Prediabetes: An Opportunity to Prevent Diabetes

HOW TO RECEIVE CREDIT

- Read the enclosed course.
- Complete the questions at the end of the course.
- Return your completed Evaluation to NetCE by mail or fax, or complete online at www.NetCE.com. (If you are a behavioral health professional or Florida nurse, please return the included Answer Sheet/Evaluation.) Your postmark or facsimile date will be used as your completion date.
- Receive your Certificate(s) of Completion by mail, fax, or email.

Faculty

Susan Semb, MSN, RN, CDE, received her Master's degree in nursing from the University of San Diego. Her nursing experience includes direct patient care, case management, staff development, program development and health education. She is presently employed as a diabetes educator in the Health Education Department of a major health maintenance organization. Ms. Semb has also authored other continuing education courses for nurses published by NetCE. In addition to her professional work, Susan volunteers for California Labs and More dog rescue and the County of San Diego Animal Shelter.

Faculty Disclosure

Contributing faculty, Susan Semb, MSN, RN, CDE, has disclosed no relevant financial relationship with any product manufacturer or service provider mentioned.

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Division Planners Disclosure

The division planners have disclosed no relevant financial relationship with any product manufacturer or service provider mentioned.

Audience

This course is designed for nurses in adult primary care, clinical, and acute care settings, healthcare and behavioral health professionals in public health and preventive medicine settings, and health education specialists.

Accreditations & Approvals

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NetCE designates this continuing education activity for 18 hours for Alabama nurses.

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AACN Synergy CERP Category A.

Social Workers participating in this intermediate to advanced course will receive 15 Clinical continuing education clock hours.

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About the Sponsor

The purpose of NetCE is to provide challenging curricula to assist healthcare professionals to raise their levels of expertise while fulfilling their continuing education requirements, thereby improving the quality of healthcare.

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Course Objective

Studies have shown that diabetes can be delayed or prevented in people with prediabetes, but risk reduction relies heavily on lifestyle changes on the part of the patients, making education and counseling of vital importance. The purpose of this course is to provide healthcare professionals with the information and skills necessary to effectively deal with this common condition and learn ways to help patients make healthy lifestyle choices.

Learning Objectives

Upon completion of this course, you should be able to:

1. Identify the incidence and prevalence of prediabetes in the United States.
2. Define the diagnostic criteria for prediabetes and diabetes.
3. Discuss major health risks associated with prediabetes.
4. Identify risk factors for diabetes and prediabetes.
5. Review the pathophysiology of type 2 diabetes.
6. Describe the results of the Diabetes Prevention Program and the associated recommendations.
7. Identify appropriate nutritional interventions to prevent diabetes.
8. Describe types of exercise and recommendations related to each for patients with prediabetes.
9. Discuss strategies and resources for helping patients select an exercise program.
10. Discuss medications used in prediabetes.
11. Evaluate the role of bariatric surgery in preventing diabetes.
12. Describe strategies to prevent diabetes in children.
13. Identify food preferences of different cultures.
14. Assist a patient in making an action plan for behavior change.
15. Outline key points included in health education for diabetes prevention.

Sections marked with this symbol include evidence-based practice recommendations. The level of evidence and/or strength of recommendation, as provided by the evidence-based source, are also included so you may determine the validity or relevance of the information. These sections may be used in conjunction with the course material for better application to your daily practice.

INTRODUCTION

Prediabetes has become a major health concern in the United States. Moderately elevated blood glucose is now recognized as a significant health risk, usually preceding the onset of type 2 diabetes and increasing the risk for cardiovascular events. With this understanding, the prevention of diabetes has emerged as a standard of health care. Several research studies have shown that intensive lifestyle intervention, such as weight loss and exercise, can prevent prediabetes from progressing to type 2 diabetes and can decrease cardiovascular risk. As a result, "lifestyle medicine" and behavioral modification are becoming increasingly important facets of modern health care.

As of 2015, 84.1 million people in the United States 18 years of age and older had prediabetes [1]. Prediabetes is defined as a blood glucose level that is higher than normal but not high enough to meet the diagnostic criteria for diabetes. Having prediabetes greatly increases the risk for later development of type 2 diabetes, and most people with type 2 diabetes have had prediabetes prior to the onset of the disease.

A landmark study published in 2002 concluded that the onset of type 2 diabetes could be delayed or prevented in some people with prediabetes [2]. It was found that weight loss and exercise were important factors that helped prevent or delay diabetes in people with higher-than-normal blood glucose who were also overweight. These findings have provided a valuable opportunity for individuals and healthcare providers to reduce the incidence of type 2 diabetes and its related morbidities.

Diabetes is a serious and costly health problem in the United States, pervading virtually all areas of healthcare practice. Efforts to prevent it can have a profound impact on healthcare spending and improve the quality of life for countless individuals. Long-term complications of high blood glucose, such as cardiovascular disease, renal failure, and retinopathy, account for the major expenditures related to diabetes care. Because these complications can take years, and sometimes decades, to fully progress, even the delay of diabetes onset would be significant.

Risk factors for the development of diabetes and prediabetes have been identified. Some of these, such as genetic predisposition and aging, are fixed and cannot be modified. Others, such as diet, body weight, and physical activity level, are changeable. Helping patients understand the changes they can make is the first step in diabetes prevention. Unfortunately, success in making and maintaining healthy lifestyle changes can be challenging. Simply giving advice is often not enough to realize actual change. Many patients are not ready to make the recommended changes, and those who initially succeed may find the changes hard to maintain. Helping a patient initiate and maintain behavior change requires an understanding of the change process and techniques for facilitating movement along the continuum of behavior change. This begins with a collaborative and patient-empowering relationship. It often requires some "letting go" on the part of the healthcare provider, who must recognize that the patient has the ultimate rights and responsibilities for his or her self-care decisions.

This course will begin by describing the significance of prediabetes and assessing the clinical information needed to provide sound health care to this population. Following this, the course will offer an abundance of evidence-based recommendations for preventing diabetes through lifestyle modification in the areas of weight management, healthy eating, and exercise. Ultimately, the goal of the program is to help healthcare professionals develop a skill set to use in promoting and supporting health behavior change in patients with prediabetes. These skills include addressing an individual's readiness to change and strategies for building motivation to change behavior. This will lead to the key points of helping patients formulate an individualized plan of action, based upon realistic goals. When these strategies are applied to interactions with patients, along with such concepts as empowerment, self-efficacy, and the stages of behavioral change, the likelihood of a successful outcome is improved.

At the very least, when behavior change is not imminent, patients' ownership of their own health may be acknowledged and a partnership forged to create a path for future change.

SIGNIFICANCE OF THE PROBLEM

Prediabetes is a remarkably common health problem that has been vastly underdiagnosed. The Centers for Disease Control and Prevention (CDC) estimate that 33.9% of the adult population in the United States has prediabetes, with nearly half (48.3%) of adults 65 years of age and older having blood glucose values that meet the criteria [3]. About one in five adolescents and one in four young adults (19 to 34 years of age) in the United States has prediabetes [4]. In spite of the high prevalence of prediabetes, only 11.6% of people with this condition are told of their diagnosis [3].

Although it is underdiagnosed, prediabetes is a serious condition that significantly increases the risk for major health problems. People with prediabetes are approximately 5 to 15 times more likely to develop diabetes than those who have normal blood glucose levels [5]. Furthermore, the harmful effects of high blood glucose begin to occur at much lower levels than currently define diabetes. In other words, complications of diabetes begin early in the course of glucose intolerance, often before diabetes is diagnosed. Studies suggest that when blood glucose is higher than normal and remains untreated, patients have a greater risk for developing the microvascular and macrovascular complications associated with diabetes [6; 7; 8]. For example, characteristics of diabetic retinopathy may be detected in people with no history of diabetes who have elevated fasting blood glucose or impaired glucose tolerance (IGT) [9]. Impaired glucose tolerance is also common in nondiabetic patients with peripheral neuropathy [10]. This data emphasize the importance of prompt detection and intervention of prediabetes. In fact, research suggests that restoring blood glucose levels to normal, rather than maintaining prediabetic levels, is necessary to prevent complications [7; 8]. When preventive efforts delay the onset of diabetes, there is less disease exposure and lower risk for the adverse consequences of high blood glucose over time. This results in better quality of life for the individual and lower healthcare costs for society.

Prediabetes and diabetes take a tremendous toll on the individual, society, and the healthcare system. The annual economic burden to the United States of both conditions combined exceeds $322 billion. This includes $244 billion in excess medical costs (e.g., physician's office and hospital visits, prescription drug costs, costly health conditions) and $78 billion in reduced productivity [11]. Spending on diabetes is expected to triple in the next 25 years [12].

In addition to monetary costs, chronic complications of diabetes significantly diminish quality of life for the individual and account for more new cases of blindness, end-stage renal disease, and lower limb amputation than any other medical diagnosis [13]. The incidence of diabetes has been steadily growing. Estimates for 2015 indicate that 30.3 million people in the United States have diabetes [3]. If obesity rates remain stable, the number of Americans with diabetes will double in the next 25 years [12]. Nearly 24% of people with diabetes do not know they have the disease [3]. According to a panel of clinical endocrinology experts, "As the prevalence of and progression to diabetes continue to increase, diabetes-related morbidity and mortality have emerged as major public health issues" [6].

Reducing the incidence of diabetes or delaying its onset provides an enormous opportunity to arrest the growth and development of this major health problem. The Diabetes Prevention Program (DPP) showed that when overweight people with prediabetes made healthy lifestyle changes, they could significantly reduce their risk for developing type 2 diabetes [2]. Healthcare professionals play an essential role in helping patients understand that they have an opportunity to prevent chronic disease and lead healthier lives.

EVALUATION AND CLASSIFICATION OF HIGH BLOOD GLUCOSE

As noted, the term "prediabetes" is used to describe blood glucose levels that are higher than normal but not high enough to be considered overt diabetes. While the term is relatively new, it is not a new disorder. Historically, healthcare providers have used various terms to describe this condition. IGT and impaired fasting glucose (IFG) are commonly used, depending upon the test used for diagnosis. In some cases, the phrase "borderline diabetes" is used, although the major authoritative bodies on diabetes and endocrinology do not provide a definition for this term. The American Diabetes Association (ADA) classifies these conditions as "categories of increased risk for diabetes" [14; 15].

After the results of the DPP were reported in 2002, the ADA introduced the term "prediabetes" to describe nondiabetic glucose intolerance. It was felt that this name would give a better description of the meaning of the disorder and would convey that it is not a benign condition [16]. Experts anticipate that use of the term "prediabetes" will help clear up confusion among the public. A survey completed in 2006 indicated that a substantial number of people with prediabetes were unaware of it. This may be due in part to confusion brought on by the different terms used by healthcare providers [17].

BLOOD GLUCOSE TESTS

There are many tests available to assess patients suspected of having diabetes or prediabetes. These include [14; 15]:

- Fasting plasma glucose (FPG): Blood is collected after the patient has had no dietary intake for eight hours or more. Normal fasting plasma glucose is less than 100 mg/dL.
- Casual plasma glucose: This is sometimes referred to as "random" or nonfasting blood glucose, as blood is collected without regard to the time of last caloric intake.
- Oral glucose tolerance test (OGTT): Blood is taken two hours after the person has ingested a glucose load of 75 grams. This is also known as a "glucose challenge." Normal nonfasting plasma glucose taken two hours following glucose challenge is less than 140 mg/dL.
- Hemoglobin A_{1c} (A_{1c}): This laboratory test uses venous blood to show the average blood glucose concentration over the previous two to three months. The test measures the amount of glucose that is chemically attached to the red blood cells (RBCs). RBCs that have been exposed to high amounts of glucose over their lifespan, which is about 90 days, will have more glucose attached to them. This will result in a higher A_{1c} reading. A_{1c} levels greater than 7.0% are associated with an increased risk for eye, kidney, and nerve damage and cardiovascular disease. Historically, A_{1c} was not used as a test for the diagnosis of diabetes or prediabetes. However, in 2010 the ADA revised its criteria for the diagnosis of diabetes to include use of A_{1c} for diagnosis. A_{1c} of less than 5.7% is considered normal.

DIAGNOSTIC CRITERIA FOR DIABETES

A diagnosis of diabetes is established when a person has any or all of the following blood glucose values [14]:

- FPG: 126 mg/dL or greater
- Casual or random plasma glucose: 200 mg/dL or greater accompanied by symptoms of hyperglycemia, (i.e., polyuria, polydipsia, and/or unexplained weight loss)
- OGTT: 200 mg/dL or greater
- A_{1c}: Greater than or equal to 6.5%

DEFINITIVE CRITERIA FOR PREDIABETES

Prediabetes is an intermediate state between normal blood glucose and diabetes. The ADA specifies the following categories of increased risk for diabetes [14]:

- IFG: Fasting plasma glucose between 100 mg/dL and 125 mg/dL
- IGT: Two-hour post glucose challenge 140 mg/dL to 199 mg/dL
- A_{1c}: 5.7% to 6.4%

With regard to these categories, the ADA states, "For all three tests, risk is continuous, extending below the lower limit of the range and becoming disproportionately greater at higher ends of the range" [15].

EVIDENCE-BASED PRACTICE RECOMMENDATION

The American Diabetes Association defines persons at increased risk for diabetes (prediabetes) as those with impaired fasting glucose (IFG) and/or impaired glucose tolerance (IGT) and/or A_{1c} 5.7% to 6.4%. Prediabetes should not be viewed as a clinical entity in its own right but rather as an increased risk for diabetes and cardiovascular disease.

(http://care.diabetesjournals.org/content/41/Supplement_1. Last accessed January 17, 2018.)

Level of Evidence: Expert Opinion

SCREENING FOR DIABETES AND PREDIABETES

The ADA recommends testing for diabetes in asymptomatic adults who are overweight or obese and who have one or more of the following risk factors for diabetes [14]:

- First-degree relative with diabetes
- High-risk race/ethnicity (e.g., African American, Latino, Native American, Asian American, Pacific Islander)
- History of cardiovascular disease
- Hypertension (≥140/90 mm Hg or on therapy for hypertension)
- HDL cholesterol level <35 mg/dL and/or triglyceride level >250 mg/dL
- Women with polycystic ovary syndrome
- Physical inactivity
- Other clinical conditions associated with insulin resistance (e.g., severe obesity, acanthosis nigricans)

Patients with prediabetes (A_{1c} ≥5.7%, IGT, or IFG) should be tested yearly. Women who were diagnosed with gestational diabetes mellitus should have lifelong testing at least every three years. For all other patients, testing for diabetes should begin at 45 years of age. If results are normal, the ADA recommends repeat testing at least every three years, with consideration for additional testing based on risk [14].

HEALTH RISKS ASSOCIATED WITH PREDIABETES

Prediabetes is not a benign condition. Both metabolic and vascular abnormalities can begin at levels less than the upper limit of what is considered normal fasting blood glucose. Most cases of type 2 diabetes are preceded by a period of blood sugar in the intermediate range of blood glucose. Many people with IFG or IGT already have microvascular complications normally associated with diabetes. Prediabetes is also associated with obesity, abnormal cholesterol, hypertension, and an increased risk for cardiovascular disease.

PROGRESSION TO TYPE 2 DIABETES

Statistics show that having prediabetes increases the risk for developing type 2 diabetes. For people with normal blood glucose, the progression to type 2 diabetes is about 5% [6]. The progression to diabetes for people with IGT is 6% to 10% per year. For persons with both IFG and IGT, the incidence of progression to type 2 diabetes is as high as 65% in six years. According to the American College of Endocrinology and the American Association of Clinical Endocrinologists (ACE/AACE), IGT should be considered a more important risk factor for progression to diabetes than IFG [6].

METABOLIC SYNDROME AND HEART DISEASE

Approximately one-half of people with IGT meet the criteria designated for metabolic syndrome. Once known as "syndrome X," metabolic syndrome is a cluster of risk factors associated with overweight and obesity that produces insulin resistance. In patients with insulin resistance, the body produces insulin, but receptor sites on liver, muscle, and adipose tissue are ineffective. When insulin resistance is present, more insulin is needed to produce a degree of glucose-lowering effect. This results in hyperinsulinemia, meaning that there are high levels of unused insulin in the blood. Hyperinsulinemia has several adverse effects on vasculature and metabolic function.

People with metabolic syndrome have twice the risk for cardiovascular disease and five times the risk for diabetes [6]. Experts anticipate that metabolic syndrome may surpass smoking as the leading risk factor for heart disease in the near future. Because of these increased risks, it is recommended that blood lipid and blood pressure goals for persons with prediabetes should be the same as those for people with established diabetes [6].

Approximately 34% of adults in the United States have metabolic syndrome, and the incidence is increasing, which is correlated with the rise in obesity rates among adults [18]. In addition to excess weight and sedentary lifestyle, specific genes and increased age are also associated with metabolic syndrome and insulin resistance [19].

A person may be diagnosed with metabolic syndrome if he or she has any three of the following risk factors [18; 20; 21]:

- Waist circumference more than 40 inches for men or more than 35 inches for women, indicating excess visceral fat (i.e., "apple" body shape)
- Triglycerides greater than 150 mg/dL
- High-density lipoprotein (HDL) cholesterol less than 40 mg/dL in men or less than 50 mg/dL in women
- Blood pressure greater than 135/85 mm Hg
- FPG greater than 100 mg/dL

The presence of metabolic syndrome is a signal of the need for lifestyle modification. Weight loss, exercise, and a low-fat diet can often improve metabolic abnormalities without medication. Even a reduction in sitting time and sedentary pastimes can have a positive effect on metabolic risk factors [22].

While the cluster of risk factors comprising metabolic syndrome has been recognized for a long time, there is mounting evidence that the individual risk factors alone are significant. "Metabolically healthy" obese men older than 50 years of age are still ten times more likely to develop type 2 diabetes than metabolically healthy men of normal weight. Some experts have concluded that the focus should be on treating the individual risk factors of metabolic syndrome rather than the cluster of abnormalities [23; 24].

MICROVASCULAR COMPLICATIONS IN PREDIABETES

Evidence suggests that the microvascular damage from high blood glucose begins early in the progression from normal glucose tolerance to frank diabetes. Studies of people with prediabetes indicate that risk for retinopathy, nephropathy, and neuropathy are all increased [6]. Retinal microaneurysms and microalbuminuria, the hallmarks of diabetic retinopathy and nephropathy respectively, have been detected in a significant number of nondiabetic people with IGT [9]. IGT is common in patients with peripheral neuropathy, and a causal relationship has been assumed, though not adequately studied. The risk for retinopathy and nephropathy may begin to increase when two-hour postprandial blood glucose levels reach 162 mg/dL [10].

RISK FACTORS FOR DIABETES AND PREDIABETES

A number of risk factors have been identified for diabetes and prediabetes and are the same for either condition. Some risk factors are fixed or unchangeable, such as age or family history. Other risk factors are related to lifestyle choices and are therefore modifiable. The ADA has an online test that may be helpful for patients to become more aware of their personal risk for type 2 diabetes. The test may be accessed at http://www.diabetes.org/are-you-at-risk/diabetes-risk-test [25].

Risk factors for diabetes and prediabetes include [6]:

- Age older than 45 years
- Family history of diabetes (in a parent, brother, or sister)
- Previously identified as having IGT, IFG, and/or metabolic syndrome
- Belonging to certain racial and ethnic groups, including non-Hispanic blacks, Hispanic/Latino Americans, Asian Americans, Pacific Islanders, American Indians, and Alaska Natives
- History of gestational diabetes
- Women who have delivered a baby weighing 9 pounds or more
- Polycystic ovary syndrome (PCOS)
- Overweight
- Sedentary lifestyle
- High blood pressure (140/90 mm Hg or more) or being treated for high blood pressure
- HDL cholesterol less than 35 mg/dL
- Triglyceride level greater than 250 mg/dL
- A history of cardiovascular disease
- Receiving antipsychotic therapy for schizophrenia or bipolar disorder

HISTORY OF GESTATIONAL DIABETES

Gestational diabetes refers to diabetes that develops during pregnancy and ceases following the postpartum period. It complicates approximately 7% of all pregnancies [15]. Gestational diabetes occurs more frequently among Asian Americans, Hispanic/Latino Americans, and non-Hispanic black Americans [13]. Other risk factors include obesity, a personal history of gestational diabetes, or a family history of diabetes. Testing for gestational diabetes should take place at the first prenatal visit if these risk factors are present. Otherwise, testing should be done between 24 and 28 weeks' gestation, usually with a glucose tolerance test [14].

Although most women with gestational diabetes will have normal glucose levels within six weeks postpartum, 35% to 60% will develop type 2 diabetes in the next 10 to 20 years [13]. Therefore, regular blood glucose testing is recommended for these women during and following pregnancy. Maintenance of a healthy body weight and regular physical activity may help prevent the onset of type 2 diabetes in this population [26]. Breastfeeding in women who have had gestational diabetes is highly encouraged because it increases insulin sensitivity in the mother and can protect both mother and infant against diabetes [27].

POLYCYSTIC OVARY SYNDROME

PCOS is an endocrine disorder that affects the ovarian function of approximately 5% to 10% of women of childbearing age [28]. It is characterized by infrequent or absence of ovulation, hyperandrogenism, and/or polycystic ovaries. Signs and symptoms of PCOS include menstrual irregularities, such as amenorrhea, oligomenorrhea, or abnormal uterine bleeding. Excess androgen hormone may cause hirsutism, alopecia, and acne.

Many studies have documented an association of PCOS with insulin resistance and IGT, resulting in an increased risk for type 2 diabetes [29]. Conversion of IGT to type 2 diabetes may be 5 to 10 times more likely in patients with PCOS than in those with IGT who do not have PCOS [29].

Women with PCOS also have increased risk for cardiovascular disease.

OGTT screening for IGT is indicated upon diagnosis of PCOS and at least every two years thereafter. Because PCOS represents an independent risk factor for glucose intolerance, screening is recommended regardless of body mass index (BMI) or other additional risk factors for diabetes.

Lifestyle modification, consisting of diet, weight loss, and regular exercise, is the cornerstone of diabetes prevention in any high-risk population. There are no specific studies on prevention of diabetes in patients with PCOS. When lifestyle interventions do not achieve weight reduction, insulin-sensitizing drugs, such as metformin or a thiazolidinedione, may be considered [29].

ACANTHOSIS NIGRICANS

Acanthosis nigricans is a skin condition associated with insulin resistance. Brownish-black patches, usually found on the back of the neck, in the axillae, and other areas exposed to repeated friction, characterize this condition. The slightly raised lesions of acanthosis nigricans feel velvety to the touch. Acanthosis nigricans is especially prevalent in children with type 2 diabetes and in obese dark-skinned individuals. Parents of children with this condition often mistake it for poor hygiene and attempt to treat it with vigorous scrubbing or topical applications. As a clinical indicator of insulin resistance, the presence of acanthosis nigricans should prompt screening for type 2 diabetes [6].

FAST FOOD CONSUMPTION

A study of 44,000 black women between 30 and 69 years of age has suggested that eating out frequently is associated with an increased incidence of diabetes onset in this population [30]. The researchers found that eating restaurant meals of hamburgers, fried chicken, fried fish, and Chinese food was independently associated with an increased risk for the development of type 2 diabetes. Study participants who reported eating hamburgers twice per week had a 40% increase in risk compared to those who did not eat any restaurant meals. Eating two meals per week of fried chicken increased the risk to 68% compared to those who had none. It should be noted that greater BMI was also associated with increased risk, suggesting that the weight gain from eating these types of foods was responsible for the increased risk for developing type 2 diabetes [30].

One study examined whether maternal intake of fried foods before conception and early pregnancy was associated with gestational diabetes [31]. The researchers found that regular intake of fried fish and fried chicken was associated with an elevated risk of gestational diabetes, whereas intake of fried potatoes, chips, or donuts was not. Another study also examined the association between pre-pregnancy consumption of fried foods and risk of gestational diabetes. This prospective study included 15,027 women in the Nurses' Health Study II cohort who were followed for 10 years. During this period, the authors documented 847 incident gestational diabetes pregnancies. They found that frequent fried food consumption, particularly away from home, was significantly associated with a greater risk of gestational diabetes [32].

AN OVERVIEW OF TYPE 2 DIABETES

Diabetes is a disease that affects the body's ability to control and utilize its supply of glucose. Glucose, the primary fuel source for the body, originates from carbohydrate food consumption and can also be generated and regulated by the liver. When glucose is not properly regulated, blood glucose levels rise. If high blood glucose levels are sustained over time, abnormalities in the structure of blood vessels and nerves can result. This leads to organ and tissue damage and can result in serious complications affecting the eyes, kidneys, and nerves. Other pathologic processes and risk factors are strongly related to the development of cardiovascular disease, which is the leading cause of death in people with diabetes.

NORMAL GLUCOSE METABOLISM

As noted, glucose is available to the body in two ways: from food that has been consumed and through the body's own production of glucose by the liver, a process known as gluconeogenesis. Exogenous dietary glucose is ingested via carbohydrate foods, either in the form of sugars or starches. The glucose is absorbed through the wall of the small intestine, enters the circulation, and travels to the cells throughout the body. The glucose is converted to energy after passing through the cell membrane. In order for glucose to pass through the cell membrane, insulin is required. Insulin is produced by the beta cells of the pancreas, and its role is to facilitate the entry of glucose into the cells by attaching to insulin receptors. These receptors are located primarily on the skeletal muscle and liver tissue. Normally, a rise in blood glucose after eating stimulates the production of insulin from the pancreas. Other hormones, known as incretins, also help regulate glucose homeostasis after eating.

Blood glucose that is not required for immediate energy needs may be stored in the muscle and liver tissue as glycogen. Glucagon, another pancreatic hormone, controls the release of glycogen from the liver and muscle tissue.

After eating, blood glucose rises, which stimulates the production and release of insulin from the pancreas. Incretin hormones are also released from the small intestine after the ingestion of carbohydrates, even before blood glucose levels begin to rise. Incretin hormones include glucagon-like polypeptide-1 (GLP-1) and glucose-dependent insulinotropic peptide (GIP). These incretins affect glucose homeostasis by controlling insulin and glucagon secretion during the postprandial period. Any derangement in the normal processes of glucose metabolism can cause hyperglycemia.

TYPE 2 DIABETES DISEASE PROCESS

An estimated 90% to 95% of people with diabetes have type 2 diabetes [3]. There are at least three major abnormalities of metabolism responsible for inducing the type 2 diabetes disease process: insulin resistance, insufficient insulin secretion, and inappropriate glucose production.

Insulin resistance, or the impairment of the body to effectively utilize available insulin, is the hallmark of both metabolic syndrome and type 2 diabetes. In people with early stage type 2 diabetes, insulin resistance reduces glucose uptake by 35% to 40%. With insulin resistance, the pancreas may produce normal or greater than normal amounts of insulin, but receptor sites for it are not available. For some people, the pancreas is temporarily able to make enough additional insulin to overcome the insulin resistance and produce normal blood glucose levels. Hyperinsulinemia is usually the case in early stages of type 2 diabetes and is associated with macrovascular risk factors of the metabolic syndrome, such as dyslipidemia and hypertension. High levels of insulin in the blood increase sympathetic activity that can raise blood pressure.

Insufficient insulin secretion by the pancreas usually occurs as part of the natural history of insulin resistance. When insulin resistance is prolonged, pancreatic beta cells ultimately become fatigued due to the hyperactivity required to compensate for persistent elevated blood glucose. Eventually, the beta cells can no longer produce enough insulin to meet the body's needs, and mild hyperglycemia begins to develop. Because the role of insulin is to facilitate the passage of glucose into cells, blood glucose continues to rise. Unfortunately, mild hyperglycemia is rarely symptomatic, and many people miss the opportunity to intervene with lifestyle changes that can prevent progression to type 2 diabetes at this point.

Inappropriate glucose production by the liver is a third major metabolic abnormality in diabetes. As an organ that can make or store glycogen, the liver plays a major role in regulation of blood glucose levels. In normal physiology, the liver can store glycogen and release it as needed to keep blood glucose in a normal range. In type 2 diabetes, insulin resistance of receptor sites can prevent the liver from receiving the signals it needs to stop releasing glucose when blood levels are sufficient. When this occurs, glucose output from the liver increases, causing blood glucose to continue rising inappropriately.

The presence of adipose tissue plays a role in glucose metabolism and the development of metabolic syndrome. In the past, adipose tissue was generally regarded as an inert substance that was related in some way to diabetes and cardiovascular disease. Today, fat tissue is recognized as a metabolically active organ, secreting hormones, cytokines, and enzymes that can affect functions throughout the body. In fact, fat is considered an endocrine organ.

Excessive fat cells contribute to insulin resistance. As fat cells enlarge, they become hypoxic, interfering with insulin uptake and causing collagen and fiber around the cells to increase. The resulting insulin resistance not only contributes to the development of hyperglycemia, but hypertension as well. Hepatic fat, which can lead to non-alcoholic liver disease, is more strongly related to insulin resistance than visceral fat.

LONG-TERM COMPLICATIONS

The chronic complications of diabetes have an immense effect on the healthcare system, society, and the individual. While the economic costs of diabetic complications are enormous, their affect upon quality of life for the individual and family can be equally devastating. The CDC reports the impact of chronic complications upon Americans with diabetes as [13]:

- Leading cause of adult-onset blindness
- Leading cause of end-stage renal disease
- Significant morbidity and disability due to foot ulcer and lower extremity amputation
- Increased risk for cardiovascular disease
- Significantly increased risk for nerve disease, periodontal disease, and a host of other health problems

The chronic complications of diabetes are usually classified as microvascular or macrovascular according to the type of blood vessel damage that underlies the problem. Microvascular complications of diabetes include retinopathy, nephropathy, and neuropathy. Prolonged hyperglycemia leads to changes in the structure of the microscopic vessels that supply the eye, the kidney, and the nerves.

Macrovascular complications of diabetes are coronary artery disease, cerebral artery disease, and peripheral vascular disease. Heart disease is the foremost cause of death in people with diabetes [13]. Moreover, people with diabetes are prone to developing both coronary and cerebral vascular disease at an earlier age than people who do not have diabetes.

Much research over the past two decades has demonstrated that good glycemic control can prevent the onset and slow the progression of the chronic complications of diabetes. Maintaining an A_{1c} of 7% to 6.5% or less is recommended for most people with diabetes for the prevention of complications [14]. Furthermore, blood pressure control, healthy lipid levels, and freedom from tobacco use offer additional significant reductions in risk.

Treatments for type 2 diabetes include moderation of carbohydrate intake, weight management, exercise, medication, and stress management. Most people with diabetes perform self-monitoring of blood glucose (SMBG) on a regular basis. Diabetes management requires substantial and ongoing self-care activity on the part of the patient or caregiver. Self-management education is a hallmark of diabetes treatment and is associated with improved outcomes. These same steps should be taken in patients with prediabetes to prevent progression of the disease and sequelae.

DIABETES PREVENTION PROGRAM

The DPP was a landmark study on the prevention of diabetes. The results, published in the *New England Journal of Medicine* in 2002, reported that diabetes could be prevented or delayed in people with IFG and IGT [2]. Using subjects with prediabetes who were overweight, the study compared the results of treatment with the diabetes medication metformin versus lifestyle changes that led to weight loss. Importantly, the DPP showed that the greatest reduction in diabetes risk was associated with lifestyle changes that resulted in a 5% to 7% loss of body weight. Ten-year follow-up of DPP subjects has shown that diet and exercise, resulting in weight loss, could keep diabetes at bay for at least a decade in those at high risk [33].

STUDY DESIGN

The DPP was a multicenter study involving 3,234 subjects with prediabetes, all whom were overweight. The subjects were assigned to one of three groups:

- Lifestyle intervention group subjects were encouraged to make significant lifestyle changes related to diet and exercise. These subjects received intensive training in making these changes and professional help with behavior modification. The recommended dietary changes included calorie reduction and decreased fat intake. The exercise recommendation for these subjects was 150 minutes per week. The goal was for subjects to lose 7% of body weight and to maintain that loss.
- Metformin group subjects were assigned to take 850 mg of metformin twice per day. This group also received information about diet and exercise but did not receive the same intensive counseling as the lifestyle intervention group.
- Control group subjects were given a placebo and information about diet and exercise. Like the metformin group, this group received information without intensive counseling.

RESULTS

At the end of nearly three years, the lowest incidence for developing type 2 diabetes was in the lifestyle intervention group. This demonstrates that weight loss and increased physical activity are more significant factors in diabetes prevention than the use of medication or placebo. For each study group, the approximate incidence of developing diabetes in three years was:

- Lifestyle group: 14% developed diabetes
- Metformin group: 22% developed diabetes
- Control group: 29% developed diabetes

These results indicate that millions of people at risk for type 2 diabetes could delay or prevent the disease by losing approximately 7% of their body weight through increasing exercise and eating a diet low in fat and calories. Overall, people in the lifestyle intervention group were able to reduce their risk for type 2 diabetes by 58%. After 10 years, the lifestyle group still had a 34% reduction in risk as compared to the placebo group. Reduction in risk was true for all participating ethnic groups and without regard to gender. Lifestyle modification was shown to be particularly beneficial to participants 65 years of age and older, whose risk was reduced by 71% [33; 34].

Further analyses of DPP data have concluded that changes in diet and exercise leading to weight loss have significant benefits in addition to diabetes prevention, including [34]:

- Decreased incidence in the development of metabolic syndrome
- Decrease in presence of high blood pressure
- Improvement in triglyceride and HDL cholesterol levels

- Lower levels of C-reactive protein and fibrinogen (risk factors for heart disease)
- Reduced incidence of problems with female urinary incontinence

The results of the DPP also showed that diabetes could be prevented with the use of metformin in people with prediabetes, with risk reduction of about 31% [34]. Risk reduction with use of metformin was found to be most effective for people 25 to 44 years of age and in those who were at least 60 pounds overweight [34]. After 10 years, the incidence of type 2 diabetes was decreased by 18% in the metformin group as compared to placebo [33].

Another study, Action for Health Diabetes (Look AHEAD), supports the findings of the DPP, showing that intensive lifestyle intervention designed to achieve and maintain weight loss produces improvements in glycemic control, as well as other health benefits. Look AHEAD is a large, 13-year study of cardiovascular morbidity and mortality in overweight or obese people with type 2 diabetes. At the four-year point, it has been found that lifestyle modifications similar to DPP recommendations can result in weight loss, reduction in blood pressure and improved lipid profile, in addition to improvement in blood glucose levels [35]. Other studies, such as the Da Qing IGT and Diabetes Study and the Finnish Diabetes Prevention Study, also provide strong evidence for the benefit of lifestyle modification in the prevention of diabetes [36].

LIFESTYLE RECOMMENDATIONS

Based on the results of several major research studies, including the DPP, the ACE/AACE make the following statement in support of preventing type 2 diabetes [6]:

> Lifestyle modification should be the cornerstone of treatment; it should be attempted with all patients and reinforced in every visit with the healthcare professional. Lifestyle is a fundamental management approach that can effectively prevent or delay progression from prediabetes to diabetes, as well as reduce both microvascular and macrovascular disease risks. Importantly, lifestyle interventions improve the panoply of risk factors for diabetes and components of the metabolic syndrome: obesity, hypertension, dyslipidemia, and hyperglycemia.

To prevent progression of prediabetes to type 2 diabetes and other health problems, lifestyle recommendations for people with prediabetes include [6; 14]:

- 7% weight reduction, with long-term maintenance at this level
- A program of regular, moderate-intensity physical activity for 30 to 60 minutes daily, at least five days per week, or 150 minutes per week
- A diet that includes calorie restriction, fat restriction, increased fiber intake, and possible limitations in carbohydrate consumption
- Structured education and support, with regular contact, to facilitate lifestyle modification

Lifestyle modification is recommended for all ages, although individual adjustment may be made based on a specific patient's needs. Studies have indicated that education on lifestyle modification to prevent diabetes can be effective in either individual or group formats [37].

The American Diabetes Association asserts that patients with prediabetes should be referred to an intensive behavioral lifestyle intervention program modeled on the Diabetes Prevention Program to achieve and maintain 7% loss of initial body weight and increase moderate-intensity physical activity (e.g., brisk walking) to at least 150 minutes per week.

(http://care.diabetesjournals.org/content/41/Supplement_1. Last accessed January 17, 2018.)

Level of Evidence: A (Clear evidence from well-conducted, generalizable randomized controlled trials that are adequately powered)

NUTRITIONAL INTERVENTIONS TO PREVENT DIABETES

General evidence-based dietary guidelines for the prevention and treatment of diabetes are to:

- Consume a variety of foods, including fruits, vegetables, grains, low-fat and fat-free dairy products, and lean meats.
- Limit food high in saturated fat, trans fatty acids, and cholesterol. Emphasize fruits, vegetables, and low-fat dairy products.
- Limit salt intake to 2,400 mg/day.
- Limit alcohol to no more than two drinks per day for men and one drink per day for women in people who choose to drink alcohol.

Increased intake of dietary fiber and whole grains may decrease the risk for developing type 2 diabetes. One study showed that replacing white rice with brown rice and other whole grains was associated with decreased diabetes risk. Investigators concluded that, for the prevention of diabetes, most carbohydrates should come from whole grains rather than refined grains [38]. In 2010, the ADA Standards of Medical Care in Diabetes were revised to specify that people at high risk for diabetes should be encouraged to consume 14 g of fiber per 1,000 calories of food intake and to consume food containing whole grains to equal at least one-half of total grain intake [15]. The ADA continues to recommend these nutritional interventions [14].

THE MEDITERRANEAN DIET

The Mediterranean diet is based on the dietary traditions of Crete, Greece, and Southern Italy as they were practiced in the 1960s. This was a time when the rates of chronic disease in that area were among the lowest in the world and adult life expectancy was the highest, despite the fact that medical services were limited. Ironically, it was considered a diet of the "poor" at the time, because it included small amounts of beef and processed foods, which were then valued as dietary symbols of prosperity. This traditional diet was plant-based, consisting mainly of fruits and vegetables, beans, nuts, whole grains, and fish, with moderate consumption of olive oil and red wine. It included relatively small amounts of dairy and red meat.

Scientists have studied the Mediterranean diet intensely over the past 50 years, resulting in ample evidence that the diet is associated with health benefits. Several of these studies have concluded that a Mediterranean-type diet can help prevent diabetes, assist in weight loss, prevent overweight people from progressing to obesity, lower the risk for heart disease, and decrease the need for medication in diabetic patients [39; 40; 41]. A 2009 study on the effects of the Mediterranean diet on postprandial blood glucose and lipid levels of people with type 2 diabetes has led researchers to conclude that "this kind of diet…could be considered a first line of choice for the treatment of patients with type 2 diabetes" [40].

General tenets of the Mediterranean diet include [39]:

- High consumption of fruits, vegetables, whole grains, beans, nuts, and seeds
- More than half of fat calories come from monounsaturated fats (mainly from olive oil)
- Low-to-moderate consumption of dairy products, eggs, fish, and poultry
- Very low consumption of red meat and sweets
- Moderate consumption of wine
- Being physically active and enjoying meals with others

According to the American Diabetes Association, reducing caloric intake is of paramount importance for those at high risk for developing type 2 diabetes, though recent evidence suggests that the quality of fats consumed in the diet is more important than the total quantity of dietary fat. For example, the Mediterranean diet, which is relatively high in monounsaturated fats, may help to prevent type 2 diabetes.

(http://care.diabetesjournals.org/content/41/Supplement_1. Last accessed January 17, 2018.)

Level of Evidence: Expert Opinion

THE DASH EATING PLAN

Dietary Approaches to Stop Hypertension (DASH) is an evidence-based eating plan that has been shown to lower blood pressure in people with moderate-level hypertension, without the use of antihypertensive medication. Adhering to DASH can also result in reduced doses of medication in people with more severe hypertension [42]. This eating plan is recommended by the National Heart, Lung, and Blood Institutes and the American Heart Association and is included as an example of a healthy eating plan in the U.S. Department of Agriculture Dietary Guidelines for Americans. Research has found that following the DASH eating plan can also offer protection against the development of type 2 diabetes [43].

The DASH eating plan emphasizes fruits, vegetables, low-fat dairy foods, whole grains, and one serving of nuts, seeds, or legumes per day. This results in increased consumption of potassium, calcium, magnesium, and fiber, nutrients that are associated with blood pressure reduction. The plan also includes moderate amounts of protein, low consumption of total fat, and decreased intake of sodium. The U.S. Department of Health and Human Services (USDHHS) has published a consumer guide that includes detailed information on how to follow the DASH guidelines, including meal plans and recipes [44]. Although not a weight-loss plan per se, evidence suggests that people can lose weight while following the DASH guidelines along with increasing physical activity. Patients can be referred to the USDHHS booklet on DASH for guidelines on lowering calories while following the DASH eating plan [45].

WEIGHT-LOSS GOALS AND RECOMMENDATIONS

Overweight people have a higher risk for prediabetes, diabetes, heart disease, and a number of other serious health problems. For people with diabetes and prediabetes, moderate weight loss (5% to 7% of body weight) can improve insulin action and decrease fasting blood glucose. Moderate weight loss can also lower the risk for cardiovascular morbidity, associated with diabetes and prediabetes, by decreasing blood pressure and improving the lipid panel.

Reducing calories and increasing physical activity are the cornerstones of healthy weight loss [46]. As their position on weight management, the Academy of Nutrition and Dietetics (formerly the American Dietetic Association) states "… successful weight management to improve overall health for adults requires a lifelong commitment to healthful lifestyle behaviors emphasizing sustainable and enjoyable eating practices and daily physical activity" [46]. For safe weight loss, the Academy of Nutrition and Dietetics and the ADA recommend a reduction of 500 to 1,000 calories per day to achieve a target weight-loss rate of 1 to 2 pounds per week [46].

A pivotal finding from the DPP was that diabetes could be prevented with only modest weight loss in at-risk subjects. It is notable that the weight loss target for the lifestyle intervention group was 7% of initial body weight, not attainment of ideal body weight. The actual results showed that even 5% weight loss was significant for disease prevention. For nurses and other healthcare providers, these results justify education and counseling to support modest weight loss in overweight patients. Suggesting a smaller, more achievable initial weight-loss target can help patients who feel overwhelmed by the expectation that they must lose a great deal of weight to achieve health benefits. To suggest an initial short-term weight loss goal of 5% might be a more realistic first step that is more likely to encourage and motivate patients.

ASSESSMENT OF BODY WEIGHT AND BODY FAT

Body Mass Index

BMI is a commonly used screening tool to identify weight problems and associated health risks. Calculated from a person's height and weight, BMI is highly correlated to obesity or fat mass and risk for disease, and charts and calculators are available online [46; 47; 48; 49; 50; 51]. While there are other ways to assess body fat, BMI provides a method that is inexpensive and easy to determine.

Weight status categories have been developed to classify health risk based on body fat determined by the BMI [47]. Using the BMI calculation, the CDC defines weight status as follows [48]:

- Underweight: BMI less than 18.5
- Normal: BMI between 18.5 and 24.9
- Overweight: BMI between 25 and 29.9
- Obese: BMI of 30 or greater

Because it is based on a calculation from an individual's weight, BMI is not a direct measure of body fat. As an indicator of health risk, BMI is not accurate in certain populations, such as highly trained athletes, who have a higher ratio of muscle to fat, or in elderly persons who have lost muscle mass [47]. In addition, Asian populations have been shown to have a higher risk for diabetes at lower BMIs [14].

Waist Circumference

Another way to assess body fat and disease risk is to measure waist circumference. This is useful because excessive abdominal fat is a risk factor for type 2 diabetes, hypertension, dyslipidemia, and cardiovascular disease [52]. Research in the Netherlands concluded that BMI and waist circumference, when accurately measured by trained staff, are equally predictive of cardiovascular disease and mortality over 10 years [53].

Excess waist circumference with associated health risk is identified as greater than 40 inches in men or greater than 35 inches in nonpregnant women [52]. The proper way to measure abdominal circumference is to place a tape measure around the bare abdomen, just above the hipbone. The tape should be parallel to the floor and snug, but not compressing the skin. Instruct the patient to exhale and relax for the measurement [52].

NUTRITIONAL INTERVENTIONS FOR WEIGHT LOSS AND MANAGEMENT

According to the Academy of Nutrition and Dietetics, a reduced-calorie diet is the basis for healthy weight loss. The goal is to create a deficit of 500 to 1,000 calories per day, with a target weight loss of 1 to 2 pounds of weight loss per week [46]. Counseling patients on safe and effective weight loss and healthy eating includes many strategies.

For effective weight management, the Academy of Nutrition and Dietetics recommends assessment and intervention by a multidisciplinary team, including a physician, registered dietitian, exercise physiologist, and behavior therapist [46]. While the interdisciplinary team approach is considered the "gold standard," access to these professionals is not always feasible for patients whose healthcare plans do not cover all of these services or for those who live in remote geographic areas. In these cases, a nurse or other knowledgeable healthcare provider may assume responsibility for teaching weight reduction and healthy eating by utilizing recommendations and evidence-based practice standards from these other disciplines. Research evidence supports that a relatively inexpensive program involving nurse support is as effective as a more resource-intense program for weight maintenance over a two-year period [54].

The following information is not intended, nor is it able, to replace the specialized training and knowledge set of a registered dietitian or other specialists in weight management. However, because these resources are not always available, information provided here can serve as a guide to nutrition education for the prevention of diabetes.

Reduction in Fat and Calories

Achieving a healthy weight requires a diet that has a total energy (or caloric) intake that is less than energy expended by metabolism, physical activity, and exercise. The average American diet consists largely of energy-dense, nutrient-poor foods with added sugars and solid fats, including grain-based baked goods, such as cookies, cakes, and yeast breads. Soft drinks represent another major source of calories in the typical American diet. Only 5% to 15% percent of daily calories should come from these sources, and while intake has decreased across all age groups and for both genders, it still exceeds the limit recommended by the USDA [55].

GUIDE TO SERVING SIZES FOR MEAL PLANNING	
Category	**One Serving Size**
Starches and grains	1 slice of bread 1 small potato (1/2 cup) 1/2 cup corn, beans, peas (cooked) 1/2 cup oatmeal (cooked) 3/4 cup dry cereal 1/3 cup pasta (cooked) 1/3 cup rice (cooked) 1 6-inch tortilla
Vegetables	1/2 cup cooked vegetables 1 cup raw vegetables
Fruit	1 small apple or orange (4 oz) 2 Tbsp dried fruit 1/2 medium banana 1/2 cup canned or frozen fruit 1 cup melon or raspberries 1 1/4 cup whole strawberries
Milk	1 cup fat-free milk 1 cup nonfat yogurt
Meat and other proteins	1 oz fish, chicken, or beef (cooked) 1/4 cup cottage cheese 1 egg 1 Tbsp peanut butter 1/2 cup tofu
Fats and oils	1 tsp oil 1 tsp butter or margarine 2 Tbsp avocado 1 Tbsp regular salad dressing 1 tsp regular mayonnaise 1 Tbsp light mayonnaise
Sweets and desserts	1/2 cup ice cream 1 small cupcake or muffin 2 small cookies
Source: [56; 57]	*Table 1*

There has been much debate about the risks and benefits of restricted carbohydrate diets, especially for people with diabetes and prediabetes. While the issue has not been fully resolved, evidence suggests that excessive total caloric intake, not carbohydrate intake alone, contributes most to the development of insulin resistance by causing weight gain. For this reason, prevention of weight gain, not carbohydrate restriction, is the recommended approach for preventing insulin resistance.

General guidelines for fat and calorie reduction include:

- Trim all fat from beef and pork and remove skin from chicken.
- Use non-fat or low-fat dairy products.
- Bake, broil, or grill food instead of frying.
- Use low-fat dressings and spreads.
- Limit saturated fat, avoid trans fat, and use moderate amounts of canola or olive oil.
- Limit sweets and desserts.

- Limit fast food and restaurant meals.
- Limit high-calorie snacks such as chips and granola bars.
- Eat more slowly.
- Leave some food on the plate.
- Replace caloric drinks, such as juice, energy drinks, and soda, with water.
- Use measuring spoons and cups to control portion sizes.

Portion Control

The term "portion distortion" refers to the perception that the amount of food served on a plate or at any single eating occasion is the appropriate amount to eat, no matter the size. It has been shown that people who eat too much at one time do not compensate by eating less later in the day. Furthermore, larger portion sizes override hunger and satiety signals, so eating continues beyond the feeling of fullness [22; 46]. Portion distortion is reinforced in society by restaurants that serve large helpings, food sold in large packages, and larger size plates and eating utensils.

Studies indicate that portion control is a valid component of a healthy and effective weight loss plan. Based on these studies, the Academy of Nutrition and Dietetics recommends that portion control be integrated into the weight-loss plan. To help patients with portion control, advise them to:

- Weigh and measure foods to ensure appropriate serving sizes (***Table 1***).
- Visualize appropriate serving sizes. Teach patients to compare food serving sizes to the size of everyday objects as a frame of reference (***Table 2***). Artificial food models of appropriate size may be useful to demonstrate serving sizes.
- Use premeasured, calorie-controlled foods, such as reduced-calorie frozen dinners or 100-calorie packages. Use smaller plates, bowls, and utensils for eating.
- Avoid eating directly out of a bag or bowl. Put one serving on a plate or dish.
- Be aware of large serving sizes in restaurants. Place half of a large portion in a take-home container before starting the meal or share an entree with another person.
- Practice the "plate method" of portion control.

The Plate Method

A group of dietitians in Idaho developed the Idaho Plate Method in 1993, based upon an earlier model from Sweden [60]. Since its inception, the plate method has been widely utilized in health education as a practical and effective way of teaching healthy eating behavior [61; 62; 63; 64]. Its premise is that healthy eating and controlling portion sizes can be simplified by using a visual image of a plate that shows the proper amounts of foods (***Figure 1***). While incorporating the nutritional recommendations from the ADA, the plate method helps people with diabetes lose weight, reduce the incidence of hypoglycemia, and make better food choices [62; 64]. The Idaho Plate Method is updated regularly and is available in English and Spanish. Information regarding the Idaho Plate Method may be accessed online at http://www.platemethod.com [60].

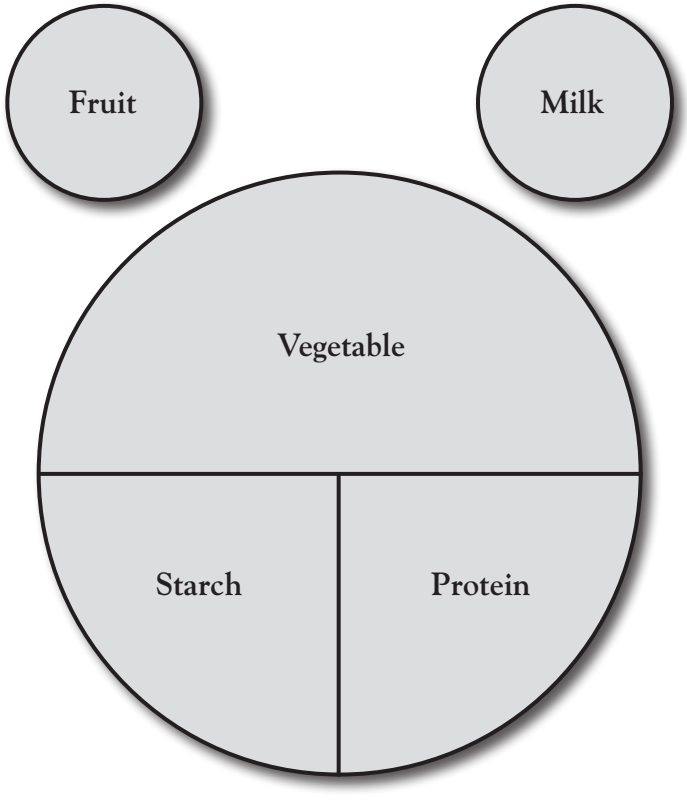
The teaching tenets of the plate method are:

- Use a nine-inch plate.
- Fill approximately half the plate with non-starchy vegetables, such as leafy greens, onions, peppers, tomatoes, cucumbers, green beans, broccoli, carrots, cauliflower, and mushrooms.
- Fill one-fourth of the plate with protein foods, such as lean cuts of meat, fish, poultry without the skin, one to two eggs, 2 ounces of low-fat cheese, one-third cup nuts, or 2 tablespoons of peanut butter.
- Fill one-fourth plate with starchy food, such as whole-grain bread, brown rice, whole-grain pasta, potato, beans, lentils, corn, or peas.

SERVING SIZES AS COMPARED TO COMMON OBJECTS	
Serving Size	**Is The Same Size As**
Bread/Grain/Starch	
Pancake or waffle	CD or DVD
Potato	Computer mouse
Cooked rice or pasta	1/2 baseball
Pretzels, chips	1 baseball
Meat/Cheese	
Cheese cubes	4 dice
Meat or poultry	Deck of cards
Grilled/baked fish	Checkbook
Fats	
Margarine, butter, mayonnaise	1 die or the tip of your thumb
Peanut butter	Golf ball
Ice cream	1/2 baseball

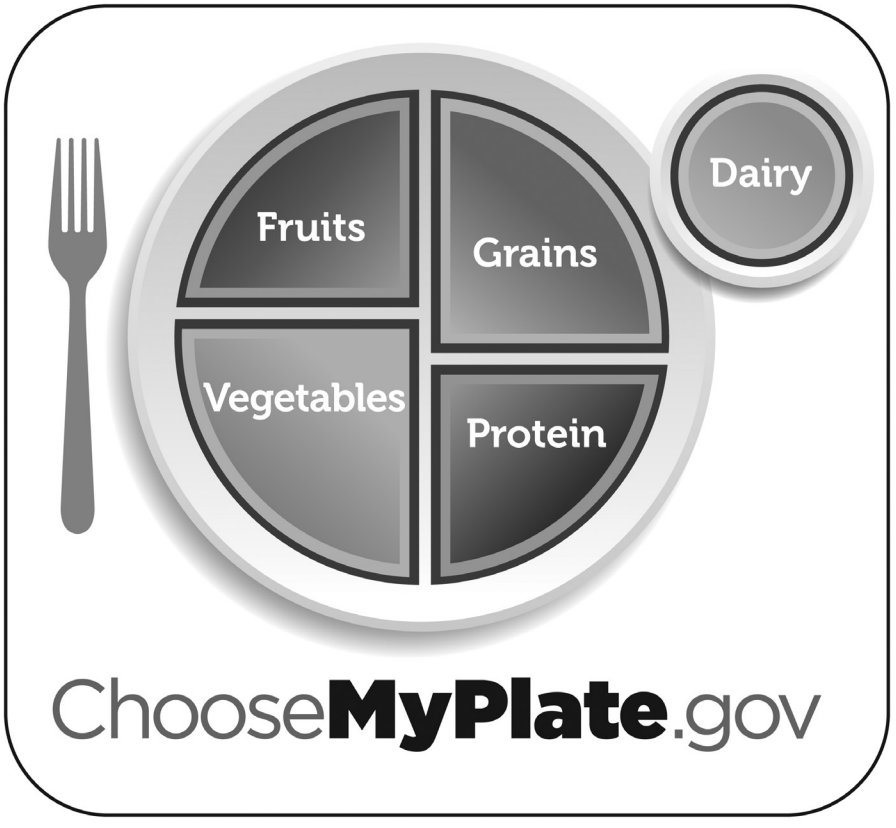
Source: [58; 59] *Table 2*

THE IDAHO PLATE METHOD



Source: [60] *Figure 1*

THE MYPLATE METHOD



Source: [66] *Figure 2*

- Add a small piece of fruit, one-half cup fresh, frozen, or canned fruit, or 2 tablespoons of dried fruit.
- Add a serving of dairy, such as one-cup milk, 6 to 8 ounces of yogurt, or one-half cup sugar-free pudding.

The plate method is very helpful as a first step in learning to control portion sizes and to choose healthy foods in the right amounts. It is useful for patients who are busy or overwhelmed by too much information and for those who do not like strict regimens. People of low-literacy and those who have barriers to weighing and measuring foods may find the plate method the most acceptable approach to healthy eating and weight management [60].

MyPlate

In 2011, the USDA Center for Nutrition Policy and Promotion released the *2010 Dietary Guidelines for Americans*, which place greater emphasis on promoting the consumption of nutrient-dense foods and to achieving and maintaining a healthy weight. As a result, a new icon to illustrate these recommendations, referred to as MyPlate, takes the place of earlier Food Guide Pyramid. Information about MyPlate is available at https://www.choosemyplate.gov [65; 66].

MyPlate illustrates a plate being one-half filled with vegetables and fruits (***Figure 2***). By comparison, the Idaho Plate Method shows one-half of the plate filled with vegetables only and a piece of fruit to the side. Both plates display one-fourth filled with lean protein and one-fourth filled with whole grain,

as well as a cup of dairy on the side. As of 2018, the American Diabetes Association continues to recommend the use of a method consistent with the Idaho Plate Method [61].

Eating Frequency

The Academy of Nutrition and Dietetics recommends that total caloric intake be "distributed throughout the day, with the consumption of four to five meals/snacks per day, including breakfast" [46]. An important counseling strategy is to help the person find a meal pattern that prevents times of heightened hunger. Advise patients to eat at least every four to five hours during waking hours. They should also try to avoid hunger in situations in which high-calorie food choices are readily available. For example, helping the patient plan healthy sack lunches and snacks may prevent overeating at vending machines or fast food establishments during working hours. Consuming a greater proportion of calories during the day, as opposed to the evening, may also prove to be beneficial to patients' weight loss goals [46].

Eating breakfast can have a positive influence on appetite control, food choices, and metabolism, and thus help with weight management [22; 46; 67]. Eating breakfast helps an individual avoid becoming overly hungry early in the day, which can later lead to overeating and poor food choices. Furthermore, eating a healthy breakfast can set the psychologic and behavioral tone for the day, prompting better food choices overall. For patients who work odd hours, eating within one hour of waking up can be considered "breakfast" regardless of the time of day it is eaten.

Use of Meal Replacements

Meal replacements are drinks, bars, and other portion-controlled or calorie-controlled packaged items that are available to replace certain meals. Use of meal replacements, along with an overall program of calorie control and regular exercise, may enhance weight loss by as much as 8.5% [68; 69]. Meal replacements may be most helpful to people who have difficulty with portion control or who need the convenience of quick and easy nourishment. They can also help a person who feels overwhelmed with choices or who is easily tempted by the vast availability of calorie-dense food choices. The Academy of Nutrition and Dietetics endorses the use of meal replacements to substitute for one or two meals or snacks per day when appropriate for an individual's lifestyle. When patients are using meal replacements for weight loss, advise them to optimize the overall nutritional content of their diet with careful selection of conventional foods that make up the rest of their diet [46].

SAMPLE NUTRITION FACTS LABEL

Nutrition Facts

8 servings per container

Serving size **2/3 cup (55g)**

Amount per serving

Calories **230**

	% Daily Value*
Total Fat 8g	**10%**
Saturated Fat 1g	**5%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 160mg	**7%**
Total Carbohydrate 37g	**13%**
Dietary Fiber 4g	**14%**
Total Sugars 12g	
Includes 10g Added Sugars	**20%**
Protein 3g	
Vitamin D 2mcg	10%
Calcium 260mg	20%
Iron 8mg	45%
Potassium 235mg	6%

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Source: [72] *Figure 3*

Label Reading

For weight management and diabetes prevention, patients may be instructed to examine the nutrition facts on a food label (***Figure 3***) [70; 71]. The first step is checking serving size and servings per package. Note that even small packages may have more than one serving. This can be misleading, as many people would expect to eat the entire package in one sitting. If the person eats the entire package of a container having two servings, all of the nutritional values on the label must be doubled. Eating just one serving is essential. A 2016 redesign of the nutrition facts label bolds serving size and number of servings to address this issue [72].

Calorie and fat content per serving should also be noted. Choices can be made by comparing the calories and fat grams per serving on different products. Advise patients to choose items with lower fat and calorie content per serving. A low-fat food contains no more than 3 grams of fat for every 100 calories. It is also important for patients to avoid foods that have trans fat listed on the nutrition facts label. Trans fats originate from the process of hydrogenating oil. If the nutrition facts label indicates that the item has no trans fats, but the ingredient list shows that it contains hydrogenated or partially hydrogenated oil, the product contains less than 0.5 mg per serving. The goal is to consume zero trans fats.

The percent daily value is also a useful tool. If a food has 5% or less of fat, cholesterol, and sodium, it is a good choice [71]. Foods that are high in fiber, vitamins A and C, calcium, and iron will have 20% or more of the recommended daily value; these are good foods to incorporate into one's diet. Note that percent daily values are average levels of nutrients for a person eating 2,000 calories per day, and a person trying to lose weight will usually require less than 2,000 calories per day. Use these values only as a guide for evaluating the relative nutrient content of foods [71; 72].

Sodium content should be analyzed, as high-sodium diets increase the risk for hypertension and kidney disease. The recommended daily intake of sodium is 2,300–2,400 mg or less. For people with certain cardiac conditions, 2,000 mg or less per day is often recommended. Patients should be advised to aim for entrees with less than 600 mg per serving, side dishes with less than 400 mg, and snacks with a maximum of 200 mg of sodium per serving.

Foods high in carbohydrates increase blood sugar faster than others, so it is important to select foods with moderate amounts of carbohydrate. Instruct patients to look at the "total carbohydrate" content of a serving, not only the sugar content, as all carbohydrates have the potential to increase blood glucose. One carbohydrate serving is equal to 15 grams.

Fiber is beneficial for weight loss and blood glucose control, so patients should select foods with the most fiber. A product is considered a good source of fiber if it has 2.5–4.9 grams of fiber per serving. Foods can officially be labeled "high fiber" if they contain at least 5 grams of fiber per serving.

Product ingredients are listed in order from the most to the least. The first ingredient indicates that the food contains more of that component than anything else. Highly processed foods usually have a long list of ingredients; healthier choices often have shorter ingredient lists.

While the U.S. Food and Drug Administration (FDA) regulates food label claims, consumers should be aware of marketing ploys that can be misleading. Many packaged foods make health statements such as "light" and "all natural," but some of these claims are not approved by the FDA. Examples of claims that are not FDA approved include "all natural," "doctor-recommended," and "strengthens your immune system." However, several food label claims are approved and regulated by the FDA, including:

- Free: The product has a very low or insignificant amount or none of the nutrient or ingredient. This is often used to describe fats, sodium, sugars, or calories.

- Low: Meaning varies according to the specific claim. In order for a product to be labeled "low fat," it must have no more than 3 grams of fat per serving. Items labeled "low sodium" have 140 mg or less of sodium per serving, and "low calorie" means that there are 40 calories or less per serving.
- Reduced: The item contains 25% less fat, sodium, cholesterol, calories, or sugars than the original product.
- Light: The item contains 33% fewer calories and 50% less fat than the original product.
- Good source: Contains 10% to 19% of the daily value of a specific nutrient per serving.
- High: Contains 20% or more of the daily value per serving.

When teaching about label reading, use a sample label to demonstrate the guidelines and to check the patient's skill at reading labels. Evaluate comprehension by asking him or her how many servings are in a package and how much should be measured out to equal a single serving. Measuring cups and sample foods can be available for the patient to practice measuring. They may be surprised to see what an actual serving size looks like. It is also helpful to have the patient practice calculating out how many calories he or she would consume by eating the whole package as compared to a single serving portion.

Food Diary

Several authorities on healthy eating and weight loss recommend using a food log to keep track of what is eaten and to record environmental and internal cues that are associated with what one eats [42; 73]. A 2008 study supported this belief, showing that keeping a food diary can double weight loss [73]. In this study, nearly 1,700 overweight or obese adults were enrolled in a long-term weight-loss program that included group sessions with nutrition and behavior experts. At the end of six months, those who kept a food diary lost an average of 18 pounds, compared to 9 pounds for those who did not.

Keeping a food diary helps people maintain an accurate record of what they consume and helps keep them on track with healthier choices. It enables the person to be more aware of eating habits and the number of calories taken in a given day. For printable food diaries that are available online, see the ***Resources*** section at the end of this course.

Tips for keeping a food diary include updating the log as soon as food is eaten, recording mood related to food intake, and noting environmental cues that may have influenced eating, such as location and social factors. Using their food logs, ask patients to analyze episodes of inappropriate eating so they can plan better alternatives next time they receive the same cue. For example, a person may be cued to eat unhealthy snacks that are available and easily accessible in the workplace. When this is identified, patients can brainstorm solutions to this situation, such as taking alternative healthy snacks to work, practicing saying "no" when these things are offered, or avoiding places where these foods are displayed or made available.

Making Healthy Substitutions

Eating more healthfully does not mean that a person has to change his or her entire diet or give up all of his or her favorite foods. The food diary can be used to identify situations in which a person makes high-calorie food choices when lower calorie substitutions could be made. This can allow the person to enjoy the types of foods he or she likes while reducing caloric intake. Some examples of healthy, reduced-calorie substitutions include:

- Use non-fat milk and/or sugar-free syrup in coffee.
- Drink sugar-free, reduced-calorie hot chocolate made with water or fat-free milk in place of a sweet dessert.
- Use slow-churned, reduced-calorie ice cream or fat-free frozen yogurt in place of regular ice cream.
- Have raw vegetables with salsa or fat-free dressing instead of chips.
- Use mustard or a small amount of oil with vinegar on sandwiches instead of mayonnaise.

- Substitute fatty lunch meats, such as bologna, with low-fat lunch meats that are 95% to 97% fat free.
- Use Canadian bacon instead of bacon or sausage.
- Replace refried beans with cooked or canned kidney or pinto beans.
- Select pasta with red sauce (marinara) instead of white sauce (Alfredo).
- Top baked potatoes with salsa or fat-free sour cream in place of butter.

Hunger Scale

Behavioral interventions for weight loss include helping people understand why they eat. Many people eat in response to cues other than hunger. While some of these may be of an emotional nature, in some cases people simply fail to differentiate when the body needs food and when it does not. The Academy of Nutrition and Dietetics recommends that people become more aware of their degree of hunger before eating. For example, a person can avoid too many calories in a day by not immediately eating when they feel the first twinge of hunger. A hunger scale can help guide a person in evaluating more precisely how hungry they are and giving them pause before eating. The following scale is suggested to assess and respond to hunger:

- 0: Not hungry at all
- 1: Slightly hungry
- 2 or 3: Moderately hungry
- 4: Overly hungry, starving

The goal is to eat when hunger is at 2 or 3 on the scale. If the person is eating when not hungry, he or she is probably eating for emotional or situational reasons, such as anxiety or in front of the television. If a patient is responding to eating cues that are unrelated to true hunger, explore alternative behaviors. For example, if a patient notes that she goes to the kitchen for a snack prior to initiating an unappealing task, she may be eating to procrastinate. In this situation, she could drink a glass of water or go for a short walk before starting the task. Caution patients not to allow themselves to become overly hungry, as this may cause them to overeat. If the hunger is rated 4, the person may have waited too long to eat and is at risk of overeating. Patients can be counseled to make a schedule for eating and to allow themselves to feel mild hunger in order to learn to identify it.

FOODS TO ENCOURAGE

The *2015 Dietary Guidelines for Americans* recommend an increased reliance on a plant-based diet, similar to the Mediterranean diet. This emphasizes vegetables, cooked dry beans and peas, fruits, whole grains, nuts, and seeds. The new guidelines also recommend increasing the intake of seafood and fat-free or low-fat dairy products [55].

Increased intake of certain food types has been shown to prevent diabetes, assist with weight management, and prevent cardiovascular disease. For example, consuming brown rice in place of white rice appears to decrease the risk for developing type 2 diabetes. Consuming a diet rich in fiber from fruits, vegetables, and whole grains reduces the risk of coronary artery disease. People who include generous amounts of fruits and vegetables in their diets are less likely to develop diabetes and cardiovascular disease [22]. Increased intake of legumes is associated with a lower body weight and a smaller waist circumference.

Fruits and Vegetables

Those with higher fruit and vegetable intake have a 24% lower risk for becoming obese than those with low intake [22]. These foods maintain fullness while reducing caloric intake. Patients can begin increasing vegetable intake by including an additional serving at both lunch and dinner. Healthy toppings for vegetables may include lemon juice, fat-free sour cream, vinegar, and/or non-caloric butter substitutes. Fruit intake can be increased by substituting fresh fruit for sweet snacks. Fruits and vegetables can be a good source of fiber, which is also an essential part of a healthy diet.

Whole Grains

A diet rich in whole grains can also reduce the risk for several chronic health conditions, such as obesity, metabolic syndrome, diabetes, and cardiovascular disease. It is also associated with lower body weight and decreased blood pressure. One study reported that diets with high amounts of whole-grain foods helped achieve significant weight loss and reduced the risk for cardiovascular disease and diabetes [74]. In this study, participants were assigned to one of two groups. One group was instructed to have all of their grain servings from whole grains. The other was instructed to have all of their grain servings from refined grains. The whole-grain group was instructed to use products with a whole grain listed as the first ingredient on the food label. Participants from both groups received the same advice for eating a healthy diet and advised to participate in moderate physical activity. After 12 weeks, participants in both groups lost similar amounts of weight, but those in the whole-grain group lost more waist circumference. The whole grain group also experienced a significant decrease in C-reactive protein, an inflammatory marker for diabetes hypertension and cardiovascular disease risk. In the refined grain group, even those who lost weight did not show a decrease in C-reactive protein [74; 75].

A grain is considered "whole" when the entire grain seed is intact. The bran and germ components, which contain most of the fiber and nutrients, are removed during the refining process. Good sources of whole grains are whole-wheat breads, whole-wheat pasta, brown rice, barley, oats, whole-grain cereal, and legumes. Instruct patients to read bread and cereal labels and look for the word "whole" in the ingredient list. If "whole grain" or "whole wheat" is the first ingredient listed, there is a good chance that this item will be an excellent source of whole grain. "Enriched" wheat usually indicates that the grain is refined. If a bread or cereal product has enriched wheat listed as the first ingredient, it is not a good source of whole grain [76].

On average, Americans consume 16 grams of fiber per day; the recommended amount is 20–35 grams per day [22]. There is conflicting evidence regarding the potential benefits of whole-grain consumption for persons with diabetes [14].

Polyunsaturated Fatty Acids

Polyunsaturated fatty acids, such as omega-3 fatty acids, improve insulin sensitivity and may help reduce risk for cardiovascular disease by reducing triglycerides, increasing HDL cholesterol, and lowering blood pressure [22]. Good sources include salmon, sardines, herring, trout, and other fatty fish, as well as fish oil supplements. Dietary guidelines recommend consuming at least two servings of non-fried fatty fish per week. Dietary supplements of omega-3 fatty acids may be recommended for people who cannot meet this requirement from diet alone. People using anticoagulant medications should be medically supervised when taking these supplements.

Linolenic acid is another type of polyunsaturated fatty acid that is believed to decrease blood clotting and inflammatory processes in the body. This is found in canola oil, walnuts, flaxseed, and olive oil. Keep in mind that unsaturated fats contain the same amount of calories as saturated fat and that the diet should consist of no more than 10% of calories from fat [55].

SOCIAL SUPPORT AND SOCIETAL CHANGE

Being involved with others can increase the chance for success at weight loss and maintenance. Support can come from an individual or a group. A study by Hollis et al. showed that subjects who attended interactive group support and education sessions were more successful at achieving weight loss [73]. Groups are available in most communities and online to support healthy weight loss and maintenance.

Numerous other studies indicate that having spouses and healthcare providers involved in behavioral modification for weight loss increases the likelihood of success [22]. Helping patients explore their individual support systems can improve their chances for success. Encourage them to make their health goals a family project that supports the health of all.

Beyond family and community support, the 2015 Dietary Guidelines Advisory Committee advocates societal change to support healthier eating in compliance with their recommendations. The committee calls upon government agencies and authoritative bodies to coordinate action to help all Americans eat well, be physically active, and maintain good health and function [55]. Health professionals, food scientists, the agricultural industry, and food manufacturers can all be involved in improving the health of the nation through education, improved availability of fresh produce and seafood, and the creation of greater financial incentives to purchase healthier foods and prepare them at home [55].

EATING BEHAVIOR AND PROBLEM SOLVING

Food and eating serve many purposes and have multiple meanings for people. Besides physical sustenance, eating provides socialization, emotional comfort, and relief from stress and anxiety, among other things. Eating is also a behavior that is driven by environmental cues and other external forces. For numerous reasons, many people overeat, consume nutritionally inferior diets, and/or regularly eat foods that increase their risk for health problems.

Behaviors associated with overweight and obesity include excessive television watching, decreased physical activity, frequent eating at fast food restaurants, consuming foods high in fat and sugar, skipping breakfast, and lack of portion control [55]. Effective weight loss counseling includes exploring the behavioral components of a patient's dietary habits and assisting with problem solving. Mindful eating is a valuable skill that can result in healthier lifestyle habits. The food diary and the hunger scale are useful tools for increasing awareness of one's actual physical need for food and for monitoring the quantity of food consumed.

Nutritional counseling should provide help in learning to understand reasons for "emotional eating." This includes helping patients identify feelings related to eating and determining where the feelings originate. It may involve encouraging the patient to respond to feelings in ways other than eating. For example, if the patient identifies that he or she is bored, explore other enjoyable activities that could be done instead of eating. If a person is depressed, provide sources of support for that problem. Thorough assessment may reveal the need for a mental health referral for help with emotionally rooted eating behaviors.

The American Association of Diabetes Educators (AADE) recommends asking patients the following questions to help with problems related to eating behavior [77]:

What three words fill in the blanks for you? When I think about healthy eating, I feel _____, _____, and _____. This question helps examine the emotions the patient has about eating and that he or she may have toward making behavior changes. If this exploration reveals barriers, it is best to ask the patient first what he or she believes will help to overcome it. The next step is to offer suggestions to enhance the patient's own ideas, if indicated.

What did you eat for dinner last night? Is there anything you could have done to make your meal healthier? These questions help assess patients' food preferences and increase their awareness of what they are eating. By asking patients to generate their own ideas for improvement, they are empowered to make behavior changes on their own behalf.

For you, what is the hardest part about healthy eating? This question enables patients to identify challenging situations and to solve problems. Healthcare professionals can guide them in making their own plan to avoid the identified problems or to be prepared to make better choices when an unavoidable situation arises.

What is the best part about healthy eating? When patients make their own statement about how change will be beneficial, it facilitates readiness. This is a powerful component of motivational interviewing, which is discussed more thoroughly in a later section of this course.

A step-wise approach to behavioral problem solving can also be helpful. Kaiser Permanente Health Education Services recommends the following sequence for behavioral problem solving [78]:

- Define the problem: Problem identification should be patient-centered. Ask the patient "What concerns you most?" and ask him or her to identify what would be good about making the change.
- Find solutions: Ask patients to list options for how the problem could be solved. If resistance to change is evident, maintain empathy and remain nonjudgmental. Ask what might help the patient become more ready to find solutions.
- Choose a solution: Of the possible solutions, instruct the patient to select the best one and make it a goal. Reflect back what the patient has said about the pros and cons of the various options.
- Evaluate progress after one week: If not successful with the chosen plan or solution, patients should consider modifying the original goal or looking at other options from the list. Explore how these other options might be put into action.

EXERCISE TO PREVENT DIABETES

An important finding from the DPP and other studies on diabetes prevention is that exercise is integral to lifestyle modification for the prevention of diabetes. In the DPP, subjects in the lifestyle intervention group participated in at least 150 minutes of moderate physical activity per week. Following the results of the DPP and other studies, the ADA now recommends 150 minutes of moderate-to-vigorous intensity physical activity per week, along with a healthful diet and a program of weight control, for the prevention of type 2 diabetes [14]. For improved health and wellness in general, the American College of Sports Medicine (ACSM), the American Heart Association, and the USDHHS all recommend 30 minutes of moderate-intensity physical activity five or more days per week, or a minimum of 150 minutes per week for adults [79].

BENEFITS OF EXERCISE

Studies indicate that most people with type 2 diabetes show decreases in blood glucose after mild-to-moderate exercise [80]. The magnitude of glucose lowering is proportionate to the duration and intensity of the exercise and persists into the post-exercise period, prolonging its benefits over two to three days [80]. Another noteworthy benefit of regular exercise is the reduction of risk factors for cardiovascular disease, such as hypertension, insulin resistance, and dyslipidemia.

Exercise improves carbohydrate metabolism and insulin sensitivity. It reduces blood glucose by lessening the production of glucose by the liver and by increasing blood glucose utilization by the skeletal muscle. Improvement in insulin sensitivity from a single bout of exercise lasts 24 to 72 hours, depending on the duration and intensity of the exercise [80]. Exercises that increase muscle mass, such as resistance exercises, can lead to enhanced glucose metabolism, as greater muscle mass is associated with better insulin uptake.

Besides lowering blood glucose, improvement in insulin sensitivity also mediates the negative effects of metabolic syndrome, reducing such cardiovascular risk factors as hypertension, hyperinsulinemia, central obesity, lipid disorders, and inflammatory markers such as C-reactive protein [80]. Other health benefits related to regular physical activity include reduced risk for osteoporosis, obesity, colon cancer, breast cancer, peripheral vascular disease, anxiety, and depression. For older adults, regular exercise is also associated with a reduced risk of falls and injury [80].

EXERCISE AND WEIGHT LOSS

Successful weight loss and long-term maintenance of lost weight require a combination of healthy nutrition, regular exercise, and behavior modification. Research shows that weight loss is more likely to occur as a result of decreased calories in the diet than from calorie burning during exercise. This is because it is very difficult for most people to create the 500 to 1,000 calorie per day deficit needed for weight loss with exercise alone [46].

The benefit of exercise to weight loss is considered "dose related," meaning that greater weight loss and less weight regain are associated with increased amounts of exercise. Moderate-intensity physical activity for between 150 and 200 minutes per week is effective in preventing weight gain, but it will not result in clinically significant weight loss without calorie restriction. Amounts of moderate-intensity physical activity beyond the recommended 150 minutes per week are usually necessary to bring about significant weight loss in the absence of calorie restriction. According to the ACSM, 200 to 300 minutes of exercise per week will provide modest weight loss. Specifically, 225 to 420 minutes (approximately four to seven hours) of moderate exercise per week are associated with weight loss of roughly 11 to 16 pounds over several weeks [81].

Although evidence suggests that 150 minutes of exercise per week alone does not result in significant weight loss, the DPP concluded that this amount does prevent diabetes, most likely by increasing insulin sensitivity. Exercise is also a critical element in preventing weight regain after the initial loss. Furthermore, it reduces risk for cardiovascular disease and diabetes beyond that produced by weight loss alone. Therefore, exercise prevails as an essential component of a healthy lifestyle for promoting overall weight loss, weight maintenance, and chronic disease prevention [46].

SPECIFIC EXERCISE RECOMMENDATIONS

Aerobic Exercise

As noted, for the prevention of type 2 diabetes, the ADA recommends a minimum of 150 minutes of moderate-to-vigorous intensity aerobic activity per week, along with a healthful diet and modest calorie restriction. Aerobic exercise is defined as "rhythmic, repeated, and continuous movements of the same large muscle groups for at least 10 minutes at a time" [36]. Examples include walking, bicycling, dancing, water aerobics, and many sports [36]. Because the effect of exercise on insulin sensitivity does not last longer than 72 hours, patients will experience the most benefit to blood glucose if aerobic sessions are no more than two days apart [36; 80].

Some public health recommendations suggest that exercise of at least 30 minutes duration is best for cardiovascular health. However, several research studies have indicated that shorter bouts of moderate physical activity that are accumulated toward the daily goal of 30 minutes can be as beneficial as longer periods. This finding has advantages for people who cannot sustain a full 30 minutes of moderate physical activity. Those with a lower level of fitness, who have limited time, or who are low in motivation may be advised to break their physical activity sessions into two or three periods per day of 10 to 15 minutes each [82]. Having this option may make exercise more realistic and appealing to people with certain challenges and barriers to exercise.

While it should be approached as a lifelong commitment, a proper exercise recommendation should include the advice to start gradually and work up to higher intensity. Exercise should also include warm-up and cool-down periods. Warm-up includes 5 to 10 minutes of low-intensity aerobic activity, followed by 5 to 10 minutes of gentle stretching. The cool down should be structured similarly to the warm-up with 5 to 10 minutes of low-intensity movement to bring the heart rate to its pre-exercise level [83].

Determining Exertion Level

Measuring exertion by relative intensity or "how it feels" is an acceptable and often desirable way to know if the activity being done is of appropriate intensity. Measuring relative intensity involves having patients note how the activity affects their breathing and heart rate as opposed to actually taking readings of pulse and respiration. This is desirable because learning to take clinical measures can be complicated for some people and can create a barrier to exercise. One simple way to measure relative intensity of moderate activity is with the "talk test." If a patient is feeling subjective signs of exertion, such as heavy breathing and body warmth, but is still able to talk, but not sing, while engaged in the activity, the intensity of the activity is adequate [84].

The ACSM recommends the use of a "perceived exertion" scale in people with diabetes, other chronic health conditions, and those older than 65 years of age. According to this guideline, moderate-intensity aerobic activity involves, "a moderate level of effort relative to an individual's aerobic fitness" [85]. Using a 10-point scale, whereby sitting is 0 and maximum effort is 10, moderate intensity is 5 or 6 and produces noticeable increases in heart rate and breathing. Vigorous activity is 7 or 8 and produces large increases in heart rate or breathing. Because people have differing levels of fitness, perceived moderate exertion could involve a brisk walk for some or a slower walk for others [80; 85].

While most public health recommendations specify moderate-intensity exercise, the ADA and the ACSM include an option for engaging in "vigorous" exercise to meet the exercise target [85]. In particular, for prevention of type 2 diabetes, the ADA recommends 150 minutes per week of "moderate-to-vigorous" physical activity. General recommendations from the ACSM advise 30 minutes of moderate aerobic activity five days per week or vigorous intensity exercise for a minimum of 20 minutes three days per week. Combinations of both exercise intensities may be used to meet this requirement. Vigorous activity is quantified as exertion of 7 or 8 on the perceived exertion scale, along with large increases in heart rate and breathing. Examples of vigorous-intensity exercises include jogging, cross-country skiing, jumping rope, or competitive sports, such as basketball. In helping patients select the intensity of an exercise program, it is important to identify what the individual feels is realistic and feasible, while taking into account age, physical function, and other health conditions.

Resistance Exercise

Experts recommend resistance exercise be a component of the complete fitness program for healthy adults. Resistance exercise is defined as, "activities that use muscular strength to move a weight or work against a resistive load" [36]. Examples include weightlifting, working with resistance bands, and using weight machines.

Resistance exercise increases muscular fitness and improves insulin sensitivity to about the same extent as aerobic exercise. It may also reduce cardiovascular risk factors such as dyslipidemia, insulin resistance, and blood pressure.

Findings on the benefits of resistance exercise to weight management are inconclusive. Some research indicates that resistance exercise is not effective for weight loss, with or without diet restriction [86]. However, other evidence suggests that resistance-training increases muscle mass and enhances body fat loss when combined with calorie restriction. Because muscle weighs more than fat, resistance exercise appears to be beneficial in reducing body fat, if not body weight.

With or without weight loss, increasing muscle mass through resistance exercise may be important in preventing diabetes. A cross-sectional analysis of data on more than 14,000 people suggested that sarcopenia (i.e., reduced muscle mass and strength) was associated with insulin resistance regardless of weight status [87]. Researchers concluded that weight loss alone might not be enough to avert diabetes. It may also be important to have adequate muscle mass and strength, which can be enhanced with resistance exercise [87].

Although there are no specific recommendations for resistance exercise to prevent diabetes, the ADA recommends that people with type 2 diabetes should be encouraged to perform resistance exercise three times per week unless contraindicated. The exercise should include all major muscle groups—legs, hips, back, abdomen, chest, shoulders, and arms. Exercise for each group should progress to three sets of 8 to 10 repetitions. Exercises should be performed to the point at which it would be difficult to do another repetition.

Initial supervision and periodic reassessments by a qualified exercise specialist are recommended to maximize health benefits and prevent injury. Muscle strengthening activities can be done on the same day as aerobic activities or on alternate days. Resistance activities do not count toward the aerobic activity total of 150 minutes per week. The CDC provides videos demonstrating the proper techniques for muscle-strengthening activities at https://www.cdc.gov/physicalactivity/basics/videos [88].

Lifestyle Physical Activity

In 2015, the ADA revised its standards of medical care to include a position statement that encourages a reduction in sedentary time (e.g., working at a computer, watching television) for all individuals [14]. The ADA recommends that a person spend no more than 90 minutes at a time engaging in sedentary behavior without a break for physical movement [14].

The ACSM states that moderate or vigorous activities of daily living, when performed in bouts of 10 minutes or more, can be counted toward the daily recommendation of approximately 30 minutes total per day. Examples of these types of activities include climbing stairs, gardening with a rake or shovel, and vacuuming. Light activities of daily living, such as shopping and cooking, do not count toward the recommended target for most people, unless the activity produces perceived moderate intensity for the individual [82].

For those who are very sedentary, obese, or otherwise unable to fulfill the daily activity recommendation, any amount of physical activity should be encouraged. A small amount of activity is considered more desirable than none at all. In these cases, patients should be encouraged to take small steps toward increasing physical activity in their daily life in whatever way they can [89].

Pedometers

Step-counting devices can promote increased physical activity in some individuals. Small and inexpensive, the pedometer tracks the number of steps taken per day. A pedometer is most effective if worn all day with attention given to finding opportunities to increase walking throughout the day. A benefit of the pedometer is that it can increase patients' awareness of how much activity they are achieving each day and to motivate them to look for opportunities to be more active, such as taking stairs instead of an elevator. Pedometers are especially useful for people who lack confidence in their ability to exercise, are resistant to a formal program, have been sedentary, have low fitness levels, or have other conditions limiting aerobic activity.

One study demonstrated that sedentary workers who averaged an increase in 3,451 steps per day over a 12-week period showed significant decrease in waist circumference [81]. Another study in England suggested that using a pedometer could reduce diabetes risk by one-half [90]. In this study, people with prediabetes who were given a pedometer and assisted in setting targeted step goals achieved a 15% greater reduction in blood glucose compared to the control group [90].

Achieving 10,000 steps per day is considered an appropriate daily step goal consistent with the recommendation of 30 minutes of moderate-intensity daily activity. If a patient is interested in using a pedometer, advise him or her to begin by wearing it for a full week without altering the usual physical activity level. This will provide a baseline upon which to build. After that time, the patient should gradually increase steps, with a goal of 10,000 steps per day for most people.

PRE-EXERCISE HEALTH EVALUATION

While there are no specific recommendations for evaluating the person with prediabetes for exercise clearance, guidelines do exist for people with diabetes and other chronic conditions. The ADA recommends that people with diabetes should be assessed before beginning a program of physical activity if it is going to be more vigorous than brisk walking. This assessment should include looking for conditions that may be associated with increased likelihood of cardiovascular disease. However, the circumstances under which a graded electrocardiogram (EKG) stress test should be considered are not well defined. Cost analysis studies have indicated that the widespread use of this test is cost-prohibitive, partly due to high risk of false-positive results, which trigger subsequent invasive testing procedures. The recommendation is that medical providers weigh the potential benefits of this type of testing against risks and costs in each individual case. In general, it is advised that anyone with diabetes older than 40 years of age be considered for an exercise stress test with EKG monitoring before undertaking aerobic physical activity with an intensity greater than the demands of everyday living, which is defined as more intense than brisk walking [83].

HELPING PATIENTS SELECT AN EXERCISE PROGRAM

It is important to guide patients to select a specific exercise plan that meets their abilities and personal preferences. Too often, patients are simply told to "get some exercise" without any support in selecting a specific and appropriate plan. Developing a plan consists of specific recommendations regarding how much activity to engage in, what type of activity, and how and when it will take place. Things to take into account include the patient's individual lifestyle, cultural preferences, current fitness level, physical limitations, social situation, schedule and time commitments, and personal preferences. It may be helpful to begin by asking patients what they are already doing or might like to start doing. This helps identify what they are most motivated to do.

It is also important to help patients select a program that will have the greatest chance for long-term maintenance. The ACSM has identified factors that influence maintenance of exercise behavior [80]:

- Setting realistic goals
- Setting an exercise schedule in advance and sticking to it
- Using an exercise partner
- Encouraging self-rewards
- Identifying alternatives to reduce boredom
- Accepting off days and being able to return to the program after backsliding

Encourage patients to choose activities that are realistic for them. Walking is the preferred form of exercise for most obese patients, but others may prefer swimming or exercise classes [22]. Attainable goals allow patients to experience success and potentially increase morale. Modest initial goals allow for gradual increase in duration and frequency of activity.

Overcoming Barriers

Educating patients on the benefits of an exercise program and the recommendations for prevention of diabetes can have a significant influence on the decision to implement a plan [80]. However, only one in three patients indicate that they have ever received advice from a healthcare provider to increase activity [22].

The best way to educate about the advantages of exercise is to ask patients what they think would be of most benefit to themselves. Most people already know that exercise has many benefits, but it is important for an individual to realize how it can help on a personal level. Patients may cite physical or health benefits as well as psychologic and social rewards. As an educator, expand upon patients' pre-existing knowledge by supplementing and enhancing their list of benefits.

Although most people agree that exercise has many health benefits, only one in six adults have a high level of physical activity [22]. Barriers to exercise can be physical, psychologic, emotional, or situational. Some barriers are perceived, such as a lack of confidence in one's ability to perform, rather than actual.

After barriers to exercise have been identified, steps can be taken to help patients overcome them. For each barrier, ask the patient what he or she thinks could help; this will allow the patient to be actively involved in resolving the barriers. Then, provide suggestions to supplement the patient's problem-solving activity. Common barriers to exercise and suggestions for helping patients overcome them include:

- Not enough time: Strategies may include scheduling time for exercise, walking on lunch break, waking 30 minutes earlier, and/or including exercise in the regular daily routine, such as on the way home from work.
- Too out of shape: Suggest starting slowly and gradually increasing both duration and intensity of exercise. Explore the feasibility of using a pedometer, and reinforce that even a little bit of activity is better than none at all.
- Too tired: Propose exercising at times of day when energy level is higher. Educate that many people feel more energetic overall when they are active on a regular basis.
- Not motivated: Recommend getting social support and/or finding an exercise partner. Ask the patient to identify what would help him or her get and stay motivated. Explore which types of activities would be most appealing.

After patients have examined their personal barriers to exercise, help them explore ideas for activities that meet their interests, lifestyle, and cultural preferences. When patients can visualize themselves performing a behavior and can verbalize their own plan of action and imagine the rewards, they are making genuine movement through the behavior change process.

Exercise Personality

Evaluating one's "exercise personality" is a way of identifying the type of activity that is most suitable for an individual. Examples of personality factors and corresponding types of exercise may include [91]:

- Likes to be outside: Walking, gardening with a shovel or rake, hiking, bicycling, swimming
- Likes to watch television: Treadmill, aerobic programs on television, stationary bicycle, other home exercise equipment
- Likes social events: Mall walking, walking for a cause (e.g., diabetes, breast cancer), taking a class, treading water while talking with friends, dancing
- Likes to be alone: Workout video, swimming, solitary walk in a safe environment, cardiovascular exercise equipment (e.g., treadmill)
- Needs direction: Exercise classes, walking partner or group, guided hikes, a personal trainer
- Family oriented: Active outings, ball games

PHARMACOTHERAPY FOR PATIENTS WITH PREDIABETES

MEDICATIONS TO PREVENT DIABETES

One arm of the DPP research study examined the efficacy of metformin as a pharmacologic agent to prevent the onset of type 2 diabetes in high-risk people. Results indicated that metformin is effective, but it is less effective than lifestyle intervention [2]. While lifestyle intervention reduced the risk for diabetes onset by 58%, metformin reduced onset by 31%. Metformin was found to be most effective in younger, more obese patients and showed little benefit for those 60 to 85 years of age [2]. The authors of another review concluded that decades of clinical use have demonstrated that metformin is generally well-tolerated and safe [92]. Nevertheless, drug therapy versus lifestyle intervention for the treatment of prediabetes remains controversial.

Although lifestyle intervention is known to be most effective, long-term adherence is challenging [92]. At the same time, preventive lifestyle interventions are equally important for treating other aspects of the metabolic syndrome, such as lowering blood pressure and normalizing lipid levels.

As of 2018, no drug is approved by the FDA to prevent diabetes or treat insulin resistance. However, metformin is recommended by the ADA for the prevention of diabetes in certain patients [14; 93]. Consensus criteria for considering the use of metformin in addition to lifestyle intervention are [14]:

- Very high risk, defined as combined IFG and IGT, plus another risk factor, such as:
  - A_{1c} 5.7% to 6.4%
  - Hypertension
  - Low HDL cholesterol
  - Elevated triglycerides
  - Family history of diabetes in a first-degree relative
- Obesity
- Age younger than 60 years
- Women with prior gestational diabetes

EVIDENCE-BASED PRACTICE RECOMMENDATION

In addition to lifestyle measures, the American Diabetes Association recommends metformin therapy for prevention of type 2 diabetes should be considered in those with prediabetes, especially for those with BMI ≥35, those older than 60 years of age, and women with prior gestational diabetes.

(http://care.diabetesjournals.org/content/41/Supplement_1. Last accessed January 17, 2018.)

Level of Evidence: A (Clear evidence from well-conducted, generalizable randomized controlled trials that are adequately powered)

A 2010 study concluded that more than 96% of people with IFG and IGT met the additional criteria for metformin use. The researchers recommended that healthcare providers routinely test for IGT in all patients with IFG to identify those who would benefit from metformin therapy in addition to lifestyle intervention. They estimate that 8% of adults in the United States could be considered appropriate candidates for the use of metformin to prevent diabetes [94]. A common side effect of metformin use is a moderate amount of weight loss, which may account for some of its beneficial effect in preventing diabetes.

Other antidiabetic medicines have also been studied for their effect on diabetes prevention. Rosiglitazone is an insulin-sensitizing drug that has led to reduced incidence of diabetes in clinical trials, but its long-term effectiveness is not known. Furthermore, clinical trials have not compared the effectiveness of rosiglitazone to lifestyle intervention or other pharmacologic agents. Other evidence suggests that using low-dose combination therapy of metformin and rosiglitazone results in risk reduction for diabetes onset [95]. In July 2010, the FDA reviewed the safety of rosiglitazone based on its potential for cardiovascular side effects. The advisory committee determined that rosiglitazone could remain on the market but with restrictions on its use and additional warnings about the risk for myocardial infarction and congestive heart failure [96]. Other side effects of rosiglitazone include weight gain, bone fracture, and peripheral edema. Inconclusive studies and safety concerns raise questions about the feasibility of this medication's use for diabetes prevention.

Another drug, acarbose, was found to reduce the progression of IGT to type 2 diabetes by 25% over 3.3 years in one study [97]. Because this medication can cause significant gastrointestinal side effects, many subjects discontinued the study medication [96]. This raises questions about the efficacy and practicality of using acarbose to prevent type 2 diabetes in actual clinical practice [97].

MEDICATIONS TO PROMOTE WEIGHT LOSS

There are five medications (orlistat, lorcaserin, liraglutide, bupropion/naltrexone, and phentermine/topiramate) approved by the FDA for the long-term treatment of obesity. These medications have been shown to be modestly effective in promoting initial weight loss, with improved results when used in combination with lifestyle changes [98; 99]. Orlistat is available by prescription (as Xenical) or over-the-counter in half-strength under the brand name Alli. It acts by deactivating gastric and pancreatic enzymes, thus preventing the absorption of fat through the gastrointestinal wall. Gastrointestinal side effects, such as bloating, gas, and oily stools, account for a high rate of discontinuation. Lorcaserin is a selective 5-HT2C receptor agonist and acts to promote weight loss by giving the patient a feeling of satiety [99]. Trials indicate that lorcaserin is safe and effective treatment, in conjunction with diet modification and exercise, for adults with a BMI ≥30 or adults with a BMI ≥27 with at least one weight-related comorbidity (e.g., hypertension, dyslipidemia, sleep apnea) [96]. Phentermine/topiramate (extended-release) combines an anorexiant and an anticonvulsant to improve short-term weight-loss outcomes in patients who have already attempted lifestyle changes (i.e., calorie-restricted diet and increased physical activity) [96]. As with lorcaserin, eligible patients will have a BMI ≥30 or a BMI ≥27 with a weight-related comorbidity [96]. The medication is contraindicated in persons with glaucoma and hyperthyroidism and is not recommended for patients with a recent history of stroke or heart disease [96]. It is also teratogenic, with proven fetal defects with first trimester exposure. Therefore, all women of childbearing age should use effective contraception consistently while taking the drug and have documented proof of a negative pregnancy test prior to the initiation of treatment and every month thereafter [96].

In 2014, combination bupropion/naltrexone was approved as a treatment option for chronic weight management [100]. Studies show that these drugs are effective in improving the percentage of total body weight lost compared to placebo [100]. The dosage is gradually titrated up, starting with one tablet (naltrexone 8 mg/bupropion 90 mg) once daily in the morning for one week and increasing one daily tablet each week for four weeks. The maintenance dose is two tablets twice daily [96]. If 5% of initial body weight has not been lost after 12 weeks, the medication should be discontinued.

Any patient taking bupropion should be carefully monitored for suicidal ideation and behaviors [96]. This medication may also increase blood pressure and heart rate and is contraindicated in patients with hypertension. It is also contraindicated in patients with a history of seizures, who are taking another bupropion-containing medication, or who are pregnant [96].

Also in 2014, the GLP-1 receptor agonist liraglutide was approved by the FDA for chronic weight management. Traditionally used to treat diabetes, liraglutide has been found to aid in appetite suppression and weight loss [101]. The dosage of liraglutide used for weight management (3 mg) differs from the dose used in diabetes medication regimens (1.8 mg), and the safety and efficacy of this higher dose for the treatment of diabetes has not been established [101]. This medication is contraindicated in those with a personal or family history of thyroid cancer.

Until 2010, another medication, sibutramine, was also available. However, it was withdrawn from the market due to safety concerns (i.e., increased risk of cardiovascular events) [102].

METABOLIC SURGERY

Reviews and meta-analyses of publications concerning metabolic surgery have consistently found improvement or resolution of diabetes in the majority of patients. A 2010 study demonstrated that gastric banding surgery could induce a remission of existing type 2 diabetes, with 73% of the study group returning to normal glycemia. Another study indicated that gastric banding induced prolonged satiety and resulted in improved glycemic control. Of those who did not achieve euglycemia, glycemic control was improved [97]. This suggests that surgical intervention may be an appropriate approach for preventing diabetes in select patients who are unable to lose weight by other means. The ADA recommends considering metabolic surgery for adults with a BMI of 40 or greater (37.5 or greater in Asian Americans) regardless of the level of glycemic control and in adults with a BMI greater than 35 (32.5–37.4 in Asian Americans) who have type 2 diabetes or associated comorbidities when lifestyle interventions are unsuccessful [14]. After metabolic surgery, patients should receive ongoing lifestyle support and medical monitoring [14].

PREVENTING DIABETES IN CHILDREN

The incidence of childhood obesity has more than tripled since the 1970s [103]. Obesity and type 2 diabetes are parallel epidemics in the United States, as these problems stem from a culture of calorie-dense foods, excess sugar consumption, and sedentary lifestyle. This has resulted in increasing rates of type 2 diabetes in youth, which was a very rare condition in past generations. Cultural and lifestyle changes over the last few decades may have even caused genetic mutations that decrease insulin sensitivity in the current generation of American children [103].

The potential burden of type 2 diabetes in children is immense. Because earlier onset of diabetes heralds longer duration and severity of its complications, this jeopardizes fiscal resources and has the potential to diminish the productivity and quality of many young lives. Keeping children at a healthy body weight appears to have lifelong effects on their mortality. Evidence suggests that obesity and glucose intolerance in children are strongly associated with increased rates of premature death [104; 105]. Young men who are obese at 20 years of age have double the risk of dying prematurely, an effect that lasts for decades. Furthermore, the chance of early death in this population increases by 10% for each BMI point greater than 25 [104]. Obesity also increases the risk for nonalcoholic fatty liver disease in children, a condition associated with insulin resistance [105].

While the estimated number of children with prediabetes is not available, one in 5 adolescents in the United States is obese; because body fat is the strongest predictor of insulin resistance in children, it is estimated that many of these children also have some level of prediabetes [103]. Puberty aggravates the risk for diabetes onset in youth due to normal biologic changes that increase insulin resistance. Children who are overweight or obese during adolescence face an even greater risk of developing type 2 diabetes.

In addition to obesity, risk factors for childhood type 2 diabetes include family history, having a birth mother with gestational diabetes and/or who did not breastfeed, and African American, Native American, or Hispanic ancestry.

More research is necessary to determine how to address prediabetes in children. It is unknown whether children with prediabetes have the same degree of risk for developing type 2 diabetes as adults with prediabetes, or if the predictors for long-term risks of diabetes are the same for children [106; 107]. The ADA recommends screening for prediabetes in children and adolescents younger than 18 years of age who are overweight or obese and who have one or more of the following risk factors for diabetes [14]:

- Maternal history of diabetes or gestational diabetes during the child's gestation
- Family history of type 2 diabetes in first- or second-degree relative
- Race/ethnicity (e.g., Native American, African American, Latino, Asian American, Pacific Islander)
- Signs of insulin resistance or conditions associated with insulin resistance (i.e., acanthosis nigricans, hypertension, dyslipidemia, PCOS, or small-for-gestational-age birth weight)

EVIDENCE-BASED PRACTICE RECOMMENDATION

The U.S. Preventive Services Task Force recommends that clinicians screen for obesity in children and adolescents 6 years and older and offer or refer them to comprehensive, intensive behavioral interventions to promote improvements in weight status.

(https://www.guideline.gov/summaries/summary/51047. Last accessed January 17, 2018.)

Strength of Recommendation/Level of Evidence: B (There is high certainty that the net benefit is moderate or there is moderate certainty that the net benefit is moderate to substantial.)

Children may be the best targets in efforts to curb the trend toward obesity and type 2 diabetes in the United States, as habits and lifestyle may be easier to change in early life, before they become firmly established. Curbing childhood overweight and obesity starts with the family environment; good family eating and exercise habits promote healthy weight in the children. Families who eat home-cooked meals on a regular basis are more likely to produce leaner children [108]. When encouraging families to adopt more appropriate eating habits, avoid using the term "diet," but instead talk about changing to a "healthy lifestyle." Tips for families adopting healthier eating habits include:

- Check online resources that are designed to help children learn about good health habits in a fun, interactive way.
- Eliminate junk food in the house.
- Modify family recipes to be healthier, such as substituting lean ground turkey for hamburger and baking foods rather than frying.
- Add more vegetables to soups, stews, and casseroles.
- Involve children in the preparation of healthy family meals.
- Do not serve a special meal to a child who does not want to eat the food served at the family meal.
- Turn off the television, radio, and music during the family meal. Focus on conversation and family interaction.
- Have children eat breakfast every day. Serve whole-grain cereals with 5 grams or less of sugar per serving. Other good choices for a healthy, child-friendly breakfast include whole-grain frozen waffles, oatmeal, and low-fat yogurt with fresh fruit.
- Healthy sack lunch ideas include sandwiches on whole grain-bread, fruits and vegetables, tuna fish, and lean sandwich meats.

The CDC recommends that children and adolescents participate in at least 60 minutes of physical activity every day [109]. A study presented at the 2010 ADA annual meeting revealed that obese boys who engaged in aerobic and resistance exercise decreased their total body fat, visceral fat, and insulin resistance, even without any changes in diet [110]. The study also indicated that resistance exercise training is appealing to boys and that it expends similar energy to aerobic training in this population.

Aerobic exercise should make up most of the 60 minutes of the daily exercise. This should include vigorous-intensity exercise at least three days per week. Children should have muscle-strengthening exercise at least three days per week as part of their 60 minutes per day. This could include push-ups and climbing on playground equipment. Bone-strengthening exercise is recommended three days per week, included in the 60 minutes per day

requirement. Bone strengthening exercises include weight-bearing exercise such as jumping rope and running [109].

Today's generation of children have more opportunity to be entertained by sedentary activities, such as television, computers, movies, and electronic games, than by active play. Screen time is correlated with obesity and poor dietary habits in children and with clinical markers for metabolic syndrome and cardiovascular disease in adults. A 2010 study showed that teenage boys with two or more hours per day of television or computer screen time are at greater risk for insulin resistance and other markers of metabolic syndrome [111].

Tips for the family working to become more active include:

- Limit television, computer, or game "screen time" to less than two hours per day.
- Assign children to active chores, such as raking leaves or carrying grocery bags.
- Have children walk or ride their bikes to school when possible.
- Have active family outings, such as walks, ball games, and swimming.
- Encourage sports. If the child is not competitive, look for team activities that focus on fun and participation rather than winning.
- Parents can be good roles models by being active themselves.

Clinic-based weight management programs appear to be effective in improving the metabolic profile of obese children, if they remain in a supervised program for several years. Results of a pilot program in Philadelphia suggest that an informal, nonintensive program of regular clinician contacts over two years can be more effective than intensive time-limited programs [112]. In this study, the greatest improvements in children's metabolic profile correlated with frequency of visits to the healthcare provider [112].

PUBLIC HEALTH INITIATIVES

On a broader level, a public health approach to fighting childhood obesity is needed. This should include school programs that integrate nutrition, physical education, and sociobehavioral approaches to promote healthy lifestyle choices among youth. School lunch programs should offer healthy choices and strictly limit foods that are high in fat and sugar from cafeterias, food courts, and vending machines. School-based exercise programs are also very important in promoting the health of children. Because working parents may not have time to exercise with their children and many children do not live where it is safe to play outside without adult supervision, children need the opportunity for physical activity during the school day.

The battle against childhood obesity should extend beyond the school into the broader public health sector. Public health education should be family-centered and provide children with knowledge and avenues for behavioral change. These educational approaches should be multicultural in nature, taking into account the various health beliefs and dietary patterns of the populations directly affected by current rates of obesity and diabetes.

ETHNIC VARIABILITY AND CULTURAL CONSIDERATIONS

Culture greatly influences patients' belief systems and values related to health and lifestyle. Culturally sensitive diabetes education programs are effective in reducing A_{1c}, total and low-density lipoprotein (LDL) cholesterol, and microalbumin [108]. Culturally competent care is defined as [113]:

> Effective individualized care that demonstrates respect for the dignity, personal rights, preferences, beliefs, and practices of the person receiving care, while acknowledging the biases of the caregiver and preventing these biases from interfering with the care provided.

Cultural competency involves practicing cultural humility, which consists of recognizing the differences and limitations of one's own culture when working with people of other cultures. Practicing cultural humility requires striving to overcome cultural biases and the barriers they may present. Cultural humility reduces the likelihood of authoritative communication from the healthcare provider. Even if education and experience have given one a good understanding of another culture, cultural humility means not assuming to know what it is like to be born of and live that culture every day [114].

With regard to therapy for preventing diabetes, a person's culture influences both food and exercise preferences. Perhaps more than any other construct, culture influences a person's food choices and his or her eating behavior. Cultural dietary preferences, meal preparation practices, and the symbolism of food represent important aspects of an individualized plan of care. When giving diet instructions, consider the food preferences of the patient's cultural group. Keep in mind that contact with the mainstream culture can influence traditional diets and people from different cultural backgrounds may have adapted their original preferences [115].

Oldways is a nonprofit organization dedicated to helping people eat healthy, plant-based diets that maintain traditional preferences and practices. This group provides several multicultural food pyramids and science-based information about traditional diets online at https://oldwayspt.org [116].

LATIN AMERICANS/HISPANICS

Diabetes is an urgent issue in the Latin American/Hispanic communities. Hispanic adults are 1.7 times more likely than non-Hispanic white adults to be diagnosed with diabetes [117]. Rates of complications of diabetes are also higher among this group. Abdominal obesity and insulin resistance greatly increase the risk for metabolic syndrome in this population.

In Latin American/Hispanic cultures, the family unit is very important and the needs of the family are placed above the needs of the individual. Winning *confianza* is important in establishing the nurse-patient relationship. This is achieved by showing respect for the culture and willingness to engage in non-healthcare-related conversation with the patient. A warm, caring, and personable manner is valued. Latino/a clients may perceive a neutral attitude from the healthcare provider as a negative attitude. This population tends to prefer teaching methods that involve storytelling and other audio presentations to printed materials [114].

The traditional Hispanic diet is high in fruits, vegetables, and fiber, and low in fat. However, acculturation to the American diet has changed traditional preferences and practices to a less healthy style of eating. Healthy choices most likely to appeal to this population include [115]:

- Vegetables: Cabbage, carrots, cassava, jicama, nopales, peppers, tomatoes (salsa)
- Fruits: Açaí, agave, banana, cherimoya, guava, mango, passion fruit, starfruit
- Grain/starch: Amaranth, bread, corn, pasta, quinoa, rice, tortilla
- Legumes, nuts, seeds: Pine nuts, black, garbanzo, kidney, and pinto beans
- Protein: Abalone, crab, sea bass, cod, chicken, eggs, beef, pork
- Dairy: Asadero cheese, yogurt, milk

According to data from Healthy People 2020, Hispanic Americans are generally less physically active than white Americans [118]. A small study of Hispanics has suggested that a group-dancing program is a culturally appealing form of exercise among Mexican Americans [119].

AFRICAN AMERICANS

Diabetes strikes 1 out of every 13 black Americans, and about one-third of these individuals are unaware they have the disease [120]. African Americans with diabetes are more likely to develop serious long-term complications and suffer greater associated disability than other racial/ethnic groups [120]. Genetic predisposition plays a major role in the higher incidence of IGT and diabetes in African Americans. As for body type, African Americans have a greater tendency for upper-body or central obesity, which is a known risk factor for metabolic syndrome.

African Americans have a high prevalence of cardiovascular risk factors that may be reduced with lifestyle modification. These include obesity, hypertension, sedentary lifestyle, and tobacco use [114; 118]. Unfortunately, studies have indicated that African Americans are less likely to participate in health screening programs. This is due in part to poor access, but may also stem from cultural and historical factors, such as mistrust in the healthcare system stemming from a history of inequitable treatment [114].

Studies have been performed to determine the best way to help African Americans make lifestyle changes for preventive health. One study concluded that being involved in group support and education sessions to promote weight loss was not effective for this population. This same study also showed that keeping food diaries did not help African American patients lose weight [73]. These findings suggest that alternate approaches to weight loss should be considered when working with African American patients.

Traditional food preferences of African Americans are regional, and many white Americans in the southern United States share these food preferences. They include [115]:

- Vegetables: Kale, spinach, collard, mustard, turnip, and dandelion greens
- Grains/starch: Corn, cornbread, yeast rolls, sweet and white potato, rice with black-eyed peas ("hoppin' John"), succotash (corn with lima beans), rice, grits
- Legumes: Field peas, green peas, pinto, navy, butter, and lima beans
- Protein: Beef and pork, poultry, fish
- Dairy: Traditionally whole milk, but 2% and nonfat milk are becoming more popular

ASIAN AMERICANS/ PACIFIC ISLANDERS

This group encompasses people from a wide geographic area, consisting of many different subcultures. However, there are a few similarities in food preferences and cultural traditions that tend to occur across these cultures.

The incidence of diabetes among Asian Americans has increased more rapidly among those who have lived in the United States for a longer period of time than among new immigrants or those living in Asia [114]. Japanese individuals living in Seattle have diabetes prevalence four to five times that of those living in Tokyo [114]. Use of BMI is not as reliable a tool for predicting diabetes risk in Asian populations, as they tend to develop insulin resistance and type 2 diabetes at much lower indices [121]. The International Diabetes Federation has determined lower measures of waist circumference for determining health risk in Asian populations [121].

EVIDENCE-BASED PRACTICE RECOMMENDATION

The American Diabetes Association recommends a lower body mass index cut point (23 rather than 25) for screening overweight or obese Asian Americans for prediabetes and type 2 diabetes to reflect the evidence that this population is at an increased risk for diabetes at lower BMI levels relative to the general population.

(http://care.diabetesjournals.org/content/41/Supplement_1. Last accessed January 17, 2018.)

Level of Evidence: B (Supportive evidence from well-conducted cohort and/or case-control studies)

Asian cultural norms include a preference for accommodation over confrontation, including submission to the group when there is conflict. Graciousness to others is valued, and effort is made to avoid making another person "lose face." When working with this population, be aware that when a person agrees, it does not always mean he or she truly agrees, but rather it is the polite response. Lack of eye contact is a sign of respect for the other person, and shyness and passivity are common traits.

In general, white rice is a basic and important component of Asian diets. Virtually every Asian meal includes white rice, accounting for up to 75% of the diet [122]. Because greater consumption of white rice is associated with higher risk for diabetes and can significantly raise blood glucose in people with diabetes, this cultural preference might present a significant challenge for many; however, specific research regarding the role of white rice in the development of diabetes is limited. One study of individuals with predominantly European ancestry showed that a greater consumption of brown rice is associated with a lower risk for type 2 diabetes [122]. Even replacing one-third of a serving of white rice per day with the same amount of brown rice was associated with lower risk. Unfortunately, it is not known if these findings can be generalized to other populations, such as Asian Americans [122].

Traditional Asian food preferences include:

- Vegetables: Carrots, broccoli, mushrooms, bok choy, cabbage, bamboo shoots, chilies, bean sprouts, scallions, leafy greens
- Fruits: Pineapple, banana, mango, tangerine, watermelon, grapes, pear
- Grains/starch: Rice, noodles
- Protein: Soybeans, tofu, fish, shellfish, egg, poultry, beef, pork

From a cultural standpoint, many Asian cultures do not value strenuous physical activity, focusing instead on martial arts and tai chi. Additional research is necessary to determine an appropriate, yet culturally sensitive, exercise intervention strategy for this population [123].

ASIAN INDIANS

Dietary practices among Asian Indians vary according to region of origin within India and the form of religion practiced. For many Asian Indians living in the United States, the traditional low-fat, high-fiber diet has evolved to include more saturated fat and fast food. Traditional dietary preferences include:

- Vegetables: Spinach, tomato, cauliflower, okra
- Fruits: Banana
- Grains/starch: Rice, chapati (a flat bread), lentils, whole-grain bread, potato
- Legumes: Peas, kidney beans
- Protein: Fish, poultry, nuts
- Dairy: Yogurt, paneer (a semi-firm cheese)

NATIVE AMERICANS

Native Americans are a diverse population, representing several hundred different groups that have settled on the North American continent. In addition, there are Alaska Natives who are distinct from Indian tribes of the continental United States. Many Native Americans live on reservations in rural areas, but just as many live in urban areas. Because each tribe has a unique history, geographic location, social system, cultural styles, and traditions, only general aspects of this group are presented here.

Diabetes is a major health problem among Native Americans, with the highest rates among the Pima Indians of Arizona, in which 50% of the adult population has diabetes [124]. Genetic predisposition along with modernization and dietary changes are responsible for the increased rate of diabetes among this population.

In general, Native Americans may not be comfortable disclosing personal information, especially to an outsider. Having a "problem" may be perceived as placing oneself lower on the rung of power. Using an aggressive approach to problem-solving during the healthcare encounter can damage the relationship. Appropriate teaching methods for this population include one-to-one instruction using demonstrations, pictures, and other visuals.

Food is an important part of most Native American cultures and is used in many cultural rituals, spiritual ceremonies, and social activities. The traditional diet was very healthy, but poverty and modernization have led to more reliance on foods such as lard, sugar, and white flour.

Traditional food preferences of Native Americans depend upon geographic location and may include:

- Vegetables: Nopales (cactus), squash, carrots
- Fruits: Strawberries, grapes, oranges, apples, melons
- Grains/starch: Corn, rice, wild rice, wheat, oats, beans, deep fried bread (fry bread)
- Legumes: Nuts, acorns
- Protein: Beans, wild game, fish, beef

BEHAVIOR CHANGE

Although convincing research results tell us that diabetes is preventable with lifestyle modification, many patients face considerable challenges in putting these recommendations into action. For example [22; 125; 126]:

- Only 1 in 33 people are at healthy weight, nonsmoking, physically active, and consume five or more fruits and vegetables per day.
- Only 1 in 3 people with prediabetes are taking steps to prevent diabetes.
- Only 1 in 6 people have a high level of physical activity.
- Two of every five people with type 2 diabetes skip breakfast.
- Americans average 16 grams of fiber per day, while the recommended minimum is 20 to 35 grams per day.
- Sixty percent of people with diabetes do not follow medical advice on how to manage their condition.

Clearly, health behavior change presents a dilemma for individuals, healthcare providers, and the public health sector. Healthcare providers often report feeling frustrated and challenged by patients who do not follow their advice. It is apparent that, in addition to providing recommendations, healthcare professionals also need to facilitate patients' behavior change process.

HEALTH BELIEF MODEL

The Health Belief Model (HBM) provides the basis for widely used strategies that assist patients in making health behavior change [127]. Originally developed in the 1950s, the HBM has been expanded and increasingly popularized over the past two decades. Based on psychologic theory, the HBM examines factors that motivate people to change health behaviors and strives to understand what makes them take action to prevent or manage illness.

Perceived susceptibility is the first construct of the HBM. This may be reflected by the patient considering "What is the likelihood that I will get diabetes?" Patients who believe the risk is low will be less likely to make changes to prevent diabetes. Educating patients about the risk factors for diabetes will help them understand their susceptibility.

Perceived severity refers to how serious a patient believes the condition to be. Patients may consider how diabetes could affect their health, quality life, and functional ability. Of all of the constructs of the HBM, perceived severity has been found to be the least powerful predictor of behavior change.

Perceived benefits refer to a patient's belief about the advantages of taking action. For example, in addition to recognizing the health benefits of weight loss, a patient may also expect it to bring psychologic, emotional, and social benefits.

Patients may be motivated to make change by stating the benefits they perceive weight loss would bring and having these reflected back to them.

Perceived barriers are the perceived negative aspects of behavior change; these are things that may impede change. A patient may feel that healthy eating is too complicated and boring. Exploring barriers and ways to overcome them are an important part of the behavior change process.

Cues to action are the "wake-up call" that prompts a patient to seek change. A call from the doctor reporting elevated blood glucose may give a patient a reason to think about changing his or her eating habits. Readiness is an important part of the behavior change process. It is important to explore the degree of readiness that patients have and learn appropriate responses to their self-identified level of readiness. These strategies will be discussed in detail later in this course.

Self-efficacy refers to a person's sense of confidence in his or her own ability to perform a behavior or a set of behaviors. Theoretically, people who are confident that they will be successful are more likely to perform that behavior. A patient's confidence can be boosted with a statement such as, "From what you have told me, I feel that you will be able to make a plan that will work for you."

Assessment of patients' self-efficacy involves asking them how confident they are that they can make the change. If confidence is low, ask them what it would take to make them feel more confident. It is important to negotiate realistic goals and an action plan with which your patient feels confident. Being able to meet a goal increases self-efficacy. If goals and action plans are not achievable, help the patient modify them to become more realistic.

ROLE OF THE HEALTHCARE PROVIDER IN BEHAVIOR CHANGE

The healthcare professional's role in helping patients change behaviors to prevent diabetes should not be underestimated. Even simply providing evidence-based advice and education can result in modest changes in health behaviors, such as those related to diet modification and tobacco cessation [22]. However, patients who passively receive education and advice are not as likely to make lasting behavior change as are those who actively participate in the process of change. Effective intervention to support behavior change usually requires multiple encounters that include more than just passively receiving advice. Patients must learn how to translate awareness into plans, and plans into action. There are several effective strategies for helping them do this.

The U.S. Preventive Services Task Force has developed the Five A's protocol, a widely used framework for supporting behavior change in clinical settings [128]. The Five A's protocol can help structure an approach to help patients make health behavior changes. The Five A's are [128]:

- Assess current practices, barriers, and readiness to change.
- Advise patient about what to change.
- Agree on patient goals (negotiate).
- Assist with change strategies and overcoming barriers.
- Arrange for resources and referral, follow-up, and support.

Collaborative Relationship

The most effective relationship for supporting behavior change is one that is collaborative. Collaboration involves mutual agreement upon an agenda, focusing on the patients' goals, and understanding their points of view. Healthcare professionals will be more effective change agents if they take opportunities to help patients identify and address their own problems rather than always giving advice. Helpful communication strategies for building a collaborative relationship include [129]:

- Asking open-ended questions (e.g., What do you think is the most important thing for you to work on today?)

- Using reflection (e.g., You find it hard to keep from eating while watching television in the evening.)
- Summarize patients' general ideas (e.g., I hear you saying that certain habits might be hard to give up, but that you would really like to eat more healthfully.)

Patient empowerment assumes that the patient is the person having the primary rights and responsibilities associated with his or her own health and lifestyle. It emphasizes the patient's role in decision making. Therefore, the goal of education is to provide the information patients will need for successful management of their own care. According to the empowerment model, educators are most effective if they recognize that they cannot and should not try to solve patients' problems for them. Instead, it is vital to provide the education patients need in order to make informed decisions and to facilitate their own decision-making process. This involves assessing readiness to change and exploring the range of options available and the consequences of each.

Providing Sensitive Care to Obese Patients

The National Weight Control Registry advises that serious long-term commitment to lifestyle changes in eating and physical activity is a key to weight loss success in obese patients [22]. Obesity can present significant psychosocial challenges for a person, including discrimination in work, social, and even healthcare settings.

Some obese patients will feel that they are treated insensitively or with judgment, including feeling shame and stigmatization in the healthcare setting. Obese patients report feeling blamed for personal failure and being simply told to lose weight without receiving any tangible support [130]. At the same time, physicians and other members of the healthcare team may be uncomfortable managing obesity. Research shows that healthcare providers often feel unprepared to help patients with behavior change [131]. In fact, patients are less likely to receive weight management advice from their physicians than they are from family and friends [22].

A study of the attitudes and opinions of obese adults in Australia found that this population prefers weight-loss interventions that are designed to help them improve their overall lifestyle, rather than just focusing on weight loss [132]. Public health interventions and media campaigns were favored over commercial weight-loss programs in this group. Furthermore, about 65% of participants felt that regulation, such as banning junk food advertising, was needed to help solve the obesity problem [132].

Stigmatization may be subtle and unintended by the healthcare provider. When working with an obese population, it is important to evaluate personal biases and examine how they may unintentionally affect your patients. Explore assumptions about body weight and dispel these stereotypes. Appropriate care of obese patients requires adopting sensitive language that enhances the therapeutic relationship. Studies show that obese patients prefer words like "weight," "excess weight," or "body mass index" as opposed to "large size," "weight problem," or "unhealthy body weight" [130].

STAGES OF CHANGE

Losing weight, eating differently, and increasing exercise are significant behavior changes for many people with prediabetes. Although it is tempting to think of change as a discrete event, it is actually an unfolding process that happens over time. "Stages of change" refers to the theory that people move through a predictable, though not always linear, series of stages as they give up unhealthy behaviors and replace them with health-enhancing behaviors. James Prochaska's Transtheoretical Model of Behavior Change, which has been widely used in diabetes self-management and smoking cessation, describes the stages of behavior change [133; 134]. Prochaska identified six stages that people go through as they attempt behavioral lifestyle changes, from precontemplation, during which the person does not intend to change within the next six months, to maintenance, when healthy behaviors have been practiced for at least six months.

For each stage of change, certain interventions on the part of the healthcare provider are recommended [133].

Precontemplation (Not Ready)

Precontemplation represents a time of resistance to change and may be accompanied by denial that there is a problem or that there would be benefits to change. A patient in this stage resists change and avoids learning or talking about his or her high-risk behavior. This patient is often labeled "noncompliant." In some cases, patients in the precontemplation stage may feel powerless to change. They may say they tried before but failed. It is important to remind these patients that change is a process and relapse is an opportunity to learn about what does and does not work.

For patients who are in the precontemplation stage of change, it is best to remain nonjudgmental and find neutral ways to raise awareness of the problem. When providing objective information, it should be based on caring and concern and not as proof for an argument. Make an effort to establish rapport by listening to the patient with compassion and empathy. Avoid the temptation to argue with the patient. Instead, acknowledge the choice and leave the door open for continued discussion in the future.

Contemplation (Getting Ready)

The contemplation stage begins when a patient becomes less resistant to the idea of behavior change. However, he or she remains acutely ambivalent about change and continues to procrastinate. At this time, the person acknowledges the need for change but is held back by his or her reasons for staying the same. A typical contemplative statement would be, "I would really like to exercise, but I just don't have the time." Although the prospect of change within the next six months is characteristic of this stage, people can remain in contemplation for an extended period of time. Patients may be assisted through this stage by promoting their self-efficacy and supporting their efforts to gather information. Specific interventions include reflective listening, providing empathic feedback, and offering information and resources as appropriate. Motivational interviewing, to be discussed in more detail later, is a powerful method for helping precontemplative and contemplative people move further along in the process of change.

Preparation (Ready)

Preparation is the third stage of behavior change. In this stage, the patient is ready to take action within the next 30 days and may begin to visualize the change. Strategies for this stage are to set goals and formulate an action plan. The healthcare professional's role is to guide the patient in making realistic goals, provide encouragement, offer resources, and help manage anxiety.

Action

During the action stage, the patient demonstrates a strong commitment to change by modifying his or her behaviors and environment. For example, the person who wants to lose weight may begin removing fattening foods from the home. He or she may begin substituting alternative behaviors for the unhealthy habits, such as packing a healthy lunch instead of depending upon fast food. Support from others during this time is very important and will help strengthen the patient's commitment to change and assist with problem solving.

Maintenance

Maintenance is the stage in which patients have maintained desired behaviors for more than six months. During maintenance, patients continue to work to prevent relapse, but their confidence in continuing the new behavior is increased. The new behaviors have become more habitual, and the person is less conscious of making an effort to perform them. Research indicates that the maintenance stage lasts from six months to five years [133]. During the maintenance stage, healthcare providers can support continued commitment to the behavior, providing feedback on positive changes in clinical measures such as blood pressure, blood glucose, and cholesterol.

Termination

Termination refers to the time when the person has no temptation to relapse and is completely self-sufficient in maintaining the status quo; the new behavior has become automatic. Long-term abstinence from smoking and drinking alcohol are examples of behaviors that best represent the termination stage of change. For areas like exercise and weight control, complete termination may not be a realistic goal for most people. In these situations, striving for ongoing maintenance is probably more appropriate [133; 134].

Dealing with Relapse

Relapse may occur at any stage of change and can result in a return to the earlier stages. Relapse is a learning opportunity for the patient and should not be viewed as failure. Instead, patients should be encouraged to view it as part of the ongoing process of growth. If a patient has relapsed, be careful to avoid showing feelings of disappointment or chagrin. Instead, help the patient explore the triggers that led to the relapse. Ask how he or she can respond differently to those triggers next time. This is an opportunity to build self-efficacy for another attempt at lasting change.

GOAL SETTING AND ACTION PLANNING

If patients need to lose weight, eat differently, and/or exercise more and they are ready to make these changes, be prepared to help them formulate a realistic plan for accomplishing this. Having specific goals increases the likelihood of performing a behavior and is associated with improved health-related behavior. Successful preventive health care requires a collaborative approach to choosing behavior change goals and identifying the steps to achievement. Dr. Kate Lorig, a prominent expert on health behavior change, suggests starting the goal setting process by asking patients what they would like to start doing to improve their health [135].

Goals vs. Action Plans

A goal has a more generalized outcome that takes place over an intermediate or long-term period, while action plans are highly specific. Examples of goals are:

- I will eat more healthfully.
- I will lose 10 pounds.
- I will exercise more.

Action plans are derived from goals. They define the specific steps that will lead to accomplishment of the goal. An action plan includes objective measures of quantity and time and should be relatively easy to accomplish. Action plans are associated with a greater degree of success and greater self-efficacy than longer-term goals [135]. Examples of action plans are:

- I will eat a small serving of fresh fruit every day as my afternoon snack for one week.
- I will follow the plate method at lunch and dinner for one week.
- In the next week, I will walk for 25 minutes in the morning for five days.

The action plan must be realistically attainable. To determine if the plan is achievable, ask your patient to use a confidence scale to ascertain the feasibility of an action plan. It is often helpful to have a picture of a ruler, numbered 0 to 10, a Likert scale, or another depiction of a linear scale that the patient can point to or write upon. Specify that 0 should be chosen if he or she is unsure if completing the action plan is possible; 10 means he or she is very sure it can be accomplished. If the patient reports a confidence level of less than 7, it indicates that he or she has made a plan that is not realistic. In these cases, help the patient revise the action plan to one that gives a confidence level of at least 7. For example:

- Original action plan scored confidence level of 5: I will eat one small serving of fresh fruit every day as my afternoon snack for one week.

- Revised action plan scores confidence level 8: I will eat one small piece of fresh fruit five days per week as my afternoon snack for one week.

Notice that a small change in the action plan can make it more realistic.

As with all behavior change plans, the action plan and its revisions are developed in collaboration with the patient and use the strategies that he or she has chosen. The action plan should support self-efficacy. Success in achieving a positive action is more important than the quantity of a clinical measure. Success breeds confidence that one can make positive lifestyle changes.

MOTIVATIONAL INTERVIEWING

While many patients might concur that some degree of lifestyle change would be beneficial, a significant number will be ambivalent about taking concrete action. Some will be entirely resistant to change, demonstrating a lack of readiness by denying the problem or any need to make behavior change. Others may already be taking action but still need to maintain the changes over time. Motivational interviewing is a dynamic strategy for guiding patients through all of these stages of change. William R. Miller originally developed this method in 1983 to help problem drinkers and was later joined by Stephen Rollnick to formalize this revolutionary concept in promoting health behavior change in other areas [136; 137].

When patients have a condition such as prediabetes, in which lifestyle modification is the primary treatment, simply giving advice is usually not enough to instigate significant change. In fact, when working with patients to make behavior change, one should expect one's role as the authority figure to diminish while their authority increases. This is because patients usually have their own answers when it comes to lifestyle modification, although they are often unacknowledged. Patients usually know what they need to do and may even have some ideas for how they might do it, but they often resist or feel ambivalent about taking action. What they need is help in becoming aware of their own resources, feeling more confident in their ability to change, and learning to put their ideas into action. Therefore, counseling a patient on health behavior change means healthcare professionals surrender the role of expert in exchange for becoming a guide.

Motivational interviewing is a therapeutic communication strategy that facilitates behavior change by focusing on a person's current interests and concerns. It creates an atmosphere in which the patient generates his or her own reasons for change. Motivational interviewing is appropriate to use in any situation in which behavior change is indicated, including with people who are resistant to change and those who lack the confidence or motivation to make change.

Motivational interviewing recognizes that there is a natural human tendency to resist being told what to do by others and that it is difficult for people to break through well-established behavioral rituals. Failure to change health-related behaviors is often in conflict with the healthcare providers' inclination to help, heal, and prevent harm. However, people who engage in unhealthy behaviors are usually already aware of what they should be doing instead.

The process of motivational interviewing identifies people who are resistant to change and allows the provider to "roll with the resistance" rather than challenge it. This intervention capitalizes on a person's ambivalence about behavior change, exploring the discrepancy between personal goals and actual behavior. Importantly, it evokes a person's own reasons for making behavior change and his or her resources for making it happen.

Patients resist behavior change for many reasons. One reason is that it is usually easier to maintain established habits than to change them. People may also be afraid of failure, or they may have anger or a lack of confidence in their ability to change.

Indicators of resistance to change may include changing the subject during a discussion, arguing, or denying the problem. When patients are clearly not ready to make behavior change, resist the urge to try to talk them into it, as this runs the risk of putting them on the defensive and making them argue in favor of staying the same. When patients repeatedly argue against change, the undesired behavior is actually reinforced. At this point, it is best to remain nonjudgmental and to keep the lines of communication open for future discussion. Examples of responses to a patient who is not willing to change are:

- It sounds like you feel the benefits of staying the same are greater than the benefits of making the change.
- What might help you be more ready to make some changes in your eating?
- Would you be interested in learning any more about resources we have for helping you eat healthier?

Many patients are ambivalent about changing. This means that they recognize the need for change and would like to do it, but they are also keenly aware of the advantages of staying the same. Ambivalence about behavior change represents both an opportunity and a hindrance. For example, the patient knows that being overweight is unhealthy but does not want to change his or her eating habits, saying, "I would like to lose weight, but I love to eat!" Notice that the patient first thinks of a reason to change, but cancels it out by thinking of the reasons not to change. These types of statements are known as "change talk." Because the patient has said he or she would like to lose weight, the perceived benefits and hypothetical solutions can be explored. The goal is to raise the patient's level of readiness to change by discovering and amplifying his or her own reasons and ways to do it. In this scenario, patients may be encouraged to talk about why they would like to lose weight and the benefits they would reap from it. For example, one could say, "Although you love to eat, you feel there would be some advantages to losing weight. What would be some of those advantages?" By having the patient state the benefits of losing weight, the patient's own change talk may be elicited. People are more influenced by what they hear themselves say than by what others tell them.

When patients are ambivalent, avoid giving them the opportunity to present arguments about why they do not want to change. A better alternative is to help patients voice their own arguments in favor of change. According to Rollnick et al., "If you are arguing for change and your patient is resisting and arguing against it, you're in the wrong role. You are taking all the good lines. It is the patient, rather than you, who should be voicing the arguments for behavior change" [136]. Change talk may be elicited from patients by asking them what they might like to change and how they might see themselves doing it.

Motivational interviewing involves a collaborative relationship that empowers patients to determine how they can make a difference in their own health. It is a skilled process that requires special training to realize its full potential. However, anyone can incorporate some of the basic tenets of motivational interviewing into their current practice by following these steps:

Ask open-ended, empowering questions. (*What would you like help with today?*)

Listen more than speak, and avoid interrupting the patient. (*Go on…*)

Summarize what the patient says. (*From what you have told me, you are worried about how prediabetes will affect your health.*)

Provide information in a neutral manner. (*Now that you know what the experts recommend for exercise, how do you think that would fit into your life? Your weight today is 178 pounds. What do you think about that?*)

Offer choices and negotiate the agenda. (*Of the things that you can do to lose weight, which one(s) would you like to work on most?*)

Listen for and respond to change talk. (*It sounds like you have been thinking about exercising more. How would exercise make your life better?*)

Evoke patients' own reasons for change. (*What benefits might you gain from getting more exercise? How important do you think this is?*)

Explore ambivalence. (*What do you like about the way things are now? What benefits would you get from exercising more?*)

Summarize what the patient is telling you. (*On one hand, I hear you saying that it would take some work on your part to exercise regularly, but on the other hand, you would feel better about yourself if you did it.*)

Assess readiness to change. (*How ready do you feel to become more physically active? On a scale of 0 to 10, how ready are you to start getting more exercise? Why did you choose that number?*)

Help your patient explore solutions. (*What has worked for you in the past? What could you see yourself doing now? What would you like about doing this?*)

Assess confidence. (*On a scale of 0 to 10, how ready are you to start exercising? Why did you choose that number? What would it take for you to have a higher number on this scale?*)

Roll with resistance and honor autonomy. (*The final decision for change is up to you. For now, it sounds like the benefits of staying the same are greater than the benefits of changing. How do you feel about keeping things the way they are?*)

Affirm the patient's statements and support self-efficacy. (*You have come up with some good ideas for how you can get more exercise. I feel confident that if you do choose to exercise, you will find a way to make it happen.*)

TOBACCO CESSATION

It is widely known that tobacco abuse is associated with a vast number of adverse health outcomes. All healthcare providers are charged with assessing patients' use of tobacco, advising them to quit, and offering strategies to help them quit. This role takes on even greater importance when working with people who have diabetes and prediabetes. Both of these conditions are independent risk factors for arterial and cardiovascular disease, and the toxic effects of smoking potentiate these risks. Tobacco use is also associated with increased incidence and severity of microvascular complications of diabetes. U.S. Public Health Service guidelines recommend that all patients be asked [138]:

- Do you smoke?
- Would you like to quit?

If a patient wants to quit, draw upon the same armament of strategies used to help motivate other health behavior change, such as losing weight, eating more healthfully, and exercising. In addition, tobacco cessation programs and pharmacologic agents are often effective. For patients who are not ready to quit, employ the same strategies discussed for people in the precontemplative stage of change.

Nicotine replacement therapy is effective in helping people stop tobacco use. This includes patches, gum, lozenges, inhalers, and nasal spray. Cessation rates improve when drug therapy combines nicotine replacement with the antidepressant bupropion [139]. Varenicline is an effective central nicotine receptor blocker but is not approved for use with nicotine replacement agents.

Not surprisingly, tobacco cessation has high rates of relapse, and most people require multiple quit attempts to remain permanently tobacco-free. After 12 weeks of abstinence, about 43% of people return to regular smoking. However, longer periods of abstinence increase long-term success rates. After five years of abstinence, relapse rates drop to

about 7% [133]. This presents an opportunity to help patients understand that tobacco cessation is a long-term process and previous attempts provide learning opportunities for the next attempt.

FOLLOW-UP AND REFERRAL

When health care involves behavior change, multiple encounters with a healthcare provider over an extended period of time seem to be most effective [2; 97; 135]. While the DPP was an intensive lifestyle change program, subsequent research indicates that follow-up may not need to be intensive. Rather, there is evidence to support that short, nonintensive encounters over time can be effective. Email or telephone encounters are appropriate when time and resources are limited. The important factor appears to be that the patient receives ongoing support from the healthcare team in some manner. Follow-up encounters should include checking on progress toward behavioral goals and troubleshooting challenges. Action plans may be revised or updated according to the patient's progress. While clinical measures, such as body weight, blood glucose, cholesterol, and blood pressure, must be done periodically, the focus of intervening encounters should be on behavior change and progress toward behavioral goals.

When feasible, patients with prediabetes should be referred to a registered dietitian for medical nutritional therapy. Ideally, an exercise physiologist or other expert in physical fitness can recommend and support an appropriate physical activity program. In any case, healthcare professionals should be prepared to help patients identify resources within their healthcare plan or the larger community to help them achieve their goals. These may include community centers, health education classes, and health clubs. Specialized classes for people with prediabetes have become more common within health care settings as the significance of this condition has grown.

HEALTH EDUCATION FOR DIABETES PREVENTION

As preventive medicine continues to emerge in today's healthcare climate, the role of the healthcare provider as educator is changing. Traditionally, standardized teaching tools have been used to provide mostly didactic and skills-based education. Today, as behavior modification becomes a larger part of medical treatment, there is less emphasis on teaching and more on coaching and guiding. The agenda for teaching must become more patient-centered in order to effectively facilitate behavior change. The patient's role is active, rather than passive. As discussed in relation to concepts of self-efficacy and motivational interviewing, patient encounters should become more collaborative and driven by the patient's agenda.

The AADE recommends a personalized education plan for every patient with prediabetes that incorporates the same self-management principles as diabetes education. In addition to patients with established prediabetes, this education should be available to family members of people with diabetes and patients with other risk factors, such as hypertension, obesity, and dyslipidemia. The AADE Position Statement on diabetes prevention education states that the educational program should [37]:

- Promote a basic understanding of the risk factors for developing type 2 diabetes.
- Communicate the importance of risk reduction for modifiable risk factors.
- Provide goals for dietary change and physical activity to achieve modest weight loss, taking into account the individual's unique situation.
- Emphasize that healthy eating and physical activity are ongoing lifestyle behaviors for effective weight loss and maintenance.
- Coach patients through the behavior change process.

- Instruct in self-management skills such as monitoring food intake and assessing percentage of daily fat intake.
- Recommend getting 150 minutes of moderate-intensity physical activity to per week.
- Provide follow-up to assess weight and help solve problems related to lifestyle management.

EVIDENCE-BASED PRACTICE RECOMMENDATION

According to the American Diabetes Association, technology-assisted tools including Internet-based social networks, distance learning, and mobile applications that incorporate bidirectional communication may be useful elements of effective lifestyle modification to prevent diabetes.

(http://care.diabetesjournals.org/content/41/Supplement_1. Last accessed January 17, 2018.)

Level of Evidence: B (Supportive evidence from well-conducted cohort and/or case-control studies)

Topics included in diabetes prevention programs include [70; 140]:

- Definition of prediabetes
- Health risks associated with prediabetes
- Identifying modifiable risk factors
- Lifestyle interventions to prevent progression to type 2 diabetes
- Significance of cardiovascular health and risk reduction
- Healthy eating behaviors
- Exercise recommendation
- Weight-loss strategies
- Assessing readiness to change
- Overcoming barriers to lifestyle change
- Goal setting and action planning
- Medical follow up to monitor blood glucose, lipids, weight, and blood pressure
- Signs and symptoms of hyperglycemia and when to call a healthcare provider

PREDIABETES EDUCATION PROGRAMS

Education to prevent diabetes is taking place on a national level. Under the new healthcare reform legislation, the CDC has authorized the establishment of a National Diabetes Prevention Program [141]. The DPP and follow-up studies have clearly demonstrated that lifestyle modification is the critical element in preventing progression from prediabetes to type 2 diabetes. Multiple studies suggest that intensive interventions, taking place over multiple sessions, are most effective [2; 97; 142]. Clinical experts, such as registered dietitians and nurses, as well as trained peers and laypersons appear to be efficacious in delivering this education [142; 143]. One diabetes prevention program, called Healthy Living Partnerships to Prevent Diabetes (HELP-PD), was a community-based lifestyle intervention program modeled after the DPP. The program design included [142]:

- Lifestyle interventions provided by registered dietitians and lay community health workers
- Initial six-month intensive phase with weekly group meetings using DVDs developed from the DPP curriculum
- Maintenance intervention beginning at six months, including weekly group meetings and additional phone or personal contact with community health workers

In this study, the control group received care consisting of two visits with a registered dietitian and a quarterly newsletter with tips for lifestyle changes. Results included a decrease in blood glucose levels of more than 4 mg/dL in the study group, compared to 0.3 mg/dL reduction in the control group [142]. The intensively treated group also achieved a weight loss of 7.3% and a 5.9 cm decrease in waist circumference after one year. The control group lost only 1.3% of body weight and had a decrease in waist circumference of only 0.8 cm.

One study examined the impact of DPP intervention on blood glucose and adiposity beyond 12 months of follow-up. This randomized controlled trial compared a 24-month lifestyle weight-loss program to an enhanced usual care condition in participants with prediabetes. The lifestyle weight-loss program sought to induce 7% weight loss at six months that would be maintained over time through decreased caloric intake and increased physical activity. The usual care group received two visits with a registered dietitian and a monthly newsletter. Results revealed that the lifestyle weight-loss program participants experienced greater decreases in fasting glucose (-4.35 mg/dL); body weight (-4.19 kg); and waist circumference (-3.23 cm) [144].

In another pilot study, people with prediabetes in rural Montana participated in a prevention program implementing the DPP lifestyle interventions through a 16-week telehealth program [143]. In this program, education was delivered by video teleconferencing to participants. Coaches and participants at both sites could see and hear each other through videoconferencing equipment. The program consisted of 16 weekly core curriculum sessions followed by six monthly after-core sessions [143]. Results of this pilot study demonstrated that a telehealth program could be just as effective as face-to-face participation. Participants in both groups had similar results, including increasing their physical activity levels and achieving a 7% weight loss. Other alternatives to intensive one-to-one counseling could include follow-up by telephone, email, or Internet-based interactive programs.

NEEDS ASSESSMENT

The educational needs assessment determines knowledge gaps and motivation to learn. It is a systematic way to gather information about experiences, beliefs, and behaviors that patients have with regard to their current lifestyle. Information gleaned from the needs assessment can be used to collaborate with patients in developing a teaching plan that meets their individual needs and priorities. For the healthcare provider, a needs assessment streamlines the teaching process by focusing upon the patients' unique needs and priorities. For patients, the needs assessment is empowering because it lets them direct the agenda. Thus, an important area to be addressed in a needs assessment is what the patient perceives as the primary learning need. Other areas that should be assessed include current understanding of one's individual risk for diabetes, current health behaviors, psychosocial and cultural factors, and readiness to change.

PRINCIPLES OF ADULT LEARNING

Employing the principles of adult learning theory will help make patient teaching more effective. An important principle of adult learning theory is that adults tend to be self-directed learners who must feel a need to learn. This is compatible with the concepts of self-efficacy and the patient-centered encounter. The first priority during the needs assessment is to determine what the patient feels is the most important issue at hand. Important principles of adult learning are outlined in the following sections.

Focus Teaching on the Patient's Perceived Problems

Determine what the patient feels he or she needs to know and what the perceived problems are. The adult learner will be more likely to acquire new knowledge and skills when teaching is directed toward specific problems rather than a comprehensive set of material.

Determine What the Patient Already Knows

Adults tend to learn more effectively when teaching incorporates prior knowledge and experiences. When teaching a problem-solving process, for example, ask the patient how he or she has dealt with a similar situation in the past. Build upon this experience to teach new material.

Keep the Patient Active in the Learning Process

Provide opportunities for interaction, questions, and sharing. Teaching is apt to be more effective when the patient's own life experiences can be incorporated into the lesson.

Allow for Self-Directed Learning

Enhance the learner's sense of autonomy by letting him or her make choices about what is being taught. For example, allow the patient to choose the mode of learning or the amount of time spent on a particular topic.

Give the Patient a Reason to Learn

Adult learners generally must perceive the benefits of what is being taught. Address this by giving the patient a brief rationale for the content being presented, focusing upon the benefits that can result from learning.

HEALTH LITERACY

Interest in and understanding of health literacy has grown tremendously over the last 20 years and has been an important component of the Healthy People initiative as well as Title V of The Patient Protection and Affordable Care Act of 2010, which defines health literacy as the degree to which a person can obtain, communicate, process, and understand the basic health information he or she needs to make informed decisions [145]. The government reports that nearly 90% of Americans have difficulty utilizing the health information that is routinely provided in healthcare facilities and in the media [146]. This is unsurprising when one considers that most Americans have never had a course in anatomy or physiology and that the average high school graduate has had a total of one health sciences class. Also notable is that the average adult reads at a 6th to 8th grade level, even if they have had education beyond those years [147].

Low health literacy has been associated with increased usage of the healthcare system. Effects of low health literacy include improper medication use, nonadherence to prescribed regimens, inability to make appropriate healthcare decisions, and ineffective self-care behaviors [148]. In people with diabetes, low health literacy has been associated with poor glycemic control, an increase in diabetic retinopathy, and hypoglycemia [149; 150]. A study conducted by the U.S. Department of Education found that adults who self-report the worst health also have the most limited literacy, numeracy, and health literacy skills [151].

Numeracy is a part of literacy that includes concepts having to do with numbers and basic mathematical functions. It includes "the ability to access, use, interpret, and communicate mathematical information and ideas, to engage in and manage mathematical demands of a range of situations in adult life" [152]. Numeracy is important for patients with diabetes and prediabetes, in which there is a need to read food labels, calculate nutrient value percentages, and interpret blood glucose values, among other skills.

Following research completed since 1990, the USDHHS has formulated the National Action Plan to Improve Health Literacy, an initiative to restructure the ways health information is created and disseminated in the United States. It calls upon multiple sectors, such as policymakers, organizations, communities, and individuals, to improve health literacy [146]. The National Action Plan is based upon the premise that improved health literacy supports patient-centered care. Patients who have access to understandable health information are more empowered to take appropriate action with their health.

There are many ways that healthcare professionals can easily incorporate improved health literacy into professional practice. First, make it a point to use plain language, both verbally and in writing, when interacting with patients. Avoid medical terms and jargon as much as possible. For example,

"high blood sugar" is simpler than "elevated blood glucose" and "heart disease" or "heart problems" are simpler than "cardiovascular complications." The CDC's Health Literacy website contains information about guidelines, laws, and standards for health literacy and plain language that can help healthcare professionals create and use health information that is accurate, accessible, and actionable [153].

Visual aids can improve patients' understanding as well. Food models and pictures can be used, including the plate method. Understand that most adults need to hear something more than once before being able to commit it to knowledge. Therefore, use repetition and vary the way the same concept is explained. Many times, the amount of information healthcare professionals are expected to disseminate can be overwhelming. If healthcare professionals are overwhelmed by the information, it is safe to assume patients will be as well. Patients recall only about one-half of the health information provided to them [154]. Therefore, provide related information in "chunks" and limit new information to one to three "need to know" concepts at one time. This provides an excellent opportunity to apply skills in providing patient-centered care, asking patients what they would like to work on most. Continue to check for understanding and encourage questions.

The teach-back method is recommended for improved health literacy [154]. This is a way to clarify patients' understanding of what has been taught. Teach back consists of asking patients to recount, in their own words, what they heard. This will allow for assessment of misunderstandings and gaps in learning. When asking for teach back, avoid making the patient feel threatened by framing the request in a way that centers any inadequacies on the healthcare system or provider. For example, one could say, "I would like to make sure I explained the plate method well to you. Can you tell me, in your own words, how you would use it to help you decide what to eat?"

Verbal instructions should be supplemented with written material. However, written material should be designed for the majority and follow appropriate guidelines for health literacy. Health information translated to other languages from English should maintain the health literacy standards of the original piece. Health education literature should also look easy to read, having a font size of 12 to 14 points. Written materials should have plenty of white space on the paper. About 25% to 35% of the page should be white, and margins should be no smaller than one-half inch. Graphics can help enhance literacy if they are appropriate in content and size and to the meaning to the document.

CULTURAL CONSIDERATIONS IN PREDIABETES EDUCATION

Culturally appropriate programs have proven effective for diabetes education and similar programs should likewise be appropriate for prediabetes education. Project Dulce is a community-based diabetes education program in San Diego, California, that uses bilingual peer educators, known as *promotoras*, to educate and support members of their own cultural or ethnic group [155]. The *promotoras* are trained lay members of a nurse-led healthcare team that adheres to clinical standards of diabetes disease management. The Project Dulce team collaborates with the participants' own healthcare providers in ensuring that care and education follows established protocols. Originally developed for the Hispanic/Latino population, Project Dulce has now been adapted for the African American, Filipino, and Vietnamese groups.

Other culturally relevant programs are currently being tested in different parts of the United States. In Detroit, there is a DPP-like program for Arab Americans, while lay health workers in African American churches support diabetes prevention programs in Georgia and Connecticut [156]. The Health Native Community Partnership is an organization devoted to empowering Native Americans to take action to promote the wellness of themselves and their community. Native Lifestyle Balance is a diabetes prevention program based on the DPP with cultural adaptations for this group [157].

COST EFFECTIVENESS OF DIABETES PREVENTION

The gold standard for preventing diabetes in high-risk populations appears to be intensive lifestyle intervention over an extended period. However, this type of program is labor- and resource-intensive and requires dedicated staff. Diabetes prevention is still a young and evolving field, and many communities and healthcare settings are not yet equipped to provide these types of programs. Certainly, limited resources have a major influence on the feasibility of funding and developing new programs.

Analysis of the DPP has shown that the interventions to prevent progression to type 2 diabetes in high-risk people can be cost effective from both societal and health systems perspectives. While the design of the DPP comprised intensive individual coaching and follow-up, group education sessions will increase its cost effectiveness. For diabetes self-management, group education is known to be as effective as individual education, and this is most likely true for prediabetes education as well [37].

Most studies on the effectiveness of diabetes prevention programs have examined intensive, multisession programs. More research is needed to explore the efficacy and cost effectiveness of diabetes prevention programs that use alternate formats. There has been limited research on the effectiveness of single-session classes. One study, however, demonstrated that a single session of motivational interviewing by telephone had a positive effect on lipid profiles and physical activity level [158]. A systematic review and meta-analysis found that the use of mobile text messaging for conveying type 2 diabetes interventions was effective for glycemic control [159]. Additionally, a feasibility study found that sending short text messages in conjunction with conventional diabetes treatment improved glycemic control and positively influenced other aspects of diabetes self-care in individuals with type 2 diabetes [160].

Time limitations in healthcare practice are generally ubiquitous, and all of the interventions for diabetes prevention may require more than a single 15-minute or brief messaging interaction. Efficiency can be maximized by using resources wisely. Consider how the rest of the healthcare team can assist the patient, and be familiar with other resources within the healthcare setting to assist the patient. Consider a referral to a dietitian or making other healthy lifestyle resources, such as weight management, healthy eating, and exercise classes, available to patients. Become familiar with community-based resources for diabetes prevention, weight loss, exercise, and general health promotion. Utilize the numerous online resources; many of them are interactive, which can enhance the patient's experience. Additional resources are provided in the ***Resources*** section of this course.

CASE STUDY

Patient S is a white woman who is 48 years of age. At a recent routine physical examination, she learns that her fasting blood glucose is 118 mg/dL. With a height of 5 feet 5 inches and a weight of 162 pounds, her BMI is 28, placing her in the category of overweight. Her physician refers her to Nurse A, a diabetes educator, for counseling and education on the prevention of diabetes, instructing her to keep a food diary and bring it to the appointment.

Nurse A begins the encounter by taking steps to develop a collaborative relationship with Patient S, first performing a learning needs assessment by asking her what she already knows about prediabetes and its risks and treatment. Nurse A determines what she wants to learn and what her goals are. Next, the patients' social situation and support system are assessed, including how family, work, and other obligations affect her lifestyle choices. Nurse A inquires regarding past smoking or alcohol use. Finally, the nurse asks what, if anything, the patient has started doing, or would like to start doing, to help herself prevent diabetes.

Patient S's physician had given her basic information on prediabetes and advised her to lose weight and begin exercising. The patient read the booklet on prediabetes and seems to have a reasonable understanding of her condition and the recommendations for treating it. However, she says she feels overwhelmed with the thought of making major lifestyle changes. She says, "I know I need to make changes, but I just can't get myself to do it." To decrease her anxiety and build self-efficacy, Nurse A replies, "The thought of change can be scary, but if you really want to, I am confident we can find some ways to help you do it."

This is a good time to assess the patient's readiness to change. Although she has some reluctance, Patient S rates her readiness to change as 8 on a scale from 0 to 10. She states that she will be going on vacation next week but will feel ready to make changes when she returns.

The next step is to negotiate an agenda for the encounter. Given that Patient S understands the basic treatment recommendations for prediabetes, the nurse asks what she would like to begin working on first. She says that she knows she needs to lose weight and wishes she could. With her permission, Nurse A takes the opportunity to educate her on the research that shows she can prevent or delay diabetes onset by losing 5% to 7% of her current body weight, which is 8 to 11 pounds. To help Patient S make realistic weight loss goals, the nurse asks, "Would you say that losing 8 pounds is something you could work on?" The patient is surprised that she only needs to lose 8 pounds; she had expected more than that. Nurse A supports the idea of greater weight loss eventually but suggests starting with 8 pounds and working from there. The nurse explains that her success in losing a few pounds at first increases the likelihood that she can lose more later.

While Patient S agrees that an 8-pound weight loss is reasonable, she remains ambivalent about making the necessary lifestyle changes. She says, "I really hope I can do this, but I'll probably never maintain it." The nurse recognizes this as change talk and takes the opportunity to explore it by asking, "Can you name three benefits you would enjoy if you did lose 8 pounds?" Patient S replies that she would drop a dress size, she would feel good about preventing diabetes, and it would motivate her to continue losing more weight.

Now that the patient has a realistic goal to lose 8 pounds, it is time to make an action plan that specifies the steps she will take to meet her goal. Nurse A starts by reviewing the key tenets of weight loss: eating less, lowering fat and calories in her diet, increasing fiber intake, and/or increasing exercise. The nurse demonstrates the plate method to the patient as a simple model for healthy eating and asks, "Which of these would you like to start working on today?" Patient S replies that she would like to do all of them, but says she is afraid it will take too much time to do all of these things. Once again, this is recognized as change talk, and Nurse A replies, "So is it safe to say that you think making some changes is worth a try?" With her consent, Nurse A begins helping Patient S specify her action plan by asking to review her food diary with her. Together, the nurse and patient determine that:

- She eats a moderate amount of fruits, vegetables, and whole grain.
- She eats high-fat, sweet, dessert-type foods once or twice every day.
- She usually chooses refined-grain products.
- She uses fattening toppings and spreads on salads, vegetables, and sandwiches.
- She often eats large portion sizes.
- She eats cereal and fat-free milk for breakfast every day.
- Her primary source of protein is chicken, prepared in a variety of ways.

Patient S's food diary reveals areas in which she can capitalize on healthy choices she is already making. Nurse A points out that she eats fruits, vegetables, and whole grains, eats breakfast, uses fat-free milk, and does not eat large amounts of saturated animal fat. Collaboratively, the two formulate a list of possible dietary changes based on her diary. Of these things, Nurse A asks her to pick two or three that she would like to start working on right away. She makes the following choices:

- Decrease intake of refined carbohydrates while increasing intake of whole grains.
- Reduce portion sizes.
- Reduce use of fattening toppings on salads, vegetables, and sandwiches.

Next, Patient S writes action plans for each of her behavior change choices. Nurse A assists the patient to begin formulating an action plan for her first choice by asking the following questions:

- *What will you do?* I will reduce my intake of refined carbohydrates while increasing my intake of whole grains.
- *How will you do it?* I will substitute whole-grain cereal and crackers for refined carbohydrate snacks and sweets.
- *How much?* I will eat one-half cup whole-grain cereal or six whole-grain crackers in place of my usual refined carbohydrate snack.
- *How often?* I will do this every day.

Patient S's completed action plan is to eat one-half cup whole-grain cereal or six whole-grain crackers every day in place of refined carbohydrate snacks.

The next step in making an action plan is to measure the patient's confidence in her ability to carry out the plan and to help her make modifications if needed. Patient S is asked to circle a number on a scale of 0 to 10 rating her confidence. She circles the number 6.

A confidence rating of 7 or more indicates that a person is reasonably confident in his or her ability to carry out the action plan. Because Patient S rated her confidence level as 6, it indicates that this action plan is probably not achievable for her. Nurse A asks her what would be more realistic, and she replies, "If I could just have a sweet treat on the weekend!" The nurse prompts her to change the "how often" part of her action plan from "every day" to "five days per week." With this modification, Patient S rates her confidence in the action plan as 9. Obviously, refraining entirely from sweet treats is desirable, but if she does not have the self-efficacy to do this, Patient S's action plan has a high risk for failure. It is better for her to experience success with small steps and build from there with future action plans.

If time allows, the nurse may continue helping the patient formulate action plans for her other chosen behavior changes. Her readiness to set a goal and make an action plan for exercise should be assessed using the same methods. With many people, especially if they are overwhelmed or lack self-efficacy, it is best to be conservative in the number of action plans they make initially. Too many action plans may be unrealistic. Usually, two or three action plans at a time is reasonable. Remind patients that when they achieve one action plan, they can begin to add more and build on their success over time.

Although there is not time for Nurse A to help Patient S formulate action plans for all of her chosen behavior changes, she has empowered her to make her own action plans. Nurse A asks the patient to report her subsequent action plans by phone, email, or at a future visit.

CONCLUSION

Today, health promotion, preventive medicine, and lifestyle modification are at the forefront of medicine. Rising costs of health care and increasing incidence of chronic conditions related to the modern lifestyle have changed our approach to medicine. Diabetes is particularly significant, because it affects millions of people and is associated with an unprecedented financial burden and incalculable toll on individuals and society.

In 2002, the results of the DDP represented a major breakthrough in the appreciation for the benefits of lifestyle modification on health promotion and disease prevention. Since that time, numerous studies have supported the findings of the DPP and many disease-prevention projects based on the DPP have been implemented throughout the nation and the world. Undoubtedly, these changes in the focus of health care have had an impact on nurses and other healthcare providers who play an important role in the prevention of diabetes. However, new demands can be challenging because people are often not ready to make the changes recommended.

This course has provided the information needed to identify a patient with prediabetes and to understand its significance and treatment. The definitive criteria for prediabetes include FPG between 100 and 125 mg/dL, OGTT 140–199 mg/dL, and/or A_{1c} 5.7% to 6.4%. These values increase the risk for progression to type 2 diabetes, and elevated blood glucose is associated with metabolic syndrome, which is a condition of increased insulin resistance and risk for cardiovascular disease.

The DPP and follow-up studies have demonstrated that type 2 diabetes can be prevented in people with IFG and IGT if they lose 5% to 7% of their body weight and exercise 150 minutes per week. Use of the antidiabetic medication metformin may also help reduce risk, especially in younger patients, but not to the degree of lifestyle modification.

A multitude of authoritative bodies have developed lifestyle recommendations based on the findings of the DPP. These recommendations include eating a balanced diet abundant in plant-based foods, reducing fat and calories, and practicing moderation with salt and alcohol consumption. These recommendations are consistent with the Mediterranean diet and the DASH eating plan, which have both been shown to lower the risk for chronic conditions such as hypertension, heart disease, and obesity.

Several strategies for helping patients lose weight and maintain weight loss have been presented in this course. Using the plate method to practice portion control is a simple and practical tool to assist patients to visualize what a healthy meal looks like on a plate. Other tools, such as food diaries, hunger scales, and label reading, are also valuable.

The benefits of exercise to health are well known, but the DPP showed a specific benefit with regard to the prevention of diabetes. Engaging in 150 minutes of moderate-to-vigorous intensity exercise per week is recommended for most people to prevent diabetes and other chronic health conditions related to sedentary lifestyle. Resistance exercise is also part of a complete physical activity program because it improves insulin sensitivity to about the same degree as aerobic activity.

This course has also examined the importance of diabetes prevention in diverse populations, such as children, people of different cultural groups, and those with variations in health literacy. Support from families and the public health sector are necessary to prevent the current epidemic of overweight and obesity in children and to ensure that health information is accessible to all. Healthcare providers working with diverse cultural groups require an adequate degree of cultural competency in order to understand and respond to variances in food and exercise preferences among different populations.

Helping a patient with prediabetes to prevent progression to type 2 diabetes involves more than clinical knowledge and the transfer of that information. While many healthcare professionals are comfortable in the teaching role, patients often do not follow recommendations for lifestyle modification. In fact, more often than not, it seems that patients already know what they are supposed to do, but do not do it for a variety of reasons. The onslaught of health problems related to the modern lifestyle habits has presented a challenge to many healthcare providers who feel unprepared to help patients make behavior change.

Developing a collaborative relationship is key to helping patients with behavior change. This relationship should acknowledge that it is the patient who holds the primary rights and responsibilities of his or her condition. In this relationship, the healthcare provider empowers the patient to make informed decisions on his or her own behalf rather than giving advice.

When a patient shows resistance to change, the healthcare provider's role is to explore the resistance rather than challenge it. Motivational interviewing is a valuable skill whereby the provider helps patients explore ambivalence about making change and set their own agendas when they are ready to make changes. Negotiating goals and setting action plans are other valuable components of a collaborative patient-provider relationship.

While resources for providing education and counseling are often limited, studies have shown that intensive and regular intervention over time are most effective for achieving and maintaining health behavior change. However, other formats, such as peer counseling and teleconferencing, have shown promise. Certainly, the future should hold many exciting new approaches to facing this challenging problem.

RESOURCES

Many resources and printable tools are available online to help healthcare professionals in assisting patients with lifestyle change, behavior modification, and diabetes prevention.

INTERACTIVE FOOD AND ACTIVITY TRACKERS

MyPlate
Allows patients to compare food intake patterns with suggested portion sizes using a plate as a template. Includes an interactive food tracker and planner.
https://www.choosemyplate.gov

PRINTABLE FOOD AND ACTIVITY DIARIES

Centers for Disease Control and Prevention My Food Diary
https://www.cdc.gov/healthyweight/pdf/Food_Diary_CDC.pdf

Centers for Disease Control and Prevention My Physical Activity Diary
https://www.cdc.gov/healthyweight/pdf/Physical_Activity_Diary_CDC.pdf

National Heart, Lung, and Blood Institute Daily Food and Activity Diary
https://www.nhlbi.nih.gov/health/educational/lose_wt/eat/diaryint.htm

TOOLS FOR THE DEVELOPMENT OF DIABETES PREVENTION PROGRAMS

Diabetes Prevention Program Lifestyle Manuals of Operations
Provides curriculum materials from the Diabetes Prevention Program.
https://dppos.bsc.gwu.edu/web/dppos/lifestyle

National Diabetes Education Project (NDEP)
Publications available to those who have diabetes, those at risk for the disease, healthcare professionals, and others who care for people with diabetes. The website has a number of copyright-free publications and programs. Many are geared to specific populations, such as Spanish-speakers, African Americans, older adults, and families.
https://www.niddk.nih.gov/health-information/communication-programs/ndep

Native Lifestyle Balance
A diabetes prevention program based on the DPP with cultural adaptations for Native Americans.
http://nlb.hncpartners.org

American Association of Diabetes Educators
AADE7 Self-Care Behaviors
An Internet-based suite of tools for diabetes education available for purchase.
https://www.diabeteseducator.org/living-with-diabetes/aade7-self-care-behaviors

TEACHING TOOLS

Idaho Plate Method
Provides products, programs, and plans for teaching portion control and healthy eating.
http://www.platemethod.com

Centers for Disease Control and Prevention: Physical Activity
Provides tips on becoming active and videos demonstrating proper form for muscle-strengthening activities.
https://www.cdc.gov/physicalactivity

Your Guide to Lowering Your Blood Pressure with DASH
https://www.nhlbi.nih.gov/files/docs/public/heart/new_dash.pdf

American Association of Diabetes Educators Tip Sheets and Handouts
Free downloadable patient education handouts, a guidebook, and short video on the seven key behaviors for diabetes management.
https://www.diabeteseducator.org/living-with-diabetes/tip-sheets-and-handouts

National Heart, Lung, and Blood Institute Serving Size Card
A wallet-sized guide to estimating portion sizes as compared to common everyday objects.
https://www.nhlbi.nih.gov/health/educational/wecan/downloads/servingcard7.pdf

DIVERSITY AND HEALTH LITERACY

National Institute of Diabetes and Digestive and Kidney Diseases Staying Active at Any Size
Health and weight management information.
https://www.niddk.nih.gov/health-information/weight-management/staying-active-at-any-size

Oldways
Traditional Diets and Oldways' Five Pyramids
Mediterranean, Latin American, Asian, and vegetarian food pyramids.
https://oldwayspt.org

Centers for Disease Control and Prevention: Simply Put
A style manual for creating easy-to-understand patient education materials.
https://www.cdc.gov/healthliteracy/pdf/Simply_Put.pdf

GLOSSARY OF TERMS

Acanthosis nigricans: Inflammatory skin condition causing dark, velvety papillary growth and discoloration in skin folds and neckline, associated with insulin resistance.

Bariatrics: Branch of medicine dealing with prevention and treatment of obesity.

C-reactive protein: A protein found in the blood, levels of which rise in response to inflammation. Associated with unstable coronary artery disease.

Exogenous: Originating outside the body or an organ. For example, injected insulin is an exogenous source of insulin.

Fibrinogen: Protein in blood plasma essential for blood clotting.

Hydrogenation: A chemical process that converts liquid fats to solid fats. Partial hydrogenation of liquid oils produces trans fatty acids. Trans fatty acids can be found in margarine, shortening, and many commercial baked foods.

Hyperinsulinemia: Excessive amount of insulin in the blood.

Gluconeogenesis: The formation of glucose in the liver from stored fats and proteins.

HDL cholesterol: The "good" cholesterol consisting of high-density lipoproteins. A high level in the blood is thought to lower the risk of coronary artery disease.

Hirsutism: Condition characterized by the excessive growth of hair or presence of hair in unusual places.

Hyperandrogenism: An excessive production of male hormones.

Incretins: A group of gastrointestinal hormones that cause an increase in the amount of insulin released from the beta cells of the islets of Langerhans after eating, even before blood glucose levels become elevated.

Microalbuminuria: Small amounts of protein found in the urine. A highly sensitive indicator of glomerular disease and a sign that kidneys are not functioning properly.

Microvascular complications: Damage to small blood vessels over time; usually caused by prolonged hyperglycemia. It is responsible for the eye, kidney, and nerve damage associated with uncontrolled diabetes.

Polydipsia: Excessive thirst, often symptomatic of elevated blood glucose.

Polyunsaturated fatty acids: An unsaturated fatty acid whose carbon chain has more than one double or triple valence bond per molecule; found chiefly in fish, corn, soybean oil, safflower oil, and walnuts. Can reduce the cholesterol levels in blood and lower risk of heart disease when used in moderate amounts.

Polyuria: Excessive urination, often symptomatic of elevated blood glucose.

Sarcopenia: Age-related loss of skeletal muscle resulting in frailty.

Saturated fat: Fats that contain the maximum amount of hydrogen possible, such as those found in meats and dairy products; can contribute to coronary heart disease and the development of some cancers.

Trans fatty acid: A fat that is produced when liquid fat (oil) is turned into solid fat through a chemical process called hydrogenation. Eating a large amount of trans fatty acids also raises blood cholesterol and risk of heart disease.

Triglycerides: A common blood fat that triggers the liver to create more cholesterol. High levels of triglycerides are usually indicative of high levels of insulin. The ratio of triglycerides to HDL is a powerful indicator of insulin levels and is strongly predictive of future cardiovascular events.

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