Diabesity – Preventing, Controlling, and Reversing a Deadly Disease
C.J. Miles, MBAHCM, MSA
Research Analyst, AMAC Foundation

“Affecting all age groups and all aspects of a person’s life, Diabetes is a major public health issue worldwide, requiring lifelong behavioral and lifestyle changes and support” (Lawrence, Conrad, & Moore, 2012, p. 24). In general, Diabetes is considered an overall term for “different conditions that all display an impairment of the body’s ability to metabolize glucose” (Steven, 2014, p. 169). Even though there are multiple types of Diabetes (mainly Type 1, Type 2 and Gestational) Type 2 is the most predominant since over 90% of diabetics have Type 2 Diabetes (Lawrence et al., 2012; World Health Organization [WHO], 2013). The increased prevalence of Type 2 Diabetes is a major concern all over the world and this rise in diagnoses is theorized to be a result of the growing epidemic of obesity across the world (Kahn, Cooper, & Del Prato, 2014; Lau, 2010; Steven, 2014). Because of this relationship, the term “Diabesity” has been coined, which is the combined epidemic of Diabetes and obesity. Patients with Diabesity have a “seven-fold increase in the risk of overall mortality compared with healthy individuals” (Lau, 2010, p. S-24).

“Obesity as a risk factor for Diabetes is independent of age, race and physical activity. While epidemiologists generally hesitate to attribute causality, the link between obesity and Diabetes is very likely causal, and as such it is also likely that preventing obesity would prevent a large number of Diabetes cases” (Adler, 2002, p. S-11). Weight, body mass index (BMI), and waist circumference (including waist-to-hip ratio) have all been identified as independent risk factors for developing Type 2 Diabetes (Lau, 2010; Siram, Yanagisawa, & Skamagas, 2010). In approximately 90% of patients in Western countries, weight gain is closely linked to Type 2 Diabetes (Adler, 2002; Lau, 2010). Furthermore, in a United States epidemiological study with more than 100,000 individuals, those with a BMI over 25 compared with those with a BMI of less than 22, had a 30-40 times increased risk of developing Type 2 Diabetes. Therefore, it is theorized that since being overweight increases the risk of Diabetes, then reducing weight should decrease the risk of getting Type 2 Diabetes (Adler, 2002).

The following paper discusses Type 2 Diabetes in detail, including what happens to the body when someone has the disease. The increasing prevalence of Diabetes is also reviewed in
addition to the comorbidity issues that diabetes need to be aware of. With the high occurrences of Diabesity and extreme comorbidity issues, many studies will be examined showing how reducing weight is a viable solution to preventing, controlling, and reversing both Type 2 Diabetes and Pre-Diabetes. Finally, there will be a treatment analysis discussed for both practitioners and patients.

**The Statistics – Diabesity around the World**

Diabetes and obesity (Diabesity) are considered to be closely interrelated health issues threatening the lives of millions and adding to global healthcare costs (Lau, 2010; Steven, 2014; Taylor, 2013). As comorbid issues, Diabesity is threatening to engulf healthcare systems across the world (Kahn et al., 2014; Lau, 2010; Steven, 2014). Currently, there is an estimated 347 million cases of Diabetes in the world (Kahn et al., 2014; Steven, 2014; WHO, 2013). The Centers for Disease Control and Prevention estimated that in 2010 about 1.9 million new cases of Diabetes were diagnosed in people ages 20 or older. They also estimate that, in 2010, 25.8 million people in the United States, or 8.3% of the population, have Diabetes, and of these, 7 million are undiagnosed (Centers for Disease Control and Prevention [CDC], 2011). Both the World Health Organization and the American Diabetes Association indicate that 90% or more of Diabetes cases are Type 2 (Lawrence et al., 2012; WHO, 2013). Furthermore, the CDC estimated that 79 million adults in the United States had Pre-Diabetes, a precursor to Type 2 Diabetes, in 2010. If these trends continue, it is estimated that one out of every three US adults will have Type 2 Diabetes by the year 2050 (Centers for Disease Control and Prevention [CDC], 2011; Lawrence et al., 2012). *See Appendix Figure 1 for a graphic illustration of the increased prevalence of Diabetes over the last 30 years.*

**Obesity Epidemic**

A major reason for the increase in Type 2 diagnoses is due to the growing epidemic of obesity that is occurring all over the world in countries both rich and poor (Rodriguez-Hernandez, Simental-Mendia, Rodriguez-Ramirez, & Reyes-Romero, 2013). For example, “the prevalence of being overweight in Type 2 Diabetes is over 90%” as compared to the general population (Adler, 2002, p. S-11). According to the World Health Organization, about 1.4 billion adults were overweight in 2005, which includes at least 400 million of them classified as obese (Lau, 2010). In 2011, an estimated 1.5 billion adults were overweight with 500 million classified
as obese (Rodriguez-Hernandez et al., 2013) and these numbers are expected to rise to 2.3 billion overweight, including 700 million obese by 2015 (Lau, 2010).

Other countries are experiencing this issue, as well. For instance, “the prevalence of obesity or combined overweight and obesity has increased particularly in Brazil, Canada, Mexico, and the United States” (Rodriguez-Hernandez et al., 2013, p. 1). In Canada, obesity as measured by height and weight (i.e. body mass index) has almost doubled in the last 20 years and now affects about 23% of the population (Rodriguez-Hernandez et al., 2013). In addition, the UK is nearing the obesity levels of America where half of women and two thirds of men were considered to be overweight in the early 2000s (Adler, 2002).

**Effects on Age Groups**

The rate of Diabetes is also increasing in age groups that previously were not considered high risk, presumably due to the increase in overweight children, adolescents, and teenagers. Statistics show that in the US alone, 20% of childhood Diabetes cases are Type 2 (Adler, 2002) and currently about one in every 400 children and adolescents have Type 2 Diabetes (Lawrence et al., 2012). In the past, this age group was typically only affected by Type 1 Diabetes. In addition, in the United States the largest diagnosis growth rate has been in the age group of 30-39, which used to be rarely diagnosed with Diabetes (Adler, 2002).

The reason why the recent high rates of diagnoses in the younger age categories are especially alarming is because age is a risk factor for Type 2 Diabetes. For example, approximately one third of diabetics in the United States are seniors age 65 or older (Lawrence et al., 2012) and over 25% of those 60 and older, or 10.9 million Americans, have Diabetes, with the vast majority having Type 2. This is because every year almost 400,000 elderly Americans are diagnosed with the disease. Furthermore, in addition to these diabetics, an additional 50% of this age group has Pre-Diabetes (Haas, 2014).

**Financial Implications**

The complications associated with Type 2 Diabetes are costly to the entire healthcare system. If efforts are not taken to address the causes and treatment of Type 2 Diabetes and Pre-Diabetes, the outcomes will remain a major financial burden for future decades to come (Kahn et al., 2014; Lawrence et al., 2012). On average, medical expenses are two to three times as much for a diabetic as they are for a person without Diabetes (CDC, 2011; WHO, 2013). The total cost of Diabetes in the United States was $174 billion in 2007 (CDC, 2011; Lawrence et al., 2012;
Taylor, 2013), which includes direct medical costs of $116 billion and indirect medical costs of $58 billion (indirect medical costs include costs related to disability, work loss, and premature death) (CDC, 2011; Lawrence et al., 2012). Diabetes-related healthcare expenses for the 65+ age group reached $65 billion in 2007 and this group mainly uses Medicare for their primary insurance (Lawrence et al., 2012). Diabetes costs are not just affecting the United States. For example, in the UK, Type 2 Diabetes accounts for 10% of the nation’s health expenditures, which is the equivalent of approximately £1 million per hour (or about $1.68 million per hour) (Taylor, 2013). “Even if only a small portion of patients with Type 2 Diabetes return to normal glucose control, the savings in disease burden and economic cost will be enormous” (Taylor, 2013, p. 1052).

**Understanding Diabetes**

Diabetes is a disease that occurs because the body has a shortage of insulin because it either does not produce enough of it or because it cannot use the insulin it does produce effectively. Insulin is a hormone produced by the pancreas with the purpose of regulating blood sugar (glucose) by converting it to energy. When a person has Diabetes and it is not controlled, glucose and fats will remain in the blood. Over time, this will damage vital organs (CDC, 2011; WHO, 2013).

There are three major types of Diabetes, which are Type 1, Type 2, and Gestational. Type 1 Diabetes was previously known as insulin-dependent, juvenile, or childhood-onset Diabetes; however, it can occur at any age and some children are now being diagnosed with Type 2. A person with Type 1 Diabetes if the body lacks sufficient insulin production, which in turn causes the auto-immune system to destroy pancreatic cells. It is speculated that Type 1 is caused by genetic, environmental, or other factors. Unfortunately, to date, there are no known ways of preventing or reversing the disease. Therefore, patients are required to rely on insulin for survival. Gestational Diabetes, on the other hand, is very similar to Type 2 except that the onset occurs during pregnancy and typically resolves after delivery. In addition, diagnosis is different because it usually occurs during prenatal exams instead of with blood tests. Women with Gestational Diabetes need to be cautious because hyperglycemia during pregnancy can be harmful to the fetus, thus making glucose control very important. In addition, women with this issue need to be careful after pregnancy because they are at risk for developing Type 2 Diabetes later in life (CDC, 2011; Lawrence et al., 2012; WHO, 2013).
As previously mentioned, Type 2 Diabetes accounts for approximately 90% of all Diabetes cases. Type 1 Diabetes accounts for approximately 5-10% and Gestational Diabetes accounts for around 2-5% of the diabetic population (CDC, 2011; Lawrence et al., 2012; WHO, 2013). There are also a very small number (less than 5%) of the diabetic population that has other types of Diabetes that result from a specific genetic condition (i.e. maturity-onset Diabetes of youth), surgery, medications, infections, pancreatic disease, and other illnesses (CDC, 2011; Lawrence et al., 2012). The focus of this discussion is on Type 2 Diabetes since it encompasses the significant majority of diabetics, which is millions of people worldwide, and it is a preventable and reversible disease.

**Pre-Diabetes**

Even though Pre-Diabetes is not necessarily a “type” of Diabetes, it is a significant issue because it is a precursor to Type 2 Diabetes. Pre-diabetics have blood glucose levels that are higher than normal, but not quite high enough to be classified as full blown Diabetes; therefore, people who have Pre-Diabetes have a high risk of developing Type 2 Diabetes (CDC, 2011; Lawrence et al., 2012). See Appendix Figure 2 for the blood glucose levels that are used to diagnose Pre-Diabetes versus Diabetes. Because of the nature of Pre-Diabetes, preventive measures and treatments are the same as with Type 2 Diabetes. Medication is typically a last resort for Type 2 since it is reversible with lifestyle changes; therefore, medication is even less likely with Pre-Diabetes since it has not yet fully progressed.

“Impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) are intermediate conditions in the transition between normality and Diabetes” (WHO, 2013, para. 15). IGT and IFG are just clinical terms for the commonly known phrase “Pre-Diabetes”. If impaired glucose tolerance is present, then there is already insulin resistance occurring within the individual (Kahn et al., 2014; Steven, 2014). In Pre-Diabetes, normal plasma glucose levels are obtained through an increase in raised plasma insulin levels, which creates an environment for hepatic (liver) fat accumulation. Excess fat in the liver is present in pre-diabetic individuals. In Type 2 diabetics, liver fat is exceptionally high (Taylor, 2013).

It is extremely important for diagnosis to occur as early as possible because damage to the heart and circulatory system can occur as early as the Pre-Diabetes phase. In addition, if diagnosis and treatment does not occur, Pre-Diabetes will result in Type 2 Diabetes in 10 years or less. Early diagnosis is still a concern, which is why data shows that half of diabetics already
have complications by the time they are diagnosed (Lawrence et al., 2012). If early diagnosis does occur, interventions that focus on diet and exercise have shown a reduction in the risk of Pre-Diabetes progressing to Type 2 Diabetes (Steven, 2014).

**Type II Diabetes Mellitus**

Unlike Type 1 Diabetes where the body does not produce enough insulin, Type 2 Diabetes Mellitus, or just Type 2 Diabetes, occurs when the body does not process insulin production correctly (CDC, 2011; Lawrence et al., 2012; WHO, 2013). The symptoms of both Type 1 and Type 2 include increased thirst (polydipsia), constant hunger, increased urination (polyuria), weight loss, vision changes such as blurred vision, extreme fatigue, and an increase in infections (Lawrence et al., 2012; WHO, 2013). However, Type 2 symptoms are not as noticeable, especially in the beginning; therefore, the disease can be easily missed until complications occur (WHO, 2013). Therefore, it is especially important for providers to conduct regular blood sugar screenings, particularly with patients that have risk factors, such as being overweight. If common signs and symptoms are present, both Type 2 Diabetes and Pre-Diabetes can be diagnosed using a fasting blood glucose sample. Otherwise, two separate glucose readings are generally needed for diagnosis (Lawrence et al., 2012).

“Type 2 Diabetes can be understood as a potentially reversible metabolic state precipitated by the single cause of chronic excess intra-organ fat” (Taylor, 2013, p. 1047). In the past, patients with early-onset Diabetes did not respond well to insulin and showed defects in the ability of islet beta cells to respond to pancreatic secretions of insulin. Therefore, insulin resistance was thought to be the main abnormality of Type 2 Diabetes. Insulin insensitivity was assumed to be a contributing factor of the liver producing an increased amount of glucose, as well as a decreased uptake of glucose in muscle and fat tissue. As a result, it was thought that the inability to secrete insulin was due to a late manifestation of the disease. However, more recent research shows that some of these related abnormalities are deemed to be attributed to adiposity (body fat around the organs), especially within the intra-abdominal cavity (Kahn et al., 2014). *See Appendix Figure 3 for an illustration of the related bodily organs.* Intra-organ adipose (fat) deposits are a characteristic of excess body fat. Liver, heart, and muscle cells are the most affected by excess intra-organ fat deposits. As a person’s body fat increases, so does their intra-organ fat deposits, which in turn makes them more susceptible to metabolic syndrome and
Diabetes (Wallace, 2010). Therefore, a reduction in body fat will reduce intra-organ fat deposits and lead to a lowered risk of Diabetes, and possibly even reversal to a normal metabolic state.

More recent theories on the etiology of Diabetes have changes with the discovery of the feedback loop within the body’s beta cells and insulin-sensitive tissues (Kahn et al., 2014):

A feedback loop operates to ensure integration of glucose homoeostasis and maintenance of glucose concentration in a narrow range. This feedback loop relies on crosstalk between beta cells and insulin-sensitive tissues. Insulin released in response to beta-cell stimulation mediates uptake of glucose, amino acids, and fatty acids by insulin-sensitive tissues. In turn, these tissues feed back information to islet cells about their need for insulin….If insulin resistance is present, as often happens in people with obesity, beta cells increase insulin output to maintain normal glucose tolerance. However, if beta cells are incapable of this task, plasma concentrations of glucose increase. (p. 1068).

During a state of insulin resistance, the beta-cell feedback function increases insulin output so as to maintain normal glucose tolerance. However, when beta-cells are not capable of increasing insulin output because of insulin resistance, glucose concentrations increase, which results in impaired glucose tolerance. Subsequently, beta-cell dysfunction progresses, thus elevating glycemia and eventually leading to Diabetes. Unfortunately, there is a reduction in the number of beta cells and a reduction in beta-cell mass with Type 2 Diabetes (Kahn et al., 2014). See Appendix Figures 4 and 5 for an illustration of diabetic beta cells and the beta-cell functioning process. “Histological studies of the pancreas in Type 2 Diabetes consistently show an average 50% reduction in number of beta cells compared with normal subjects [and] beta-cell loss appears to increase as duration of Diabetes increases (Taylor, 2013, p. 1050). Therefore, preservation of beta cells is important to maintain or improve glucose tolerance (Kahn et al., 2014; Taylor, 2013). According to Taylor (2013), it could be possible to restore the number of beta cells, even in the later stages of the disease if Diabetes is reversed. “Beta-cell number following reversal of Type 2 Diabetes remains to be examined, but overall, it is clear that at least a critical mass of beta cells is not permanently damaged but merely metabolically inhibited” (p. 1050).

Systemic inflammation is also a common characteristic and risk factor of obesity. Furthermore, it is linked to insulin sensitivity and beta-cell dysfunction, which can subsequently result in the onset of Diabetes (Kahn et al., 2014; O’Rourke, 2009; Rodriguez-Hernandez et al.,
Inflammation is also associated with metabolic syndrome, which is also called insulin resistance syndrome (O’Rourke, 2009; Rodriguez-Hernandez et al., 2013). “The metabolic syndrome is characterized as the presence of three or more of the following features: obesity, hyperglycemia, hypertension, low HDL cholesterol levels, and/or hypertriglyceridemia [(high triglycerides)]” (Rodriguez-Hernandez et al., 2013, p. 3). Rodriguez-Hernandez and colleagues (2013) report that there are higher concentrations of inflammatory cytokines in obese patients than in lean patients. In addition, the main source of these inflammatory cytokines is the adipose tissue. Furthermore, “several studies have shown that subclinical inflammation…predicts the development of Diabetes” (p. 4).

**Co-Morbidity and Mortality**

Comorbidity, which is a major issue for diabetics, can be defined as the presence of an additional disease or condition with reference to an initial diagnosis (in this case Diabetes) that affects the individual’s ability to function and survive (“Comorbidity”, 2013). As the number of Diabetes cases continue to grow, so does the concern about mortality and complications associated with the disease. Type 2 Diabetes is associated with many complications and premature mortality (Adler, 2002; Lau, 2010; Lawrence et al., 2012). In fact, it could be said that “the burden of Diabetes relates not so much to its associated metabolic derangements, but rather to the complications associated with the disease” (Adler, 2002, p. S-12).

One of the major and most recognized comorbidity issues associated with Diabetes is obesity. The health issues of patients with “Diabesity” are multiplied as compared to patients who have only Diabetes or only obesity. In addition, both health problems cause similar comorbid issues and obesity can lead to Diabetes. See Appendix Figure 6 for a graphic illustration of the relationship between Diabetes and obesity. Obesity is not only a risk factor for Diabetes, but it is also a risk factor for elevated triglycerides, decreased HDL cholesterol, hypertension, and a larger waist circumference with increased intra-organ abdominal adiposity (Siram et al., 2010). The EURODIAB epidemiological study involving over 3,000 diabetic patients confirmed that an increase in waist to hip ratio increased those risks (Adler, 2002). Therefore, “Diabesity” as a comorbid condition multiplies the risks of cardiovascular disease, microvascular disease, and even death (Siram et al., 2010).

Diabetics are at risk for many serious illnesses. The most common are high blood sugar (hyperglycemia) and high blood pressure (hypertension). However, other very serious
complications can also occur, including cardiovascular disease, heart attack, stroke, diabetic neuropathy, peripheral arterial disease (PAD), limb amputations, diabetic retinopathy, blindness, kidney disease, kidney failure, and non-alcoholic fatty liver disease (NAFLD) (Adler, 2002; CDC, 2011; Lawrence et al., 2012; Rodriguez-Hernandez et al., 2013; Steven, 2014; WHO, 2013). Literature shows that Diabetes is the leading cause of adult-onset blindness, kidney failure requiring dialysis or transplantation, and lower limb amputations not related to injuries (CDC, 2011; Lawrence et al., 2012).

“Type 2 Diabetes is associated with increased risk of cardiovascular mortality and morbidity” (Steven, 2014, p. 170). Diabetic patients have up to a five-fold increase in developing heart disease as compared to their non-diabetic counterparts. The greatest heart-related morbidity issues for diabetics are stroke and ischemic heart disease. This is because “increased glucose levels help contribute to atherosclerosis and increase the likelihood of macro-cardiovascular events” (Lawrence et al., 2012, pp. 23-24).

Diabetic neuropathy is when a rise in glucose levels result in nerve damage. Combined with reduced blood flow, neuropathy in the feet increases the chance of foot and leg ulcers and infections. This can be especially devastating because it can result in foot and lower leg amputations (Lawrence et al., 2012; WHO, 2013). Peripheral arterial disease (PAD) results from the narrowing of blood vessels. Symptoms include intermittent aches, pains, and discomfort while walking or exercising, but disappears while resting. PAD can also lead to lower limb amputations. Amputations occur in approximately 15% of diabetics and are more common in older patients (Lawrence et al., 2012).

Elevated blood glucose levels can also lead to diabetic retinopathy, which is a common microvascular complication. It is a slow process where the blood vessels in the eye are exposed to continuously high blood glucose levels, which results in an obstruction of blood flow. This causes ischemic areas in the eyes that induce production of new capillaries that can hemorrhage. The entire process can eventually result in eye complications or even complete vision loss (Lawrence et al., 2012). In fact, retinopathy is the cause of 10,000 new cases of blindness every year (Lawrence et al., 2012) and 1% of global blindness is attributed to Diabetes (WHO, 2013).

In addition to retinopathy, prolonged exposure to increased glucose levels can also cause proteinuria, which is the presence of proteins in the urine. As comorbid issues, proteinuria and hypertension combined cause the regulation of blood flow through the glomerulus of the kidney
to be lost, which subsequently leads to microalbuminuria, kidney disease, and kidney failure (Lawrence et al., 2012; “Proteinuria”, 2013). Furthermore, obesity is also an independent risk factor for microalbuminuria, which is an early indication of Diabetes-related kidney disorder for both Type 1 and Type 2 Diabetes (Adler, 2002).

Non-alcoholic fatty liver disease (NAFLD) is another complication that can be caused by both Diabetes and obesity. NAFLD occurs because liver inflammation can be induced by the metabolically active intra-abdominal fat that is associated with a high body mass index (BMI) and waist circumference. NAFLD occurs in about 14-21% of “normal” patients; however, the prevalence rate is as high as 70% in diabetic patients and 90-95% in obese patients (Rodriguez-Hernandez et al., 2013).

Because of all these issues and associated comorbidities, the overall mortality rates related to Diabetes is disturbing:

- “In 2004, an estimated 3.4 million people died from consequences of fasting high blood sugar. A similar number of deaths has been estimated for 2010” (WHO, 2013, para. 7).
- “Diabetes was the seventh leading cause of death listed on US death certificates in 2007” (CDC, 2011, p. 2).
- Diabetics have at least twice as much risk of death as non-diabetics of the same age (CDC, 2011; Lawrence et al., 2012; WHO, 2013).
- “Patients with both Diabetes and obesity have a seven-fold increase in the risk of overall mortality compared with healthy individuals” (Lau, 2010, p. S-24).
- “Patients who are diagnosed at a younger age have an increased risk of premature death than those of the same age without the disease” (Lawrence et al., 2012, p. 23).
- “Diabetes decreases a person’s life expectancy by up to 15 years” (Lawrence et al., 2012, p. 21).

**Literature Review: Decades of Proven Success**

As explained previously, beta-cell dysfunction does have a clear genetic component in the development of Type 2 Diabetes; however, environment plays an essential role. “Interaction of genes that affect body adiposity with environmental factors results in development of obesity and associated insulin resistance. However, only when genes for abnormal beta-cell function are present along with those for body adiposity does interaction with the environment result in
development of Type 2 Diabetes” (Kahn et al., 2014, p. 1070). The following studies illustrate how weight components, such as BMI and waist-to-hip ratio, have a significant impact on Type 2 Diabetes reversal and prevention.

**Early Indications of Diabetes Reversal – Surgical Methods**

One of the first implications that Type 2 Diabetes is a fully reversible disease came about from a study around 25 years ago when obese diabetic patients underwent bariatric surgery. The study showed that, not only did blood glucose levels normalize after surgery, but 10 years later, almost 90% of the patients were still Diabetes-free. In a more recent study, Type 2 diabetics were divided into 2 groups – a gastric banding surgery group, which is less invasive than bariatric surgery, and an intensive medical therapy group. Gastric banding did not have as impressive results in reversing Type 2 Diabetes as bariatric surgery; however, average fasting plasma glucose did fall to normal levels in the surgical group, but only declined modestly in the intensive medical therapy group that received oral medication and insulin. Even though diabetic remission was much stronger in the surgical group (73%) than in the medical therapy group (13%), the study did find that remission was actually related to the degree of weight loss and not the method of weight loss. For example, weight loss of 15kg (33 pounds) allowed for a complete reversal of Diabetes. There was just a higher rate of remission in the surgical group because surgery was more effective in achieving weight loss – specifically, a loss of 20% body weight (Taylor, 2013).

A Swedish cohort study published in the year 2000 divided a set of severely obese subjects into two groups who were both highly matched. The individuals were divided into a control group and a group who underwent gastric surgery for obesity. After an eight year follow-up, average weight loss in the surgical group was 20kg (44.1 pounds) and the control group had a non-significant average weight gain of 0.5kg (1.1 pounds). The surgical group showed a marked reduction in the incidence of Diabetes, with an odds ratio of 0.16, which is equivalent to a risk reduction ratio of 84% (Adler, 2002).

These early studies do clearly show that Type 2 Diabetes can be reversed through surgical procedures that reduce fat mass. At the time these studies were conducted, they led to a widespread belief that it was the surgery itself that reversed Diabetes because normalization of glucose levels occurred immediately after the surgery before weight loss actually occurred. However, it was later realized that there are other changes in the body that follow bariatric
surgery that were overlooked, such as a profound decrease in calorie intake (Taylor, 2013). “The sudden reversal of traffic into fat stores brings about a profound change in intracellular concentration of fat metabolites” (Taylor, 2013, p. 1048). It is well-known that during hypocaloric conditions (intake of less than 1,200 calories), fat is mobilized first from the liver and other abnormal sites, rather than from visceral or subcutaneous fat stores. This was studied during moderate calorie restriction in Type 2 diabetics over an eight-week period. During this short time, fasting plasma glucose levels improved as a likely result of an 81% decrease in liver fat content and a normalization of hepatic insulin sensitivity (Taylor, 2013).

Therefore, while surgery is an option for reversing Pre-Diabetes and reversing and preventing Type 2 Diabetes, it is also a drastic option that is not right for many people. However, these early studies did show that weight loss does make a difference and it led to more recent studies showing that surgery is not necessary and other means of weight loss works just as well. “If the rapid changes in metabolism following bariatric surgery are a consequence of the sudden change in calorie balance, the defects in both insulin secretion and hepatic insulin sensitivity of Type 2 Diabetes should be correctable by change in diet alone” (Taylor, 2013, p. 1048).

**Diabetes Intervention without Surgery**

In the early 1990s, a 5-year study including 41 early-stage Type 2 diabetics and 181 pre-diabetics examined the effects of lifestyle changes. The five year protocol that included dietary changes, physical activity, training, and annual check-ups were completed by 90% of the original patients. At the end of the study, body weight was reduced by between 2.3 and 3.7%. The overall results showed that lifestyle changes did have an impact on Pre-Diabetes and early diagnosis. Glucose tolerance normalized in more than 50% of the patients with Pre-Diabetes compared to 10.6% of this group progressing to full Type 2 Diabetes. In addition, more than 50% of the already diagnosed diabetics reversed their diabetic state after a six year follow-up. Furthermore, blood pressure, lipids, and hyperinsulinemia were reduced, there was a preservation of early insulin responsiveness to glucose loading, and mortality was decreased by 33%. The researchers concluded that “long-term intervention in the form of diet and physical exercise is feasible even on a large scale, and that substantial metabolic improvement can be achieved which may contribute to prevent or postpone manifest Diabetes” (Eriksson & Lindgärde, 1991).

Lau (2010) reported on a few studies involving overweight and obese individuals and the relationship to Type 2 Diabetes. In the National Institutes of Health-Sponsored Diabetes
Prevention Program (DPP), a study of 3,234 adults with impaired glucose tolerance (IGT), patients were assigned to three random groups. The first was a placebo group, the second was a Metformin group, and the third was a lifestyle intervention group where patients had to diet and exercise to achieve and maintain a weight loss of at least 7% of initial body weight. The placebo group averaged a loss of .22 pounds; the Metformin group lost an average of 4.63 pounds; and the lifestyle intervention group lost an average of 12.35 pounds. This last group, with its fairly modest weight loss and no medication intervention, resulted in a 58% risk reduction of Diabetes compared to the placebo group. Furthermore, post-study follow-up showed sustained benefits of weight loss in delaying and preventing Diabetes (Lau, 2010).

In another study examined by Lau (2010) that contained 4,970 overweight adults with either Type 1 or Type 2 Diabetes, intentional weight loss (an average reduction from 33.5 BMI to 27.7 BMI) was associated with a 28% reduction in Diabetes-related mortality and a 25% reduction in overall mortality compared with subjects who either gained weight or had no weight loss. In another study of 263 patients with Type 2 Diabetes, it was found that every kilogram (2.2 pounds) of weight lost could be correlated with an increase of 3-4 months survival. In addition, 22 pounds of weight loss predicted an increase of about 35% of life expectancy.

In another study, a hypocaloric diet was used to see if diabetic complications could be reversed. One group consisted of Type 2 diabetics who were studied both before and during a 600 calorie per day diet for eight weeks. The second group, the control group, was age and weight matched but not diagnosed with Diabetes. After only seven days, the diabetic group had a 30% decrease in liver fat – similar to levels of the control group – and their hepatic (liver) insulin sensitivity was normalized. (Note that previous research had already established a close association between liver fat content and hepatic glucose production.) In addition, after the first week plasma glucose was also normalized. After the full eight weeks of the study, maximum insulin response normalized. Furthermore, over the course of the study pancreatic fat content decreased until it was at the same level as the control groups’. Researchers determined that this dietary intervention study was highly suggestive of a causal link between intra-organ fat levels and metabolic effect (Taylor, 2013).

Siram et al. (2010) reviewed 18 studies of obese Type 2 diabetics undergoing weight-loss treatment methods. They found that a 10kg (22pound) weight loss over a 12 week period reduced glucose levels by 25%. Those who achieved greater weight loss achieved greater reductions in
fasting plasma glucose levels. In addition to glucose, these patients were able to reduce their blood pressure, both systolic and diastolic, by 8%, serum cholesterol by 9%, and triglyceride levels by 27%. They also found similar results in hospitalized Type 2 diabetics who were forced to eat calorie-controlled diets as compared to unrestricted diets at home. Therefore, they concluded that “excess calorie intake plays a major role in glucose dysregulation and is an important target for management of body weight and Diabetes mellitus” (Siram et al., 2010, p. 535).

**Conquering Type II Diabetes**

“Type 2 Diabetes has long been regarded as inevitably progressive, requiring increasing numbers of oral hypoglycemic agents and eventually insulin, but it is now certain that this disease process can be halted with restoration of normal carbohydrate and fat metabolism” (Taylor, 2013, p. 1047). The statistics from government agencies, such as the Centers for Disease Control and Prevention, in addition to many clinical trials, have shown that Type 2 Diabetes is preventable and reversible. In addition, by achieving glycemic control, a person can reduce and even eliminate associated diseases in the eyes, kidneys and peripheral nerves, as well as improve blood glucose, lipid levels and blood pressure (Siram et al., 2010). Lifestyle intervention, specifically weight management, is a key component to prevention and reversal of Diabetes and Diabetes-related complications (Lau, 2010). “The major goal of a treatment plan is to reduce elevation of blood glucose levels. Type 2 Diabetes is treated first through lifestyle changes, such as weight reduction, a change in dietary intake, and exercise. If adhering to the recommended diet and exercise fails to reduce blood glucose levels, then medications may be prescribed” (Lawrence et al., 2012, p. 23).

**The Challenges**

There is no doubt that there are barriers diabetics face when trying to lose weight and unfortunately, unsuccessful attempts at weight loss can be very discouraging (Polonsky, Fisher, & Hessler, 2010). Multiple studies have shown that these patients typically find it more difficult to lose weight than their non-diabetic obese counterparts. This is presumably due to age factors, comorbidities, and medication treatments that diabetics have to deal with (Adler, 2002; Rodriguez-Hernandez et al., 2013; Siram et al., 2010; Taylor, 2013).

There are many pharmacological therapeutic options that target inflammatory signaling pathways to improve insulin action and achieve glycemic control, which is the central problem
for Type 2 diabetics. Paradoxically, however, many of these options have side effects that either
cause weight gain or make it very difficult to lose weight. For example, studies have shown that
medications such as insulin, sulfonylureas, thiazolidinediones (TZDs), and meglitinides, which
are all meant to control glucose levels, can cause significant weight gain (Adler, 2002;
Rodriguez-Hernandez et al., 2013; Siram et al., 2010). Furthermore, hypertension is liked to both
Diabetes and obesity. Patients who are taking blood pressure medication, such as atenolol and
captopril, could face weight-gaining side effects of these medications, too (Adler, 2002).
Diabetics may also have poor nutritional habits and consume an excessive amount of calories.
These patients may not be aware of the amount of calories they are consuming or they may not
be adhering to prescribed diets (Siram et al., 2010).

Medication is not the only issue that results in weight gain or lack of weight loss in
diabetics. For example, these patients may have poor nutritional habits and are not aware of the
amount of calories they are consuming. In general, there could be medical, cultural,
psychological, social, and even financial factors that affect nutritional and physical behavior.
“Some examples include limitations on physical activity due to physical deconditioning, heart
disease, and arthritis; cultural eating patterns that favor carbohydrate-rich and energy-dense
foods; fear of hypoglycemia, which causes reactive-eating and diminished activity; mental
illness, such as depression and schizophrenia; inability to afford costly Diabetes medications;
and lack of social support in the home” (Siram et al., 2010, p. 536).

Another barrier that is not as obvious, yet very significant, is lack of provider
involvement, which involves education and advice for the patient. “Patient education is
increasingly important as consultations become more patient centered and doctors work towards
developing shared management plans with patients; however….with the constraints of 10-minute
appointments, practitioners may struggle to provide sufficient information and discussion time
for the patient, particularly in complex and chronic conditions such as Diabetes” (Steven, 2014,
p. 168). Since the patient-physician encounter is so short and recently decreasing, patient
education is becoming even more important. However, literature reviews have shown that the
second half of the office visit (once the purpose of the visit has been established) is not adequate
in regards to dealing with the nature of the problem or discussing treatment options (Steven,
2014).
Strategies for Success

It is possible to return to normal blood glucose levels through healthy lifestyle changes including physical activity, eating healthy foods, and maintaining a health weight (Lawrence et al., 2012). Despite the challenges diabetics face, both physicians and patients need to accept that “long-term weight loss is achievable for a worthwhile population of [diabetic] patients” (Taylor, 2013, p. 1052). The Centers for Disease Control and Prevention, through decades of research, has determined that diabetics can avoid disability and premature death through physical activity, dietary interventions, self-management training, and ongoing support, with medication only used in certain circumstances. Their studies have shown tremendous results, including (CDC, 2011):

- Reducing $A_1c$ (a measure of blood glucose control) by 1% can reduce the risk of eye, kidney, and nerve disease by 40%;
- Controlling blood pressure can reduce the risk of heart disease and stroke by 33%-40% and the risk of eye, kidney, and nerve disease by 33%;
- Improving control of low-density lipoprotein (LDL) cholesterol can reduce cardiovascular complications by 20%-50%;
- Treating diabetic eye disease with laser therapy can reduce the risk of blindness by 50-60%; and
- Accessing comprehensive foot care programs can reduce amputation rates by 45%-85% (p. 3).

Provider responsibility. Patients in general, regardless of the health issue they are facing, need to take some responsibility for their own health. The exact requirements for doing this can vary by an individual’s needs and risk factors, but generally including preventive measures, diet, exercise, health check-ups, and following appropriate medication regimens. However, the patient cannot do this alone. In all developed countries, not just the United States, healthcare professionals must educate individuals regarding proper disease prevention and control if they expect the patient to follow through. “Educating patients is crucial in delivering shared management. In Diabetes, empowering self-management in the form of diet, exercise, weight control, and understanding of blood glucose levels and medication compliance can have a significant impact on health outcomes” (Steven, 2014, p. 168). Many studies, such as the ones discussed later, have shown that provider education is a proven method in helping diabetics achieve successful outcomes.
According to the Royal College of General Practitioners (RCGP) contextual statement 2:01, during consultation, General Practitioners (GPs) should “share information with patients in an honest and unbiased manner, in order to educate them about their health (doctor as teacher)” (as cited in Steven, 2014, p. 169). Even though the RCGP is the “professional membership body for family doctors in the UK and overseas” (Royal College of General Practitioners [RCGP], n.d., para. 1), the United States has very similar standards for physicians. For example, Opinion 10.01 of the American Medical Association’s (AMA’s) Code of Medical Ethics states that, “the patient has the right to receive information from physicians and to discuss the benefits, risks, and costs of appropriate treatment alternatives. Patients should receive guidance from their physicians as to the optimal course of action” (“Opinion 10.01”, 1992, para. 2). In addition, physicians in the United States are sworn in with the Hippocratic Oath. There are many different versions of the oath because it has been modernized, but they all have the same meanings. Louis Lasagna, Academic Dean of the School of Medicine at Tufts University, wrote a modernized version in 1964 that is used in many medical schools today. A portion of it states, “I will remember that I do not treat a fever chart, a cancerous growth, but a sick human being, whose illness may affect the person’s family and economic stability. My responsibility includes these related problems, if I am to care adequately for the sick….I will prevent disease whenever I can, for prevention is preferable to cure” (University of California, 2006, p. 1). As all of these examples show, the practitioner has a duty to the patients in assisting with preventive care, informing them of the options they have, and educating them about their condition and self-management whenever possible.

Polonsky and colleagues (2010) found that “efforts to encourage more frequent and effective weight-related conversations between patients and their healthcare provider might help patients to achieve and maintain more successful weight loss outcomes” (p. 156). In their survey-style study, they interviewed 575 overweight diabetic patients in order to analyze to what degree provider education and involvement has affected their weight-loss and disease management success. The group analyzed were long-term patient in that the average time since diagnosis was 11 years. The patients were divided into two weight classifications, which were pre-obese (a BMI between 25 and 29.9) and obese (a BMI of 30 or more). The researchers observed that having a larger BMI was associated with younger ages, lower incomes, less education, and being female (Polonsky et al., 2010).
The overall results of Polonsky et al.’s (2010) study showed that weight misperceptions as they relate to Diabetes were directly associated with healthcare provider behavior across all BMI levels. For example, of all the patients in the study, only 59% reported that their healthcare provider educated them about the relationship between weight and Diabetes. The patients who reported that weight reduction was recommended by their physician(s) also stated that specific suggestions were rarely comprehensive. For instance, 66% of the patients were advised to eliminate “problematic foods” from their diet and only 29% were encouraged to add healthier foods to their diet. In addition, only 27% were given specific suggestions for exercise. Of the patients who were at least advised to lose weight, only about one-third of them (31%) said that their provider followed up with them regarding this advice. The researchers were able to conclude from this data that “healthcare providers’ actions, discussions, and encouragement regarding weight management, especially when recommendations are specific and when follow-up occurs, are linked to the patients’ more frequent weight management efforts” (Polonsky et al., 2010, p. 156).

As the previous study indicated, provider education, specific recommendations, and follow-up are essential for patient success. In another study involving self-management education, $A_1$C levels improved 1% for every additional 23.6 hours of contact a patient had with an educator as compared to the control group. However, one to three months after the educational intervention completed, there was a decline in improvements, therefore suggesting that there is a need for constant reinforcement, counseling, and follow-up. In another study that was a meta-analysis of weight-loss intervention studies involving 4,659 patients who underwent diet, exercise, and/or behavioral interventions, it was concluded that any given intervention resulted in an average of a 3.1% body weight reduction from baseline when compared to the control patients undergoing usual care (Siram et al., 2010).

As research shows, it is very important for a diabetic patient to understand what the barriers are that they may have to face in terms of weight loss. Patients need to be counseled on realistic and concrete weight-loss goals and lifestyle changes so that the changes do not seem so overwhelming. Some ideas include portion control using the plate method, avoiding sweetened beverages, and participating in 30 minutes of physical activity five days per week. Specific instructions from a provider, such as these, have been shown to have a greater influence on patient behavior (Siram et al., 2010).
As important as specific suggestions are, it is equally important for providers to take into account that “different patients will require different forms of education according to their personal experiences, skills, and the services they are able to access” (Steven, 2014, p. 169). Furthermore, as more patients take ownership of their disease management, it is essential that practitioners stay current on healthcare developments of prevention and treatment of Diabetes, as well as new sources of education and support for patients. For example, patients may not speak English well, which would make it more difficult to understand certain recommendations. In addition, there are many resources out there that can be found on the internet; however, it should not be assumed that these patients all have the internet access or are computer literate. In addition, not all internet sources are reliable, so patients need to be aware of which resources are the best. Finally, providers should try to make themselves aware of support groups in the area so that they can inform their patients of this additional support method (Steven, 2014). “Group support programs that help people with Pre-Diabetes develop better eating habits, improve their coping skills, and increase their physical activity level have been proven to be effective” (CDC, 2011, p. 2).

As a nation, the UK has made some efforts to assist with patient education and support. For instance, they have a help line for diabetic patients called “Diabetes UK” and it is available in multiple languages. In addition, some practices employ nurses called Diabetes Management Specialists. “These nurses often provide crucial support for patients with Diabetes and play an important role in education. They often have longer appointment times and can be used to explain new diagnoses, give more detailed advice regarding diet and weight loss, and have more time to follow-up with patients” (Steven, 2014, p. 169). For some of the available Diabetes support and educational resources in the U.S., see Appendix Figure 8.

As the UK is showing, physicians are not the only ones who can be responsible for educating patients about Diabetes management. A multidisciplinary approach can be very successful in assisting diabetic patients (Lawrence et al., 2012; Siram et al., 2010). For example, registered dieticians can be utilized to educate and counsel diabetic patients about calorie goals and lifestyle improvements (Siram et al., 2010). Nurses are a major source for education, as well. They can “come to the forefront in teaching and stress weight reduction through diet and exercise, along with smoking cessation and adherence to the medication regime”. It is also felt that nurses can “educate patients, family members, and the community as a whole about lifestyle
changes to prevent Diabetes and its complications” (Lawrence et al., 2012, p. 22). Nurses are not restricted to education at the doctor’s office or bedside in a hospital room. Nurses have a large community influence and they can educate through mobile clinics, standing clinics, health fairs, schools, businesses, and places of worship. This can result in public knowledge of preventive strategies and early treatment of Type 2 Diabetes (Lawrence et al., 2012).

Finally, healthcare practitioners need to make sure that education is not limited to diagnosis and basic treatment. Due to comorbidity issues and other complications, diabetic patients need to be educated on a multitude of areas. The following list includes essential aspects of disease management education (Steven, 2014):

- Blood glucose monitoring and appropriate responses to triggers;
- Healthy ways to lose weight;
- Exercise, including safety factors related to the particular patient involved;
- Medication education (if prescribed), such as how to take medication, the need for consistency, potential side effects, and how to administer insulin;
- Blood pressure control;
- Cholesterol control;
- Importance of smoking cessation;
- The need for regular eye exams, kidney tests, and foot checks; and,
- For pre-menopausal women, education regarding Diabetes and pregnancy.

**Patient responsibility.** “Type 2 Diabetes can be prevented through healthy food choices, physical activity, and weight loss” (CDC, 2011, p. 2). Therefore, achieving and maintaining a healthy weight is imperative for optimal management of Type 2 Diabetes. It can be reversed with these same activities. Only in some instances are insulin or other medications necessary. In fact, patients diagnosed with Pre-Diabetes who lose a modest 5-7% of body weight (10-14 pounds for a 200-pound individual) and engage in moderate activity for at least 150 minutes per week can reduce the risk of developing Type 2 Diabetes by 58% (CDC, 2011). For those who have already developed Type 2 Diabetes, even a moderate weight loss of 5-10% body fat, which is the equivalent of 10-20 pounds for a 200-pound individual, has been shown to improve glucose levels, lipid profiles, and blood pressure (Lau, 2010; Siram et al., 2010). Lifestyle interventions to induce weight loss are also likely to improve a diabetic’s cardiometabolic profile and reduce the risk of microvascular disease, cardiovascular disease and mortality (Siram et al., 2010).
Furthermore, glycemic control has been shown to reduce the risk of both macrovascular and microvascular events and complications, such as retinopathy, nephropathy, and neuropathy (Siram et al., 2010; Steven, 2014).

The World Health Organization (2013) reports that “simple lifestyle measures have been shown to be effective in preventing or delaying the onset of Type 2 Diabetes” (para. 22). However, overweight diabetic patients, especially those who are middle-aged, need to be aware that exercise alone may not produce weight loss. Several studies have shown that controlling caloric intake combined with regular exercise is much more effective than just exercise or just calorie reduction. “The necessary initial major loss of body weight demands a substantial reduction in energy intake. After weight loss, steady weight is most effectively achieved by a combination of dietary restriction and physical activity. Both aerobic and restrictive exercise are effective [and] the critical factor is sustainability” (Taylor, 2013, p. 1052). The World Health Organization (2013) recommends being physically active, eating a healthy diet, and avoiding tobacco use. More specifically, physical activity should include at least 30 minutes of regular, moderate activity on most days for maintenance, or more activity when trying to lose weight. A recommended healthy diet includes three to five servings of fruits and vegetables per day along with a reduction in sugar and saturated fats. Tobacco should be avoided because smoking increases the risk of cardiovascular disease, which is already a comorbidity of Diabetes.

These recommendations may seem overwhelming at first, especially when the patient does not know where to begin, what exactly to do, or they feel the goal is out of reach. This is also why it is especially important for the healthcare provider to discuss specifics with the patient and for the patient and physician to work together to set realistic goals. “A generally safe and realistic weight-loss rate is 1-2 pounds per week until the goal weight is reached. A net negative balance of approximately 3,500 calories is required to lose 1 pound of body fat. Therefore, a net negative energy balance of 500 calories per day for 1 week results in a 1-pound weight loss. This may be achieved through reduced calorie intake and increased physical activity” (Siram et al., 2010, p. 536). A diabetic patient should realize that there are different methods of weight loss to choose from and that weight loss is an achievable goal, despite the potential barriers.

One option for weight loss that has been growing in popularity is the Mediterranean Diet (Mayo Clinic, 2013; Rodriguez-Hernandez et al., 2013). Observational studies have shown that this diet decreases the prevalence of metabolic syndrome. Furthermore, interventional studies
have shown a decrease in markers of inflammation (an immune system response linked to obesity) in patients consuming the Mediterranean diet (Rodriguez-Hernandez et al., 2013). “The heart-healthy Mediterranean diet is a healthy eating plan based on typical food and recipes of Mediterranean-style cooking” (Mayo Clinic, 2013, para. 1). This diet is rich in fruits, vegetables, monounsaturated fats, and fiber (Mayo Clinic, 2013; Rodriguez-Hernandez et al., 2013). In addition to promoting physical activity, the diet emphasizes (Mayo Clinic, 2013):

- Eating primarily plant-based foods, such as fruits and vegetables, whole grains, legumes, and nuts;
- Replacing butter with healthy fats, such as olive oil;
- Using herbs and spices instead of salt to flavor foods;
- Limiting red meat to no more than a few times per month; and
- Eating fish and poultry at least twice a week (para. 6).

Of course this is just one option. For those who are looking for something a little simpler, there is the “plate method” which is used for portion control and keeping meals balanced (Siram et al., 2010). See Appendix Figure 7 for an illustration of the plate method. Other basic lifestyle changes that a diabetic needs to keep in mind include “eating three balanced meals daily, including breakfast…avoiding sweetened beverages, daily walking or swimming, and adhering to medication [when prescribed]” (Siram et al., 2010, p. 536). In addition, there are many ways for someone to exercise and patients can choose activities that they find enjoyable. One recommendation is to use a pedometer. This is a useful and inexpensive way for patients to monitor how many steps they have taken each day, which will allow them to easily set and reach goals (Siram et al., 2010).

If the patient and physician do choose to use pharmacological therapy in addition to diet and exercise, the patient needs to be aware of the potential weight-gaining side effects. However, there are some options that are considered “weight-neutral” or “weight-losing” medications. These include “metformin, alpha-glucosidase inhibitors (AGIs), glucagon-like peptide-1 (GLP-1) analogs, dipeptidyl peptidase-4 (DPP-4) enzyme inhibitors, and amylin analogs” (Siram et al., 2010, p. 534). Pharmacological therapy should always be discussed with a physician because every individual’s needs are different. Even though weight loss may not be a side-effect of these medications, there could be contraindications for certain individuals, such as “renal insufficiency, decompensated heart failure, liver disease, hypoxemic lung disease, and a history
of lactic acidosis” (Siram et al., 2010, p. 538). [DISCLAIMER: These medications are reported based on clinical trials, and are not to be considered as an endorsement or recommendation by AMAC Foundation, its employees, or any of its affiliates. Talk to your doctor before taking any medication.]

As previously mentioned, Type 2 Diabetes management can be increasingly difficult as one becomes older and it is affecting a large portion of the senior population. However, it is possible to lose weight and improve the condition at this age. Type 2 diabetics of any age need to maintain blood glucose levels, eat a healthy die, exercise, and maintain a healthy weight. However, seniors with Diabetes do need to be careful with their exercise program. For example, older adults should speak with their healthcare provider regarding vigorous exercise, especially if they have any heart problems. In addition, if you are starting to exercise for the first time in a while, start slowly and then increase the activity level. For instance, start out by walking a very short distance and then increase the speed and distance walked every week. This is one example where a pedometer would be useful. Another option is a fitness class designed for seniors, some of which have chair exercises for those who have difficulty walking. Even household chores and yard work is helpful in maintaining regular activity levels and keeping blood flowing. Regardless of the activity chosen, seniors especially need to check with a doctor before starting any new exercise program (Haas, 2014).

If a diabetic patient is able to reach their goals through lifestyle modification, elimination of medication is in their best interest. However, safety is extremely important. “The provider and patient must be ready to reduce doses of medication including insulin and insulin secretagogues to prevent hypoglycemic episodes” (Siram et al., 2010, p. 543). A patient should never quit medication without doctor recommendations and it is important for the provider to assess the possibility of hypoglycemia and titrate medications at 4-12 week time intervals. “Gradual titration of glucose-lowering medications may minimize hypoglycemia and/or weight gain while allowing the individual to incorporate lifestyle changes that may improve insulin sensitivity and reduce medication requirements” (Siram et al., 2010, p. 543). Furthermore, patients need to be cognizant that maintaining their weight loss is just as important as their original weight loss. Even if they’ve reversed Pre-Diabetes or Type 2 Diabetes, it can come back. One of the most important things that patients need to realize is that lifestyle modification on a long-term basis is an achievable goal, it just requires continued effort (Lau, 2010; Siram et al., 2010).
Conclusion

Even though the prevalence of Pre-Diabetes and Type 2 Diabetes is escalating, it has also brought more attention to prevention and treatment methods, as well as educational efforts. Because of this, diabetic patients are, on average, living longer because of public health efforts. Hospitalization rates and cardiovascular disease among diabetics have declined, the percentage of adult diabetics with visual impairments have been reduced, and there are less reports of kidney failure related to Diabetes (CDC, 2011).

Pre-Diabetes, Type 2 Diabetes, and especially “Diabetesy” may seem like overwhelming obstacles. The individuals facing these issues need to be fully aware of the future health consequences they will face if measures are not taken. However, the good news is that Type 2 Diabetes is a reversible metabolic syndrome. Even though diabetic patients frequently find it more difficult to lose weight than non-diabetic obese individuals, if they are “strongly motivated to regain normal health, substantial weight loss is entirely possible” (Taylor, 2013, p. 1052). Weight loss is just like any other challenge – motivation is the key to success.
References


Appendix

Figure 1. Increasing prevalence of Diabetes in the United States.

![Graph showing the increasing prevalence of diabetes in the United States from 1980 to 2009.](http://www.cdc.gov/diabetes/statistics/incidence/fig1.htm)

Figure 2. Blood Glucose Levels: Criteria for Diagnosing Prediabetes and Diabetes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Fasting BG</th>
<th>BG 2 Hours After High Carbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>70–99 mg/dl</td>
<td>&lt; 140 mg/dl</td>
</tr>
<tr>
<td>Prediabetes</td>
<td>100–125 mg/dl</td>
<td>140–199 mg/dl</td>
</tr>
<tr>
<td>Diabetes</td>
<td>≥ 126 mg/dl</td>
<td>≥ 200 mg/dl</td>
</tr>
</tbody>
</table>

Above image provided by Diabetes Services, Inc. @ [www.diabetesnet.com](http://www.diabetesnet.com)
Figure 3. Pancreas and surrounding organs in the human body.

![Diagram of pancreas and surrounding organs](image1)

Above image provided by [www.medterms.com](http://www.medterms.com).

Figure 4. Microscopic images of healthy and diabetic beta cells.

![Healthy Beta-Cells and Diabetic Beta-Cells](image2)

Healthy Beta-Cells  Diabetic Beta-Cells

Above image provided by the lab of Dr. Peter Butler
([http://health-fts.blogspot.com/2012/02/diabetes-type-2.html](http://health-fts.blogspot.com/2012/02/diabetes-type-2.html))
Figure 5. Normal and diabetic beta-cell functioning process.

Above image provided by www.informationaboutdiabetes.com
Figure 6. Relationship between overweight/obese population and Diabetic population

Above image provided by Wallace (2010) – See “References”.

Figure 7. “Plate Method” for Portion Control in Lifestyle Modification Diets.

Above image provided by: Siram, Yanagisawa, and Skamagas, 2010, p. 536 – See “References”.
Figure 8. Resources for help with Diabetes in the United States.

American Association of Diabetes Educators
100 West Monroe Street Suite 400
Chicago, IL 60603
Ph: 800-338-3633
Email: aade@aadenet.org
Website: www.aadenet.org

"The American Association of Diabetes Educators is made up of doctors, nurses, dieticians, and other health professionals with special interest and training in Diabetes care. It can supply the names of these types of health professionals in your local area."

American Diabetes Association (ADA)
1701 North Beauregard Street
Alexandria, VA 22311
Ph: 800-DIABETES (800-342-2383)
Email: AskADA@diabetes.org
Website: www.diabetes.org/

"The American Diabetes Association (ADA) is a national organization for health professionals and consumers. Almost every state has a local office. ADA sets the standards for the care of people with Diabetes. Its focus is on research for the prevention and treatment of all types of Diabetes. ADA provides patient and professional education mainly through its publications, which include the monthly magazine Diabetes Forecast, books, brochures, cookbooks and meal planning guides, and pamphlets. It provides information for parents about caring for a child with Diabetes."

National Diabetes Education Program
1 Diabetes Way
Bethesda, MD 20814-9692
Ph: 800-438-5383
Email: ndep@info.nih.gov
Website: www.ndep.nih.gov/

"The National Diabetes Education Program (NDEP) is sponsored by the U.S. National Institutes of Health (NIH) and the U.S. Centers for Disease Control and Prevention (CDC). The program’s goal is to improve the treatment of people with Diabetes, to promote early diagnosis, and to prevent the development of Diabetes."

Above information provided by: WebMD – Diabetes Health Center (http://www.webmd.com/diabetes/guide/type-2-diabetes-resources)