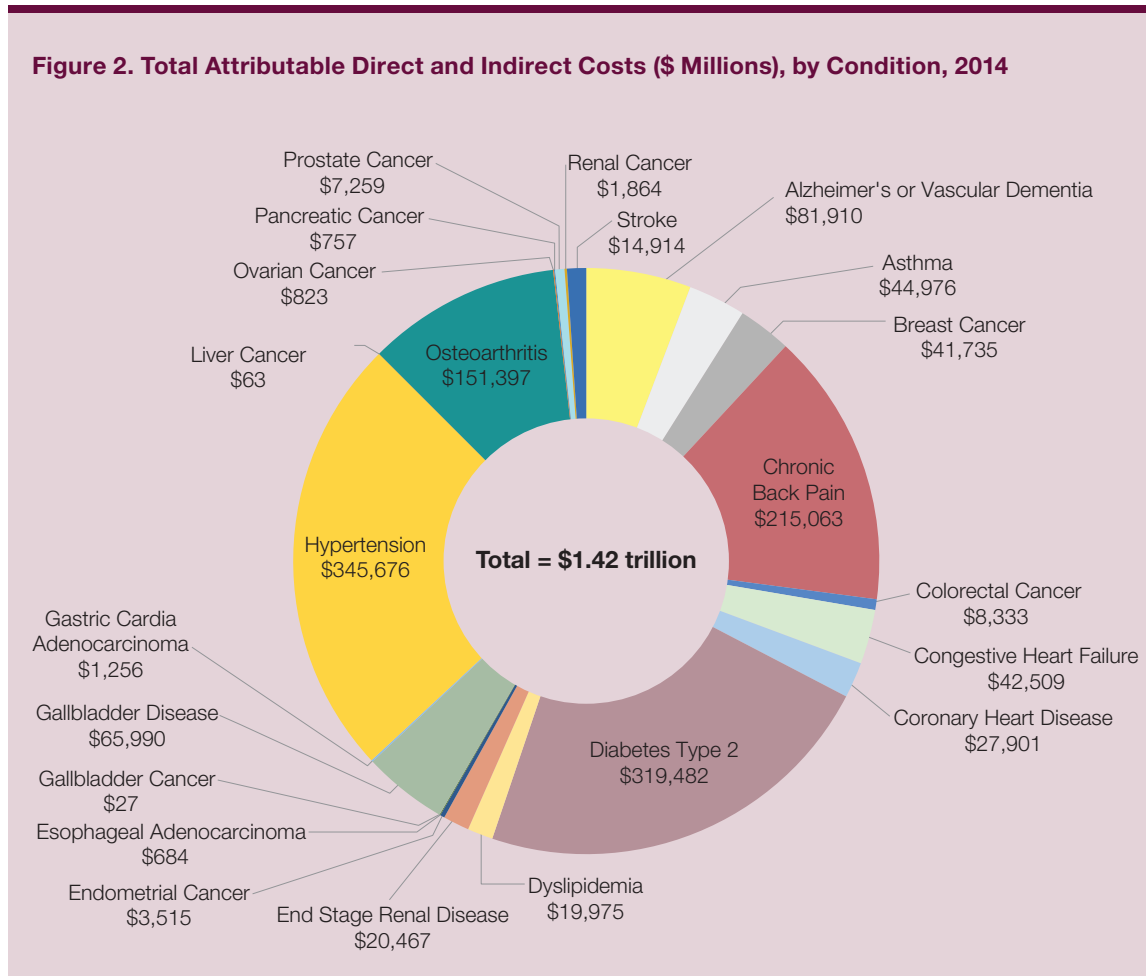
Sources: Table 13, Table 14, Table 15, Table 16.

† Included in heart disease, diabetes, and stroke. †† Included in diabetes and hypertension.





**Figure 2. Total Attributable Direct and Indirect Costs (\$ Millions), by Condition, 2014**



Sources: Table 13, Table 14, Table 15.

## Conclusions and Recommendations

Fortunately, the economic losses are not irreversible. For example, a recent review of interventions designed to reduce obesity concluded that for individuals with a body mass index (BMI) of 40 or greater, a 5 percent weight reduction would yield \$2,137 in medical cost savings annually. For individuals with a BMI of 35, the same percentage reduction would result in \$528 savings.<sup>6</sup>

The results of this study should be used to educate the public and private sectors and inform policy related to preventing and reversing obesity in the United States. There is no magic bullet, and no single tactic, to address the obesity epidemic because multiple factors are responsible for its rise. We see a great need for a multifaceted, long-term commitment to advocating for healthy body weight. Employers, medical providers, insurers, biopharmaceutical firms, the food and beverage industry, governments, and communities must work together—and the individuals affected by obesity and being overweight need to accept some personal responsibility to modify their behavior.



# 1. Introduction

This study calculates the epidemiologic and economic effects of increased levels of obesity and overweight in the United States, including estimates of the costs associated with obesity paid by individuals and their households, employers, government, and society as a whole. It uses a range of data sources to comprehensively establish the extent of conditions related to obesity as well as the costs. Key points in the methodology include the following:

- The principal unit of analysis is the number of individuals living in the United States who have sought treatment for medical conditions found to be caused by obesity. We use population attributable risk (PAR) for these conditions to calculate the number of individuals whose episodes of illness can be attributed to obesity. The PAR is defined as the proportion of a disease occurring in the total population attributable to the exposure in question.<sup>7, 8</sup>
- Throughout this report, we use the concept of the treated prevalence of health conditions that are associated with obesity. This corresponds to the percentage of the population that not only has the condition in question, but has received treatment for it.
- We use estimates of the costs of medical treatment from the Medical Expenditure Panel Survey (MEPS).<sup>9</sup> The MEPS is a nationally representative sample of non-institutionalized Americans collected by the U.S. Agency for Healthcare Research and Quality (AHRQ). It includes a household survey component (HC) and an insurance component (IC), which provides information for employer-provided insurance plans. We also use the results of studies by the Centers for Disease Control and Prevention (CDC)<sup>10</sup> and the National Cancer Institute<sup>11</sup> as well as published journal articles.
- This study reports the final amounts in 2014 U.S. dollars, using inflation rates calculated by the Bureau of Labor Statistics for the Consumer Price Index when needed.<sup>12</sup> Estimates of indirect economic costs related to lost productivity are calculated and reported separately from direct medical costs. As an alternative approach to calculating indirect costs, we also estimate the economic consequences of premature mortality and disability associated with these conditions by using disability-adjusted life years (DALYs), which combine premature deaths with partial years lost attributable to reduced productivity. We have calculated the costs of DALYs as an alternative approach to estimating indirect costs. However, we have not included the costs of the DALYs in our total estimates, since there is overlap between these costs and the indirect costs reported in the literature and MEPS.



## 2. The Prevalence of Obesity and Overweight

The international standard for measuring obesity is the body mass index (BMI), adopted by the World Health Organization (WHO),<sup>13, 14</sup> 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, as follows:

$$\text{BMI} = \frac{\text{kg}}{\text{m}^2}$$

The WHO standards for BMI are as follows:

- Underweight: below 18.5
- Normal: 18.5 to 24.9
- Overweight: 25 to 29.9
- Obesity: 30 or higher

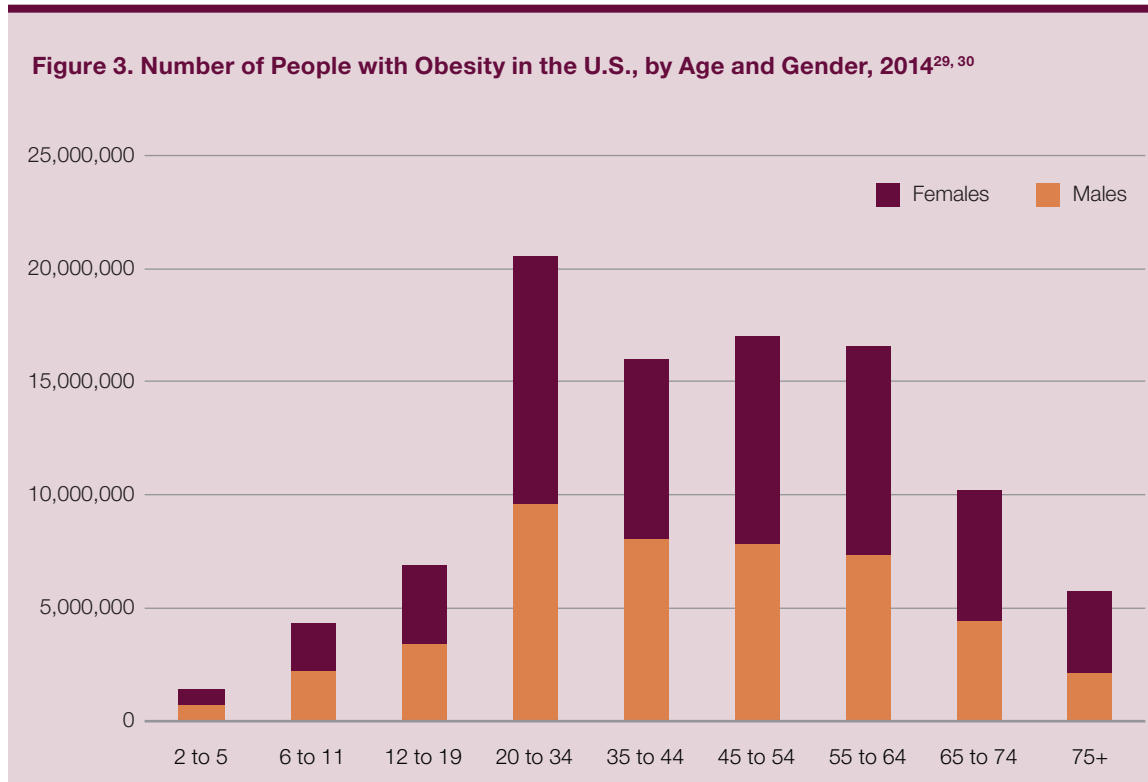
The U.S. standards follow the WHO's and include a classification of extreme obesity, indicated by a BMI of 40 or higher.<sup>15, 16, 17</sup> BMI data are collected and analyzed by the National Center for Health Statistics (NCHS), part of the Centers for Disease Control and Prevention. The NCHS collects nutrition and BMI data through several sources, including the National Health Interview Survey (NHIS)<sup>18, 19</sup> and the National Health and Nutrition Examination Survey (NHANES).<sup>20, 21, 22</sup> The CDC also collects data on BMI and obesity through the Behavioral Risk Factor Surveillance System (BRFSS), based on telephone surveys.<sup>23</sup> The NHANES is the primary source used in this study for data on the prevalence of obesity and being overweight.

Recent research suggests that more precise measures of the fat proportion of total body weight could better explain health risk exposure due to being obese.<sup>24</sup> Optimally, a state-of-the-art body composition measure that distinguishes fat from lean mass—and also identifies the location of fat on the body (abdominal fat poses greater risk for several health conditions)—would aid our ability to determine the relative risk for varied disease categories. Among national data sources, the NHANES has the most sophisticated measures. It uses dual-energy X-ray absorptiometry as well as measured height and weight to calculate BMI, providing a valid and reliable measure of health risks attributable to obesity, especially at values above 35.<sup>25</sup>

Table 4 in the Appendix presents a breakdown of the U.S. population by age and gender in 2014, using data from the U.S. Census Bureau. The NHANES sampling frame is based on census data but does not include military personnel or institutionalized populations such as

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prison inmates. In 2014, the U.S. population measured by the NHANES sampling frame was 311.2 million, compared to 318.9 million estimated by the Census Bureau.<sup>26</sup> Applying the NHANES-measured rates of obesity and overweight to the full population, Tables 5 and 6 in the Appendix show the percentages and absolute numbers for obesity in 2014. The numbers are also shown in Figure 3, below.



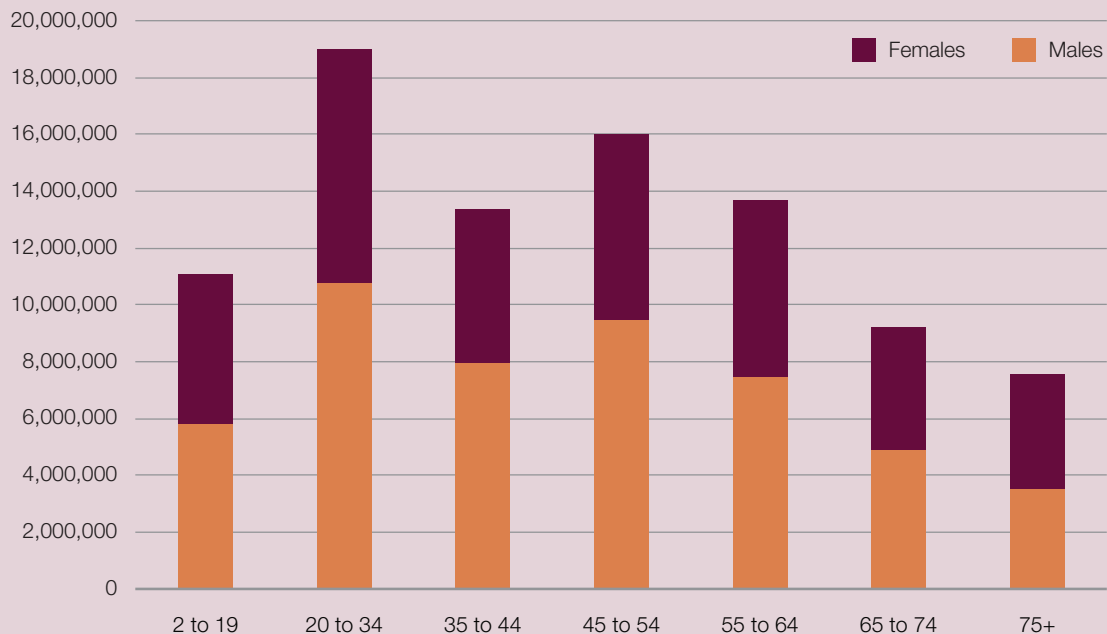
Sources: National Health and Nutrition Examination Survey (NHANES), U.S. Census Bureau.

In sum, there were 98.7 million U.S. residents with obesity in 2014, and another 89.9 million were overweight. In all, 188.6 million people, or 60.7 percent of the population age 2 and over, were either obese or overweight. Among the population age 20 and over, the prevalence of obesity was 36.4 percent, and an additional 33.3 percent were overweight. These results from the NHANES are comparable with other estimates from the literature.<sup>27, 28</sup>

Tables 7 and 8 in the Appendix show the percentages and absolute numbers of individuals who were overweight in 2014, by age and gender, also shown in Figure 4, below.<sup>31, 32, 33</sup>



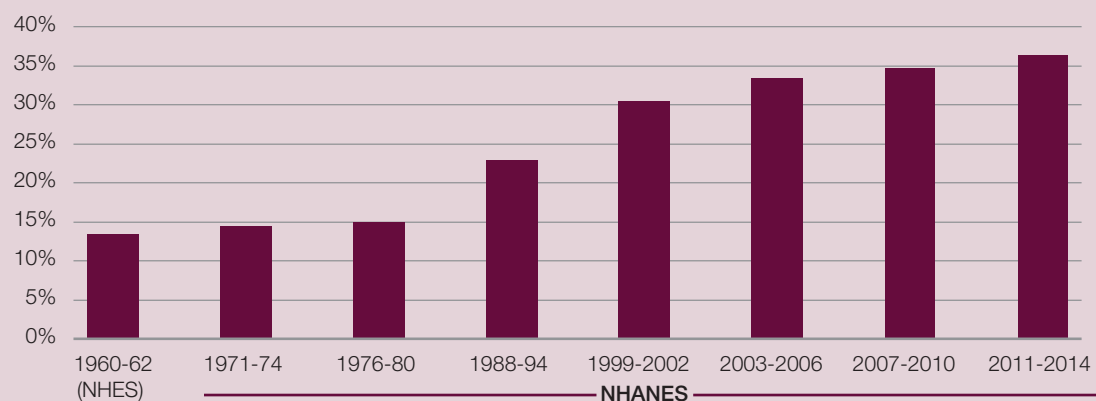
**Figure 4. Number of Overweight People, by Age and Gender, 2014<sup>34, 35</sup>**



Sources: NHANES, U.S. Census Bureau.

With these data included, Figure 5, below, shows the trends in adult obesity rates since 1962.<sup>36</sup> The rate was 13.4 percent at that time and has risen steadily.

**Figure 5. Adult Obesity Rates, 1962-2014**



Sources: Data for 1960-1962 are from the National Health Examination Survey (NHES). Data for 1971-2014 are from NHANES.



## Weighing Down America

Obesity has been rising in virtually all Organization for Economic Cooperation and Development (OECD) countries over the past two decades, but the U.S. has been a leader for quite some time. By 1991, based on OECD data, the U.S. already had the highest obesity rate among member countries at 23.3 percent; by 2008, the figure had jumped to 33.8 percent.<sup>37</sup> In 2013, adult obesity was 35.3 percent in the U.S. based on the OECD measure, but Mexico was rapidly closing the gap, with obesity at 32.4 percent.<sup>38</sup> New Zealand, Hungary, Australia, Canada, Chile, the UK, and Ireland were not far behind. East Asian nations such as Japan and South Korea had the lowest obesity rates at 3.6 percent and 4.6 percent, respectively. However, pre-obesity rates in these nations are growing at substantially faster paces, suggesting that the obesity epidemic and its associated conditions may be coming to their shores.

Within the U.S., obesity has been spreading. As recently as 1990, fewer than 15 percent of people in every state were obese.<sup>39</sup> Now the human suffering and economic impacts of diseases caused by obesity are having a disproportionate geographic impact. Southern states were the first to cross the 15 percent threshold. By 2014, Arkansas, Mississippi, and West Virginia each had a prevalence exceeding 35 percent, and there were 19 states with an obesity prevalence between 30 and 35 percent. Twenty-three states had obesity rates between 25 and 30 percent. Just five were between 20 and 25 percent—and obesity affected 20 percent or more of the population in every state in the union.<sup>40</sup>

What has caused Americans to become so heavy? The simple answer is that we either began consuming more calories or expended fewer calories through physical activity; a more likely explanation is the combination of the two. According to the first law of thermodynamics, energy cannot be created or destroyed. In the context of obesity, the human body expresses that principle by converting energy to fat for use at another time.<sup>41</sup> Technological changes in food production have played a role in decreasing the cost of highly caloric, less nutritious foods (processed foods and sugary drinks) relative to less energy dense, but more nutritious foods. Additionally, portion sizes have grown as relative prices have declined.

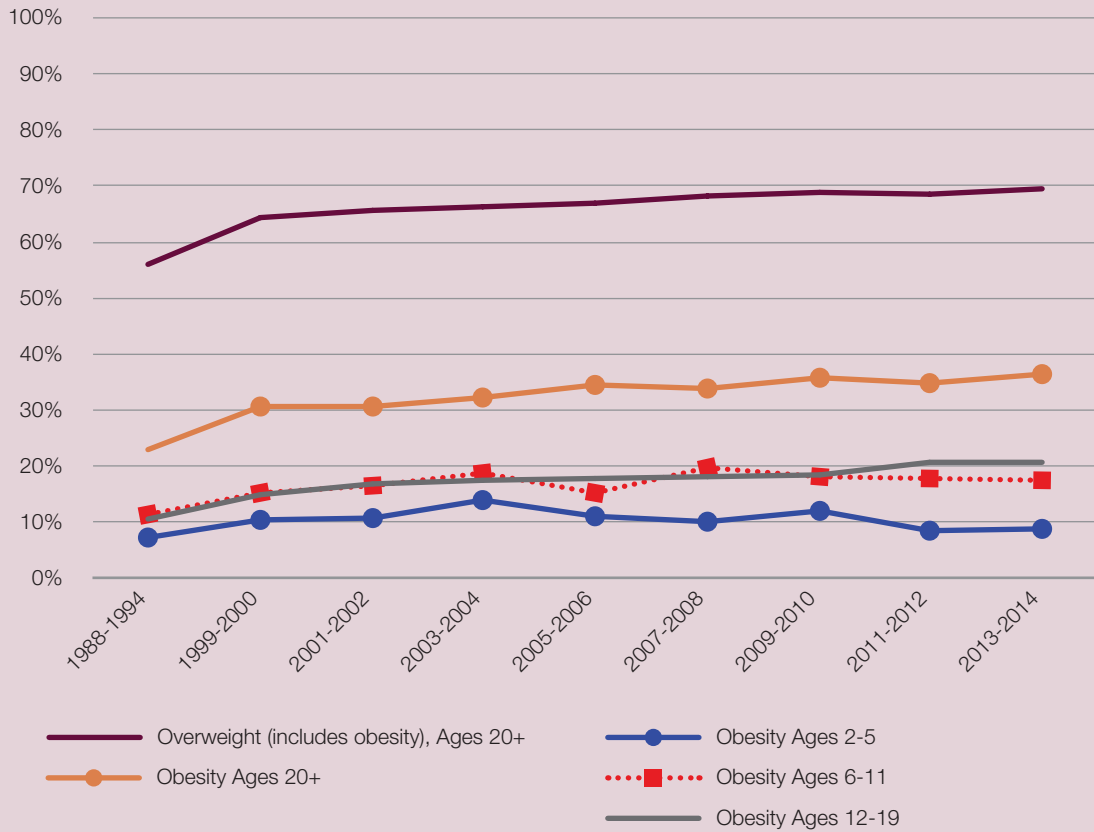
Figure 6, below, shows the increases in overweight and obesity prevalence in the U.S. since 1994. Adult Americans increased their caloric intake by nearly 300 calories per day between 1970 and 2014. The number of calories per capita provided through aggregate food supply in the U.S. increased by 19 percent from 1983 to 2000—resulting in an average dietary intake of 2,700 of calories per day in 2000. On average, Americans consumed 57 pounds more meat annually per person in 2010 than they did in the 1950s.<sup>42</sup>

In the home, the abundance of electronic devices such as TVs, computers, and videogames has resulted in more sedentary behavior and higher consumption of snack foods. In the workplace, the transition to a knowledge-based economy more reliant on services and less on physical labor, along with the substitution of labor-saving machinery, has reduced calories expended.<sup>43</sup> Americans used to be compensated for exercising, you might say—it was called “work.”

Other lifestyle changes such as the growth of two-income families have led to additional food consumption outside the home, much of it high-calorie, unhealthy fast food.



Figure 6. Overweight and Obesity Prevalence, by Age Group, 1988-2014\*



Source: NHANES.







# 3. Health Conditions Caused by Obesity

This section reviews the epidemiologic evidence linking obesity and overweight BMI to a range of diseases. The relative risks used for the calculations in our study are highlighted.

The rapid increase in the prevalence of obesity has had severe consequences for public health. 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 pro-inflammatory state.<sup>44</sup>

Extreme fat retention in the body is detrimental because fat cells networked together act effectively as an endocrine organ. Fat cells release resistin, a hormone that causes insulin resistance and type 2 diabetes. They also release another hormone, leptin, which has deleterious impacts on the cardiovascular system.<sup>45</sup> The pancreas tries to counterbalance the insulin resistance by producing even more insulin, which raises the risk of a variety of cancers.<sup>46</sup> 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.<sup>47</sup>

The higher an individual's BMI, the greater the risk for type 2 diabetes, as excess weight affects the body's ability to regulate insulin.<sup>48, 49</sup> This effect is observed independently of waist circumference.<sup>50</sup> In a study of 10,568 adults who participated in the 2010 NHANES, 18.5 percent of obese participants had diabetes, compared to 8.2 percent of those overweight and 5.4 percent of normal-weight participants. The associated relative risk for obese people is 3.43, meaning that obese individuals are 3.43 times more vulnerable to contracting diabetes than a person of normal weight.<sup>51</sup> The relative risk of type 2 diabetes related to being overweight is 1.52,<sup>52</sup> meaning that overweight people are 1.52 times more likely to contract diabetes than normal-weight individuals.

End stage renal disease (ESRD)—sometimes referred to as kidney failure—is the last stage of kidney disease and compares with 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.<sup>53</sup> This relationship has been confirmed in more recent research, with a meta-analysis showing that overweight individuals have an RR of 1.87, and those who are obese have an RR of 3.57.<sup>54</sup>

Dyslipidemia refers to an imbalance of lipids in the blood. In the U.S., most cases are hyperlipidemias—an excess of cholesterol or fat. Obese individuals have a 1.74 relative risk for dyslipidemia, compared to those of normal weight. Overweight individuals have a relative risk of 1.56.<sup>55</sup> Among the cardiovascular diseases causally tied to obesity, hypertension has

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the strongest association, and obese women face a higher risk of developing hypertension than men with the same BMI. Several studies have shown a strong link between BMI and hypertension.<sup>56, 57</sup> A systematic review and meta-analysis published in *BMC Public Health* in 2009 found the relative risks for overweight females and males to be 1.65 and 1.28, respectively. The RRs for obesity are 2.42 and 1.84.<sup>58</sup>

On average, a 1-point increase in an individual's BMI leads to a 10-percent increase in the risk of coronary heart disease (CHD).<sup>59, 60</sup> 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 RR for obese women was 2.44 (2.17 to 2.74).<sup>61</sup> A meta-analysis of 31 studies—encompassing 389,239 individuals and 20,652 CHD events—found an RR of 1.33 for those overweight and 1.69 for obese people after adjusting for age, gender, and smoking status.<sup>62</sup>

BMI is also strongly correlated with the incidence of congestive heart failure.<sup>63</sup> Analysis of the Framingham Heart Study found an RR of 2.12 for obese women and 1.90 for obese men.<sup>64</sup> A pooled meta-analysis of studies found that being overweight is associated with relative risks for CHF of 1.27 and 1.31 for women and men, respectively; obesity is associated with relative risks of 1.78 and 1.79.<sup>65</sup>

The medical community has been aware of the causal connection between obesity and various cancers since the late 1970s. An important epidemiologic study conducted in the 1970s found a strong association between obesity and cancers of the breast, colon, endometrium, gallbladder, liver, pancreas, and ovaries. Relative risks for gallbladder cancer are estimated to be 1.5 for overweight individuals and 2.0 for those who are obese.<sup>66, 67</sup> 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.<sup>68, 69</sup> Obesity is also a risk for liver cancer; the relative risk for those who are obese is estimated to be between 1.5 and 4.0.<sup>70, 71</sup>

However, awareness of the cancer connection is much lower than that of type 2 diabetes or cardiovascular disease.<sup>72</sup> For women, obesity is estrogenic and stimulates the development of breast, ovarian, and endometrial cancers. Men increase their risk by storing a greater proportion of their fat in the midsection, leading to higher incidence of kidney, gallbladder, liver, and prostate cancer.

Obesity has a double impact on women's risk for breast cancer. It has consistently been found to be associated with breast cancer, increasing the prevalence by 30 percent to 50 percent.<sup>73, 74, 75, 76, 77, 78, 79, 80</sup> A summary review published in 2004 calculated a relative risk of 1.3 for overweight women and 1.5 for obese women.<sup>81</sup> In addition, among women who have breast cancer, those who are overweight or obese have shorter survival times and worse prognoses.<sup>82, 83</sup>

Obese women have a high relative risk of ovarian cancer compared to women of normal weight—the RR of developing ovarian cancer is 1.53 for overweight women and 3.22 for those who are obese.<sup>84</sup> There is also a linear relationship between endometrial cancer risk and BMI, possibly related to an increase in circulating estrogen. The relative risk is 2.0 for overweight women and 3.5 for those who are obese.<sup>85</sup>



### 3. Health Conditions Caused by Obesity

Several studies have shown a link between obesity in men and the likelihood of developing advanced prostate cancer. Moreover, among those who do have the disease, obese men are more likely to develop advanced symptoms and to die—as well as suffer a recurrence after having a radical prostatectomy. RRs are 1.14 for overweight men and 1.05 for obese men.<sup>86, 87, 88, 89, 90, 91</sup>

Obesity and overweight have been consistently associated with the incidence of colorectal cancer, particularly in men. Relative risks are 1.20 and 1.50 for overweight and obese women, respectively, and 1.50 and 2.0 for men.<sup>92, 93, 94, 95, 96</sup> Being overweight leads to an estimated 1.55 relative risk of developing adenocarcinoma of the esophagus, while the RR for obese individuals is 2.3.<sup>97, 98, 99</sup>

The best estimates of the RR for pancreatic cancer are 1.24 and 1.28 for overweight women and men, respectively, and 1.60 and 2.29 for obese women and men.<sup>100</sup> The relative risk of developing renal cancer is estimated at 1.15 and 1.41 for overweight women and men, respectively, and 1.20 and 1.82 for obese women and men.<sup>101</sup>

Obesity can lead to inflammation of the airways in the lungs, increasing the risk of asthma and potentially the severity of asthma cases.<sup>102, 103</sup> These relationships vary by gender, with several studies showing that women have a greater risk than men.<sup>104, 105</sup> 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.<sup>106</sup> 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.<sup>107</sup> 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.<sup>108, 109</sup>

In the past decade, several studies have demonstrated a strong causal relationship between obesity on one hand and Alzheimer's and vascular dementia on the other.<sup>110</sup> 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.<sup>111, 112</sup> 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.<sup>113</sup>

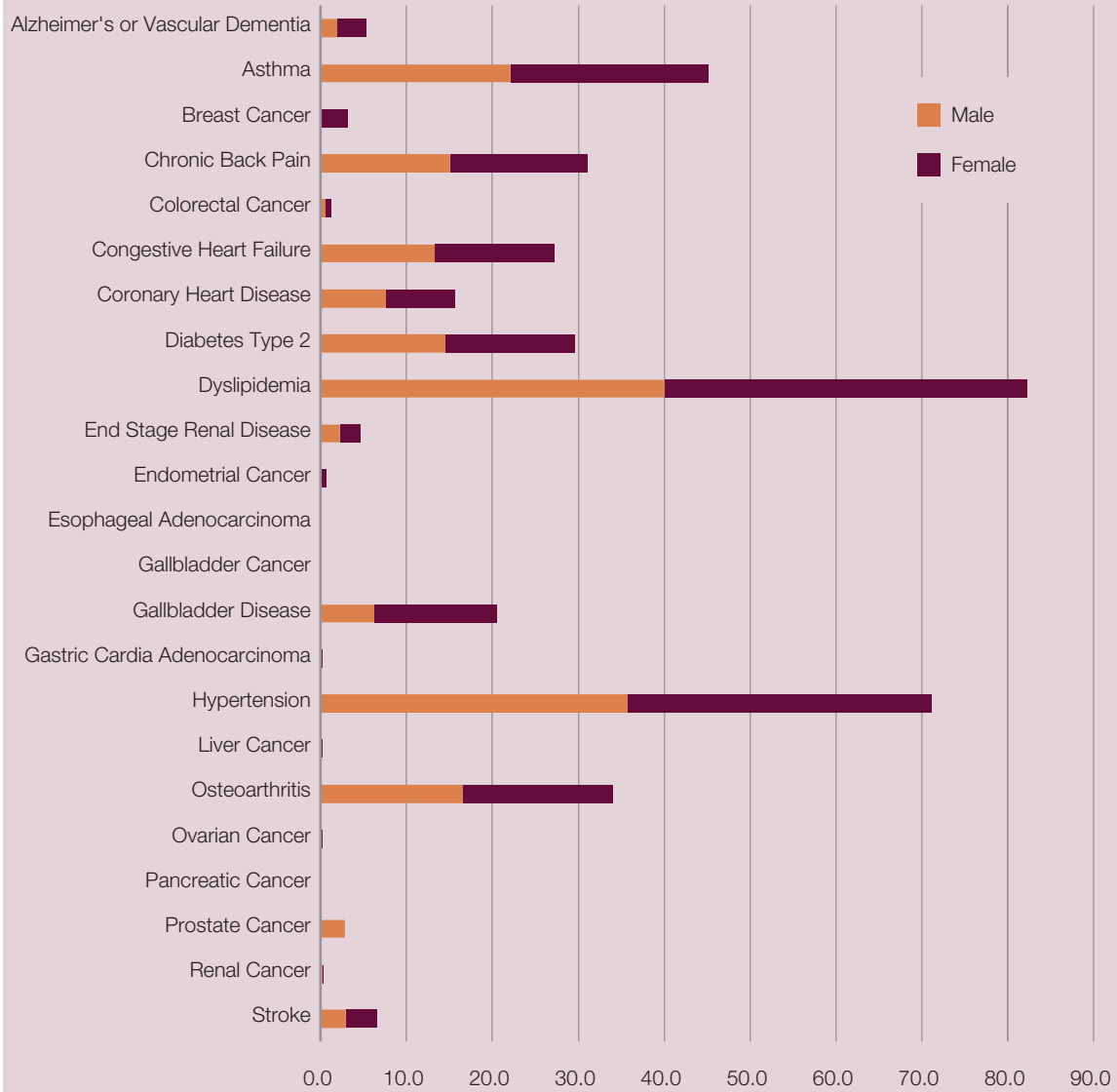
We have not included mental disorders such as depression among the conditions causally linked to obesity as there is still disagreement about the direction of linkage. There is widespread agreement that they are highly correlated, but many researchers maintain that depressed individuals may be more susceptible to obesity. Others believe the direction of causality is the opposite, stemming from the social stigma associated with obesity in addition to low self-esteem (see Section 8). In this study, we have included estimates of the cases, medical costs, and productivity impacts associated with obesity's link to depression, but we have not included these estimates in the final calculations of the economic impact of obesity.

For each disease shown to be causally associated with obesity or being overweight, Table 10 in the Appendix and Figure 7 on the next page show the number of U.S. cases in 2014—whether related to obesity or not. Data sources include the Centers for Disease Control, the National Cancer Institute (NCI), and peer-reviewed articles, as detailed in the references included in Table 10.



Weighing Down America

Figure 7. Total Cases, 2014 (Millions)



Source: Table 10.



## 4. Cases Attributable to Obesity and Being Overweight

For each condition, we identified the relative risk for individuals who are obese, defined as having a body mass index of 30 or higher, and individuals who are overweight, defined as BMI between 25 and 30, compared to people of normal weight (see Table 11 in Appendix).

We used the population attributable risk to calculate the percentage of the cases of each disease that can be causally linked to being obese or overweight. The PAR—also called etiologic fraction or just attributable risk—is the proportion of cases of a disease and associated mortality in a given population that can be considered causally related to exposure to a risk factor.<sup>114</sup> PAR is calculated as:

$$\frac{(\text{Incidence in total population}) - (\text{Incidence in unexposed group})}{(\text{Incidence in total population})}$$

In the case of chronic illnesses, prevalence is continuous—so that incidence in a given year is equal to prevalence. So as a hypothetical example, if the prevalence of a particular condition for an entire population is 20.0 percent within a given year and the prevalence among those who are *not* obese is 17.2 percent, the prevalence attributable to obesity would be:

$$\frac{(0.2 - 0.172)}{0.2} = \frac{0.028}{0.2} = 0.14 = 14.0\%$$

The PAR can also be calculated using a mathematically equivalent formula with the prevalence of the exposure to the risk factor and the relative risk (RR) for a specific condition.<sup>115, 116</sup> The formula for calculating the PAR in this way is:

$$\frac{\text{Prev. (Exposure)} * (\text{RR} - 1)}{\text{Prev. (Exposure)} * (\text{RR} - 1) + 1}$$

Using this formula, we can calculate the PAR for multiple conditions using the prevalence of overweight and obesity as the prevalence of exposure, together with the appropriate relative risks for each condition. The resulting PARs are detailed in Table 12 in the Appendix to this paper. Based on the PARs and the prevalence of each condition, it is possible to calculate the total number of cases of each condition that are in fact attributable to obesity (see Table 2 and Figure 8, below).

## Weighing Down America

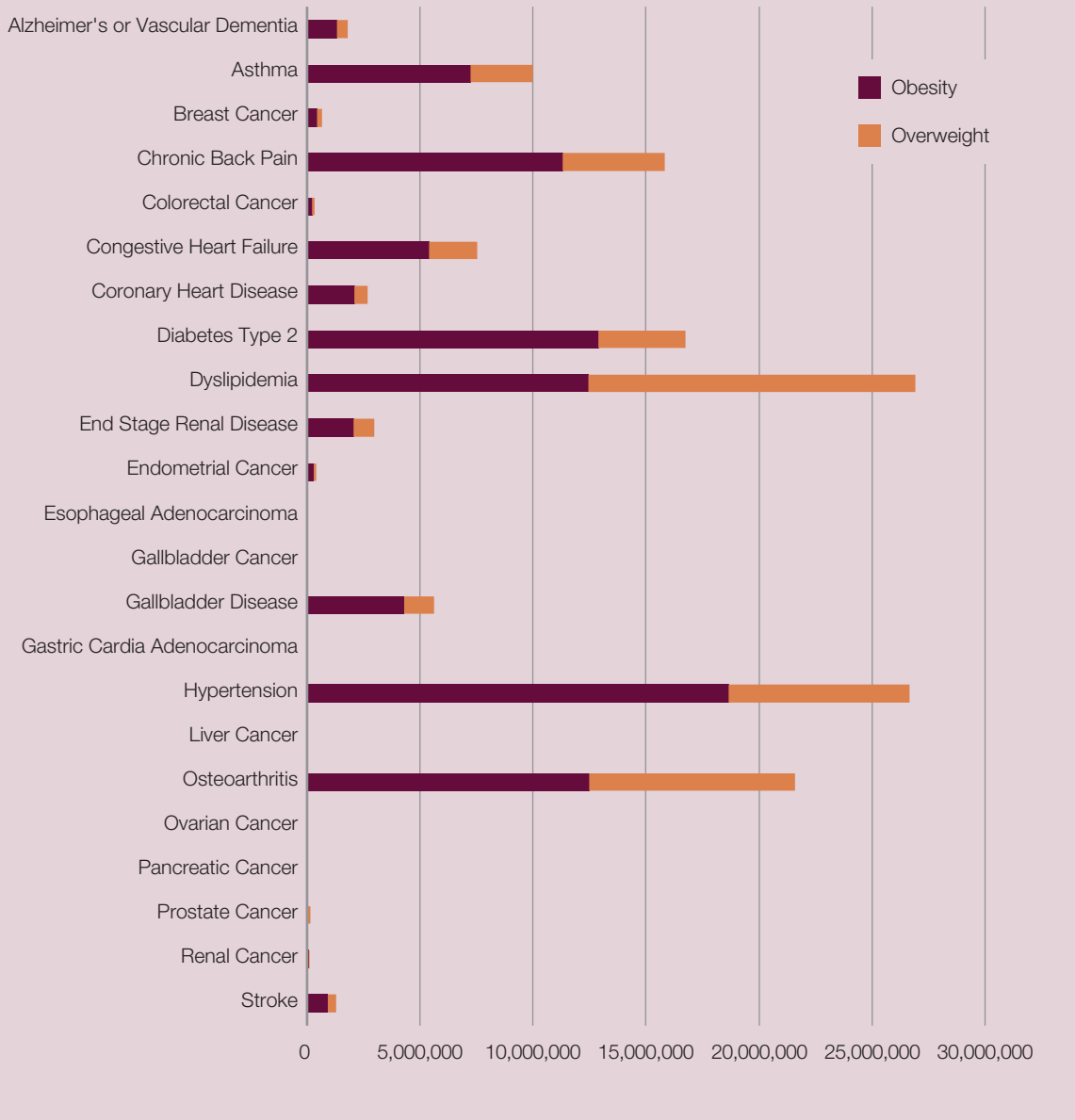
**Table 2. Cases Attributable to Obesity and Overweight, 2014**

Condition	Cases Attributable		Total Attributable Cases
	Overweight	Obese	
Alzheimer's or Vascular Dementia	487,714	1,314,891	1,802,605
Asthma	2,725,682	7,248,193	9,973,875
Breast Cancer	217,096	441,509	658,604
Chronic Back Pain	4,521,492	11,309,262	15,830,754
Colorectal Cancer	112,851	223,826	336,676
Congestive Heart Failure	2,119,708	5,418,920	7,538,628
Coronary Heart Disease	581,655	2,108,829	2,690,484
Diabetes Type 2	3,869,005	12,892,751	16,761,756
Dyslipidemia	14,447,093	12,454,143	26,901,236
End Stage Renal Disease	925,077	2,067,039	2,992,115
Endometrial Cancer	128,438	289,921	418,359
Esophageal Adenocarcinoma	5,027	10,691	15,718
Gallbladder Cancer	1,057	2,014	3,070
Gallbladder Disease	1,319,767	4,313,972	5,633,739
Gastric Cardia Adenocarcinoma	9,938	18,936	28,874
Hypertension	8,012,576	18,638,613	26,651,189
Liver Cancer	-----	7,110	7,110
Osteoarthritis	9,096,337	12,497,428	21,593,765
Ovarian Cancer	8,594	16,920	25,514
Pancreatic Cancer	3,300	10,438	13,738
Prostate Cancer	125,231	42,277	167,508
Renal Cancer	29,771	68,276	98,047
Stroke	357,041	930,957	1,287,999
<b>Totals</b>	<b>49,104,450</b>	<b>92,326,914</b>	<b>141,431,364</b>

Sources: Table 10 and Table 11.



Figure 8. Total Cases Attributable to Obesity and Overweight, by Condition, 2014



Sources: Table 10 and Table 12.

The number of cases attributable to being overweight or obese is highest for dyslipidemia, a total of 26.9 million, followed by hypertension with 26.7 million cases and osteoarthritis with 21.6 million. However, endometrial cancer has the highest total PAR, with 65.8 percent of cases attributable to obesity or overweight, followed by end stage renal disease at 65.0 percent and osteoarthritis at 63.3 percent. Type 2 diabetes had 16.8 million cases tied to high BMI, accounting for 56.5 percent of the total.





## **Weighing Down America**

There were 26.7 million cases of hypertension attributable to overweight and obesity, or 37.4 percent of total cases. High BMI levels were tied to 51.0 percent of chronic back pain cases. Obesity and overweight were responsible for 17.2 and 27.7 percent of coronary heart disease and congestive heart failure cases, respectively.

Among cancers, breast cancer had the highest number of attributable cases in 2014: 658,604, followed by endometrial cancer with 418,359 attributable cases. Colorectal cancer had the third-highest number at 336,676, with obesity and overweight accounting for 28.1 percent of all colorectal cancer cases. Of all the cancers caused by obesity and overweight, endometrial had the highest percentage of cases linked to obesity and overweight—65.8 percent—followed by esophageal adenocarcinoma at 42.9 percent and both gallbladder cancer and gastric cardia adenocarcinoma at 36.7 percent.

There were 1.8 million cases of Alzheimer's and vascular dementia attributable to overweight and obesity, equivalent to 34.0 percent of all cases. This high linkage is not well understood. Asthma had 10.0 million cases attributable to obesity and overweight, or 22.1 percent of all cases. High BMI levels are responsible for 1.3 million cases of stroke, or 19.8 percent of total cases.

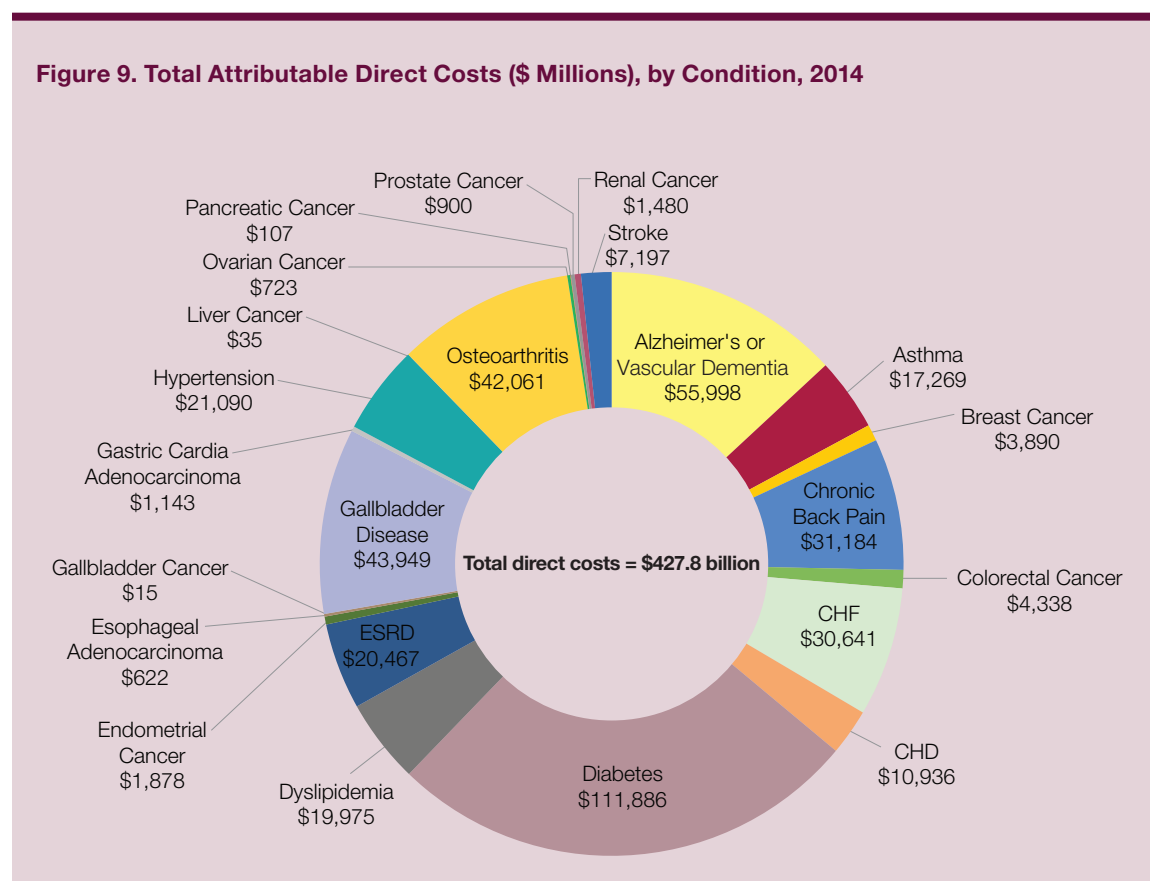


# 5. Costs

The costs of medical treatment for each condition are based on the literature and the Medical Expenditure Panel Survey (MEPS), an annual household survey conducted by the Agency for Healthcare Research and Quality (AHRQ).<sup>117</sup> Estimates from previous years are adjusted for inflation using the Consumer Price Index for medical care, as calculated by the U.S. Bureau of Labor Statistics.<sup>118</sup> Health-care expenditures are grouped by medical condition based on the MEPS classifications, which use clinical classification software (CCS), developed by the AHRQ, which categorizes medical conditions into 260 groups.<sup>119</sup>

Total direct and indirect costs for each condition are detailed in Tables 14 and 15 in the Appendix. In 2014, direct costs in the U.S. for medical treatment for health conditions causally related to obesity totaled \$427.8 billion (see Table 15 in the Appendix and Figure 9, below).

**Figure 9. Total Attributable Direct Costs (\$ Millions), by Condition, 2014**



Sources: Table 13, Table 14, Table 15.

## Weighing Down America

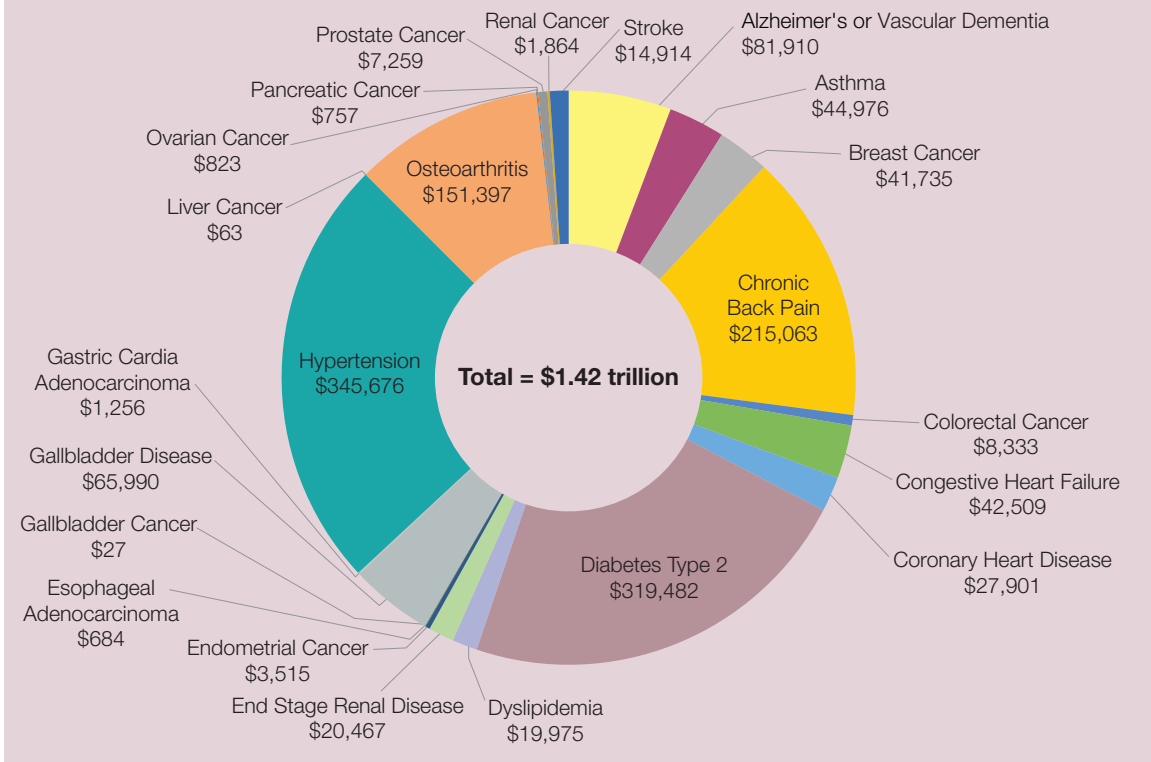
Type 2 diabetes has the highest treatment costs due to the large volume of cases and relatively expensive direct treatment costs per case of \$6,675. Total direct costs for type 2 diabetes were \$111.9 billion in 2014—26.1 percent of all health-care costs for diseases attributable to obesity and overweight. Alzheimer’s and vascular dementia had the second-highest total treatment costs at \$56.0 billion, with each case costing an average of \$31,065 annually for direct medical care. That is the third-highest annual treatment cost per year among the disease categories, following esophageal adenocarcinoma and gastric cardia adenocarcinoma at \$39,593. Dementia also has high risk factors associated with other diseases, including heart disease, and due to diminished capacity to perform the activities of daily living, those afflicted are less capable of managing other chronic diseases, which increases medical costs for those conditions as well. Gallbladder disease cases attributable to obesity and overweight accounted for \$43.9 billion in direct treatment expenditures, followed by osteoarthritis at \$42.1 billion.

In addition, the total indirect costs related to lost work time or lower productivity caused by diseases attributable to obesity and being overweight amounted to \$988.8 billion in 2014. For the majority of the conditions, we used the indirect costs per case reported by the MEPS household survey, carried out by the AHRQ. These estimates represent the cost of lost workdays due to disease, calculated as lost employee output.<sup>120</sup> However, the MEPS data used by AHRQ do not include the time costs for informal caregivers—which for some conditions, such as Alzheimer’s, can be considerable. Nor do they include the full costs of the effects of chronic disease on employee performance and output. For this reason, these estimates of indirect costs could be considered conservative. For specific conditions where reliable estimates of the reduced productivity associated with these diseases are available in the literature, we have used these estimates instead of the MEPS numbers, as detailed in Table 14.

The direct medical expenses of treating conditions caused by obesity represented 13.9 percent of health-care spending in the United States in 2014. Together, the direct and indirect costs for these conditions were \$1.42 trillion, equivalent to 8.2 percent of gross domestic product that year (Table 15 in the Appendix and Figure 10, below).<sup>121</sup>



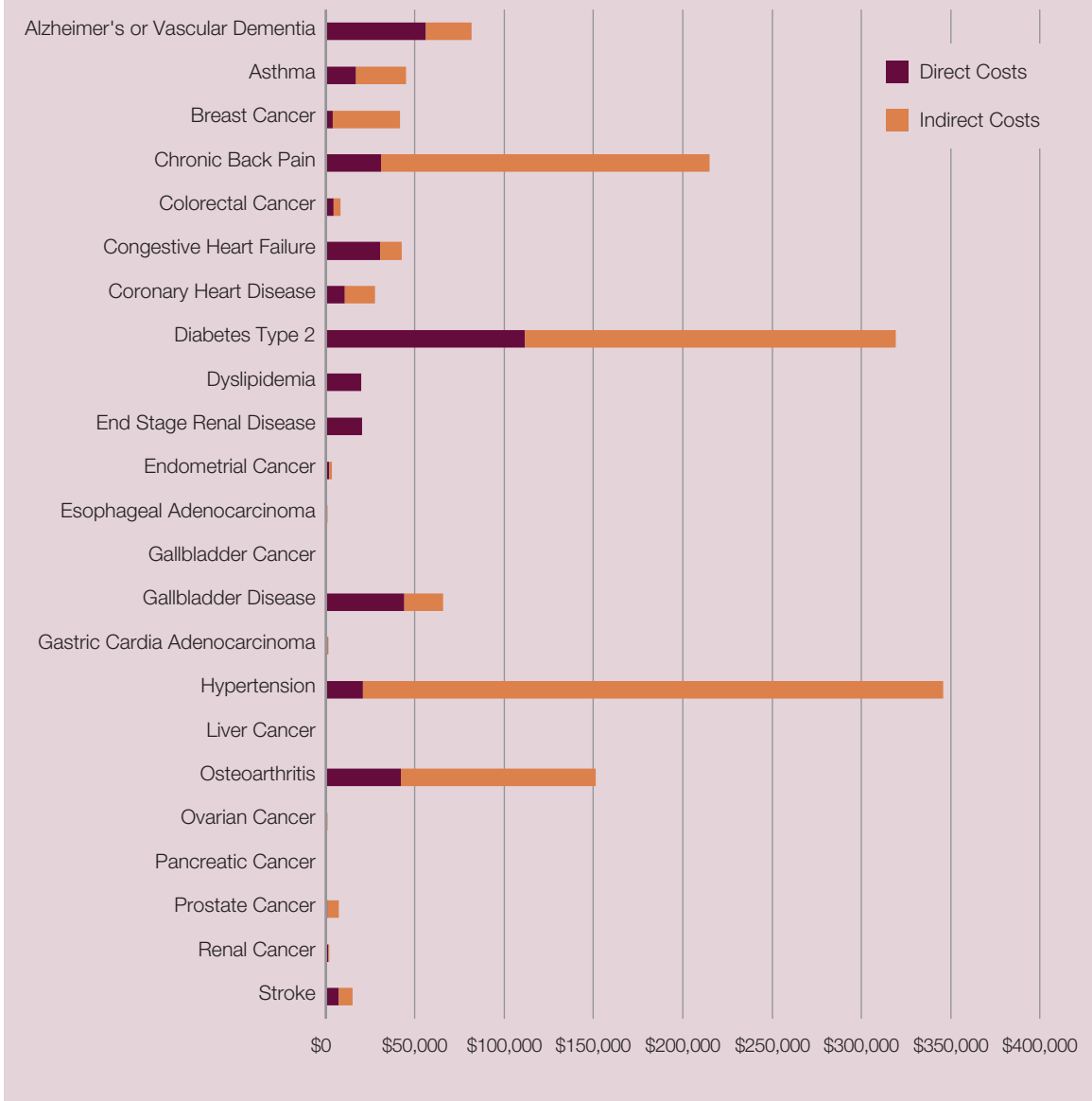
**Figure 10. Total Attributable Direct and Indirect Costs (\$ Millions), 2014**



Sources: Table 13, Table 14, Table 15.



Figure 11. Costs Attributable to Obesity and Overweight, by Condition, 2014 (\$ Millions)



Sources: Table 13, Table 14, Table 15, Table 16.



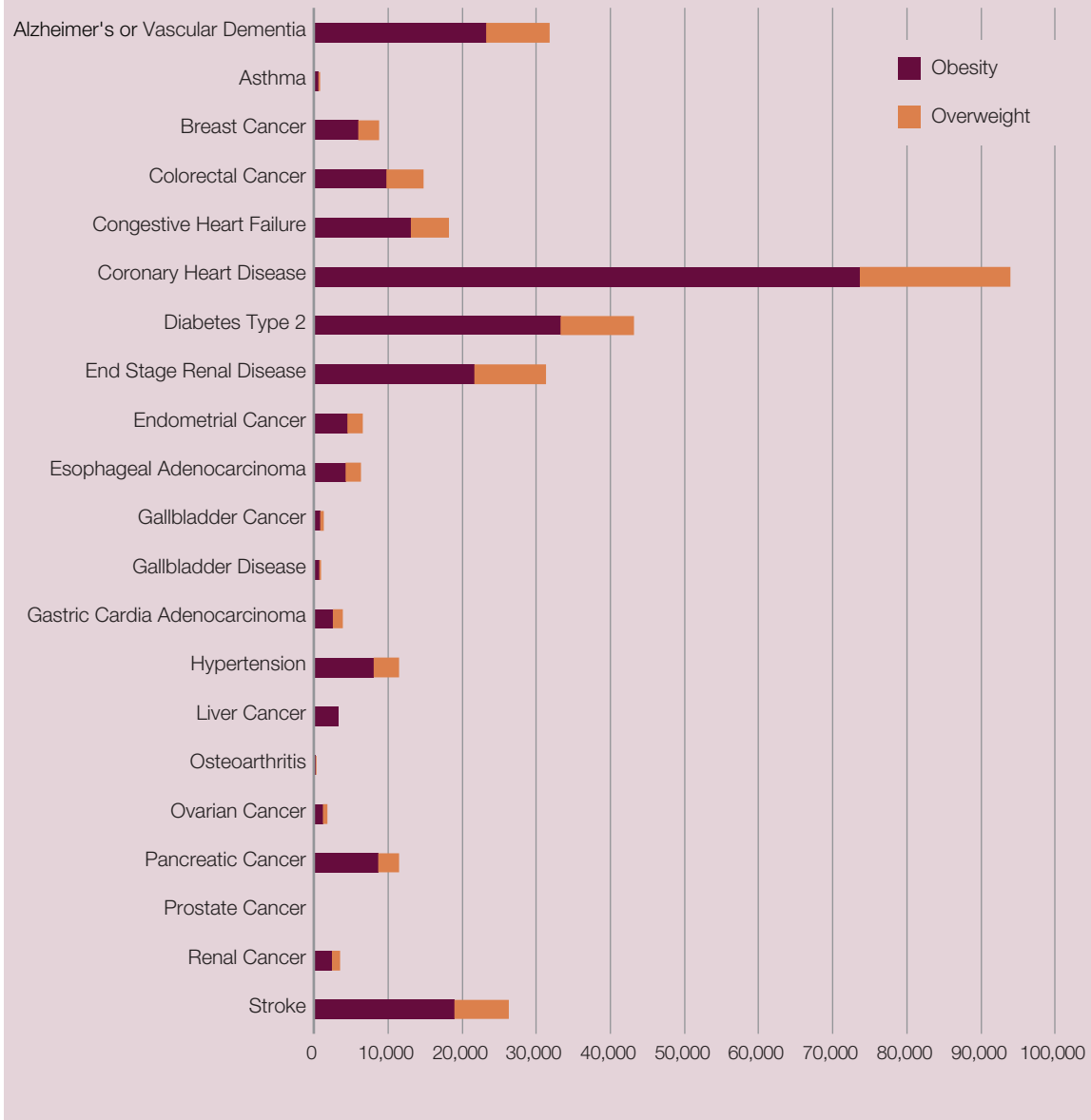
## 6. Deaths and Disability Attributable to Obesity

While direct medical expenditures are the most manifest costs of illnesses caused by obesity, they are by no means the only costs. These illnesses also take their tolls in lost productivity and premature mortality. A 2011 study using data from the National Health Interview Survey found that the hazard rate for all-cause mortality among young adults was 1.07 for overweight and 1.41 for obesity—meaning that at any given age obese individuals are on average 1.41 times more likely to die than those who are not obese.<sup>122</sup>

It is not clear whether being overweight—but not obese—carries a significant risk for premature mortality.<sup>123, 124</sup> One systematic review including 2.9 million people and more than 270,000 deaths found that individuals who were overweight but not obese were less likely to die than those of normal weight, with a hazard rate of 0.94 (95 percent confidence interval 0.91 - 0.96).<sup>125</sup> However, in a meta-analysis covering 1.46 million white adults with an average follow-up period of 10 years, hazard ratios for all-cause mortality were 1.11 and 1.29 for overweight and obese women, respectively, and 1.09 and 1.38 for overweight and obese men.<sup>126</sup> A separate review of 36 studies found that the overall relative risk for mortality associated with an elevated BMI level was 1.24.<sup>127</sup>

We calculated the deaths for each condition attributable to obesity and being overweight by applying the population attributable risk for each condition related to obesity and being overweight. The National Center for Health Statistics (NCHS) maintains mortality data for a wide range of conditions,<sup>128</sup> which we supplemented with data from the published literature (see Table 16 in the Appendix).<sup>129</sup>

Figure 12. Deaths Attributable to Obesity and Overweight, by Condition, 2014



Source: National Center for Health Statistics (NCHS).

Despite the well-established literature quantifying the monetary value of premature mortality, assigning such a value to human life is a controversial task,<sup>130, 131, 132, 133</sup> and there is considerable variation among studies in the value assigned. The value of life is most commonly calculated using quality of life estimates and wage premiums for risky jobs.

The values used among studies commonly cited in the literature range from \$3.3 million to \$7.1 million per life.<sup>134</sup> A review of 29 cost-benefit studies found that the mean value given to a human life in these studies was \$4.2 million.<sup>135</sup> A separate review of 21 studies found a range of \$3.1 million to \$13.7 million.<sup>136</sup> Most of these studies base the value of life on



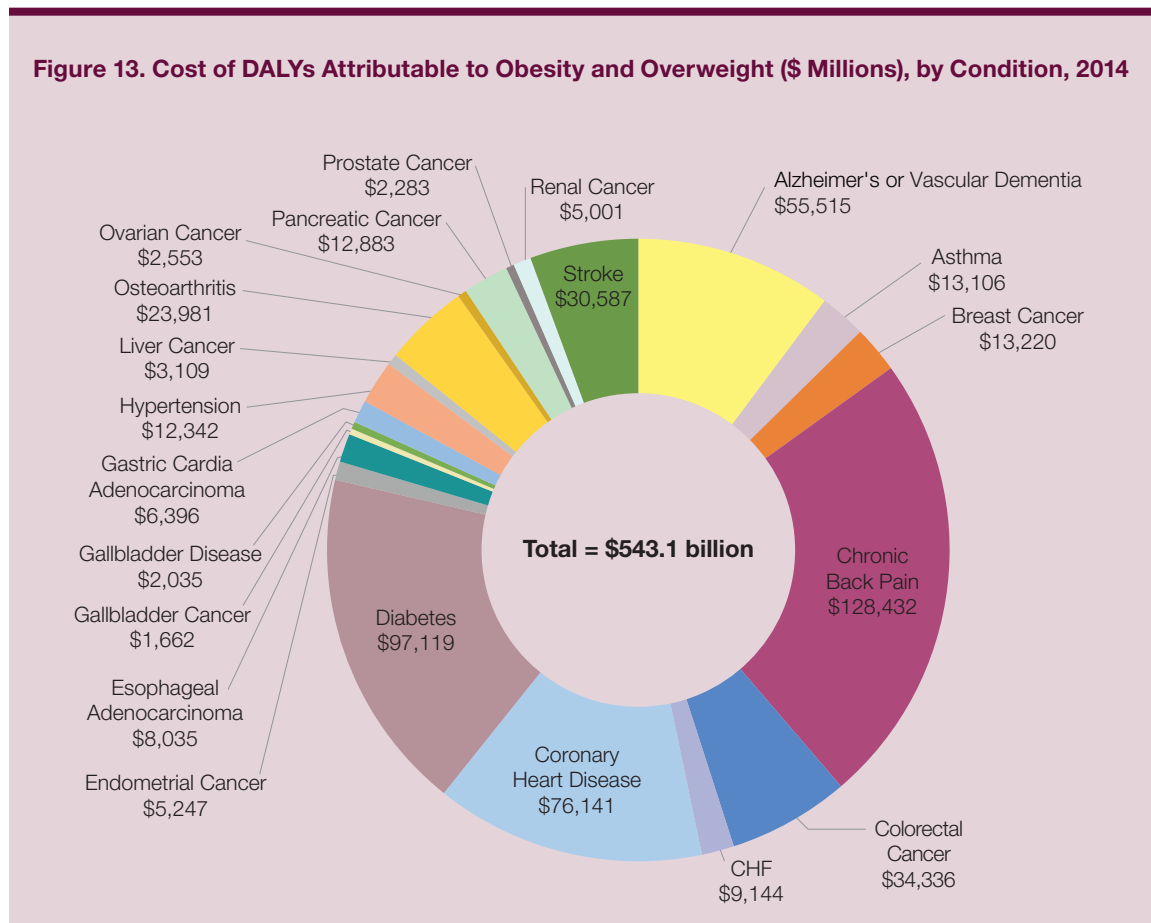
## 6. Deaths and Disability Attributable to Obesity

lost productivity. A different approach—using wage-risk tradeoffs—places the value of a life between \$4 million and \$9.4 million.<sup>137</sup>

In addition to mortality resulting from conditions related to obesity, there are productivity losses to individuals and society as a whole due to disability caused by the same conditions. Disability-adjusted life years, or DALYs, combine years lost due to premature mortality with partial years lost due to reduced productivity. DALYs are an aggregate measure of the total impact that a particular disease or condition has on a population level.

DALYs are calculated as the sum of years of life lost (YLLs) and years lost due to disability (YLDs), with weights assigned for disability depending on the severity of the condition. The weights, which range from 0 (perfect health) to 1 (equivalent to death), are determined by the World Health Organization.<sup>138</sup> YLLs and YLDs are discounted by 3 percent annually so that the values of future healthy years, YLLs, and YLDs are worth less than the values that apply to the present year.<sup>139</sup>

Appendix Table 17 shows the total burden of disease, measured in DALYs, attributable to the effects of obesity and being overweight, calculated using the U.S. per-capita GDP in 2014: \$54,407. The total DALYs attributable to obesity represent an economic burden of \$543.1 billion in 2014 (see Table 17 and Figure 13, below). This figure does not include future productivity losses related to deaths and disability in 2014.



Sources: World Health Organization (WHO), Institute for Health Metrics and Evaluation (IHME), U.S. Census Bureau, World Bank.





### **Weighing Down America**

Chronic back pain caused by obesity was responsible for \$128.4 billion in DALYs in 2014, first among disease categories due to the large productivity losses accompanying the condition. It was followed by diabetes, which was responsible for \$97.1 billion in DALY losses. DALYs attributable to coronary heart disease were the third-highest, representing \$76.1 billion in lost value in 2014. This originates from the high mortality rate at a fairly young age associated with CHD. Fourth was Alzheimer's and vascular dementia, which accounted for \$55.5 billion lost in DALYs. Colorectal cancer was responsible for \$34.3 billion lost in DALYs. Stroke was next, with \$30.6 billion.



## 7. A Case Study of Obesity and Diabetes

The increase in type 2 diabetes in the United States during the last 50 years has been dramatic—reflecting broad changes in people’s diets, exercise, and physical activity. In 1962, 1.91 million individuals had diabetes, equivalent to 1.1 percent of the population. In 1994, 7.74 million people, or 3 percent of the population, had the disease. The CDC estimates that in 2012, 9.3 percent of the U.S. population had diabetes—that’s 29.1 million people.<sup>140</sup> Of these, 8.1 million were undiagnosed.<sup>141</sup> Diabetes has become one of the most prevalent and expensive diseases confronting the nation.

These changes are closely linked with rising obesity levels. Historical data allow us to measure the public health and economic impacts associated with the diabetes epidemic and tease out the role of obesity. In 1962, the National Health Examination Survey (NHES) found that 13.4 percent of U.S. adults ages 20 to 74 were obese and an additional 31.5 percent were overweight. In 1994, the corresponding numbers, as measured by NHANES, were 22.9 percent and 33.1 percent.<sup>142</sup> In 2014, 36.4 percent of the U.S. population ages 20-plus were obese, and another 33.3 percent were overweight.

Using the established relative diabetes risks for people who are obese and overweight—3.43 and 1.52, respectively<sup>143</sup>—it is possible to calculate the corresponding population attributable risks, or PARS, which measure the proportion of the disease burden attributable to a particular risk factor. For obesity, these PARs were 0.25 in 1962, 0.36 in 1994, and 0.44 in 2014. For overweight, the corresponding PARs were 0.14, 0.15, and 0.13 (Table 3).

## Weighing Down America

**Table 3. Costs of Diabetes Attributable to Obesity and Overweight, 1962-2014**

	1962	1994	2014
Source of Prevalence Data for Obesity and Overweight	NHIS	NHANES	NHANES
Source of Prevalence Data for Diabetes	NHIS	NHIS	NHIS
Population Measured	Adults 20-74	Adults 20+	Adults 20+
Prevalence of Obesity	13.4%	22.9%	36.4%
Prevalence of Overweight	31.5%	33.1%	33.3%
Obesity RR for Diabetes	3.43	3.43	3.43
Overweight RR for Diabetes	1.52	1.52	1.30
Obesity PAR for Diabetes	0.25	0.36	0.44
Overweight PAR for Diabetes	0.14	0.15	0.13
Prevalence of Diabetes (millions)	1.91	7.74	29.65
Cases Attributable to Obesity	469,165	2,767,209	12,899,362
Cases Attributable to Overweight	268,825	1,136,581	3,869,005
Total Cases Attributable to Obesity and Overweight	737,989	3,903,790	16,768,367
Direct Health Spending per Case (in 2014 \$)	N/A	\$3,006	\$6,675
Direct Health Spending Attributable to Obesity and Overweight (in 2014 \$ Billions)	< \$1	\$11.7	\$111.9

Sources: NHANES, National Health Interview Survey (NHIS), Medical Expenditure Panel Survey (MEPS), Table 5, Table 7, Table 11, Table 12, Table 14.

The results show 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, after accounting for inflation by converting to 2014 dollars. In addition, the indirect productivity costs of diabetes attributable to obesity and overweight totaled \$207.6 billion in 2014.



## 8. Obesity and Depression

The 2009-2012 NHANES found that 7.6 percent of the U.S. population ages 12 and over suffered from depression, defined as moderate or severe depressive symptoms within the past two weeks.<sup>144</sup> There is a clear correlation between obesity and depression: Obese individuals are more likely to be depressed. But the direction of causality between obesity and depression is not always clear. The correlation could result from obese individuals being more likely to be depressed, but it could stem from depressed individuals being more likely to be obese.<sup>145, 146, 147</sup> It has also been shown that for individuals with diabetes, obesity can increase the severity of depression.<sup>148, 149, 150, 151</sup>

The 2006 Behavioral Risk Factor Surveillance System, with a sample size of more than 215,000, found that obese adults are significantly more likely to have depression than non-obese adults—on average 1.6 times more likely.<sup>152</sup> Based on this relative risk of 1.6 and the prevalence of depression of 4.6 percent, the resulting PAR of depression among adults attributable to obesity is 0.121.

In 2009, 17.6 million adults in the U.S. were treated for depression. Adjusting these numbers for population growth suggests that 18.4 million adults were treated for depression in 2014. After applying the PAR for obesity, 2.2 million cases of adult depression in 2014 can be attributed to obesity. Direct medical spending to treat the condition averaged \$3,540 per case in 2010, as measured by the MEPS, equivalent to \$3,969 in 2014 currency after adjusting for inflation.<sup>153</sup> Multiplying this figure by the affected population, spending to treat depression in 2014 totaled \$8.7 billion, most of which went to drug prescriptions and doctor visits.

A separate study found that the total economic burden of depression was \$210.5 billion in the U.S. in 2010—of which 45 percent was attributable to health care, 50 percent to reduced productivity, and 5 percent to suicide.<sup>154</sup> Adjusting for medical inflation and applying the PAR for obesity, 0.121, to this number results in total costs of \$28.6 billion attributable to obesity, consisting of \$12.9 billion in direct health-care costs and \$15.7 billion in indirect costs. In sum, the direct costs of treating depression caused by obesity are estimated to be between \$8.7 billion and \$12.9 billion, with an additional \$15.7 billion in indirect costs. Because of uncertainty concerning the direction of causality in the obesity-depression relationship, we have not included these costs in our overall assessment of obesity's economic impact.



# 9. Conclusions and Recommendations

This study finds substantial costs associated with obesity in the United States. In 2014, total direct costs for medical treatment for health conditions causally related to obesity and being overweight totaled \$427.8 billion. Indirect costs related to lost work time and lower productivity amounted to \$988.8 billion. Together, the direct and indirect costs for these conditions were \$1.42 trillion, equivalent to 8.2 percent of the U.S. gross domestic product. In addition, there were more than 320,000 deaths attributable to obesity and being overweight. The total DALYs attributable to obesity in 2014 represented an economic burden of \$543.1 billion in 2014.

Such economic losses are preventable. For example, a recent review of interventions designed to reduce obesity concluded that for individuals with BMIs of 40 or greater, a 5 percent weight reduction would save \$2,137 in medical costs annually. For those with BMIs of 35, the same percentage reduction would save \$528 in medical costs annually, and individuals starting from a BMI of 30 would save \$69.<sup>155</sup> Many argue that people have the right to behave as they choose in a free society because they harm only themselves. However, government and society at large bear much of the cost through higher insurance premiums and Medicare and Medicaid spending. The costs of obesity are not fully self-contained.

The results of this study should be used to educate the public and the private sector in the United States and inform policy related to preventing and reversing obesity. There is no magic bullet to address the obesity epidemic, as multiple factors are responsible for its spread. A single tactic will prove insufficient. We see a great need for a multifaceted, long-term commitment to advocating for healthy body weight. Employers, medical providers, insurers, biopharmaceutical firms, the food and beverage industry, governments, and communities must work together—and the individuals affected by obesity and being overweight must accept some personal responsibility to modify their behavior.

Employers should recognize that they have a vested interest in providing behavior modification counseling and offering financial and other incentives to employees and their families to lose weight. Public health groups should be engaged at the community level to raise awareness about the scourge of obesity. The federal government should launch and support an anti-obesity campaign through the media and other means, similar to the anti-smoking campaign launched in the 1970s. Greater clarity should be brought to the reimbursement rules for health practitioners who provide weight-loss advice and counseling. More research on the most cost-effective obesity interventions is necessary.

If we fail to alter the trajectory we are on, then higher medical costs, lost work time and productivity, unnecessary premature death, and slower long-term economic growth will weigh down America.



# Appendix

## Additional Tables

**Table 4. U.S. Population, by Age and Sex, 2014<sup>156</sup>**

Age Range	Male	Female	Total
<2 years	4,041,110	3,869,363	7,910,473
2 to 5	8,158,085	7,813,183	15,971,268
6 to 11	12,618,523	12,097,075	24,715,598
12 to 19	17,151,681	16,386,582	33,538,263
20 to 34	33,709,641	32,719,037	66,428,678
35 to 44	20,159,229	20,353,904	40,513,133
45 to 54	21,425,044	22,033,807	43,458,851
55 to 64	19,321,882	20,755,699	40,077,581
65 to 74	12,349,045	14,049,245	26,398,290
75+	8,002,247	11,842,674	19,844,921
<b>Totals</b>	<b>156,936,487</b>	<b>161,920,569</b>	<b>318,857,056</b>

Source: U.S. Census Bureau.

**Table 5. Prevalence of Obesity by Age and Sex, 2011-2014<sup>157</sup>**

Age Range	Male	Female	Total
<2 years	----**	----**	----**
2 to 5	8.6%	9.2%	8.9%
6 to 11	17.6%	17.5%	17.6%
12 to 19	20.1%	21.0%	20.5%
20 to 34	28.5%	33.4%	30.9%
35 to 44	39.8%	39.1%	39.4%
45 to 54	36.6%	41.7%	39.2%
55 to 64	38.1%	44.4%	41.4%
65 to 74	36.2%	40.7%	38.6%
75+	26.8%	30.5%	29.0%
<b>Totals</b>	<b>30.0%</b>	<b>33.5%</b>	<b>31.7%</b>

\*\*Not included in NHANES estimates.

Source: NHANES.



## Weighing Down America

**Table 6. Number of Obese People, by Age and Sex, 2014<sup>158</sup>**

Age Range	Male	Female	Total
<2 years	----	----	----
2 to 5	701,595	718,813	1,420,408
6 to 11	2,220,860	2,116,988	4,337,848
12 to 19	3,447,488	3,441,182	6,888,670
20 to 34	9,607,248	10,928,158	20,535,406
35 to 44	8,023,373	7,958,376	15,981,750
45 to 54	7,841,566	9,188,098	17,029,664
55 to 64	7,361,637	9,215,530	16,577,167
65 to 74	4,470,354	5,718,043	10,188,397
75+	2,144,602	3,612,016	5,756,618
<b>Totals</b>	<b>45,818,724</b>	<b>52,897,204</b>	<b>98,715,928</b>

\*\*Not included in NHANES estimates.

Sources: U.S. Census Bureau, NHANES.

**Table 7. Prevalence of Overweight, by Age and Sex, 2011-2014<sup>159</sup>**

Age Range	Male	Female	Total
<2 years	----	----	----
2 to 19	15.4%	14.5%	15.0%
20 to 34	31.9%	25.1%	28.6%
35 to 44	39.5%	26.5%	33.0%
45 to 54	44.2%	29.7%	36.8%
55 to 64	38.6%	29.9%	34.1%
65 to 74	39.9%	30.5%	34.9%
75+	44.2%	34.1%	38.2%
<b>Totals (ages 2+)</b>	<b>32.7%</b>	<b>25.3%</b>	<b>28.9%</b>

\*\*Not included in NHANES estimates.

Source: NHANES.



**Table 8. Number of Overweight People, by Age and Sex, 2014<sup>160</sup>**

Age Range	Male	Female	Total
<2 years	----**	----**	----**
2 to 19	5,840,957	5,263,042	11,103,998
20 to 34	10,753,375	8,212,478	18,965,854
35 to 44	7,962,895	5,393,785	13,356,680
45 to 54	9,469,869	6,544,041	16,013,910
55 to 64	7,458,246	6,205,954	13,664,200
65 to 74	4,927,269	4,285,020	9,212,289
75+	3,536,993	4,038,352	7,575,345
<b>Totals</b>	<b>49,949,605</b>	<b>39,942,671</b>	<b>89,892,276</b>

Sources: U.S. Census Bureau, NHANES.

**Table 9. Adults with Overweight, Obesity, and Grade 3 Obesity (BMI  $\geq$  40)<sup>161, 162</sup>**

Years	Overweight, not Obese	Obese	BMI $\geq$ 40
1960-62 (NHES)	31.5%	13.4%	0.9%
1971-74	32.3%	14.5%	1.3%
1976-80	32.1%	15.0%	1.4%
1988-94	33.1%	22.9%	2.9%
1999-2002	34.7%	30.4%	4.9%
2003-2006	33.3%	33.4%	5.4%
2007-2010	34.4%	34.7%	6.0%
2011-2014	33.3%	36.4%	6.9%

Source: NHANES.



## Weighing Down America

**Table 10. Total Prevalence of Conditions Associated with Obesity, 2014**

Condition	Male	Female	Total	References
Alzheimer's or Vascular Dementia	1,974,510	3,325,490	5,300,000	a
Asthma	22,099,000	23,001,000	45,100,000	b, c
Breast Cancer	-----	3,077,381	3,077,381	d
Chronic Back Pain	15,060,689	15,949,822	31,010,510	e
Colorectal Cancer	593,413	602,753	1,196,166	f
Congestive Heart Failure	13,317,648	13,861,225	27,178,873	g, h, i, j
Coronary Heart Disease	7,662,160	7,974,901	15,637,061	g, h, i, j
Diabetes Type 2	14,595,093	15,058,613	29,653,706	k
Dyslipidemia	39,983,235	42,183,367	82,166,602	l
End Stage Renal Disease	2,255,820	2,347,895	4,603,715	m
Endometrial Cancer	-----	636,096	636,096	n
Esophageal Adenocarcinoma	28,456	8,159	36,615	o
Gallbladder Cancer	2,058	6,303	8,360	p
Gallbladder Disease	6,300,000	14,200,000	20,500,000	q, r
Gastric Cardia Adenocarcinoma	45,000	33,620	78,619	s
Hypertension	35,805,882	35,383,660	71,189,542	t
Liver Cancer	36,903	15,013	51,916	u
Osteoarthritis	16,590,059	17,502,949	34,093,008	v, w, x, y
Ovarian Cancer	-----	197,301	197,301	z
Pancreatic Cancer	23,314	23,453	46,767	aa
Prostate Cancer	2,860,732	-----	2,860,732	bb
Renal Cancer	228,895	155,789	384,684	cc
Stroke	2,965,526	3,552,901	6,518,427	dd, ee, ff

References: a<sup>163</sup>, b<sup>164</sup>, c<sup>165</sup>, d<sup>166</sup>, e<sup>167</sup>, f<sup>168</sup>, g<sup>169</sup>, h<sup>170</sup>, i<sup>171</sup>, j<sup>172</sup>, k<sup>173</sup>, l<sup>174</sup>, m<sup>175</sup>, n<sup>176</sup>, o<sup>177</sup>, p<sup>178</sup>, q<sup>179</sup>, s<sup>180</sup>, t<sup>181</sup>, u<sup>182</sup>, v<sup>183</sup>, w<sup>184</sup>, x<sup>185</sup>, y<sup>186</sup>, z<sup>187</sup>, aa<sup>188</sup>, bb<sup>189</sup>, cc<sup>190</sup>, dd<sup>191</sup>, ee<sup>192</sup>, ff<sup>193</sup>



Table 11. Relative Risks for Overweight and Obesity

Condition	Relative Risk		References
	Overweight	Obese	
Alzheimer's or Vascular Dementia	1.35	2.04	a
Asthma	1.23	1.61	d
Breast Cancer	1.30	1.50	b, c, g, j, m, n
Chronic Back Pain	1.59	2.81	d
Colorectal Cancer	1.35	1.75	b, c, g, n
Congestive Heart Failure	1.29	1.78	d
Coronary Heart Disease	1.33	1.69	r
Diabetes Type 2	1.52	3.43	q
Dyslipidemia	1.74	1.56	q
End Stage Renal Disease	1.87	3.57	f
Endometrial Cancer	2.00	3.50	g
Esophageal Adenocarcinoma	1.55	2.30	b, g, h
Gallbladder Cancer	1.50	2.00	b, g
Gallbladder Disease	1.27	1.88	b, g
Gastric Cardia Adenocarcinoma	1.50	2.00	b, g
Hypertension	1.47	2.13	d
Liver Cancer	-----	1.50	b, g
Osteoarthritis	2.28	3.08	d
Ovarian Cancer	1.53	3.22	d
Pancreatic Cancer	1.26	1.94	d
Prostate Cancer	1.14	1.05	d
Renal Cancer	1.28	1.51	d
Stroke	1.22	1.64	l, o, p

References: a<sup>194</sup>, b<sup>195</sup>, c<sup>196</sup>, d<sup>197</sup>, e<sup>198</sup>, f<sup>199</sup>, g<sup>200</sup>, h<sup>201</sup>, i<sup>202</sup>, j<sup>203</sup>, k<sup>204</sup>, l<sup>205</sup>, m<sup>206</sup>, n<sup>207</sup>, o<sup>208</sup>, p<sup>209</sup>, q<sup>210</sup>, r<sup>211</sup>



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**Table 12. Population Attributable Risks**

Condition	Summary PAR	
	Overweight	Obese
Alzheimer's or Vascular Dementia	0.092	0.248
Asthma	0.060	0.161
Breast Cancer	0.071	0.143
Chronic Back Pain	0.146	0.365
Colorectal Cancer	0.094	0.187
Congestive Heart Failure	0.078	0.199
Coronary Heart Disease	0.037	0.135
Diabetes Type 2	0.130	0.435
Dyslipidemia	0.176	0.152
End Stage Renal Disease	0.201	0.449
Endometrial Cancer	0.202	0.456
Esophageal Adenocarcinoma	0.137	0.292
Gallbladder Cancer	0.126	0.241
Gallbladder Disease	0.064	0.210
Gastric Cardia Adenocarcinoma	0.126	0.241
Hypertension	0.113	0.262
Liver Cancer	-----	0.137
Osteoarthritis	0.267	0.367
Ovarian Cancer	0.044	0.086
Pancreatic Cancer	0.071	0.223
Prostate Cancer	0.044	0.015
Renal Cancer	0.077	0.177
Stroke	0.055	0.143

Sources: Calculated from Table 5, Table 7, and Table 11.



**Table 13. Cases Attributable to Obesity and Overweight, 2014**

Condition	Cases Attributable		Total
	Overweight	Obese	
Alzheimer's or Vascular Dementia	487,714	1,314,891	1,802,605
Asthma	2,725,682	7,248,193	9,973,875
Breast Cancer	217,096	441,509	658,604
Chronic Back Pain	4,521,492	11,309,262	15,830,754
Colorectal Cancer	112,851	223,826	336,676
Congestive Heart Failure	2,119,708	5,418,920	7,538,628
Coronary Heart Disease	581,655	2,108,829	2,690,484
Diabetes Type 2	3,869,005	12,892,751	16,761,756
Dyslipidemia	14,447,093	12,454,143	26,901,236
End Stage Renal Disease	925,077	2,067,039	2,992,115
Endometrial Cancer	128,438	289,921	418,359
Esophageal Adenocarcinoma	5,027	10,691	15,718
Gallbladder Cancer	1,057	2,014	3,070
Gallbladder Disease	1,319,767	4,313,972	5,633,739
Gastric Cardia Adenocarcinoma	9,938	18,936	28,874
Hypertension	8,012,576	18,638,613	26,651,189
Liver Cancer	-----	7,110	7,110
Osteoarthritis	9,096,337	12,497,428	21,593,765
Ovarian Cancer	8,594	16,920	25,514
Pancreatic Cancer	3,300	10,438	13,738
Prostate Cancer	125,231	42,277	167,508
Renal Cancer	29,771	68,276	98,047
Stroke	357,041	930,957	1,287,999
<b>Totals</b>	<b>49,104,450</b>	<b>92,326,914</b>	<b>141,931,364</b>

Sources: Calculated from Table 10 and Table 12.



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**Table 14. Costs per Case for Each Health Condition, 2014**

Condition	Attributable Cases	Cost per Case, 2014		References
		Direct	Indirect	
Alzheimer's or Vascular Dementia	1,802,605	\$31,065	\$14,375	a, b, c, d
Asthma	9,973,875	\$1,731	\$2,778	e
Breast Cancer	658,604	\$5,907	\$57,462	f, g, h, i
Chronic Back Pain	15,830,754	\$1,970	\$11,615	j, k, l
Colorectal Cancer	336,676	\$12,885	\$11,867	f, g, l, m
Congestive Heart Failure	7,538,628	\$4,065	\$1,574	n, x
Coronary Heart Disease	2,690,484	\$4,065	\$6,306	n, x
Diabetes Type 2	16,761,756	\$6,675	\$12,385	o, p
Dyslipidemia	26,901,236	\$743	†	q, r
End Stage Renal Disease	2,992,115	\$6,840	††	s, t, u
Endometrial Cancer	418,359	\$4,490	\$3,912	f, k
Esophageal Adenocarcinoma	15,718	\$39,593	\$3,912	f, k
Gallbladder Cancer	3,070	\$4,901	\$3,912	f, k
Gallbladder Disease	5,633,739	\$7,801	\$3,912	f, k
Gastric Cardia Adenocarcinoma	28,874	\$39,593	\$3,912	f, k
Hypertension	26,651,189	\$791	\$12,179	n, q, v, w, x
Liver Cancer	7,110	\$4,901	\$3,912	f, k
Osteoarthritis	21,593,765	\$1,948	\$5,063	g, h, w
Ovarian Cancer	25,514	\$28,339	\$3,912	f, k
Pancreatic Cancer	13,738	\$7,801	\$47,281	f, m, n
Prostate Cancer	167,508	\$5,374	\$37,958	i
Renal Cancer	98,047	\$15,098	\$3,912	f, k
Stroke	1,287,999	\$5,588	\$5,991	c, e, o, v, x

† Included in heart disease, diabetes, and stroke.<sup>212</sup>

†† Included in diabetes and hypertension.

References: a<sup>213</sup>; b<sup>214</sup>; c<sup>215</sup>; d<sup>216</sup>; e<sup>217</sup>; f<sup>218</sup>; g<sup>219</sup>; h<sup>220</sup>; i<sup>221</sup>; j<sup>222</sup>; k<sup>223</sup>; l<sup>224</sup>; m<sup>225</sup>; n<sup>226</sup>; o<sup>227</sup>; p<sup>228</sup>; q<sup>229</sup>; r<sup>230</sup>; s<sup>231</sup>; t<sup>232</sup>; u<sup>233</sup>; v<sup>234</sup>; w<sup>235</sup>; x<sup>236</sup>



Table 15. Total Costs Attributable to Obesity and Overweight, 2014

Condition	Cost (in \$ Millions)		
	Direct Costs	Indirect Costs	Total
Alzheimer's or Vascular Dementia	\$55,998	\$25,912	\$81,910
Asthma	\$17,269	\$27,707	\$44,976
Breast Cancer	\$3,890	\$37,845	\$41,735
Chronic Back Pain	\$31,184	\$183,879	\$215,063
Colorectal Cancer	\$4,338	\$3,995	\$8,333
Congestive Heart Failure	\$30,641	\$11,867	\$42,509
Coronary Heart Disease	\$10,936	\$16,965	\$27,901
Diabetes Type 2	\$111,886	\$207,596	\$319,482
Dyslipidemia	\$19,975	†	\$19,975
End Stage Renal Disease	\$20,467	††	\$20,467
Endometrial Cancer	\$1,878	\$1,637	\$3,515
Esophageal Adenocarcinoma	\$622	\$61	\$684
Gallbladder Cancer	\$15	\$12	\$27
Gallbladder Disease	\$43,949	\$22,041	\$65,990
Gastric Cardia Adenocarcinoma	\$1,143	\$113	\$1,256
Hypertension	\$21,090	\$324,586	\$345,676
Liver Cancer	\$35	\$28	\$63
Osteoarthritis	\$42,061	\$109,336	\$151,397
Ovarian Cancer	\$723	\$100	\$823
Pancreatic Cancer	\$107	\$650	\$757
Prostate Cancer	\$900	\$6,358	\$7,259
Renal Cancer	\$1,480	\$384	\$1,864
Stroke	\$7,197	\$7,716	\$14,914
<b>Totals</b>	<b>\$427,787</b>	<b>\$988,789</b>	<b>\$1,416,576</b>

Sources: Calculated from Table 13 and Table 14.

† Included in heart disease, diabetes, and stroke.

†† Included in diabetes and hypertension.





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**Table 16. Deaths Attributable to Obesity and Overweight, 2014**

Condition	Total Deaths	Attributable Deaths		Deaths
		Overweight	Obese	
Alzheimer's or Vascular Dementia	93,541	8,608	23,207	31,815
Asthma	3,630	219	583	803
Breast Cancer	41,325	2,915	5,929	8,844
Chronic Back Pain	-----	-----	-----	-----
Colorectal Cancer	52,529	4,956	9,829	14,785
Congestive Heart Failure	65,466	5,106	13,053	18,158
Coronary Heart Disease	545,985	20,309	73,632	93,941
Diabetes Type 2	76,488	9,980	33,255	43,235
Dyslipidemia	†	†	†	†
End Stage Renal Disease	48,146	9,675	21,617	31,292
Endometrial Cancer	9,967	2,012	4,543	6,555
Esophageal Adenocarcinoma	14,690	2,017	4,289	6,306
Gallbladder Cancer	3,710	469	894	1,363
Gallbladder Disease	3,377	217	711	928
Gastric Cardia Adenocarcinoma	10,730	1,356	2,584	3,941
Hypertension	30,770	3,463	8,056	11,519
Liver Cancer	24,032	-----	3,291	3,291
Osteoarthritis	500	133	183	317
Ovarian Cancer	14,276	622	1,224	1,846
Pancreatic Cancer	38,996	2,752	8,704	11,455
Prostate Cancer	558	24	8	33
Renal Cancer	13,906	1,076	2,468	3,544
Stroke	133,103	7,291	19,010	26,300
<b>Totals</b>	<b>1,225,724</b>	<b>83,201</b>	<b>237,070</b>	<b>320,271</b>

Sources: NCHS, Table 12.

† Included in heart disease, diabetes, and stroke.



Table 17. DALYs Lost Due to Obesity and Overweight, 2014

Condition	DALYs Lost per 100,000 Population	Total DALYs Lost 2014	DALYs Lost to Obesity & Overweight	Cost in 2014 (\$ Millions)
Alzheimer's or Vascular Dementia	941	3,000,062	1,020,364	\$55,515
Asthma	342	1,089,216	240,880	\$13,106
Breast Cancer	356	1,135,386	242,989	\$13,220
Chronic Back Pain	1,450	4,624,065	2,360,569	\$128,432
Colorectal Cancer	703	2,242,171	631,088	\$34,336
Congestive Heart Failure	190	605,924	168,066	\$9,144
Coronary Heart Disease	2,551	8,133,693	1,399,468	\$76,141
Diabetes Type 2	990	3,157,960	1,785,037	\$97,119
Dyslipidemia	†	†	†	†
End Stage Renal Disease	546	1,740,067	1,130,930	††
Endometrial Cancer	46	146,645	96,448	\$5,247
Esophageal Adenocarcinoma	108	344,015	147,675	\$8,035
Gallbladder Cancer	26	83,158	30,541	\$1,662
Gallbladder Disease	43	136,120	37,408	\$2,035
Gastric Cardia Adenocarcinoma	100	320,101	117,561	\$6,396
Hypertension	190	605,924	226,839	\$12,342
Liver Cancer	131	417,224	57,140	\$3,109
Osteoarthritis	218	695,906	440,771	\$23,981
Ovarian Cancer	114	362,859	46,922	\$2,553
Pancreatic Cancer	253	806,103	236,794	\$12,883
Prostate Cancer	225	716,631	41,962	\$2,283
Renal Cancer	113	360,659	91,924	\$5,001
Stroke	892	2,845,193	562,192	\$30,587
<b>Totals</b>		<b>33,569,082</b>	<b>11,113,567</b>	<b>\$543,127</b>

Sources: WHO, IHME, U.S. Census Bureau, World Bank, Table 12.

† Included in heart disease, diabetes, and stroke.

†† Included in diabetes and hypertension.



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